Cambridge Assessment International Education

Grade thresholds – November 2017

Cambridge IGCSE Physics (0625)

Grade thresholds taken for Syllabus 0625 (Physics) in the November 2017 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 11	40	–	–	23	20	18	16	14
Component 12	40	–	–	21	19	17	15	13
Component 13	40	–	–	22	20	17	15	13
Component 21	40	27	23	20	17	15	13	11
Component 22	40	28	24	21	18	16	14	12
Component 23	40	28	24	21	18	16	13	10
Component 31	80	–	–	55	49	41	33	25
Component 32	80	–	–	47	40	32	25	18
Component 33	80	–	–	54	46	39	31	23
Component 41	80	49	40	31	27	21	15	9
Component 42	80	53	43	33	29	22	16	10
Component 43	80	45	35	26	23	18	14	10
Component 51	40	30	27	24	20	17	14	11
Component 52	40	29	25	22	19	16	14	12
Component 53	40	27	24	21	18	16	14	12
Component 61	40	29	26	23	20	17	14	11
Component 62	40	28	24	21	18	16	14	12
Component 63	40	26	22	19	16	14	11	8

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **200**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
BX	21, 41, 51	149	130	111	93	79	66	52	38
BY	22, 42, 52	155	135	115	95	81	68	55	42
BZ	23, 43, 53	142	123	104	85	74	63	51	39
CX	21, 41, 61	148	129	110	92	79	66	52	38

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Grade thresholds continued

Cambridge IGCSE Physics (0625)

Option	Combination of Components	A*	A	B	C	D	E	F	G
CY	22, 42, 62	154	134	114	94	81	68	55	42
CZ	23, 43, 63	142	122	102	83	72	61	48	35
FX	11, 31, 51	–	–	–	127	111	95	79	63
FY	12, 32, 52	–	–	–	112	97	82	68	54
FZ	13, 33, 53	–	–	–	122	106	90	75	60
GX	11, 31, 61	–	–	–	126	110	95	79	63
GY	12, 32, 62	–	–	–	111	96	82	68	54
GZ	13, 33, 63	–	–	–	120	104	88	72	56

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/51**

Paper 5 Practical Test **October/November 2017**

CONFIDENTIAL INSTRUCTIONS

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Instructions for preparing apparatus

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In addition to the usual equipment of a physics laboratory, each candidate will require the apparatus specified in these Confidential Instructions. If a candidate breaks any of the apparatus, or loses any of the material supplied, the matter should be rectified and a note made in the Supervisor's Report.

Number of sets of apparatus

As a *minimum*, the number of sets of apparatus provided should be $N/3$, where N is the number of candidates (per session). A few spare sets should, preferably, be available to avoid any candidate being delayed when moving to another question.

The order in which a given candidate attempts the four questions is immaterial. It is suggested that candidates spend **about 20 minutes on each of questions 1 to 3 and about 15 minutes on question 4**.

Assistance to candidates

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The following regulations must be strictly adhered to.

(i) No hint may be announced to the candidates as a whole.

(ii) A candidate who is unable to proceed and requires assistance must come up to the Supervisor and state the difficulty. Candidates should be told that the Examiners will be informed of any assistance given in this way.

(iii) A report must be made of any assistance given to the candidate, with the name and candidate number of the candidate.

It is suggested that the following announcement be made to the candidates.

'The Examiners do not want you to waste time through inability to get on with an experiment. Any candidate, therefore, who is unable to get on with the experiment after spending five minutes at it may come to me and ask for help. I shall report to the Examiners any help given in this way, and some marks may be lost for the help given. You may ask me for additional apparatus which you think would improve the accuracy of your experiments, and you should say, on your script, how you use any such apparatus supplied.'

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Question 1

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Metre rule with a mm scale. See note 1.

(ii) Triangular block to act as a pivot for the metre rule. This block is to stand on the bench.

(iii) A 200 g mass, labelled **P**. See notes 2 and 3.

(iv) Masses of 100 g, 200 g, 300 g, 400 g and 500 g labelled **1.0 N**, **2.0 N**, **3.0 N**, **4.0 N** and **5.0 N**, respectively. See note 2.

Notes

1. If the metre rule has two scales in opposite directions, one scale must be taped over.

2. Any suitable masses that can rest on the metre rule can be used.

3. The value of the mass of **P** must **not** be visible to the candidates.

Action at changeover

Remove the masses from the rule.
Remove the metre rule from the pivot.
Check that the apparatus is ready for the next candidate.

Question 2

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Power supply of approximately 1.5 V–3 V. Where candidates are provided with a power supply with a variable output voltage, the voltage must be set by the Supervisor and fixed (e.g. taped). See note 2.

(ii) Three resistors of nominal value 4.7 Ω with a power rating of at least 2 W. See note 3.

(iii) Switch. The switch may be an integral part of the power supply.

(iv) Ammeter capable of reading up to 1.00 A, with a resolution of at least 0.05 A. See note 4.

(v) Voltmeter capable of measuring the supply p.d. with a resolution of at least 0.1 V. See note 4.

(vi) Sufficient connecting leads to construct the circuit shown in Fig. 2.1, with two additional leads.

Notes

1. The circuit is to be connected by the Supervisor as shown in Fig. 2.1.

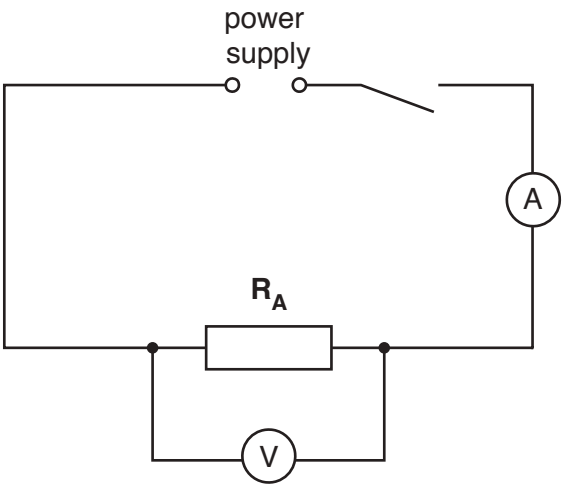

Fig. 2.1

2. If cells are to be used, they must remain adequately charged throughout the examination. Spare cells must be available.

3. The resistors must be labelled $\mathbf{R_A}$, $\mathbf{R_B}$ and $\mathbf{R_C}$. The values of resistance must **not** be visible to the candidates. The resistors must have suitable terminals so that candidates are able easily and quickly to rearrange the circuit.

4. Either analogue or digital meters are suitable. Any variable settings must be set by the Supervisor and fixed (e.g. taped). Spare meters should be available.

5. Spare leads should be available.

Action at changeover

Set up the circuit so that it is arranged as shown in Fig. 2.1.
Check that the circuit works. Switch off.

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Question 3

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Converging lens, focal length approximately 15 cm, with a suitable holder.

(ii) Illuminated object with a triangular hole of height 1.5 cm (see Fig. 3.1). The hole is to be covered with thin, translucent paper (e.g. tracing paper). See note 2.

(iii) Metre rule with a mm scale.

(iv) Screen. A white sheet of stiff card approximately 15 cm × 15 cm, fixed to a wooden support is suitable. See Fig. 3.2.

(v) A 12 V, 24 W lamp and holder. A 12 V power supply. Spare lamps should be available.

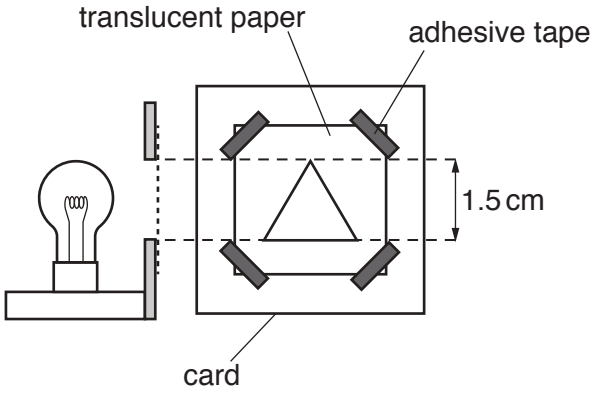

Fig. 3.1

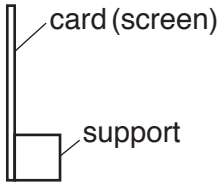

Fig. 3.2

Notes

1. The lamp for the illuminated object should be a low voltage lamp, approximately 24 W or higher power (a car headlamp bulb is suitable), with a suitable power supply.

2. The centre of the hole which forms the object, the lamp filament and the centre of the lens in its holder are all to be at the same height above the bench.

3. The apparatus is to be situated away from direct sunlight.

Action at changeover

Check that the apparatus is ready for the next candidate.

Question 4

No apparatus is required for this question.

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SUPERVISOR'S REPORT

General

The Supervisor is invited to give details of any difficulties experienced by particular candidates giving their names and candidate numbers. These should include reference to:

(a) difficulties due to faulty apparatus;

(b) accidents to apparatus or materials;

(c) any other information that is likely to assist the Examiner, especially if this cannot be discovered in the scripts;

(d) any help given to a candidate.

Information required

A plan of workbenches, giving details by candidate number of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts.

Information required (cont.)

A list by name and candidate number of candidates requiring help, with details of the help provided.

CENTRE NO. .....

NAME OF CENTRE .....

Declaration (to be signed by the Supervisor).

The preparation of the practical examination has been carried out so as to maintain fully the security of the examination.

SIGNED .....
Supervisor

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PHYSICS **0625/52**

Paper 5 Practical Test **October/November 2017**

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Number of sets of apparatus

As a *minimum*, the number of sets of apparatus provided should be $N/3$, where N is the number of candidates (per session). A few spare sets should, preferably, be available to avoid any candidate being delayed when moving to another question.

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Assistance to candidates

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Question 1

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Clamp, boss and stand.

(ii) 2 pendulum bobs. See notes 1, 2 and 3.

(iii) 2 lengths of thin string, each of length approximately 60 cm. See note 1.

(iv) Metre rule, graduated in mm.

(v) Set-square.

(vi) Stopwatch with a resolution of at least 0.1 s.

(vii) Split cork, or similar device, to hold the string of a pendulum between the jaws of the clamp. See notes 1, 2 and 3.

Notes

1. One bob must be made from modelling clay, rolled into a spherical shape with diameter approximately 2.0 cm. This pendulum must be set up for the candidates with length approximately 55 cm from the bottom of the split cork to the bottom of the pendulum bob. The pendulum string must be embedded within the bob so that the pendulum can swing without the bob slipping from the string. See Fig. 1.1.

The second bob must be made from approximately the same mass of the modelling clay as the first bob. This is to be rolled into a cylinder of length approximately 5.0 cm, with the string embedded within the bob so that the pendulum can swing without the bob slipping from the string. See Fig. 1.1.

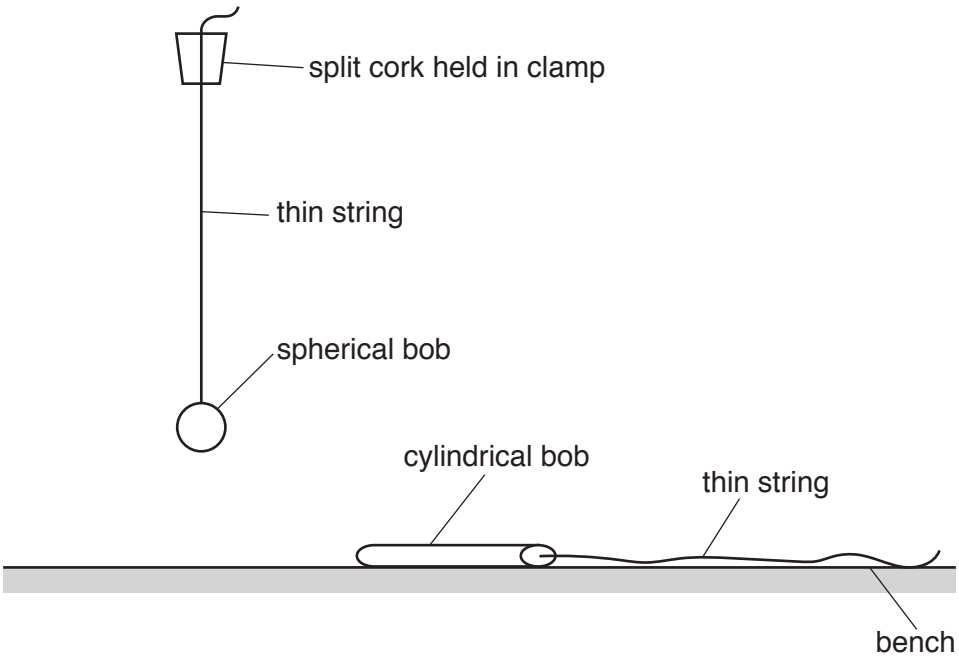


Fig. 1.1

2. Candidates must be able easily to exchange one pendulum for the other pendulum.

3. Candidates must be able easily to adjust the length of a pendulum when it is supported from the split cork.

4. It may be necessary to increase the stability of the clamp stand, for example, by using a G-clamp or by placing a weight on the base.

5. Spare pendulum bobs as described in note 1 must be available.

Action at changeover

Check that the apparatus is set up as described in note 1.

Check that the bobs are the correct shape.

Question 2

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Thermometer, –10 °C to 110 °C, graduated in 1 °C intervals.

(ii) 250 cm^3 beaker, labelled **A**.

(iii) 100 cm^3 or 250 cm^3 measuring cylinder.

(iv) Supply of hot water. See notes 1 and 2.

(v) Supply of water at room temperature. See note 3.

(vi) Supply of paper towels to mop up any spills of water.

(vii) Stirrer.

Notes

1. Hot water is to be available for each candidate throughout the experiment. The water should be maintained at an approximately constant temperature between 75 °C and 85 °C. Each candidate will require about 300 cm^3 of hot water in total. Candidates must be able to pour hot water into the measuring cylinder and beaker safely.

2. Candidates should be warned of the dangers of burns or scalds when using very hot water.

3. Water at room temperature is to be available for each candidate throughout the experiment. The supply of water must be labelled '**cold water**'. Each candidate will require about 300 cm^3 of cold water in total.

Action at changeover

Empty the beaker and measuring cylinder.

Check the supply of hot water.

Check the supply of water at room temperature.

Question 3

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

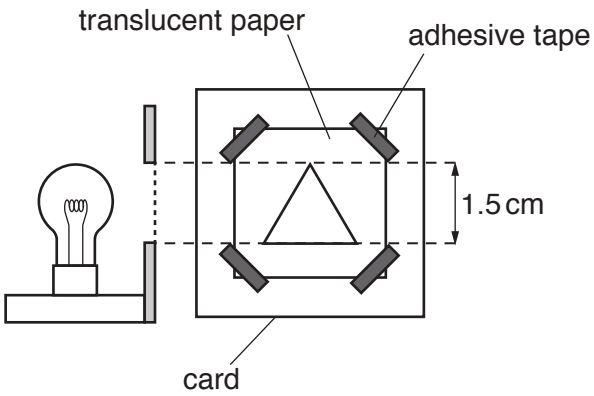
(i) Converging lens, focal length between 14.0 cm and 16.0 cm, with a suitable holder.

(ii) Illuminated object with a triangular hole of height 1.5 cm (see Fig. 3.1). The hole is to be covered with thin translucent paper (e.g. tracing paper). See note 2.

(iii) Metre rule, graduated in mm.

(iv) Screen. A white sheet of stiff card approximately 15 cm × 15 cm, fixed to a wooden support is suitable. See Fig. 3.2.

(v) Spare lamps should be available.



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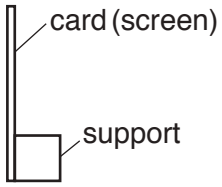

Fig. 3.2

Notes

1. The lamp for the illuminated object should be a low voltage lamp, approximately 24 W or higher power (a car headlamp bulb is suitable), with a suitable power supply.

2. The centre of the hole which forms the object, the lamp filament and the centre of the lens in its holder are all to be at the same height above the bench.

3. The apparatus is to be situated away from direct sunlight.

Action at changeover

Check that the apparatus is ready for the next candidate.

Question 4

No apparatus is required for this question.

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Question 1

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Two 250 cm^3 beakers, one labelled **A** and one labelled **B**. See note 1.

(ii) Lid for beaker **B**, with a hole to allow a thermometer to be inserted. See note 2.

(iii) Thermometer: –10 °C to 110 °C, graduated in 1 °C intervals. See note 3.

(iv) Clamp, boss and stand. See note 3.

(v) Stopclock or stopwatch or wall-mounted clock showing seconds. Candidates will be required to take readings at 30-second intervals. They may use their own wristwatches. The question will refer to a stopclock.

(vi) Supply of hot water. See note 4.

(vii) Paper towels to soak up any water spillages.

Notes

1. If the beakers do not have graduations at 75 cm^3 and 100 cm^3, indelible marks must be drawn. On beaker **A** the mark must be at the 100 cm^3 level and labelled **100 cm^3**. On beaker **B** the mark must be at the 75 cm^3 level and labelled **75 cm^3**.

2. Thin cardboard is a suitable material for the lid.
Spare lids must be available.

3. The thermometer must be supplied mounted in the clamp, so that the bulb of the thermometer will be below the 75 cm^3 level in each beaker. Candidates must be able, easily and safely, to insert the thermometer into each beaker. The thermometer must be clamped near the top so that candidates are able to read temperatures from the maximum temperature of the hot water.

4. Hot water is to be available for each candidate throughout the experiment. The hot water should be maintained at an approximately constant temperature between 80 °C and 100 °C. Each candidate will require about 250 cm^3 of hot water in total.
Candidates must be able to pour hot water into the beakers safely.

5. Candidates should be warned of the dangers of burns and scalds when using very hot water.

Action at changeover

Remove the thermometer from beaker **B**.
Empty the water from the beakers.
Check that the apparatus is intact.
Supply a new lid if necessary.

Question 2

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Two 2 W resistors, one approximately 5 Ω labelled **X**, and the other approximately 10 Ω labelled **Y**. The values should be obscured so that candidates cannot read them. See note 1.

(ii) Power supply of approximately 2 V–3 V. See note 3.
Where candidates are provided with a variable power supply, the voltage should be set by the Supervisor and fixed, e.g. taped.

(iii) Switch. The switch may be an integral part of the power supply.

(iv) Sufficient connecting leads to set up the circuit shown in Fig. 2.1, with 4 spare leads.

(v) Ammeter capable of measuring currents up to 1.00 A with a resolution of at least 0.05 A. See note 4.

(vi) Voltmeter capable of measuring up to 3.0 V with a resolution of at least 0.1 V. See note 4.

Notes

1. The resistors must have suitable terminals so that candidates are able easily and quickly to rearrange the circuit.

2. The circuit is to be set up for candidates as shown in Fig. 2.1.

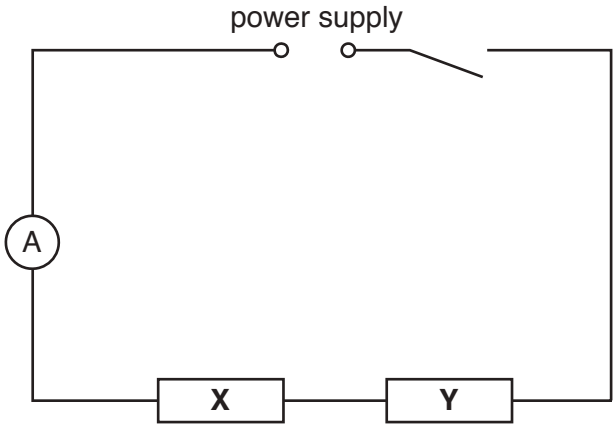

Fig. 2.1

3. If cells are used, they must remain adequately charged throughout the examination. Spare cells must be available.

4. Analogue or digital meters are suitable. Any variable settings should be set by the Supervisor and fixed, e.g. taped. Spare meters should be available. The voltmeter must not be connected to the circuit but must have leads and terminals that enable it to be connected to different parts of the circuit.

Action at changeover

Disconnect the voltmeter with its leads from the circuit.
Connect the circuit as shown in Fig. 2.1 and check that the circuit is working.
Switch the circuit off.

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Question 3

Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

(i) Metre rule, graduated in mm, of weight approximately 1 N to 2 N. See notes 1 and 2.

(ii) 2 loops of thin wire. See note 1.

(iii) 1 loop of thin string. See note 3.

(iv) Forcemeter capable of reading forces up to at least 2.5 N with a resolution of 0.05 N or 0.1 N. See note 5.

(v) 100 g mass, incorporating a hanger.

(vi) 2 bosses, 2 clamps and 2 stands.

(vii) 50 cm ruler or 30 cm ruler graduated in mm. Candidates may use their own.

(viii) Set-square. Candidates may use their own.

Notes

1. A loop of wire is to be taped securely to each end of the metre rule as shown in Fig. 3.1 so that the metre rule can be suspended, with its scale facing upwards. Thin string is a suitable alternative.

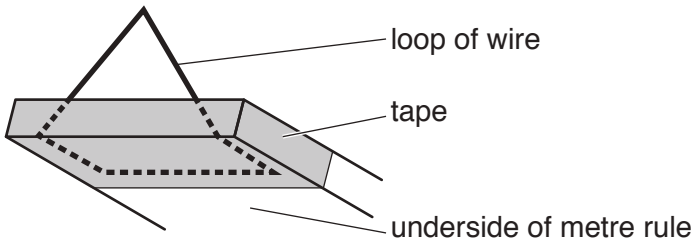

Fig. 3.1

2. If the metre rule has two scales in opposite directions, one scale must be taped over.

3. The loop of string must be looped around the metre rule so that the 100 g mass may be suspended from it in different positions.

4. The apparatus must be set up for the candidates as shown in Fig. 3.2, with the metre rule suspended between a clamp at the 0.0 cm end and the forcemeter at the 100.0 cm end. When the 100 g mass is suspended at the 95.0 cm mark, with the metre rule horizontal, the mass must be clear of the bench and the clamp holding the forcemeter must be below the top of the stand.
The wires suspending the metre rule must be vertical.
The 100 g mass should be suspended near the centre of the rule.

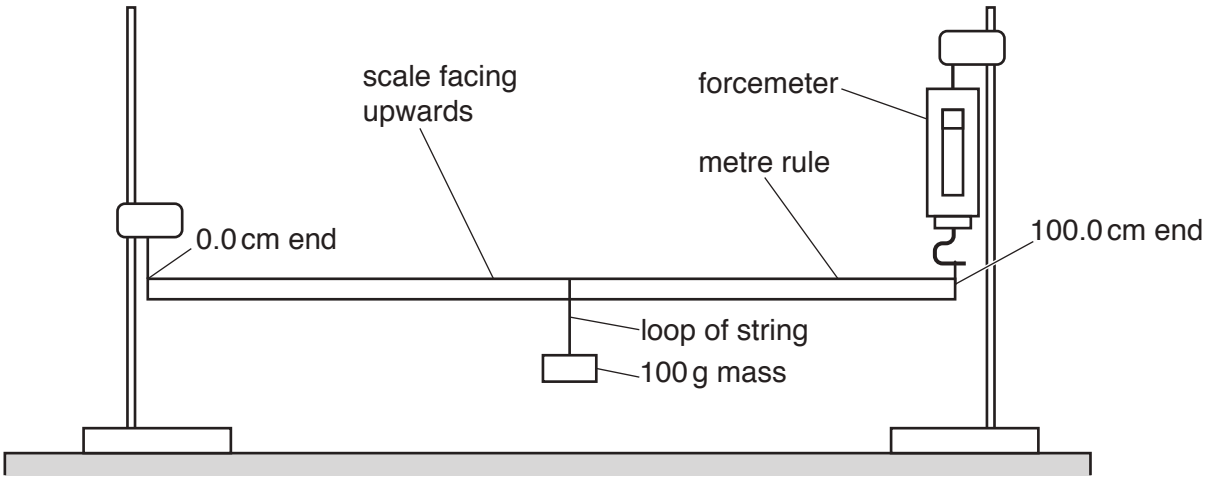

Fig. 3.2

5. The forcemeter must not exceed its full scale deflection when the 100 g mass is suspended at the 95.0 cm mark. If it does, a forcemeter capable of reading higher values must be used.

Action at changeover

Check that the apparatus is arranged as shown in Fig. 3.2 with the 100 g mass near the centre of the rule.
Check that the wire loops are secure.

Question 4

No apparatus is required for this question.

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This form must be completed and returned with the scripts.

SUPERVISOR'S REPORT

General

The Supervisor is required to give details of any difficulties experienced by particular candidates, giving their names and candidate numbers. These should include reference to:

(a) difficulties due to faulty apparatus;

(b) accidents to apparatus or materials;

(c) any other information that is likely to assist the Examiner, especially if this cannot be discovered in the scripts;

(d) any help given to a candidate.

Information required

A plan of workbenches, giving details by candidate number of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts.

The space below can be used for this, or it may be on separate paper.

Information required (cont.)

A list by name and candidate number of candidates requiring help, with details of the help provided.

CENTRE NO. .....

NAME OF CENTRE .....

Declaration (to be signed by the Supervisor)

The preparation of the practical examination has been carried out so as to maintain fully the security of the examination.

SIGNED .....
Supervisor

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PHYSICS **0625/11**

Paper 1 Multiple Choice (Core) **October/November 2017**

MARK SCHEME

Maximum Mark: 40

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Question	Answer	Marks
1	A	**1**
2	C	**1**
3	B	**1**
4	D	**1**
5	A	**1**
6	B	**1**
7	B	**1**
8	B	**1**
9	B	**1**
10	C	**1**
11	B	**1**
12	D	**1**
13	B	**1**
14	A	**1**
15	D	**1**
16	A	**1**
17	D	**1**
18	B	**1**
19	A	**1**
20	B	**1**
21	C	**1**
22	A	**1**
23	D	**1**
24	D	**1**
25	C	**1**
26	B	**1**
27	C	**1**
28	D	**1**

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Question	Answer	Marks
29	C	**1**
30	D	**1**
31	C	**1**
32	A	**1**
33	B	**1**
34	B	**1**
35	C	**1**
36	D	**1**
37	B	**1**
38	D	**1**
39	B	**1**
40	B	**1**

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PHYSICS **0625/12**

Paper 1 Multiple Choice (Core) **October/November 2017**

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1	B	**1**
2	C	**1**
3	D	**1**
4	D	**1**
5	A	**1**
6	B	**1**
7	A	**1**
8	B	**1**
9	C	**1**
10	B	**1**
11	B	**1**
12	D	**1**
13	B	**1**
14	A	**1**
15	D	**1**
16	D	**1**
17	D	**1**
18	B	**1**
19	C	**1**
20	B	**1**
21	A	**1**
22	C	**1**
23	D	**1**
24	D	**1**
25	A	**1**
26	B	**1**
27	C	**1**
28	C	**1**

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Question	Answer	Marks
29	C	**1**
30	C	**1**
31	A	**1**
32	B	**1**
33	B	**1**
34	B	**1**
35	C	**1**
36	C	**1**
37	D	**1**
38	A	**1**
39	B	**1**
40	A	**1**

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PHYSICS **0625/13**

Paper 1 Multiple Choice (Core) **October/November 2017**

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1	A	**1**
2	B	**1**
3	B	**1**
4	D	**1**
5	A	**1**
6	B	**1**
7	B	**1**
8	B	**1**
9	D	**1**
10	C	**1**
11	B	**1**
12	B	**1**
13	B	**1**
14	A	**1**
15	D	**1**
16	A	**1**
17	D	**1**
18	C	**1**
19	D	**1**
20	C	**1**
21	D	**1**
22	C	**1**
23	D	**1**
24	D	**1**
25	C	**1**
26	D	**1**
27	C	**1**
28	B	**1**

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Question	Answer	Marks
29	D	**1**
30	C	**1**
31	A	**1**
32	C	**1**
33	B	**1**
34	C	**1**
35	D	**1**
36	C	**1**
37	A	**1**
38	D	**1**
39	B	**1**
40	D	**1**

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PHYSICS **0625/21**

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1	A	**1**
2	A	**1**
3	A	**1**
4	D	**1**
5	B	**1**
6	C	**1**
7	B	**1**
8	C	**1**
9	D	**1**
10	D	**1**
11	B	**1**
12	B	**1**
13	B	**1**
14	A	**1**
15	A	**1**
16	D	**1**
17	A	**1**
18	C	**1**
19	A	**1**
20	C	**1**
21	A	**1**
22	C	**1**
23	D	**1**
24	D	**1**
25	A	**1**
26	B	**1**
27	B	**1**
28	C	**1**

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Question	Answer	Marks
29	C	**1**
30	A	**1**
31	C	**1**
32	B	**1**
33	B	**1**
34	B	**1**
35	A	**1**
36	D	**1**
37	C	**1**
38	A	**1**
39	B	**1**
40	A	**1**

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PHYSICS **0625/22**

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1	B	**1**
2	D	**1**
3	C	**1**
4	D	**1**
5	C	**1**
6	C	**1**
7	C	**1**
8	C	**1**
9	C	**1**
10	C	**1**
11	A	**1**
12	B	**1**
13	B	**1**
14	A	**1**
15	D	**1**
16	A	**1**
17	D	**1**
18	C	**1**
19	B	**1**
20	C	**1**
21	D	**1**
22	A	**1**
23	A	**1**
24	D	**1**
25	B	**1**
26	C	**1**
27	C	**1**
28	C	**1**

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Question	Answer	Marks
29	A	**1**
30	A	**1**
31	C	**1**
32	B	**1**
33	C	**1**
34	B	**1**
35	D	**1**
36	A	**1**
37	B	**1**
38	B	**1**
39	D	**1**
40	A	**1**

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Question	Answer	Marks
1	A	**1**
2	A	**1**
3	A	**1**
4	D	**1**
5	C	**1**
6	D	**1**
7	D	**1**
8	C	**1**
9	C	**1**
10	B	**1**
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12	B	**1**
13	B	**1**
14	A	**1**
15	D	**1**
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22	C	**1**
23	A	**1**
24	D	**1**
25	D	**1**
26	D	**1**
27	B	**1**
28	C	**1**

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Question	Answer	Marks
29	A	**1**
30	B	**1**
31	C	**1**
32	C	**1**
33	D	**1**
34	B	**1**
35	C	**1**
36	D	**1**
37	C	**1**
38	A	**1**
39	C	**1**
40	D	**1**

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PHYSICS **0625/31**

Paper 3 Core Theory **October/November 2017**

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Question	Answer	Marks
1(a)	stopwatch or stopclock	**B1**
1(b)	improved accuracy	**B1**
1(c)(i)	circle around 3rd OR 3.55	**B1**
1(c)(ii)	3.93 + 4.07 + 3.99 = 11.99	**C1**
	(11.99 ÷ 3 =) 4.0 (s)	**A1**
1(c)(iii)	0.40 (s) OR **(c)(ii)** ÷ 10	**B1**

Question	Answer	Marks
2(a)	Any four from: Measure the distance between the two bridges Start stopwatch when stick hits water / starts moving (with river) stop stopwatch when stick reaches bridge Y Use speed = distance ÷ time repeat procedure and find average	**B4**
2(b)	2nd box ticked The forward force and the backward force are equal	**B1**

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Question	Answer	Marks
3(a)	subtraction of forces to obtain resultant or 30 (N)	**B1**
	up(wards)	**B1**
3(b)	any five from: measure mass (on top pan balance) part fill measuring cylinder with water (and note volume) submerge link in measuring cylinder determine increase in volume increase in volume = volume of link use density = mass ÷ volume Only award full marks for a viable method	**B5**

Question	Answer	Marks
4(a)	1 solar / Sun	**B1**
	2 wind	**B1**
4(b)(i)	any two from: (renewable sources) are replaceable in a short time no (atmospheric) pollution conserves fossil fuels do not contribute to global warming no fuel costs	**B2**
4(b)(ii)	any one from: dilute source of energy owtte dependent on weather / intermittent supply	**B1**

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Question	Answer	Marks
5(a)	solid	**B1**
5(b)	gas	**B1**
5(c)	liquid	**B1**
5(d)	gas	**B1**

Question	Answer	Marks
6(a)	ray leaves glass at top surface	**B1**
	ray refracted away from normal	**B1**
6(b)(i)	ray reflected into glass	**B1**
	angle *i* = angle *r* by eye	**B1**
6(b)(ii)	total internal reflection	**B1**
6(c)	waves with arcs centred on gap	**B1**
	same wavelength	**B1**

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Question	Answer	Marks
7(a)(i)	arrows horizontal / on line from radio to man	**B1**
	arrows in opposite direction	**B1**
7(a)(ii)	middle box ticked longitudinal	**B1**
7(a)(iii)	number in range 20–20 000	**B1**
	hertz	**B1**
7(a)(iv)	(frequency of ultrasound) is above human (hearing) range	**B1**
7(b)(i)	speed = dist ÷ time or any two corresponding values of distance ÷ time e.g. 600 ÷ 0.4	**C1**
	1500 (m / s)	**A1**
7(b)(ii)	900 (m) read from graph	**C1**
	depth = 450 (m)	**A1**

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Question	Answer	Marks
8(a)	Any 3 from: compass placed near magnet direction of compass needle marked change position of compass repeat (above procedure) join points(to show field lines) owtte	**B3**
8(b)	complete curved lines drawn in correct pattern	**B1**
	No lines crossing / symmetrical pattern	**B1**
	Correct direction indicated by arrow	**B1**

Question	Answer	Marks
9(a)(i)	Thermistor correctly identified	**B1**
9(a)(ii)	correct symbol for voltmeter	**B1**
	Voltmeter in parallel with thermistor	**B1**
9(b)(i)	V= IR	**C1**
	(R) = 6.0 ÷ 0.010	**C1**
	600 (ohms or Ω)	**A1**
9(b)(ii)	Resistance is decreasing	**B1**
	So current will increase	**B1**
9(b)(iii)	Current greater than 0.04 (A)	**B1**
9(c)	700 (ohms or Ω)	**B1**

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Question	Answer	Marks
10(a)(i)	Pointer(s) not on zero	**B1**
	Pointers in opposite directions	**B1**
10(a)(ii)	Any 2 from:	
	Increase speed of wire	**B2**
	wrap wire into a coil	
	Increase strength of magnet	
10(b)	$N_s/N_p = V_s/V_p$ OR $660 \div 60 = V_s \div 25\,000$	**C1**
	V_s or output voltage = $(660 / 60) \times 25\,000 = 11 \times 25\,000$	**C1**
	275 000 (V)	**A1**
10(c)	Any 2 from:	
	Reduced energy / power losses	**B2**
	Smaller conductors needed	
	Reduced voltage drop (across cable)	

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Question	Answer	Marks
11(a)(i)	84	**B1**
11(a)(ii)	126	**B1**
11(a)(iii)	84	**B1**
11(b)	beta and gamma OR gamma and beta	**B1**
11(c)	0.4 ÷ 2 = 0.2	**C1**
	AND 0.2 ÷ 2 = 0.1 or 2 × 138	**C1**
	276 (days)	**A1**

Question	Answer	Marks
12(a)(i)	(They) emit ionising radiation	**B1**
	(which) damage DNA/cells/cause tumours/cancers	**B1**
12(a)(ii)	Any 2 from:	
	reduce exposure time	**B2**
	keep source at distance	
	use of suitable shielding	
	monitor exposure to radiation	

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PHYSICS **0625/32**

Paper 3 Core Theory **October/November 2017**

MARK SCHEME

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Question	Answer	Marks
1(a)	2nd line – advantage	**B1**
	3rd line – advantage	**B1**
	4th line – disadvantage	**B1**
1(b)	any three from: (cold) water is pumped into the ground warm rocks heat water / hot water turns to steam / water boils (steam) drives or turns or moves turbine (turbine) drives or turns or moves generator	**B3**

Question	Answer	Marks
2(a)	A – accelerates (from rest)	**B1**
	B – constant speed (of 2 m / s)	**B1**
	C – accelerates at faster rate / higher acceleration than previously	**B1**
	D – faster constant speed (of 10 m / s)	**B1**
2(b)	2 minutes = 120 s	**C1**
	area under the graph OR $d = s \times t$ OR 2×120	**C1**
	240 (m)	**A1**

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Question	Answer	Marks
3(a)(i)	$D = M / V$	**C1**
	450 / 145	**C1**
	3.1 (g / cm^3)	**A1**
3(a)(ii)	$W = m \times g$ in any form	**C1**
	0.45×10	**C1**
	4.5 (N)	**A1**
3(b)	$P = F / A$ in any form	**C1**
	30 / 80	**C1**
	0.375 (N / cm^2) OR 0.38 (N / cm^2)	**A1**

Question	Answer	Marks
4(a)	(gravitational) <u>potential</u> (energy)	**B1**
4(b)	arrow at the lowest point of swing	**B1**
4(c)	friction / air resistance / drag	**B1**
4(d)	any three from: cabin has kinetic energy two surfaces rub together / friction thermal energy generated / KE transferred to thermal dissipated to surroundings / air	**B3**

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Question	Answer	Marks
5(a)	insulator	**B1**
5(b)	Any five from: conduction / slow or limited transfer of thermal energy molecules move slower / lose kinetic energy convection stated as (drink cools) volume decreases density (of cooler drink) increases cooler water falls evaporation (of hot water) more energetic molecules escape / less energetic molecules remain	**B5**

Question	Answer	Marks
6(a)	normal correctly positioned	**B1**
6(a)(ii)	correct reflected ray at 45° to normal	**B1**
6(a)(iii)	*r* correctly indicated	**B1**
6(a)(iv)	angle *i* = angle *r*	**B1**
6(b)	parallel to the incident ray at P	**B1**
6(c)	F correctly labelled / 10 cm from lens	**B1**
	10 (cm)	**B1**

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Question	Answer	Marks
7(a)	green and indigo	**B1**
7(b)	radio and microwaves	**B1**
	infra-red	**B1**
7(c)	damages cells / heats cells	**B1**
7(d)	reduced exposure / leave room / move far away	**B1**
	metal apron / exposure badge / metal shielding	**B1**

Question	Answer	Marks
8(a)	1st row tick under orbiting the nucleus	**B1**
	2nd row tick under in the nucleus	**B1**
	3rd row tick under in the nucleus	**B1**
8(b)(i)	6	**B1**
8(b)(ii)	13	**B1**
8(c)(i)	same proton / atomic number	**B1**
	different nucleon number / number of neutrons / mass number	**B1**
8(c)(ii)	any acceptable isotope with proton number of 6	**B1**

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Question	Answer	Marks
9(a)(i)	steel	**B1**
9(b)(i)	variable resistor indicated	**B1**
9(b)(ii)	(steel) bar inside coil	**B1**
	switch closed OR current increased through coil	**B1**
	bar moved through coil (in same direction) OR current decreased and switch opened	**B1**
9(c)	at least one complete correct field line through and above coil	**B1**
	at least one complete correct field line through and below coil	**B1**

Question	Answer	Marks
10(a)(i)	25.6 (Ω)	**B1**
10(a)(ii)	$V = IR$ in any form	**C1**
	0.23×5.6	**C1**
	1.29 OR 1.3	**A1**
10(b)	resistance decreases	**B1**
	current increases	**B1**

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Question	Answer	Marks
11(a)	$N_1 / N_2 = V_1 / V_2$	**C1**
	(49 / 900) × 220 OR use of ratios seen	**C1**
	11.98 OR 12 (V)	**A1**
11(b)	copper	**B1**
11(c)	d.c. is in one direction only / a.c. changes direction	**B1**

Question	Answer	Marks
12(a)(i)	electric bell working owtte	**B1**
	no sound from bell / bell is quieter	**B1**
12(a)(ii)	any two from: sound will travel through air / glass sound will not cross a vacuum sound needs a medium to travel through	**B2**
12(a)(iii)	<u>vibrations</u>	**B1**
12(b)	20 Hz from first column	**B1**
	20 kHz from second column	**B1**

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/33**

Paper 3 Core Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)(i)	A **AND** B cars identified	**B1**
	A = fastest AND B = slowest	**B1**
1(a)(ii)	speed = distance ÷ time in any recognised form	**C1**
	50 ÷ 4	**C1**
1(b)(i)	12.5 (m / s)	**A1**
	100 × 3.6 **OR** 360 (s) indicated	**C1**
	answers in the range 5–7 minutes	**A1**
1(b)(ii)	any one from:	
	car will move faster / slower at times / speed not constant	**B1**
	road will have bends / hills etc.	
	slower moving traffic or other sensible road conditions	

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Question	Answer	Marks
2(a)	measuring cylinder (partially filled) with water / displacement can filled with water	**B4**
	object (submerged) into water owtte	
	new volume noted / displaced water collected in measuring cylinder	
	(volume of object =) difference in volumes / volume of water collected	
2(b)	density = mass ÷ volume written in any recognised form	**C1**
	347 ÷ 18	**C1**
	19.28 **OR** 19.3 (g / cm^3)	**A1**

Question	Answer	Marks
3(a)	$w = m \times g$ in any recognised form	**C1**
	2250 / 10	**C1**
	225 (kg)	**A1**
3(b)(i)	moment = force × distance from pivot in any recognised form	**C1**
	400 × 0.4 **OR** 400 × 40	**C1**
	160 **OR** 16 000	**A1**
	Nm **OR** Ncm	**B1**
3(b)(ii)	apply force further from pivot owtte	**B1**

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Question	Answer	Marks
4(a)(i)	elastic	**B1**
4(a)(ii)	elastic	**B1**
	kinetic	**B1**
4(a)(iii)	kinetic	**B1**
	thermal	**B1**
4(b)	pull band further back / exert greater force on band / increase elastic potential energy	**B1**

Question	Answer	Marks
5(a)	Tyre B	**B1**
	larger / bigger surface area	**B1**
	less pressure (on ground) / weight distributed	**B1**
5(b)	molecules gain kinetic energy / move faster	**B1**
	more (frequent) / harder collisions (with tyre)	**B1**
	Increased / greater pressure (on tyre)	**B1**

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Question	Answer	Marks
6(a)(i)	mercury	**B1**
6(a)(ii)	arrow between 0 °C and start of capillary tube	**B1**
6(a)(iii)	0 (°C) **AND** 100 (°C)	**B1**
6(b)	emitter	**B1**
	conductor	**B1**
	convection	**B1**
	radiation	**B1**

Question	Answer	Marks
7(a)	wavelength correctly indicated	**B1**
7(b)	12 (cm)	**B1**
7(c)	40 / 60	**C1**
	0.67 (Hz)	**A1**
7(d)	direction of travel perpendicular to direction of vibration owtte	**B1**
7(e)	any component of the electromagnetic spectrum	**B1**

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Question	Answer	Marks
8(a)(i)	top ray passes through f_2	**B1**
	bottom ray passes through f_2	**B1**
	refraction correctly shown either at centre of lens **OR** at both edges of lens	**B1**
8(a)(ii)	C to f_2	**B1**
8(b)(i)	critical angle	**B1**
8(b)(ii)	ray internally reflected	**B1**
	reflecting angle = incident angle	**B1**

Question	Answer	Marks
9(a)	light travels faster than sound **OR** reverse argument	**B1**
9(b)	reflection (from building) / bouncing back (from building)	**B1**
9(c)	time taken for first sound = 0.5 s	**C1**
	Time taken for echo = 2.5 s **OR** time for sound to travel from hammer and return = 2.0 s	**C1**
	2.0 s	**A1**
9(d)	quieter / less amplitude / less energy	**B1**

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Question	Answer	Marks
10(a)(i)	two curved field lines drawn above and below the magnet	**B1**
	lines start and finish at the poles of the magnet	**B1**
10(a)(ii)	both arrows point left	**B1**
10(a)(iii)	(plotting) compass	**B1**
10(b)	place end on end / see if attraction / repulsion occurs	**B1**
	repulsion at one end	**B1**

Question	Answer	Marks
11(a)	ammeter in series	**B3**
	voltmeter across wire	
	two cells correctly linked positive to negative	
11(b)	V = IR in any recognised form	**C1**
	R = 2.7 ÷ 0.3	**C1**
	9 (Ω)	**A1**
11(c)	1 higher / more	**B1**
	2. lower / less	**B1**

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Question	Answer	Marks
12(a)	Gamma	**B1**
12(b)	1 helium nuclei **OR** nuclide notation **OR** 2p, 2n	**B1**
	2 low / few cm of air / stopped by paper	**B1**
12(c)	2 half-life indicated	**B1**
	25 (%)	**B1**

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)(i)	Distance = area under graph OR 0.5 × 20 × 13	**C1**
	130 m	**A1**
1(a)(ii)	(a =) (v – u) / t OR (a =) v / t OR 13 / 20	**C1**
	0.65 m / s^2	**A1**
1(a)(iii)	(F =) ma OR 1200 × 0.65	**C1**
	= 780 N	**A1**
1(b)	Acceleration decreases OR rate of increase of speed decreases OR speed increases at a lower rate	**B1**

Question	Answer	Marks
2(a)	Extension of a spring is (directly) proportional to load / force / weight OR $F = ke$ where e is extension	**B1**
2(b)(i)	Straight line drawn from origin to (64 mm, 120 N)	**B1**
2(b)(ii)	$F = ke$ in any form OR 120 / 64 OR 120 / 6.4 OR 120 / 0.064	**C1**
	c.a.o. 1.9 N / mm OR 19 N / cm OR 1900 N / m	**A1**
2(c)	Above 120 N / at 140 N, the spring does not obey Hooke's law OR the extension is not proportional to the load / weight / force	**B1**
	The elastic limit / limit of proportionality of the spring has been exceeded	**B1**

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Question	Answer	Marks
3(a)	(Measure of) quantity / amount of matter OR (property) that resists change in motion / speed / momentum OR measure of a body's inertia	**B1**
3(b)(i)	$d = m / V$ OR in words OR 0.44 / 0.080^3 OR 0.44 / 5.12×10^{-4} OR 440 / 8^3 OR 440 / 512 OR 0.44 / 8^3 OR 0.44 / 512	**C1**
	0.86 g / cm^3 OR 860 kg / m^3 OR 8.6×10^{-4} kg / cm^3	**A1**
3(b)(ii)	Sinks OR does not float AND (cube) denser (than oil)	**B1**
3(c)(i)	$W = mg$ OR (g =) W / m OR 0.70 / 0.44	**C1**
	1.6 N / kg	**A1**
3(c)(ii)	(P =) hdg OR $0.030 \times 850 \times 1.6$	**C1**
	41 Pa	**A1**

Question	Answer	Marks
4(a)	Atoms collide with wall (and rebound) OR atoms rebound from wall	**B1**
	(Atoms) undergo change of momentum	**C1**
	Force on wall = (total) rate of change of momentum (of atoms) OR = change of momentum (of atoms) per second OR = change of momentum (of atoms) / time	**A1**
4(b)(i)	Fewer atoms per unit volume OR density of gas less	**B1**
	Rate of collision (with walls of balloon) decreases OR Fewer collisions per unit area	**B1**
4(b)(ii)	PV = constant OR $P_1V_2 = P_2V_2$ OR (P_2 =) P_1V_1 / V_2 OR $1.0 \times 10^5 \times 9.6 / 12$	**C1**
	8.0×10^4 Pa	**A1**

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Question	Answer	Marks
5(a)	Tick 2nd box only	**B1**
5(b)(i)	At least 3 parallel wavefronts in shallow water sloping upwards from left to right	**B1**
	Wavefronts in shallow water meet wavefronts in deep water	**B1**
5(b)(ii)	Indication that frequency is same in deep and shallow water	**C1**
	In deep water $v = f\lambda$ in any form OR ($f =$) v / λ OR 80 / 1.4	**C1**
	= 57.1 (Hz)	**C1**
	Wavelength in shallow water = v / f OR 60 / 57.1 = 1.05 cm	**A1**
	OR	
	speed in deep water / speed in shallow water = 0.80 / 0.60	**(C1)**
	= 1.33	**(C1)**
	(f is constant so) λ in deep water / λ in shallow water = 1.33	**(C1)**
	λ in shallow water = 1.4 / 1.33 = 1.05 cm	**(A1)**

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Question	Answer	Marks
6(a)	1500 m / s liquid 5000 m / s solid 300 m / s gas	**B2**
6(b)(i)	X and Y marked at centres of any two rarefactions	**B1**
6(b)(ii)	Area of low pressure or low density (of atoms) or where atoms / molecules far apart	**B1**
6(c)	v = = d / t or 2 d / t in any form	**C1**
	$d = v t / 2$ OR $3.0 \times 10^8 \times 2.56 / 2$	**C1**
	3.84×10^8 m OR 3.84×10^5 km	**A1**

Question	Answer	Marks
7(a)	One ray with correct path through lens	**B1**
	Another ray with correct path through lens Rays intersect to right of F and below axis, inverted image	**B1**
	drawn <u>and</u> labelled I	**B1**
7(b)	enlarged, upright and virtual <u>only</u> underlined or ringed	**B2**
	Two of above descriptions underlined	**B1**
7(c)	On entering prism: green ray deflection more than red ray and above normal	**B1**
	On leaving prism: diverging downwards from red ray and not along surface of prism	**B1**

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Question	Answer	Marks
8 Hydroelectric		
8(a)	Hydroelectric named OR water from behind dam	**B1**
	K.E. of (falling) water used / P.E. of stored water	**B1**
	Turbine / waterwheel / paddle wheel operated	**B1**
	(Turbine) turns / drives a generator (that produces electricity)	**B1**
8(b)	Rain (fills lakes in high places)	**B1**
	Cause of rain is the Sun, so renewable	**B1**
8(c)	Sun evaporates water from sea etc. to fall (later) as rain	**B1**
	Sun is the source of energy.	**B1**
8 Tidal flow		
8(a)	Tides / tidal flow named	**B1**
	K.E. of water used	**B1**
	Turbine / waterwheel / paddle wheel operated	**B1**
	(Turbine) turns / drives a generator (that produces electricity)	**B1**
8(b)	Moon (and Sun) causes tides	**B1**
	Moon (and Sun) permanently in place, so renewable	**B1**
8(c)	Attraction due to Moon's (and Sun's) gravity causes tides	**B1**
	Sun is a source of (part of) the energy OR Sun is not the primary source of energy	**B1**

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Question	Answer	Marks
8 Waves		
8(a)	Waves on surface of sea	**B1**
	K.E. of water used to oscillate a floating mechanism	**B1**
	Turbine / waterwheel / paddle wheel operated	**B1**
	(Turbine) turns / drives a generator (that produces electricity)	**B1**
8(b)	Wind causes waves	**B1**
	Sun causes wind, so renewable	**B1**
8(c)	Winds are air currents caused by thermal energy / heat from the Sun	**B1**
	Sun is the source of energy	**B1**

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Question	Answer	Marks
9(a)(i)	(3 × 1.5 =) 4.5 V	**B1**
9(a)(ii)	$1 / R = 1 / R_1 + 1 / R_2$ OR $R = 1 / (1 / R_1 + 1 / R_2)$ OR (R =) $R_1R_2 / (R_1 + R_2)$	**C1**
	Correct substitution of 3 and 6	**C1**
	(R =) 2.0 Ω	**A1**
9(a)(iii)	$V = IR$ in any form OR (I =) V / R OR 4.5 / 3	**C1**
	1.5 A	**A1**
	OR	
	I_{total} = 4.5 / 2 = 2.25 A	**(C1)**
	For 3 Ω, I = 2.25 × 6 / 9 = 1.5 A	**(A1)**
9(b)(i)	Connect ammeter (in wire) from A to B OR from H to G	**B1**
9(b)(ii)	Connect voltmeter (terminals) to A and H OR B and G OR C and D OR E and F	**B1**

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Question	Answer	Marks
10(a)(i)		**B1**
10(a)(ii)	To allow flow (of current) in one direction	**B1**
10(b)(i)	Wire from B to + or – terminal of battery and wire from A to other terminal of battery	**B1**
	Diode to allow current in at + terminal or out at – terminal	**B1**
10(b)(ii)	Alternating current in coil Y sets up alternating magnetic field OR causes change in magnetic flux	**B1**
	Alternating field / change in flux cuts coil X OR Alternating field links with coil X	**B1**
	(Alternating) voltage / current is induced in coil X OR (Alternating) voltage / current is produced in coil X by electromagnetic induction	**B1**

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Question	Answer	Marks
11(a)(i)	An electron	**M1**
	In / from / by the nucleus	**A1**
11(a)(ii)	Proton numbers balance on left and right sides of equation	**B1**
	Nucleons numbers balance on left and right sides of equation	**B1**
	$^{0}_{-1}\beta$	**B1**
11(b)	Time for activity / count rate / number of nuclei / number of atoms to halve	**B1**
11(c)(i)	α-particles would be stopped / absorbed by <u>the plastic</u> / <u>bottle</u>	**B1**
11(c)(ii)	γ-rays would not be absorbed by the liquid / bottle OR reading not reduced (in passing through liquid / bottle) OR very penetrative so no change in detector reading	**B1**

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/42**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

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Published

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Question	Answer	Marks
1(a)	$\rho = m / V$ in any form OR (m =) ρV OR (m =) $9000 \times 7.5 \times 10^{-5}$	**C1**
	(m =) 0.68 kg **accept** 680 g	**A1**
1(b)(i)	$W = m g$ in any form or (W =) $m g$ OR (W =) 0.68×10	**C1**
	(W =) 6.8 N	**A1**
1(b)(ii)	any **one** of: weight has direction / mass does not weight is a vector / mass is not weight varies / mass does not mass is amount of matter weight is a force / mass is not	**B1**
1(c)(i)	$\rho = h \rho g$ in any form OR (ρ =) $\rho / h g$ OR (ρ =) $560 / (0.027 \times 10)$	**C1**
	(ρ =) 2.1×10^3 kg / m^3	**A1**
1(c)(ii)	explains why there is a resultant downward force	**B1**

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Question	Answer	Marks
2(a)	accelerate / increase speed OR decelerate / decrease speed OR stop	**B1**
	change direction / move in a curve o.w.t.t.e.	**B1**
2(b)	change of shape OR size	**B1**
2(c)(i)	$F = m\,a$ in any form OR (a =) F / m OR (a =) 3500 / 1400	**C1**
	(a =) 2.5 m / s^2	**A1**
2(c)(ii)	$a = (v - u) / t$ in any form OR (t =) $(v - u) / a$ OR (t =) (30 – 0) / 2.5 OR 30 / 2.5	**C1**
	(t =) 12 s	**A1**
2(c)(iii)	friction / air resistance / drag	**B1**

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Question	Answer	Marks
3(a)	suitable fuel for a power station	**B1**
	any **three** from five: • thermal energy / heat (from fuel) • water / steam / gas heated OR steam produced • (steam / gas) turns / moves / drives turbine • (turbine) turns / moves / drives generator • 2 correct energy transfers	**B3**
3(b)	sun is energy source for plants / living matter (to grow) o.w.t.t.e.	**B1**
	plant / animal (remains compressed) into fuel OR carbon / chemical energy stored / trapped in plant / animal (remains)	**B1**
3(c)	not renewable (as fuel is consumed)	**M1**
	could only be replaced over very long time period (e.g. clearly > 50 years)	**A1**

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Question	Answer	Marks
4(a)(i)	any **one** of these six: • evaporation: at surface OR no bubbles form) pair 1 • boiling: throughout liquid OR bubbles form) • evaporation: at any temperature OR no heat needed) pair 2 • boiling: at specific temperature OR heat needed) • evaporation: affected by draught / surface area) pair 3 • boiling: not affected by draught / surface area)	**B1**
	any **one** pair of points	**B1**
4(a)(ii)	(it / rate) increases AND {more molecules have enough energy to escape OR break bonds}	**B1**
4(b)(i)	remains constant	**B1**
4(b)(ii)	$E = m\,l$ in any form OR (E =) $m\,l$	**C1**
	P = energy / t in any form OR (P =) energy / t	**C1**
	($P = 0.095 \times 2.3 \times 10^6 / (12 \times 60)$ =) 300 W	**A1**

Question	Answer	Marks
5(a)	any **three** of these five: • any sensible mention of the sun (as source of energy) • (thermal / heat / *IR* / electromagnetic) radiation • white (or clearly implied) surfaces absorb less or don't absorb • white (or clearly implied) surfaces reflect more • to keep house cooler OR to reduce thermal energy / heat transferred to house	**B3**
5(b)	decreases	**B1**

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Question	Answer	Marks
6(a)(i)	diffraction	**B1**
6(a)(ii)	4 arcs between dashed lines centred vertically at centre of gap	**B1**
	any 3 wavelengths same as incident wavelengths including wavelength from wavefront in gap	**B1**
6(b)(i)	wavefronts have smaller angular width OR do not extend as far as dashed lines OR less (angular) spread	**B1**
6(b)(ii)	increased wavelength OR more spreading	**B1**
	use of $v=f\lambda$ OR increased wavelength	**B1**

Question	Answer	Marks
7(a)	real (answers in any order for **7(a)**)	**B1**
	enlarged OR magnified	**B1**
	Inverted OR upside down	**B1**
7(b)(i)	1st straight incident ray from close to point object to mirror correctly reflected, $i = r$	**M1**
	2nd straight incident ray <u>from point object</u> to mirror correctly reflected, $i = r$	**A1**
7(b)(ii)	BOTH reflected rays extended back to intersect behind mirror	**M1**
	BOTH reflected rays extended back <u>in straight lines</u> AND I in correct position AND {labelled OR clearly indicated}	**A1**

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Question	Answer	Marks
8(a)	$R_S = R_A + R_B$ in any form OR (R_S =) $R_A + R_B$ OR (R_S =) 4 + 8	**C1**
	(R_S =)12 (Ω)	**C1**
	(R_P =)1 / (1 / R_S + 1 / R_C) in any form OR (R_P =) $R_S R_C$ / (R_S + R_C) OR (R_P =) 1 / (1 / 12 + 1 / 6) OR (R_P =) (6 × 12) / 18	**C1**
	(R_P =) 4.0 Ω	**A1**
8(b)	V_8 = supply V × (8 / 12) OR = 24 × (8 / 12)	**C1**
	(V_8 =) 16 V	**A1**
	OR alternative route	
	I_8 = supply V / 12 OR = 24 / 12 OR = 2 (A)	**(C1)**
	(V_8 = 2 × 8 =) 16 V	**(A1)**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="3">9(a)(i)</td><td>A (fixed)resistor
B thermistor
C L.E.D. OR light emitting diode</td><td></td></tr>
<tr><td>2 correct</td><td>B1</td></tr>
<tr><td>3 correct</td><td>B1</td></tr>
<tr><td>9(a)(ii)</td><td>any four from six:
• if cold / hot resistance of thermistor high / low
• if cold / hot voltage (across) thermistor high / low
• if cold / hot voltage of input to LED high / low
• if cold / hot there is current / no current in LED
• if cold LED lights / brighter
• if hot LED does not light / dimmer</td><td>B1</td></tr>
<tr><td rowspan="4">9(b)</td><td>
<table>
<tr><th>Row</th><th>A</th><th>B</th><th>C</th><th>(output of AND)</th><th>X</th></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>2</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>4</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>5</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>6</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>7</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>8</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
</td><td></td></tr>
<tr><td>row 1 of X correct – answer 0</td><td>B1</td></tr>
<tr><td>rows 2 AND 3 of X correct – both answers 0</td><td>B1</td></tr>
<tr><td>rows 4–8 of X correct – all answers 1</td><td>B1</td></tr>
</table>

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Question	Answer	Marks
10(a)(i)	clockwise arrows on at least 3 circles	**B1**
10(a)(ii)	(magnetic) field becomes weaker / decreases (as distance from wire increases)	**B1**
10(b)(i)	any **four** from these six: • charge flows OR current in solenoid / wire / circuit • solenoid becomes magnet / magnetised • bolt becomes magnet / magnetised • (such that) unlike poles (of solenoid and bolt are) facing o.w.t.t.e. • bolt is attracted • bolt moves / (door) locks / spring stretched	**B4**
10(b)(ii)	solenoid OR bolt no longer magnetised OR bolt no longer attracted	**B1**
	(spring contracts and pulls) bolt back / bolt returns (to original position) / (door) unlocked	**B1**

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Question	Answer	Marks
11(a)	nucleon numbers balance each side of equation	**B1**
	proton numbers balance each side of equation	**B1**
	$^{0}_{-1}\beta$	**B1**
11(b)(i)	background radiation OR radiation from the environment	**B1**
	rocks / ground / buildings / food / space / weapons testing / nuclear accidents or waste / sun / air / radon / argon	**B1**
11(b)(ii)	random (variation)	**B1**
11(b)(iii)	clear evidence of subtracting 23 from (original) count	**C1**
	clear evidence of dividing original / corrected count by 4	**A1**
	clear evidence of adding <u>23</u> correctly to result after division	**A1**

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PHYSICS **0625/43**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

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Question	Answer	Marks
1(a)(i)	(x =)½ $v_f t$ **or** ½ × 12 × 30 **or** (x =)½ at^2 **or** ½ × 0.40 × 30^2	**C1**
	180 m	**A1**
1(a)(ii)	(a =)$\Delta v / t$ **or** 12 / 30	**C1**
	0.40 (m / s^2) **or** 12 / 30	**C1**
	(F =)ma **or** 2.0 × 10^4 × 0.40 **or** 2.0 × 10^4 × 0.40 × 12 / 30	**C1**
	8000 N	**A1**
1(b)	drag / friction / air resistance mentioned	**C1**
	drag / friction / air resistance increases (as speed increases)	**A1**

Question	Answer	Marks
2(a)	(m =)ρV **or** 950 × 8.2 × 10^{-5} **or** 0.95 × 82	**C1**
	7.8 / 7.79 × 10^N (where N is a integer)	**C1**
	0.078 / 0.0779 kg **or** 78 / 77.9 g	**A1**
2(b)(i)	(p =)$h\rho g$ **or** 0.094 × 950 × 10	**C1**
	890 / 893 Pa	**A1**
2(b)(ii)	atmospheric pressure (is acting)	**B1**
2(c)(i)	steel is denser (than liquid) **or** denser than 950 kg / m^3	**B1**
2(c)(ii)	take new reading **and** subtract 82 (cm^3) / original reading	**B1**

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Question	Answer	Marks
3(a)(i)	nuclear fusion	**B1**
3(a)(ii)	nuclei combine / join together	**B1**
	small nuclei to larger nuclei **or** hydrogen to helium (in some way) **or** loss of mass	**B1**
3(b)	any suitable resource e.g. fossil fuels; hydroelectric; wave; wind	**M1**
	renewable **or** not (according answer) **and** matching explanation	**A1**
3(c)	**two** advantages from: no polluting gases / quiet / low maintenance / can be placed on roofs / clean / cheap to run	**B2**
	two disadvantages from: intermittent supply / unattractive / takes up space / uses land / d.c. output	**B2**

Question	Answer	Marks
4(a)	molecules of solid arranged in lattice / in organised pattern / without gaps / orderly / fixed structure	**B1**
4(b)(i)	glass heated first **or** at first liquid not heated / does not expand / takes time (to heat up) **or** glass poor conductor	**B1**
	glass expands	**B1**
	capacity / volume of flask increases	**B1**
4(b)(ii)	liquid (starts to) warms up	**B1**
	liquid expands more than the solid / glass	**B1**

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Question	Answer	Marks
5(a)	(quantity of internal) energy that raises temperature	**M1**
	per degree Celsius / per unit temperature change	**A1**
5(b)(i)	560 / 562 / 561.6 J	**B1**
5(b)(ii)	kinetic energy / potential energy / total energy (of atoms / molecules / particles)	**B1**
	kinetic added to potential energy (of atoms / molecules / particles)	**B1**
5(c)	line from 100 °C **and** falling	**B1**
	falls at decreasing rate	**B1**
	levels off at labelled / approximate 22 °C	**B1**

Question	Answer	Marks
6(a)(i)	box next to 3.0×10^8 (second box down) ticked	**B1**
6(a)(ii)	(λ =)c / f **or** $3.0 \times 10^8 / 4.8 \times 10^{14}$	**C1**
	6.2 / 6.25 / 6.3×10^{-7} m	**A1**
6(b)(i)	1. sines have no unit **or** sines are ratio of two lengths **or** ratio of two speeds (whose units cancel) **or** units cancel	**B1**
	2. (v =) c / n **or** $3.0 \times 10^8 / 1.5$	**C1**
	2.0×10^8 m / s	**A1**
6(b)(ii)	information / message / music/sound / signal / data (encoded as pulses of light) sent	**B1**
	light (travels along fibre) **or** infra-red (radiation)	**B1**
	light detected (at far end) **or** message decoded **or** total internal reflection mentioned	**B1**

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Question	Answer	Marks
7(a)(i)	any **two** rays that start at the top of the image from: • seems to come from F_1 to lens and emerges paraxially • passes through centre of lens undeviated • paraxial to the lens and passes through F_2	**M2**
	two correct rays traced back **and** image indicated	**A1**
7(a)(ii)	any **two** of enlarged; inverted; real underlined	**B1**
	enlarged **and** inverted **and** real underlined	**B1**
7(b)	refracted ray in prism below yellow ray **and** above normal	**B1**
	emergent ray diverging away from the yellow ray and above side of prism	**B1**

Question	Answer	Marks
8(a)	touch the sphere with the earth wire	**B1**
	negatively charged **and** electrons flow to sphere	**B1**
	remove earth wire **or** electrons / negative charges attracted (by rod)	**B1**
8(b)	four **or** more straight, radial lines **and** uniformly spaced	**B1**
	at least one arrow outwards **and** no wrong arrows	**B1**
8(c)	(I =) Q/t **or** 7.0 / (5.0 × 60) **or** 7.0 / 5.0 **or** 1.4 (A)	**C1**
	0.023(3333) A	**A1**

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Question	Answer	Marks
9(a)(i)	cosine **or** sine curve **and** maximum value equal to |minimum value|	**B1**
	two complete cycles of 0.02 s between 0 and 0.040 s	**B1**
9(a)(ii)	point marked *A* where output voltage is zero	**B1**
9(b)(i)	magnetic field (due to a.c.) mentioned	**B1**
	changing / alternating (magnetic) field **or** field lines cut solenoid	**B1**
	e.m.f. / voltage induced (in coil)	**B1**
9(b)(ii)	diode	**B1**
	prevents / stops the backward current **or** allows only one direction of current	**B1**

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Question	Answer	Marks
10(a)	electromagnetic (waves / rays / radiation)	**M1**
	high frequency / energy **or** short wavelength	**A1**
10(b)(i)	no change **or** (stays at) 43	**B1**
10(b)(ii)	no change **or** (stays at) 99	**B1**
10(c)(i)	(radiation) always present / due to environment / in absence of radioactive sample / natural (radiation)	**B1**
10(c)(ii)	112 – 16 **or** 96 **or** 112 / 28 **or** ¼ or 18 / 2	**C1**
	28 – 16 **or** 12 **or** 1 / 8 **or** 18 / 3 **or** 9.0 (hours)	**C1**
	6.0 hours	**A1**
10(d)	any **two** of: • (distance): tongs / manipulator / centre of cardboard box • (absorption): lead gloves / suit / lead glass screen / googles / glasses • (time): limit exposure time / keep in box until needed / film badge	**B2**

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PHYSICS **0625/51**

Paper 5 Practical **October/November 2017**

MARK SCHEME

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Question	Answer	Marks
1(a)	*a* = 19 – 21	**1**
1(b)(i)	*Q* values 1.(0), 2.(0), 3.(0), 4.(0), 5.(0)	**1**
1(b)(ii)	*b* values all less than 50 cm and decreasing	**1**
1(b)(iii)	Correct 1 / *Q* values 1.(0), 0.5(0), 0.33(3), 0.25, 0.2(0)	**1**
1(c)	Graph:	
	Axes correctly labelled	**1**
	Suitable scales	**1**
	All plots correct to ½ small square	**1**
	Good line judgement, thin, continuous line	**1**
1(d)	Triangle method clearly shown on graph	**1**
	At least half line used for triangle method and *G* recorded	**1**
1(e)	*P* correct calculation of *G* / *a* and in range 1.8 – 2.0	**1**

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Question	Answer	Marks
2(a)(i)	V to at least 1 dp and < 3 V	**1**
	I to at least 2dp and < 1 A	**1**
2(a)(ii)	R_1 correct	**1**
2(b)(i),(ii)	New values of V and I and R_2 correct AND $2 \times R_1 \pm 10\%$	**1**
2(c)(i)	New values of V and I with $I_3 < I_2$	**1**
2(c)(ii)	R_3 present and V, I, R units seen at least once and not contradicted	**1**
2(d)	Statement to match readings AND Justification to include the idea of within (or beyond, ecf) the limits of experimental accuracy	**1**
2(e)	Determine each resistance in turn	**1**
2(f)	Three resistors in parallel, voltmeter in parallel with resistors and correct symbols for voltmeter and resistors	**1**
	Variable resistor in series, correct symbol in a workable circuit	**1**
2(g)	Repeat with different currents	**1**

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Question	Answer	Marks
3(a)	Table:	
	v = in range 45 – 80	**1**
	uv correct	**1**
	$D = u + v \pm 1$ cm	**1**
3(b)	v = in range 25 – 35	**1**
	$D = u + v \pm 1$ cm	**1**
3(c)	One from: Different size / Different brightness Sharpness / clearness / coloured edges	**1**
3(d)(i),(ii)	f values both rounding to 14 – 16 (cm)	**1**
3(d)(iii)	f_A correct	**1**
	2 or 3 significant figures	**1**
3(e)	Any **two** from: Difficulty deciding exact position of sharpest image Difficulty measuring to centre of lens Product uv increases problem Image edges blurred / not clear Insufficient sets of results	**2**

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Question	Answer		Marks
4	**MP1**	Stopwatch (or equivalent) AND (metre) rule / ruler	**1**
	MP2	Measure time for 5 (+) oscillations	**1**
	MP3	Divide by number of oscillations to find period (*T*)	**1**
	MP4	Repeat for each bob	**1**
	MP5	Variable; **one** from: Initial amplitude / starting position Length of pendulum / thread Number of oscillations	**1**
	MP6	Table with column headings for *t*, or period (*T*), or both AND *d*, with correct units	**1**
	MP7	Conclusion: Plot graph(s) of *d* against period (*T*) or *t* (or vice versa) OR compare period (*T*) or *t* values for different diameters	**1**

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PHYSICS **0625/52**

Paper 5 Practical **October/November 2017**

MARK SCHEME

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Question	Answer	Marks
1(a)	correct use of set-square AND vertical ruler	**1**
1(b)(i)	t_1 = 29.5 ± 2.5 (s)	**1**
1(b)(ii)	correct T_1 from candidate's value of t_1	**1**
	unit s seen at least once in **(i)** or **(ii)**	**1**
1(c)(i)	t_2 = 27.7 ± 2.5 (s)	**1**
1(c)(ii)	$T_2 < T_1$ and to 2 or 3 significant figures	**1**
1(d)	statement to match readings	**1**
	justification to include the idea of within (or beyond e.c.f) the limits of experimental accuracy e.g. (very) close / almost equal / the same	**1**
1(e)	final box ticked	**1**
1(f)	4 or 5 correct (fewer than 4 correct = 0 marks)	**1**
	From top box to bottom box V, V, V, V, P, P all correct (= full marks)	**1**

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Question	Answer	Marks
2(a)	realistic room temperature	**1**
2(b)	realistic hot water temperature	**1**
	mixture temperature between hot and room	**1**
	temperature fall correct AND °C seen at least once and not contradicted	**1**
2(c)	to make sure that the temperature is the same throughout	**1**
2(d)	realistic new temperatures	**1**
2(e)	realistic new temperatures	**1**
2(f)	room temperature seen and correct conclusion	**1**
2(g)	heat loss (to surroundings) / time delays in transferring the water or did not wait for thermometer readings to stabilise	**1**
2(h)	insulation	**1**
2(i)	same starting temperature / same room temperature	**1**

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Question	Answer	Marks
3(a)(i),(ii)	correct *u* values 20(.0), 22(.0), 25(.0), 30(.0), 35(.0)	**1**
	v values decreasing and all > 22.0 cm	**1**
	consistent 2 or consistent 3 significant figures for *v*	**1**
3(b)	graph:	
	axes correctly labelled and not reversed	**1**
	suitable scales	**1**
	all plots correct to ½ small square	**1**
	good best-fit curve judgement, thin, continuous line	**1**
3(c)(i)	2 points and straight line correct	**1**
3(c)(ii)	u_1 and v_1 read correctly to ½ small square	**1**
3(c)(iii)	correct calculation of *f* from candidate's values	**1**
	f value rounding to 14–16 cm	**1**

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Question	Answer	Marks
4	**method:** **MP1** measure length of band	1
	MP2 hang load, measure new length	1
	MP3 repeat with different thicknesses/widths	1
	control variable: **MP4** use same (original) length of band each time	1
	table: **MP5** table with columns for thickness, (load) and length / extension with units	1
	conclusion: **MP6** plot a graph of extension / length against thickness (for the same load) OR load against extension / length for different thicknesses OR comparison via a table e.g. compare extensions / lengths of different thicknesses for the same load	1
	one additional point: **MP7** use same load / same range of loads use at least 5 thicknesses / take at least 5 different readings to plot a graph show how to measure extension e.g. $l - l_0$ use same type / material of rubber band	1

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PHYSICS **0625/53**

Paper 5 Practical **October/November 2017**

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Question	Answer	Marks
1(a)	θ for beaker A decreasing	**1**
1(b)(i)	θ for beaker B decreasing, more slowly than for A AND all θ values to at least 1 °C	**1**
1(b)(ii)	units ALL correct (symbols or words)	**1**
	t values all present (30, 60, 90, 120, 150 and 180)	**1**
1(c)	**two** appropriate precautions: e.g. avoidance of parallax(only if explained) wait until reading stops rising at start ensure thermometer not touching beaker	**2**
1(d)(i)	conclusion matching results	**1**
	correct mention of comparative temperature change over 180 s	**1**
1(d)(ii)	any suitable improvement relating to comparison: e.g. same volume of water, same initial temperature, insulate sides, use plastic beaker, stand on mat, use a thicker / more insulated lid,	**1**
	<u>matching</u> explanation: e.g. lid only factor changed, cooling more rapid for higher temperatures cooling different for different volumes, thermal energy only escapes from surface, less transfer of thermal energy by sides, effect of lid more marked any appropriate similarity:	**1**
1(d)(iii)	e.g. both cool more rapidly at the start	**1**

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Question	Answer	Marks
2(a)	correct voltmeter symbol in parallel with **X**	**1**
2(b)(i)	I_S< 1.00 A AND to 2dp at least	**1**
2(b)(ii)	V_X<V_Y AND both<3.0(V) AND to 1dp at least	**1**
2(b)(iii)	*V*s within 10% of V_X+V_Y	**1**
2(b)(iv)	statement matching readings	**1**
	justification, with use of values seen, matching readings and statement e.g.: '3.5 V and 3.6 V are within limits of experimental accuracy'	**1**
2(c)	correct calculation of *R*s	**1**
	2 / 3 sig figs and unit(Ω)	**1**
2(d)	resistors in parallel with correct symbol	**1**
	rest of circuit correct	**1**
2(e)	I_P >I_S	**1**

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Question	Answer	Marks
3(a)(i)	5 *F* values all increasing	**1**
	all to at least 1d.p.	**1**
3(b)(ii)	any reliable method e.g. equal distances between rule and bench in at least two places, line up with named horizontal surface, use of set-square between stand and rule	**1**
3(b)	graph:	
	axes labelled with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid and scales starting at 0,0)	**1**
	plots all correct to ½ small square AND precise plots	**1**
	Well-judged line AND thin line	**1**
3(c)(i)	F_0 correct from graph	**1**
3(c)(ii)	W_R in range 1 to 3 N AND 2 / 3 sig figs and unit (N)	**1**
3(d)	statement matching plotted points AND explanation referring to line and scatter of data	**1**
3(e)	repeat all readings and take average	**1**

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Question	Answer		Marks
4	**MP1**	**additional apparatus:** screen AND (metre) rule	**1**
	MP2	**diagram:** suitable arrangement of apparatus with *u* and *v* labelled correctly	**1**
	MP3	**method:** obtain (clear focused) image AND measure *u*, *v*	**1**
	MP4	repeat for other values of *u*	**1**
	MP5	**one precaution for clear, focused image:** move screen slowly / backwards and forwards, object AND lens AND screen perpendicular to bench / vertical, object and lens at same height (from bench), use of dark room / bright light	**1**
	MP6	**one precaution with measurements:** clamp rule / fix to bench, mark centre of lens on holder avoidance of parallax explained and specific	**1**
	MP7	**one additional point:** additional precaution, calculate *f* <u>from given equation</u> at least 3 values obtained, calculate average, mention of at least one appropriate *u* value, mention of preliminary expt to obtain rough *f* value (e.g. light from window)	**1**

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PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2017**

MARK SCHEME

Maximum Mark: 40

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Question	Answer	Marks
1(a)(i)	1.8 (V)	**1**
	0.38 (A)	**1**
1(a)(ii)	R_1 4.74 (4.737, 4.7)	**1**
1(b)	R_2 = 9.47 OR 9.5 (*2* or 3 significant figures required)	**1**
1(c)	Pointer at 0.13	**1**
1(d)	Statement YES or NO (owtte) Justification to include the idea of within (or beyond, ecf) the limits of experimental accuracy, matching the statement	**1**
1(e)	Determine each resistance in turn	**1**
1(f)	Three resistors in parallel, ONE voltmeter in parallel with resistors and correct symbols for voltmeter and resistors	**1**
	Variable resistor in series with the supply, correct symbol in a correct circuit	**1**
1(g)	Repeat with different currents OR to obtain a range of readings	**1**

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Question	Answer	Marks
2(a)(i),(ii)	v = 6.(0) AND d = 8.(0) or v = 60 AND d = 80	**1**
	correct matching unit	**1**
2(b)(i),(ii),(iii)	V = 60 cm (or 10 × candidate's v) and D = 80 cm (or 10 × candidate's d)	**1**
	UV 1200 (ecf)	**1**
2(c)	**One** from: Different size Different brightness Sharpness / clearness / coloured edges	**1**
2(d)(i),(ii),(iii)	f values 15(.0) and 14.9 (14.87)	**1**
	f_A correct method	**1**
	2 or 3 significant figures	**1**
2(e)	Any **two** from: Difficulty deciding exact position of sharpest image Difficulty measuring to centre of lens Product uv increases problem Image edges blurred / not clear Insufficient sets of results	**2**
2(f)(i)	5 – 10	**1**
2(f)(ii)	Difference of at least 40 cm with a range 15–100	**1**

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Question	Answer		Marks
3	**MP1**	Stopwatch (or equivalent) AND (metre) rule / ruler	**1**
	MP2	Measure time for 5 (+) oscillations	**1**
	MP3	Divide by number of oscillations to find period (*T*)	**1**
	MP4	Repeat for each bob	**1**
	MP5	Variable; one from: Initial amplitude / starting position Length of pendulum / thread Number of oscillations	**1**
	MP6	Table with column headings for *t*, or period (*T*), or both AND *d*, with correct units	**1**
	MP7	Conclusion: Plot graph(s) of *d* against period (*T*) or *t* (or vice versa) OR compare period (*T*) or *t* values for different diameters	**1**

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Question	Answer	Marks
4(a)	1 / *Q* values 1.(0), 0.5(0), 0.3<u>3</u>(3), 0.25, 0.2(0)	**1**
4(b)	Graph:	
	Axes correctly labelled and right way round	**1**
	Suitable scales	**1**
	All 5 plots correct to ½ small square	**1**
	Good line judgement, thin, continuous line	**1**
4(c)(i),(ii)	At least half line used for triangle method	**1**
	Clearly shown on graph	**1**
	P = 1.8 – 2.2 (N)	**1**
4(d)	1.9	**1**
4(e)	Two from: Difficulty in obtaining balance Difficulty in judging centre of loads Loads may slip / slide Forcemeter not sensitive Forcemeter zero error	**2**

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2017**

MARK SCHEME

Maximum Mark: 40

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Answer	Marks
1(a)(i)	*d* = 5.0 (cm)	**1**
1(a)(ii)	*D* = 50 cm	**1**
1(a)(iii)	clear correct use of set-square AND vertical ruler	**1**
1(b)(i)	28.12	**1**
1(b)(ii)	1.406 / 1.41 / 1.4	**1**
	unit s / secs / seconds seen in **1(b)(i)** or **1(b)(ii)** at least once	**1**
1(c)	statement to match readings justification to include the idea of within (or beyond e.c.f.)	**1**
	the limits of experimental accuracy e.g. (very) close / almost equal	**1**
1(d)	final box ticked	**1**
1(e)	V, V, V, V, P, P all correct = 2 marks 4 or 5 correct = 1 mark Fewer than 4 correct = 0 marks	**2**

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Question	Answer	Marks
2(a)	24 (°C)	**1**
2(b)	34 (°C)	**1**
2(c)	30 (°C) AND °C seen once in **2(a)**, **2(b)** or **2(c)**	**1**
2(d)	to make sure that the temperature is the same throughout / to allow the water to mix and reach its final temperature faster	**1**
2(e)	heat loss (to surroundings) / time delays in transferring the water / did not wait for thermometer readings to stabilise / (initial) temperatures of the (cold / hot) water not the same	**1**
2(f)	insulation	**1**
2(g)	same starting temperature (of hot / cold water) / same room temperature	**1**
2(h)	recognisable measuring cylinder	**1**
	perpendicular viewing	**1**
	to bottom of mensicus	**1**

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Question	Answer	Marks
3(a)	Graph	
	axes correctly labelled	**1**
	suitable scales	**1**
	all plots correct to ½ small square	**1**
	good best-fit curve judgement thin, continuous line based on all the plots	**1**
3(b)(i)	2 points and straight line correct	**1**
3(b)(ii)	u_1 and v_1 read correctly to ½ small square	**1**
3(b)(iii)	correct (calculation of) *f* from candidate's values *f* value rounding to 14 – 16cm	**1**
3(c)	any **two** from: upside down less bright / brighter coloured edges different sizes	**2**
3(d)	any **two** from: darkened room / bright object object AND lens AND screen perp. to bench / vertical object and lens same height (from bench) move screen (**not** lens) slowly / backwards and forwards clamp rule / fix rule to bench	**2**

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Question	Answer	Marks
4	**method:** **MP1** measure length of band	1
	MP2 hang load, measure new length	1
	MP3 repeat with different thicknesses/widths	1
	control variable: **MP4** use same (original) length of band each time	1
	table: **MP5** table with columns for thickness, (load) and length / extension with units	1
	conclusion: **MP6** plot a graph of extension / length against thickness (for the same load) OR load against extension / length for different thicknesses OR comparison via a table e.g. compare extensions / lengths of different thicknesses for the same load	1
	one additional point: **MP7** use same load / same range of loads use at least 5 thicknesses / take at least 5 different readings to plot a graph show how to measure extension e.g. $l - l_0$ use same type / material of rubber band	1

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Question	Answer	Marks
1(a)	units ALL correct (symbols or words)	**1**
	t values all present (0, 30, 60, 90, 120, 150 and 180)	**1**
1(b)	**two** appropriate precautions, e.g.: avoidance of parallax(only if explained), wait until reading stops rising at start, ensure thermometer not touching beaker	**2**
1(c)(i)	conclusion matching results	**1**
	correct mention of comparative temperature change over 180 s	**1**
1(c)(ii)	any suitable improvement relating to comparison: e.g. same volume of water, same initial temperature, insulate sides, use plastic beaker, stand on mat, use a thicker / more insulated lid,	**1**
	matching explanation: e.g. lid only factor changed, cooling more rapid for higher temperatures, cooling different for different volumes, thermal energy only escapes from surface, less transfer of thermal energy by sides, effect of lid more marked	**1**
1(c)(iii)	any appropriate similarity: e.g. both cool more rapidly at the start	**1**
1(d)(i)	23 (°C)	**1**
1(d)(ii)	any suitable suggestion with a valid explanation greater temperature at end as cannot fall below room temperature, lower rate of cooling as temperature difference between water and room is smaller	**1**

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Question	Answer	Marks
2(a)	correct voltmeter symbol in parallel with **X**	**1**
2(b)	I_S = 0.18 (A)	**1**
2(c)(i)	V_X = 1.2 (V) AND V_Y = 2.3 (V)	**1**
2(c)(ii)	correct units (A, V) seen in **(b)** and **(c)**	**1**
2(c)(iii)	statement matching readings	**1**
	justification, with use of values seen, matching readings and statement e.g: '3.5 V and 3.7 V are within limits of expt accuracy'	**1**
2(d)	correct calculation of *R*s (20.6)	**1**
	2 / 3 sig figs and unit(Ω)	**1**
2(e)(i)	resistors in parallel with correct symbol	**1**
	rest of circuit correct	**1**
2(e)(ii)	valid suggestion AND explanation consistent with results	**1**

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Question	Answer	Marks
3(a)(i)	F = 0.75	**1**
3(a)(ii)	any reliable method e.g. equal distances between rule and bench in at least two places, line up with named horizontal surface, use of set-square between stand and rule	**1**
3(b)	graph:	
	axes labelled with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid and scales starting at 0,0)	**1**
	plots all correct to ½ small square AND precise plots	**1**
	Well-judged line AND thin line	**1**
3(c)(i)	F_0 correct from graph	**1**
3(c)(ii)	W_R in range 0.90 to 1.4	**1**
	2 / 3 sig figs and unit (N)	**1**
3(d)	statement matching plotted points AND explanation referring to line and scatter of data	**1**
3(e)	repeat all readings and take average	**1**

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Question	Answer		Marks
4	**MP1**	**additional apparatus:** screen AND (metre) rule	**1**
	MP2	**diagram:** suitable arrangement of apparatus with *u* & *v* labelled correctly	**1**
	MP3	**method:** obtain (clear focused) image AND measure *u*, *v*	**1**
	MP4	repeat for other values of *u*	**1**
	MP5	**one precaution for clear, focused image:** move screen slowly / backwards and forwards, object AND lens AND screen perpendicular to bench / vertical, object and lens at same height (from bench), use of dark room / bright light	**1**
	MP6	**one precaution with measurements:** clamp rule / fix to bench, mark centre of lens on holder avoidance of parallax explained and specific	**1**
	MP7	**one additional point:** additional precaution, calculate *f* <u>from given equation</u> at least 3 values obtained, calculate average, mention of at least one appropriate *u* value, mention of preliminary expt to obtain rough *f* value (e.g. light from window)	**1**

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PHYSICS **0625/11**

Paper 1 Multiple Choice (Core) **October/November 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = $10\,m/s^2$).

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1 A student measures the volume of a cork.

He puts some water into a measuring cylinder and then one glass ball. He puts the cork and then a second, identical glass ball into the water as shown.

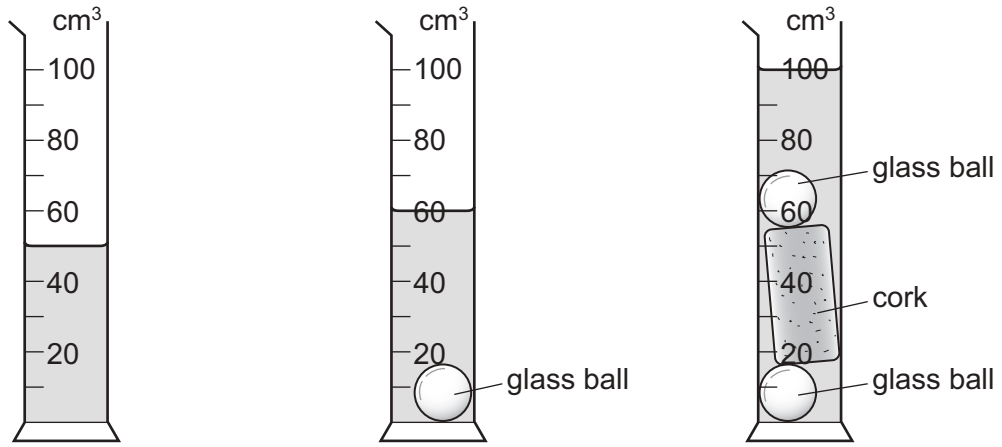


diagram 1 diagram 2 diagram 3

Diagram 1 shows the first water level.

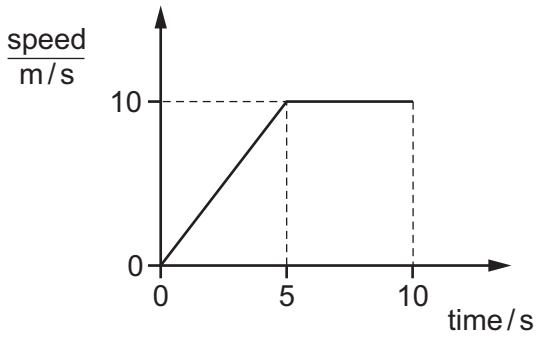
Diagram 2 shows the water level after one glass ball is added.

Diagram 3 shows the water level after the cork and the second glass ball are added.

What is the volume of the cork?

A 30 cm^3 **B** 40 cm^3 **C** 50 cm^3 **D** 100 cm^3

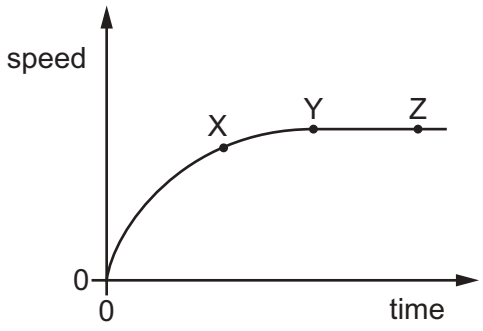
2 The graph shows how the speed of a car varies over a period of 10 s.



How far does the car travel during the 10 s?

A 10 m **B** 50 m **C** 75 m **D** 100 m

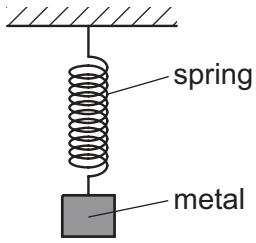
3 The diagram shows how the speed of a falling object changes with time.



Which row describes the motion of the object between X and Y, and between Y and Z?

	between X and Y	between Y and Z
A	accelerating	at rest
B	accelerating	constant speed
C	decelerating	at rest
D	decelerating	constant speed

4 A spring is stretched by hanging a piece of metal from it.



Which name is given to the force that stretches the spring?

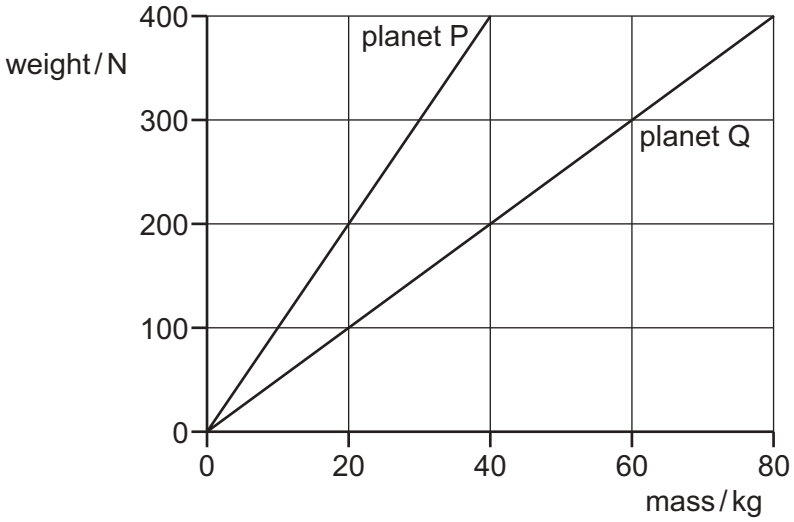
A friction

B mass

C pressure

D weight

5 The graph shows how weight varies with mass on planet P and on planet Q.



An object weighs 400 N on planet P. The object is taken to planet Q.

Which row is correct?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	40	200
B	40	400
C	80	200
D	80	400

6 What is needed to determine the density of a regularly shaped block?

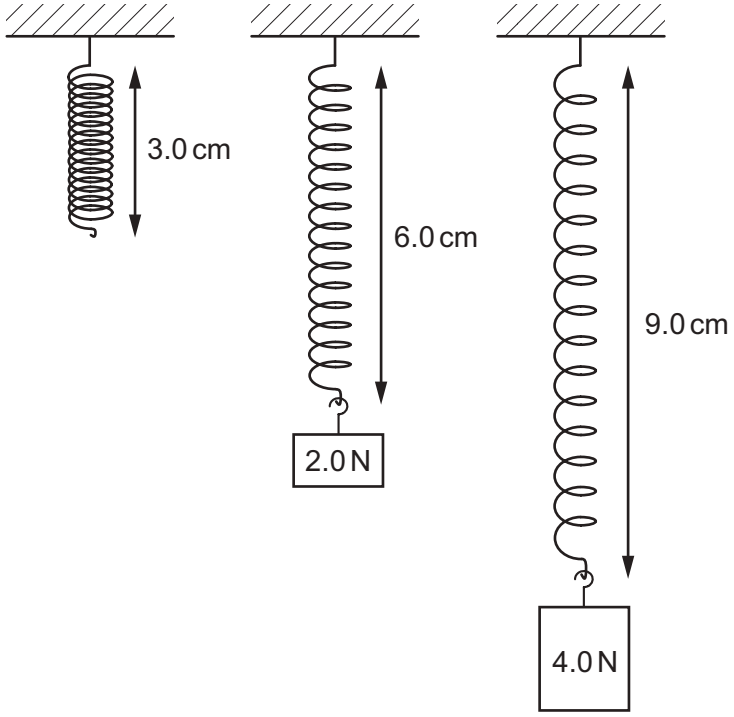
A a balance and a beaker

B a balance and a ruler

C a measuring cylinder and a beaker

D a measuring cylinder and a ruler

7 A student conducts an experiment by hanging different loads on a spring. The diagrams show the lengths of the spring with different loads.



Which row gives the correct extensions of the spring?

	extension / cm		
	0 N	2.0 N	4.0 N
A	0	3.0	3.0
B	0	3.0	6.0
C	3.0	3.0	3.0
D	3.0	6.0	9.0

8 A car mechanic is trying to loosen a wheel nut. He applies a force to the end of a spanner (wrench) at right-angles to the spanner.

Which method provides the largest turning effect on the nut?

A applying double the force to a spanner that is half as long

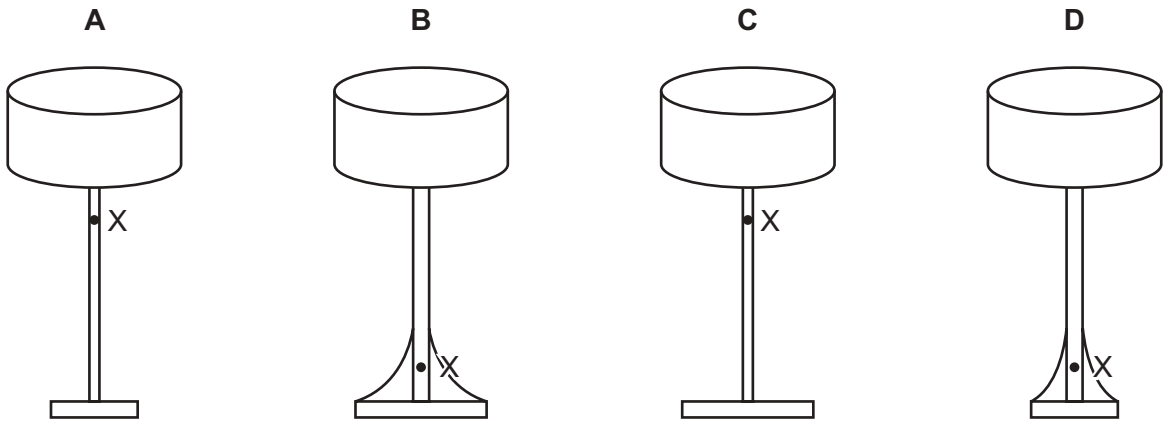
B applying double the force to a spanner that is twice as long

C applying double the force to the same spanner

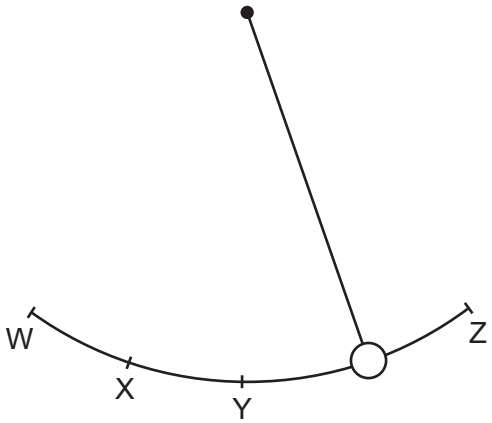
D applying the same force to a spanner that is twice as long

9 The diagrams show four table lamps resting on a table. The position of the centre of mass of each lamp is labelled X.

Which lamp is the most stable?



10 A pendulum bob swings from W, through points X and Y, to Z and then back to W.



Which statement is correct?

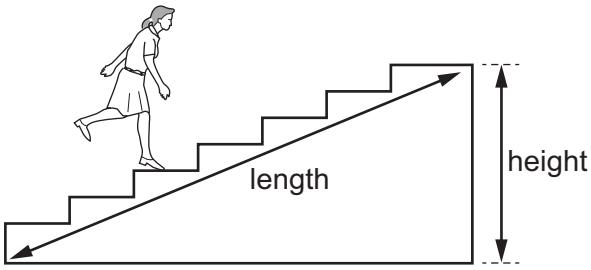
A The gravitational potential energy of the bob is smallest at W.

B The gravitational potential energy of the bob is smallest at X.

C The gravitational potential energy of the bob is smallest at Y.

D The gravitational potential energy of the bob is the same at all points of the swing.

11 A student runs up a flight of stairs.



Which information is **not** needed to calculate the rate at which the student is doing work against gravity?

A the height of the flight of stairs

B the length of the flight of stairs

C the time taken to run up the stairs

D the weight of the student

12 What is a manometer used to determine?

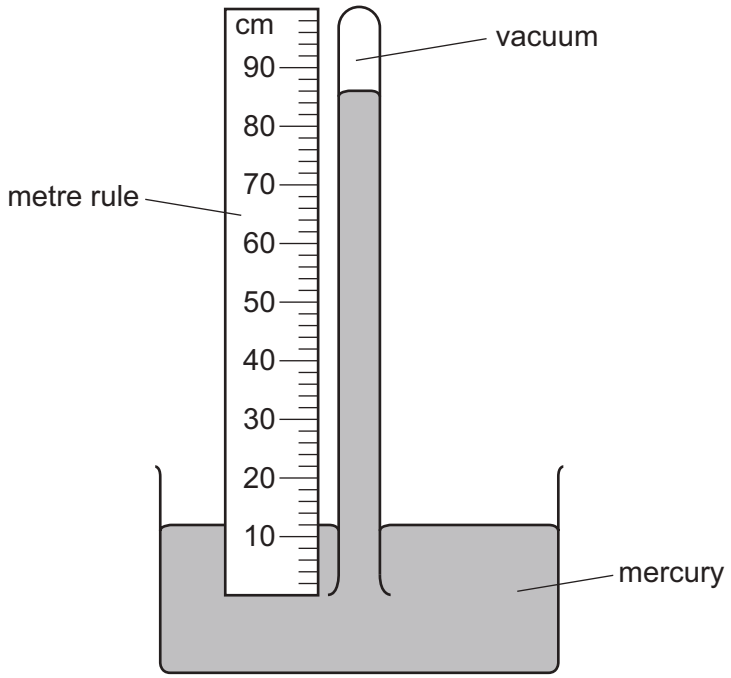
A the difference between two densities

B the difference between two forces

C the difference between two heights

D the difference between two pressures

13 The diagram shows a simple mercury barometer.

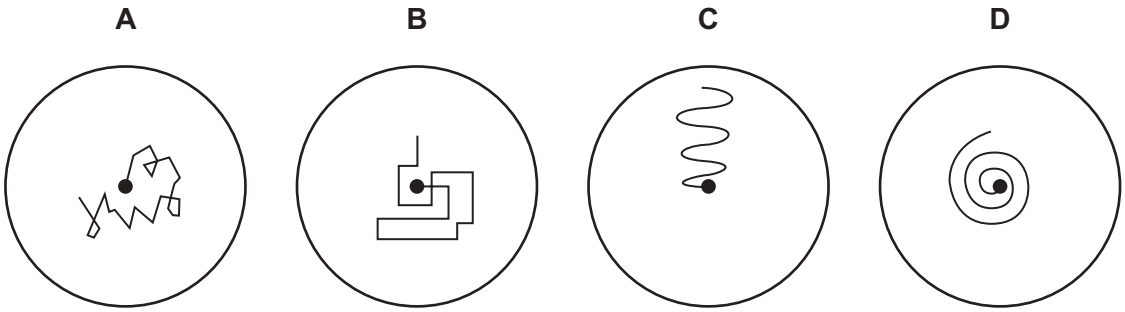


Which length is used to find the value of atmospheric pressure?

A 12 cm **B** 74 cm **C** 86 cm **D** 100 cm

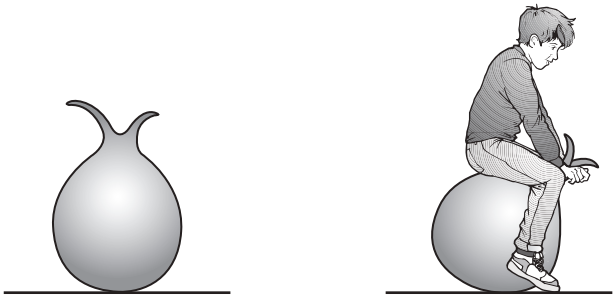
14 A pollen grain in a beaker of still water is viewed through a microscope.

Which diagram shows the most likely movement of the pollen grain?



15 The diagram shows an air-filled rubber toy. A child sits on the toy and its volume decreases.

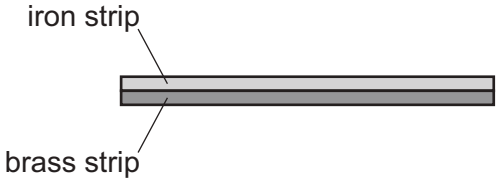
The temperature of the air in the toy does not change.



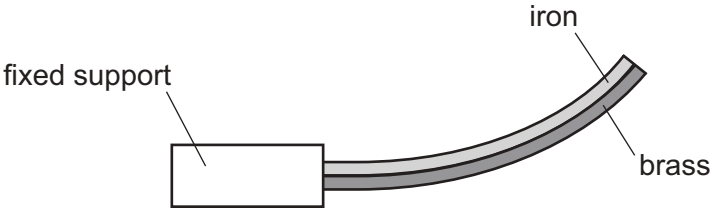
How does the air pressure in the toy change and why?

	pressure	reason
A	decreases	air molecules move more slowly
B	decreases	air molecules strike the rubber less frequently
C	increases	air molecules move more quickly
D	increases	air molecules strike the rubber more frequently

16 A strip of iron and a strip of brass are firmly attached to each other along their entire length. This combination is a bimetallic strip.



This bimetallic strip is heated and it bends as shown.



The bimetallic strip is now cooled and becomes straight again.

What causes the bimetallic strip to become straight again?

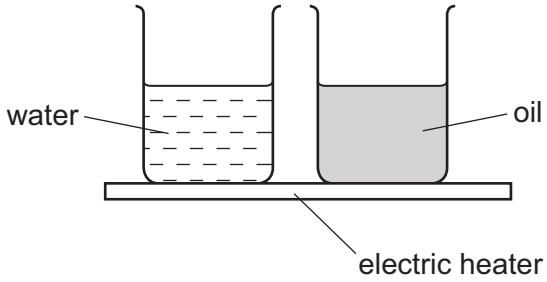
A The brass contracts more than the iron.

B The brass expands more than the iron.

C The iron contracts more than the brass.

D The iron expands more than the brass.

17 The diagram shows an electric heater being used to heat a beaker of water and an identical beaker containing oil. Both are heated for one minute.



The temperature of the water and the temperature of the oil increase steadily. The increase in temperature of the oil is much greater than that of the water.

Why is this?

A Oil has a higher boiling point than water.

B Oil has a lower boiling point than water.

C The oil has a larger thermal capacity than the water.

D The oil has a smaller thermal capacity than the water.

18 The air temperature in a cold room is 15 °C.

A heater that contains water at 50 °C is used to heat the room.

By which process is most of the thermal energy transferred throughout the air in the room?

A conduction

B convection

C evaporation

D radiation

19 Which statement about convection currents is correct?

A Convection currents occur because, when cooled, liquids contract and become more dense.

B Convection currents occur because, when warmed, liquids expand and become more dense.

C Convection currents only occur in liquids.

D Convection currents only occur in solids and liquids.

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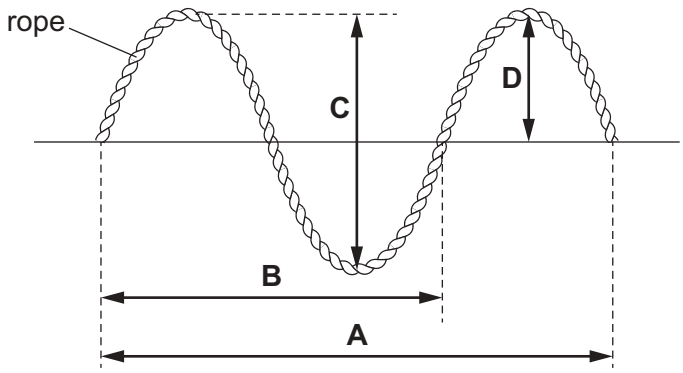
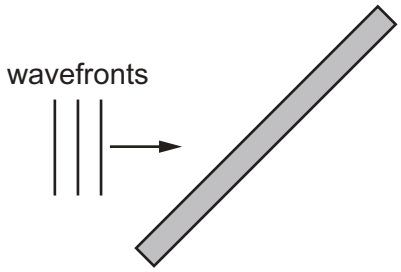
20 The diagram represents a wave travelling along a rope.

Which labelled arrow indicates the wavelength of the wave?

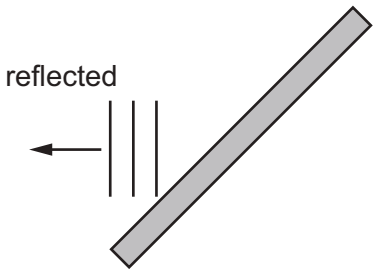


21 The diagram represents plane wavefronts of a water wave about to strike a solid barrier.

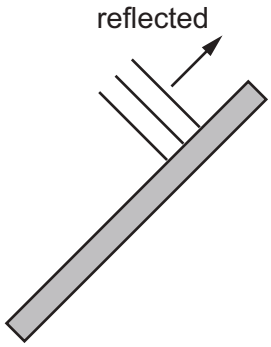


Which diagram shows the position of the wavefronts after reflection at the barrier?

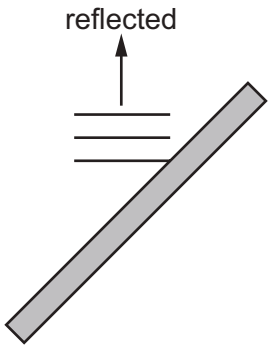
A



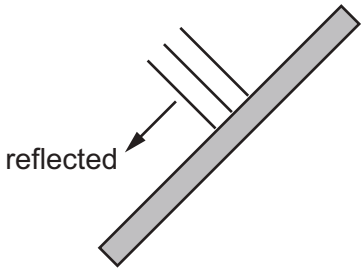
B



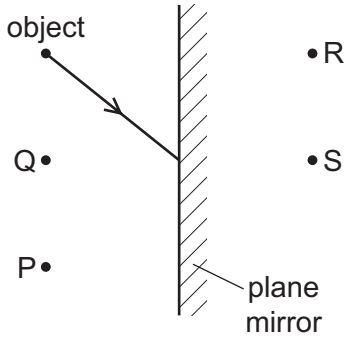
C



D



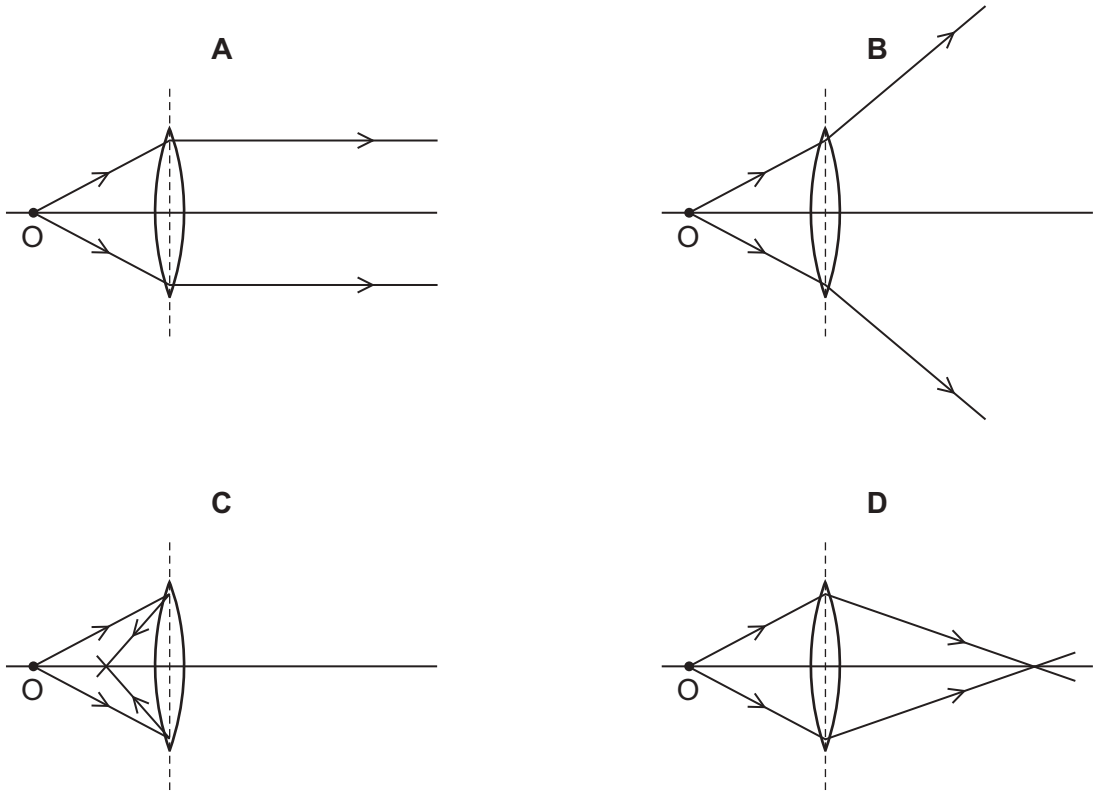
22 The diagram shows an object in front of a plane mirror. A ray of light from the object is incident on the mirror.



Through which point does the reflected ray pass, and at which point is the image of the object formed?

	point through which reflected ray passes	point at which image is formed
A	P	R
B	P	S
C	Q	R
D	Q	S

23 Which ray diagram shows a converging lens forming a real image of a small object O?



24 Visible light, X-rays and microwaves are all components of the electromagnetic spectrum.

Which statement about the waves is correct?

A In a vacuum, microwaves travel faster than visible light and have a shorter wavelength.

B In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.

C In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.

D In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.

25 Space is a vacuum. Waves from stars are used to reveal information about the stars.

Which type of waves do **not** reveal information about stars?

A infra-red

B radio waves

C ultrasound

D γ-rays

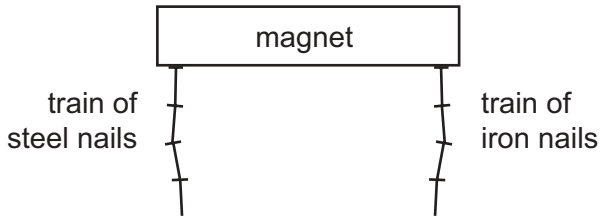
26 A student stands 180 m in front of a vertical, flat cliff and bangs together two pieces of wood to make a short, loud sound.

A timer records the echo of the sound 1.5 seconds after the pieces of wood are banged together.

Based on this result, what is the speed of sound?

A 120 m / s **B** 240 m / s **C** 270 m / s **D** 540 m / s

27 A train of steel nails and a train of iron nails hang from a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains?

A Both trains fall apart.

B Both trains stay together.

C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

28 The north pole of a bar magnet is placed in turn next to each end of a rod X. One end of the rod moves away from the north pole but the other end moves towards the north pole.

The experiment is repeated with the bar magnet and a different rod Y but this time both ends of the rod move towards the north pole.

From which materials could the rods X and Y be made?

	rod X	rod Y
A	soft iron	copper
B	soft iron	soft iron
C	steel	copper
D	steel	soft iron

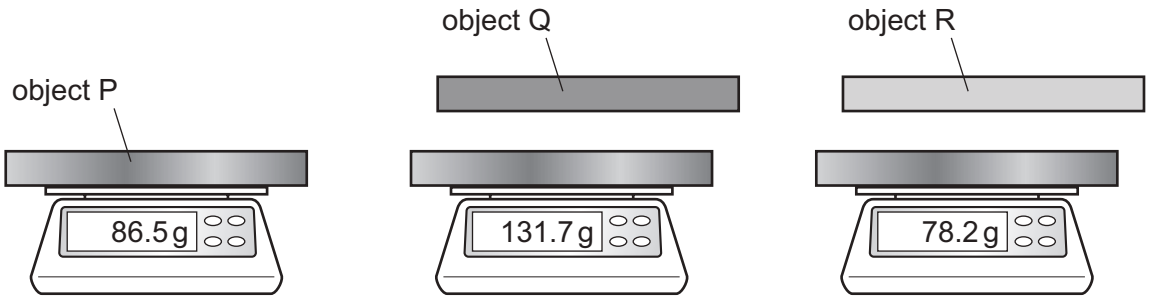
29 A student investigates the electrostatic charges on three objects P, Q and R.

The student places object P on the insulated pan of a balance and notes the reading on the balance.

The student then holds object Q a small distance above object P and notes the reading on the balance.

Finally, the student holds object R the small distance above object P and notes the reading on the balance.

The student's observations are shown.



Which row gives possible charges that explain these observations?

	charge on P	charge on Q	charge on R
A	negative	positive	negative
B	negative	negative	negative
C	positive	positive	negative
D	positive	negative	positive

30 Which equation is used to calculate resistance?

A resistance = p.d. + current

B resistance = p.d. – current

C resistance = p.d. × current

D resistance = p.d. ÷ current

31 A student connects a circuit with a power supply, a lamp and an ammeter.

Where must the ammeter be connected?

A in parallel with the lamp to measure current in the lamp

B in parallel with the lamp to measure potential difference across the lamp

C in series with the lamp to measure current in the lamp

D in series with the lamp to measure potential difference across the lamp

32 Two 3.0 Ω resistors are connected in parallel.

Which statement about their combined resistance is correct?

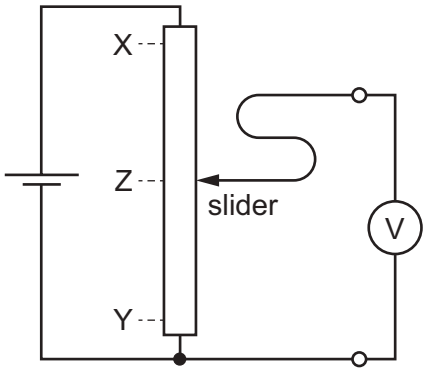
A The combined resistance is less than 3.0 Ω.

B The combined resistance is 3.0 Ω.

C The combined resistance is more than 3.0 Ω but less than 6.0 Ω.

D The combined resistance is 6.0 Ω.

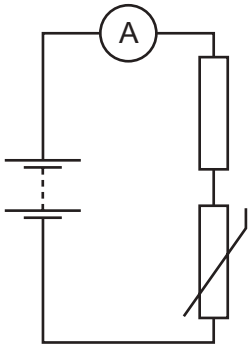
33 The diagram shows a potential divider circuit.



How does the movement of the slider affect the voltmeter reading?

	movement of slider	voltmeter reading
A	Z to X	falls to zero
B	Z to X	increases
C	Z to Y	falls to zero
D	Z to Y	increases

34 The diagram shows a circuit with a fixed resistor connected in series with a thermistor and an ammeter.



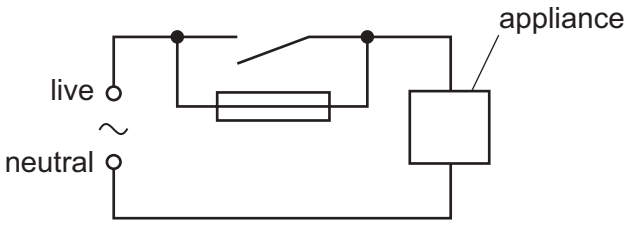
Which row shows how temperature change affects the resistance of the thermistor and the current in the circuit?

	temperature	resistance of thermistor	current in circuit
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

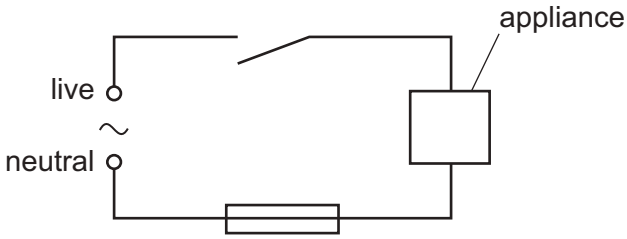
35 An appliance is connected to a mains supply. Its circuit also contains a switch and a fuse.

Which circuit shows the fuse in the correct position?

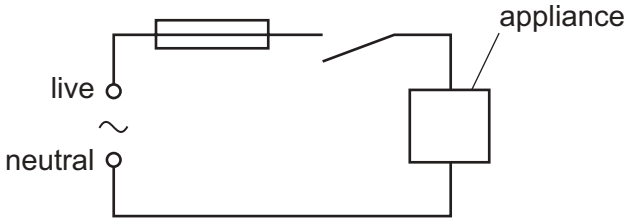
A



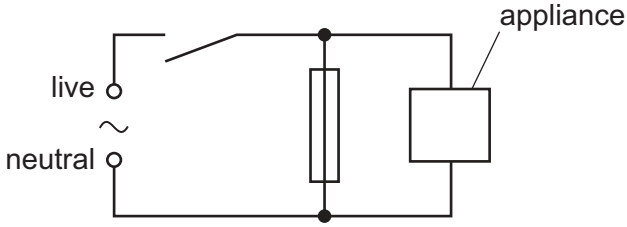
B



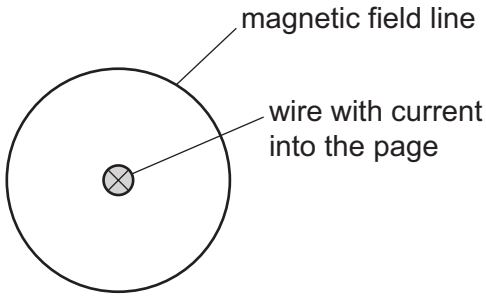
C



D



36 There is an electric current in a straight wire in the direction into the page. This produces a magnetic field around the wire. All the field lines are circles but only one field line is shown.



Which row describes the magnetic field?

	direction of the field lines	spacing of the field lines
A	anti-clockwise	evenly spaced over the whole field
B	anti-clockwise	more widely spaced further from the wire
C	clockwise	evenly spaced over the whole field
D	clockwise	more widely spaced further from the wire

37 A wire carrying a current is placed in a magnetic field. The wire experiences a force due to the field.

Which action does **not** change the direction of the force?

A increasing the current and reversing the field direction

B increasing the current, keeping the field direction constant

C reversing the current and increasing the field strength

D reversing the current, keeping the field direction constant

38 Different isotopes of chlorine are represented as $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

They behave the same way chemically.

Why is this?

A They have the same nuclide notation.

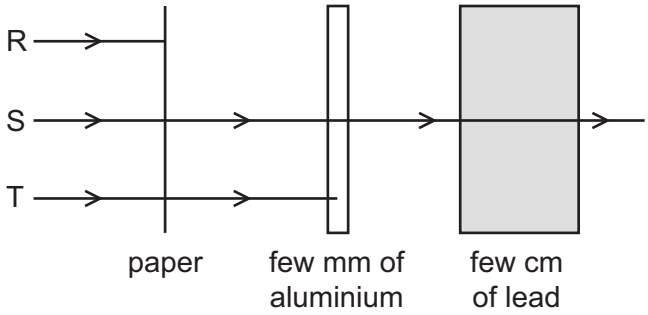
B They have the same number of neutrons.

C They have the same number of nucleons.

D They have the same number of protons.

39 A radioactive source emits three types of radiation R, S and T.

The diagram shows an experiment set up to study the penetrating properties of R, S and T.



Which types of radiation are R, S and T?

	R	S	T
A	α-particles	β-particles	γ-rays
B	α-particles	γ-rays	β-particles
C	β-particles	α-particles	γ-rays
D	γ-rays	β-particles	α-particles

40 What is meant by the *half-life* of a radioactive isotope?

A half of the time taken for all of the original nuclei to decay

B the time taken for half of the original nuclei to decay

C the time taken for the charges on all the nuclei to halve

D the time taken for the mass of each nucleus to halve

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/12**

Paper 1 Multiple Choice (Core) **October/November 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.

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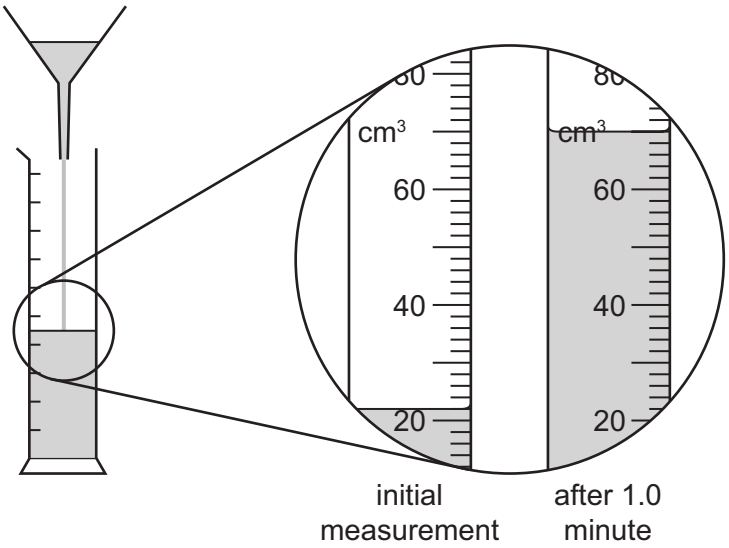
1 A student investigates the rate of flow of oil through a funnel.

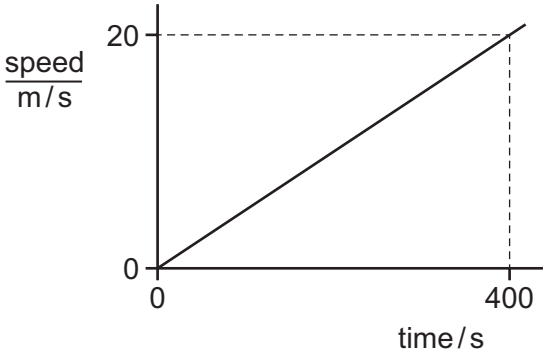
The diagrams show the experiment and the volume of oil in the measuring cylinder at the start of the experiment, and one minute later.



What is the rate of flow of oil through the funnel during the one minute?

A 0.73 cm^3/s **B** 0.80 cm^3/s **C** 44 cm^3/s **D** 48 cm^3/s

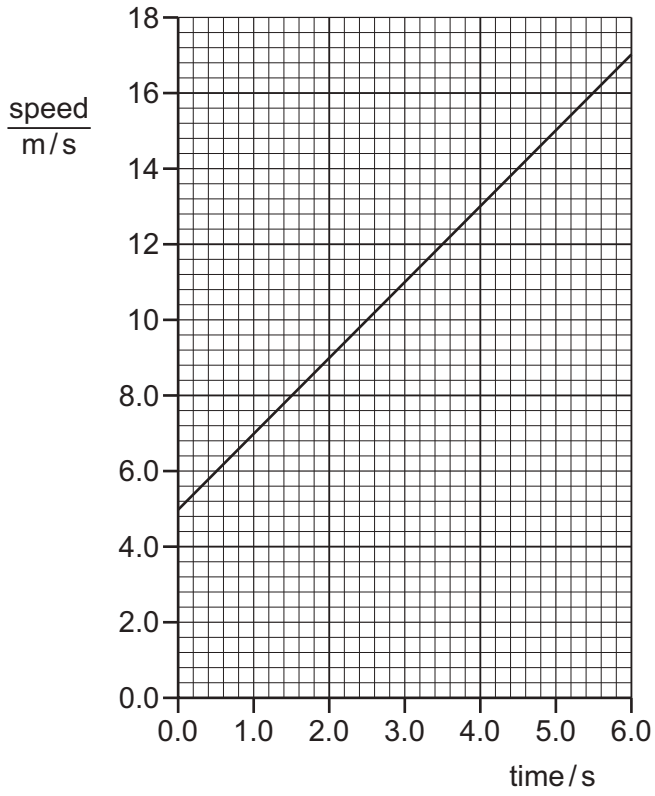
2 The graph represents the motion of a vehicle.



What is the distance travelled by the vehicle in 400 s?

A 20 m **B** 400 m **C** 4000 m **D** 8000 m

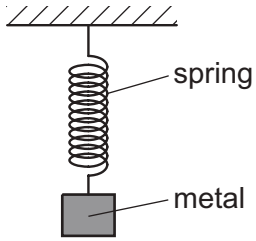
3 The speed-time graph represents the motion of an object.



What is the average speed of the object?

A 2.0 m/s **B** 6.0 m/s **C** 8.5 m/s **D** 11 m/s

4 A spring is stretched by hanging a piece of metal from it.



Which name is given to the force that stretches the spring?

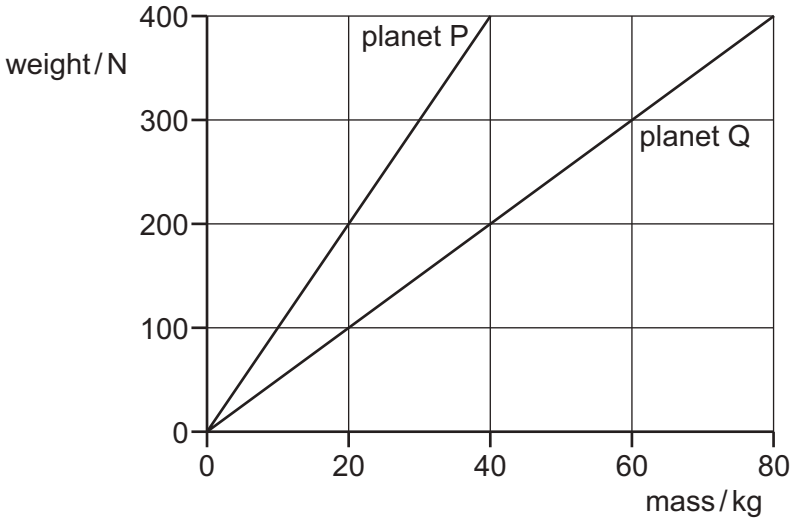
A friction

B mass

C pressure

D weight

5 The graph shows how weight varies with mass on planet P and on planet Q.



An object weighs 400 N on planet P. The object is taken to planet Q.

Which row is correct?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	40	200
B	40	400
C	80	200
D	80	400

6 What is needed to determine the density of a regularly shaped block?

A a balance and a beaker

B a balance and a ruler

C a measuring cylinder and a beaker

D a measuring cylinder and a ruler

7 The diagram shows an aircraft flying in a straight horizontal line at constant speed.

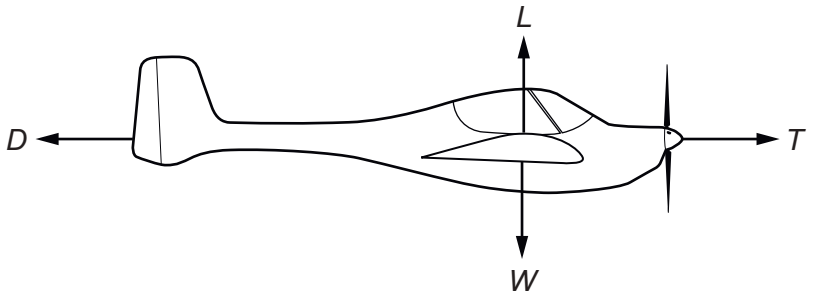
W is the weight of the aircraft.

L is the lift (upward force) due to air flow over the wings.

T is the thrust force due to the engine.

D is the air resistance (drag).

The diagram shows the direction of these forces.



What are the relationships between the forces?

A *L* = *W* and *T* = *D*

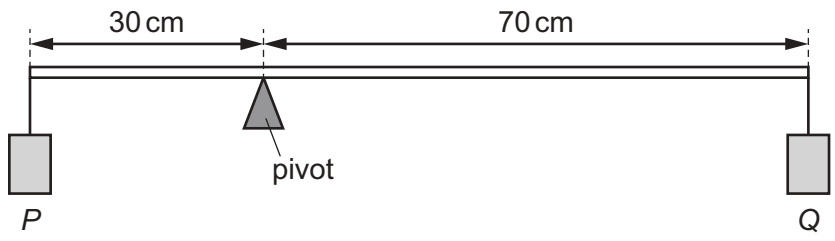
B *L* = *W* and *T* is greater than *D*

C *L* is greater than *W* and *T* = *D*

D *L* is greater than *W* and *T* is greater than *D*

8 A pivoted beam supports a load *P* at one end and a load *Q* at the other end.

The weight of the beam can be ignored.



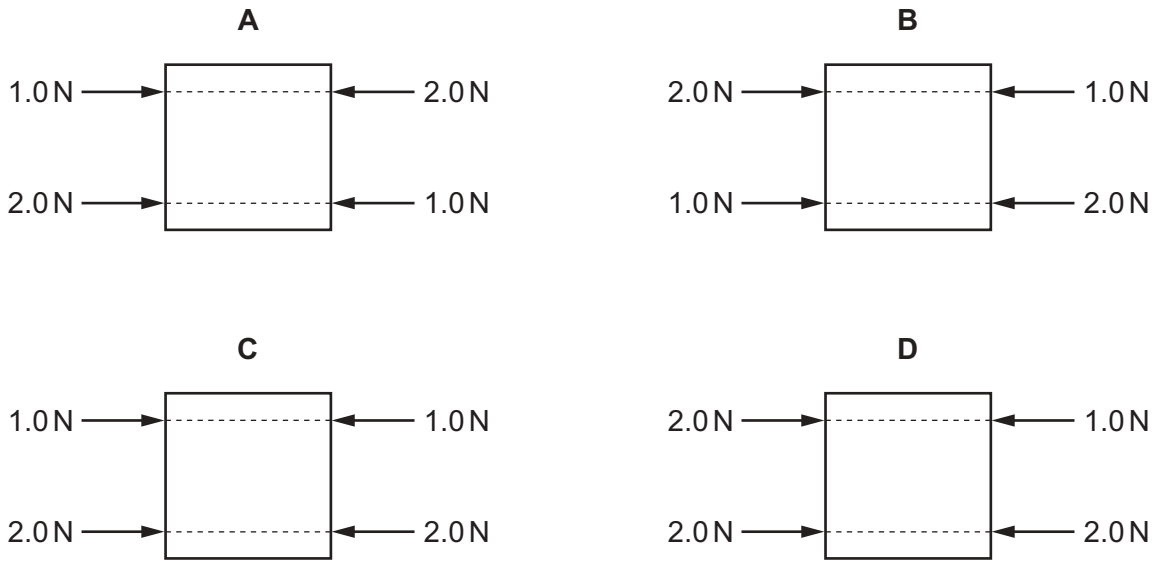
The beam is balanced.

Which row gives possible values for *P* and for *Q*?

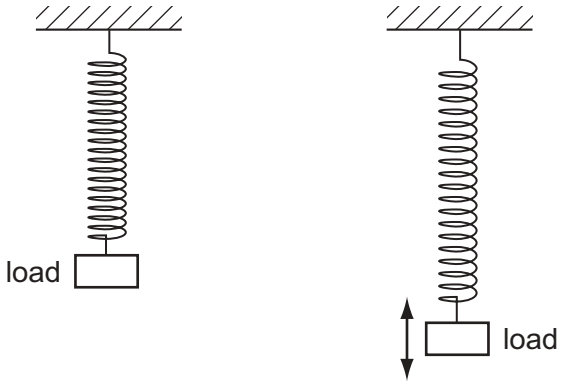
	P / N	*Q* / N
A	21	7
B	21	9
C	30	10
D	30	70

9 Each diagram shows a metal plate with four parallel forces acting on it. These are the only forces acting on the plates.

In which diagram is the plate in equilibrium?



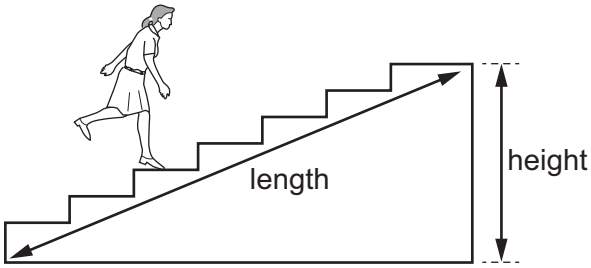
10 A load is attached to the end of a spring. A student pulls the load down from its rest position and releases it. It oscillates vertically and eventually comes to rest.



Which row gives the type of energy transferred to the apparatus, and the type of energy to which this has then been transferred when the load comes to rest?

	type of energy transferred to the apparatus	type of energy to which this has then been transferred when the load comes to rest
A	elastic energy in the spring	chemical energy in the spring and in the air
B	elastic energy in the spring	thermal energy in the spring and in the air
C	gravitational potential energy in the load	chemical energy in the spring and in the air
D	gravitational potential energy in the load	thermal energy in the spring and in the air

11 A student runs up a flight of stairs.



Which information is **not** needed to calculate the rate at which the student is doing work against gravity?

A the height of the flight of stairs

B the length of the flight of stairs

C the time taken to run up the stairs

D the weight of the student

12 A book has a mass of 400 g.

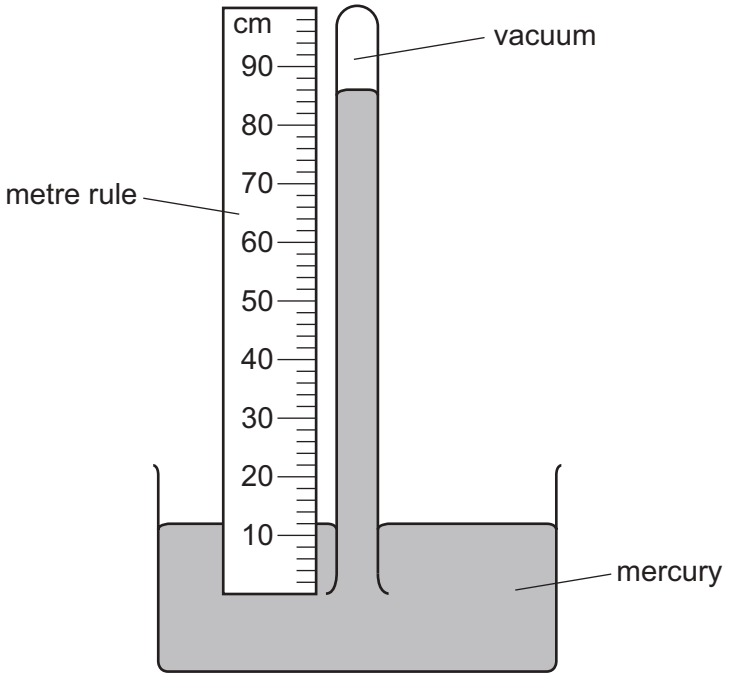
One of its surfaces measures 0.10 m × 0.20 m. This surface is in contact with a table.

The gravitational field strength *g* is 10 N / kg.

What is the pressure exerted on the table due to the book?

A 0.08 N / m^2 **B** 8.0 N / m^2 **C** 20 N / m^2 **D** 200 N / m^2

13 The diagram shows a simple mercury barometer.

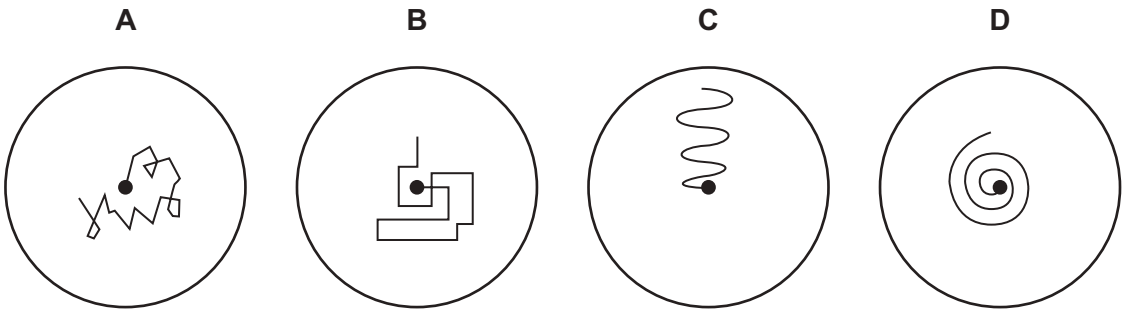


Which length is used to find the value of atmospheric pressure?

A 12 cm **B** 74 cm **C** 86 cm **D** 100 cm

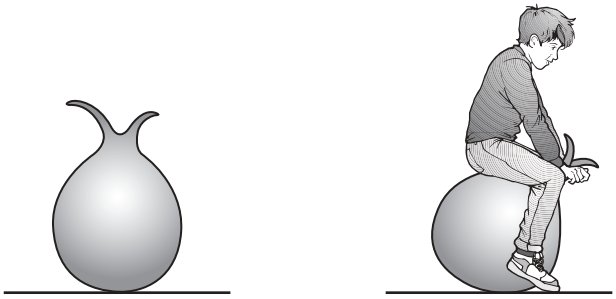
14 A pollen grain in a beaker of still water is viewed through a microscope.

Which diagram shows the most likely movement of the pollen grain?



15 The diagram shows an air-filled rubber toy. A child sits on the toy and its volume decreases.

The temperature of the air in the toy does not change.



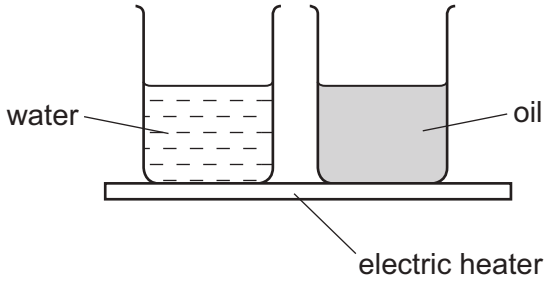
How does the air pressure in the toy change and why?

	pressure	reason
A	decreases	air molecules move more slowly
B	decreases	air molecules strike the rubber less frequently
C	increases	air molecules move more quickly
D	increases	air molecules strike the rubber more frequently

16 Which row identifies the fixed points on the Celsius scale?

	lower fixed point	upper fixed point
A	boiling point of mercury	melting point of pure ice
B	boiling point of pure water	melting point of pure ice
C	melting point of mercury	boiling point of pure water
D	melting point of pure ice	boiling point of pure water

17 The diagram shows an electric heater being used to heat a beaker of water and an identical beaker containing oil. Both are heated for one minute.



The temperature of the water and the temperature of the oil increase steadily. The increase in temperature of the oil is much greater than that of the water.

Why is this?

A Oil has a higher boiling point than water.

B Oil has a lower boiling point than water.

C The oil has a larger thermal capacity than the water.

D The oil has a smaller thermal capacity than the water.

18 Which statement about the direction of a change of state is correct?

A Evaporation is the reverse process to boiling.

B Evaporation is the reverse process to condensation.

C Evaporation is the reverse process to melting.

D Evaporation is the reverse process to solidification.

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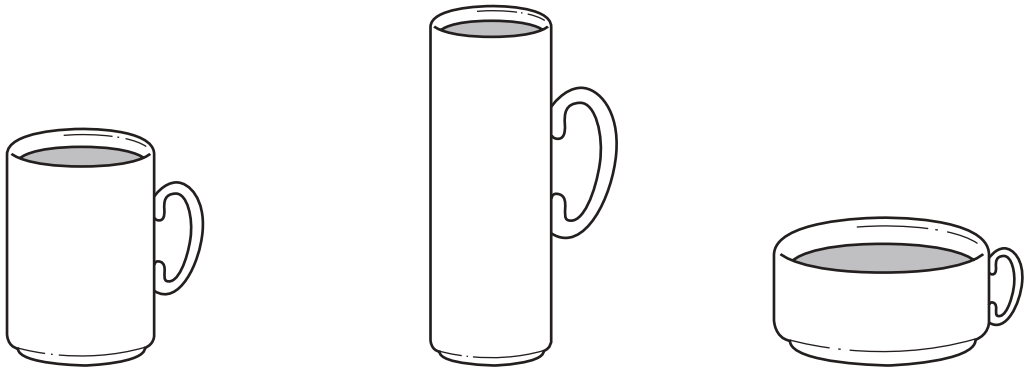
19 Three cups are made from the same insulating material.



cup 1 cup 2 cup 3

The cups are each filled with the same volume of hot tea.

In which cup does the tea cool most quickly and in which cup does it cool most slowly?

	most quickly	most slowly
A	1	3
B	2	1
C	3	2
D	3	1

20 Why does a balloon filled with hot air rise?

A Cold air is less dense than hot air.

B Cold air is more dense than hot air.

C Heat rises.

D The density of the balloon is greater than the density of the surrounding gas.

21 A wave moves along the surface of water.

What is the wavelength of the wave?

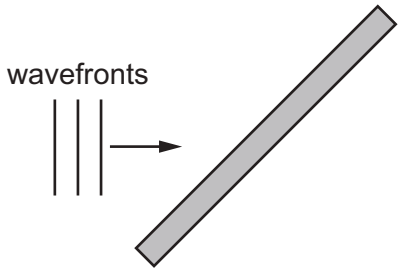
A the distance between one crest and the next crest

B the distance that a crest moves along the surface in one second

C the distance that a particle of water moves up and down

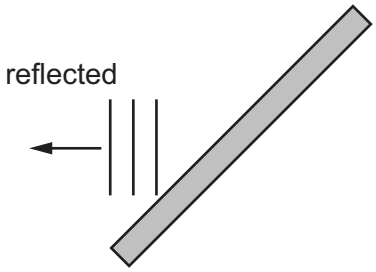
D the number of waves that pass a fixed point in one second

22 The diagram represents plane wavefronts of a water wave about to strike a solid barrier.

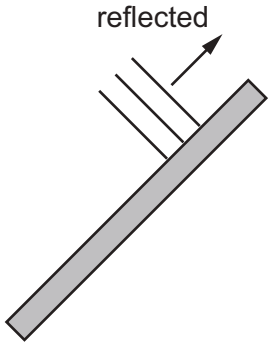


Which diagram shows the position of the wavefronts after reflection at the barrier?

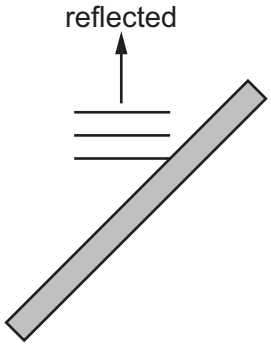
A



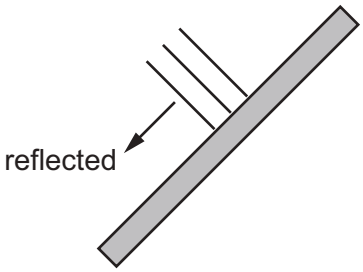
B



C

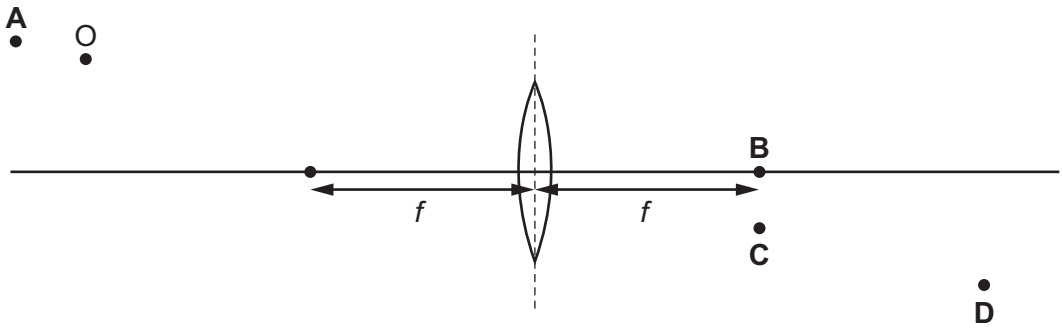


D

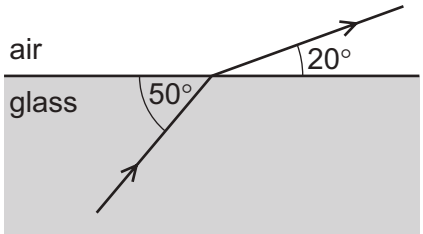


23 The diagram shows an object O in front of a thin converging lens of focal length *f*.

At which point will the lens form a sharp image of the object?



24 The diagram shows light travelling from glass to air.



What is the angle of refraction for this ray of light?

A 20° **B** 40° **C** 50° **D** 70°

25 Which piece of equipment is designed to produce a type of electromagnetic wave?

A electric fire

B electric generator

C electric motor

D electromagnet

26 What is ultrasound?

A sound waves that are so loud that they damage human hearing

B sound waves that are too high-pitched for humans to hear

C sound waves that are too low-pitched for humans to hear

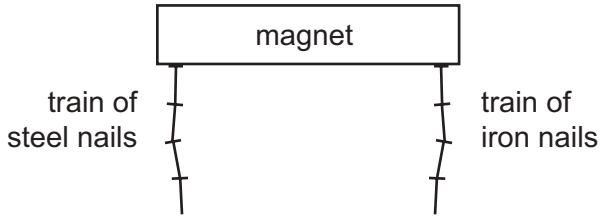
D sound waves that are too quiet for humans to hear

27 A student finds that it takes sound 0.33 seconds to travel 100 metres.

From this information, what is the speed of sound?

A 30 m / s **B** 60 m / s **C** 300 m / s **D** 600 m / s

28 A train of steel nails and a train of iron nails hang from a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains?

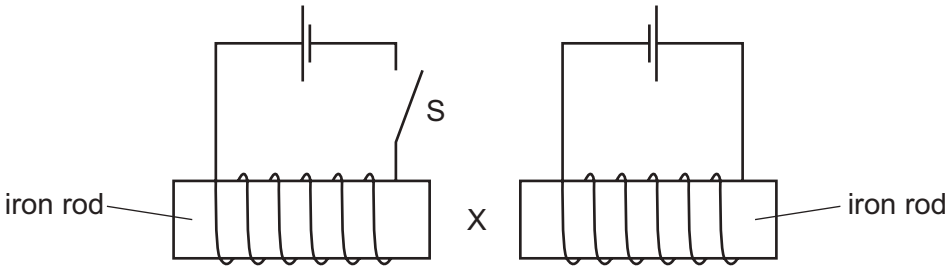
A Both trains fall apart.

B Both trains stay together.

C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

29 Two circuits are set up as shown. The iron rods are placed close together and are able to move.



What happens to the size of the gap at X when switch S is closed?

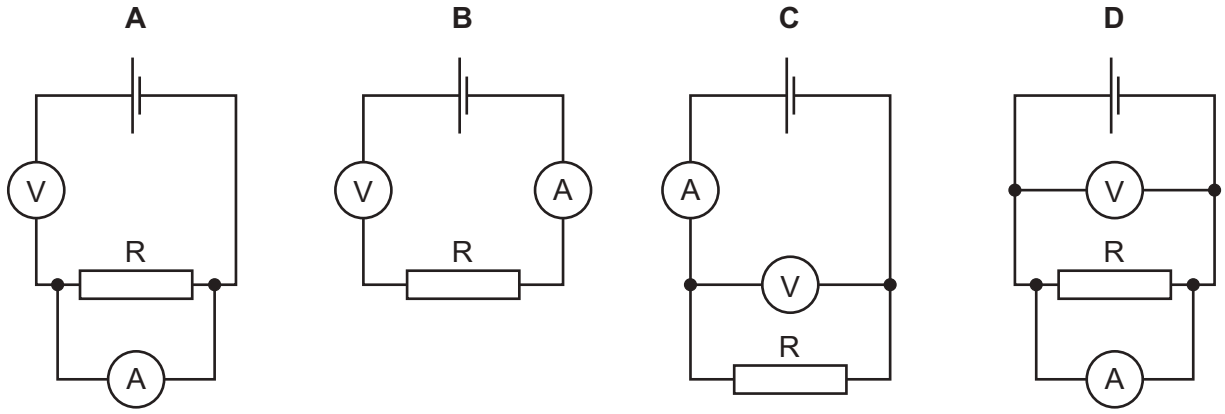
A It decreases.

B It decreases then increases.

C It increases.

D It does not change.

30 Which circuit can be used to determine the resistance of resistor R?



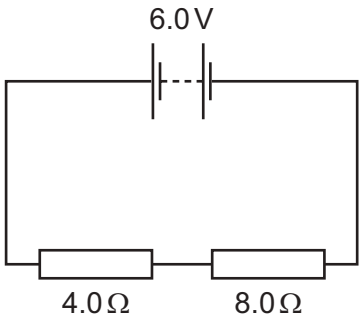
31 A wire has a resistance *R*.

A second wire made from the same metal has double the length and has double the diameter of the first wire.

What is the resistance of the second wire?

A $\frac{R}{2}$ **B** R **C** $4R$ **D** $8R$

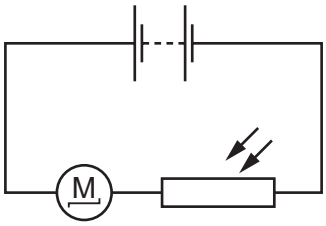
32 The circuit diagram shows a 4.0 Ω resistor and an 8.0 Ω resistor connected to a 6.0 V battery.



What is the potential difference (p.d.) across the 4.0 Ω resistor?

A 0.5 V **B** 2.0 V **C** 4.0 V **D** 6.0 V

33 The diagram shows a motor and a light-dependent resistor (LDR) connected in a circuit.



Which change decreases the current in the motor so that it turns more slowly?

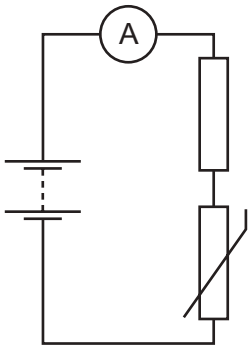
A connecting a resistor in parallel with the LDR

B connecting a resistor in series with the LDR

C exchanging the positions of the motor and the LDR in the circuit

D increasing the brightness of the light falling on the LDR

34 The diagram shows a circuit with a fixed resistor connected in series with a thermistor and an ammeter.

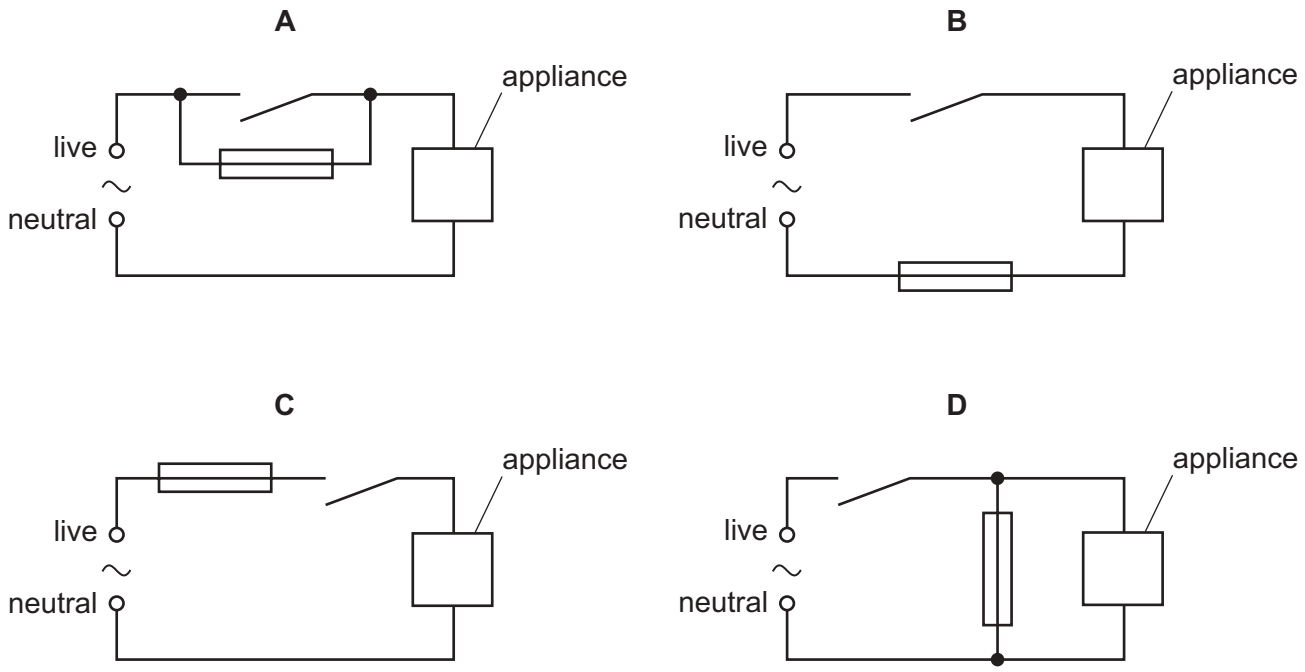


Which row shows how temperature change affects the resistance of the thermistor and the current in the circuit?

	temperature	resistance of thermistor	current in circuit
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

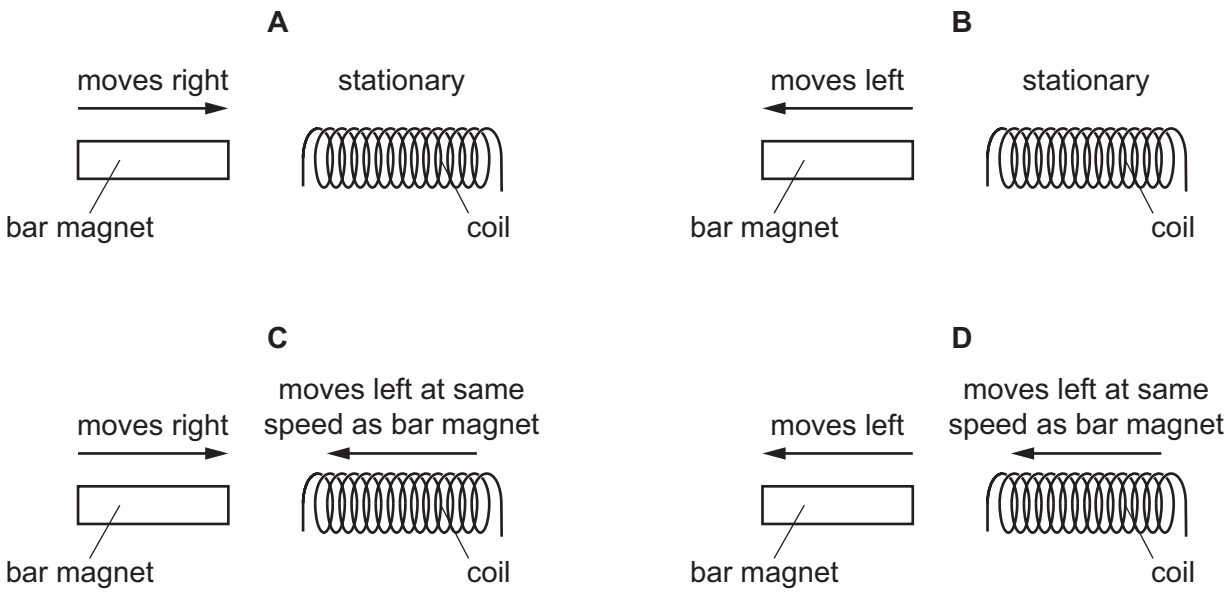
35 An appliance is connected to a mains supply. Its circuit also contains a switch and a fuse.

Which circuit shows the fuse in the correct position?



36 The diagram shows a bar magnet and a coil of wire. The bar magnet is moved at the same speed in each experiment.

In which situation is the largest electromotive force (e.m.f.) induced?



37 Diagram 1 shows a wire carrying an electric current. The wire is between the poles of a magnet.

The current and the magnetic field produce a force on the wire which is upwards, as shown.

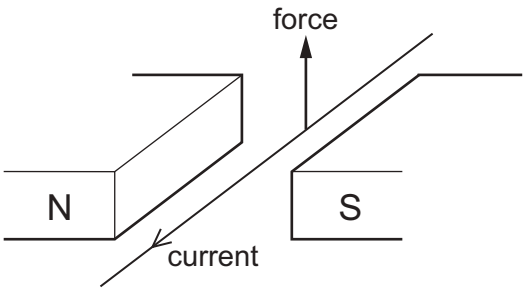


diagram 1

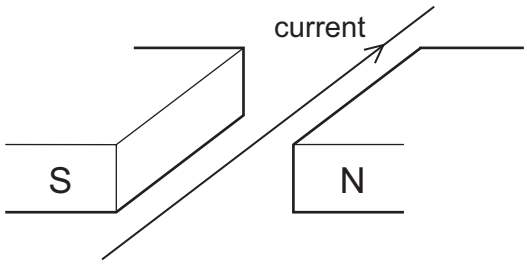


diagram 2

The magnetic poles and the current are now both reversed, as in diagram 2.

In which direction is the force on the wire in diagram 2?

A downwards

B towards the North pole of the magnet

C towards the South pole of the magnet

D upwards

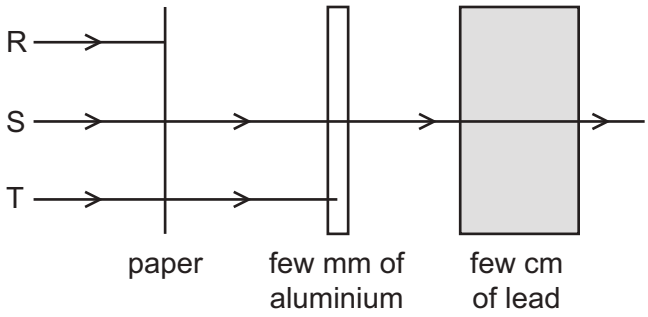
38 A nuclide of radon-222 is represented by $^{222}_{86}Rn$.

How many protons and how many neutrons are in a nucleus of this nuclide?

	protons	neutrons
A	86	136
B	86	222
C	222	86
D	222	136

39 A radioactive source emits three types of radiation R, S and T.

The diagram shows an experiment set up to study the penetrating properties of R, S and T.



Which types of radiation are R, S and T?

	R	S	T
A	α-particles	β-particles	γ-rays
B	α-particles	γ-rays	β-particles
C	β-particles	α-particles	γ-rays
D	γ-rays	β-particles	α-particles

40 A radioactive source has a half-life of 0.5 hours.

A detector near the source shows a reading of 6000 counts per second.

Background radiation can be ignored.

What is the reading on the detector 1.5 hours later?

A 750 counts per second

B 1500 counts per second

C 2000 counts per second

D 3000 counts per second

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/13**

Paper 1 Multiple Choice (Core) **October/November 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = $10\,m/s^2$).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.

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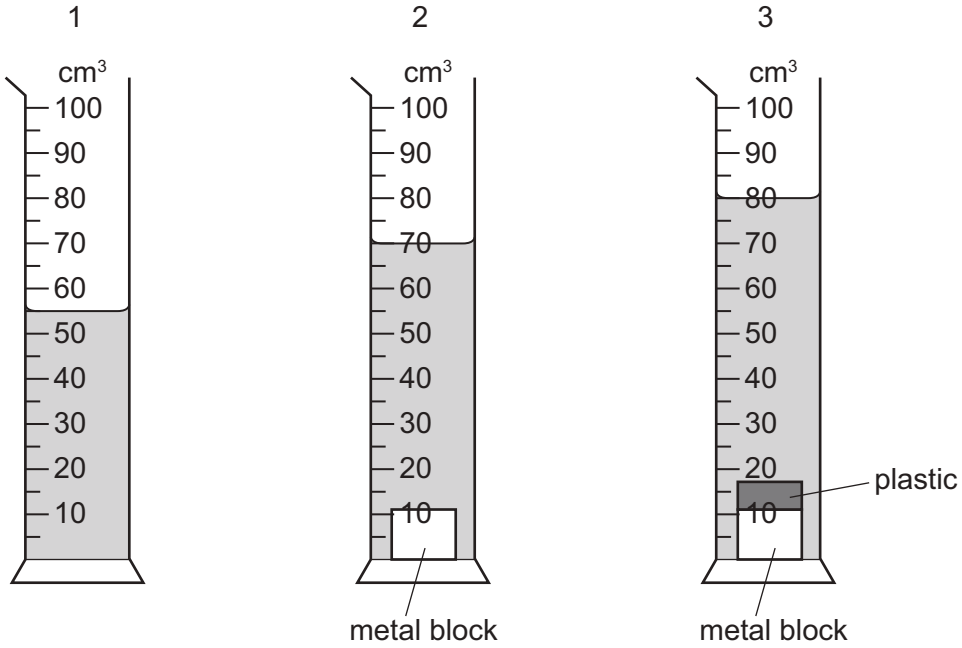
1 A measuring cylinder contains some water. A small metal block is slowly lowered into the water and is then removed.

Finally a piece of plastic is attached to the metal block and the block is again slowly lowered into the water.

The diagrams show the measuring cylinder at each stage of this process.

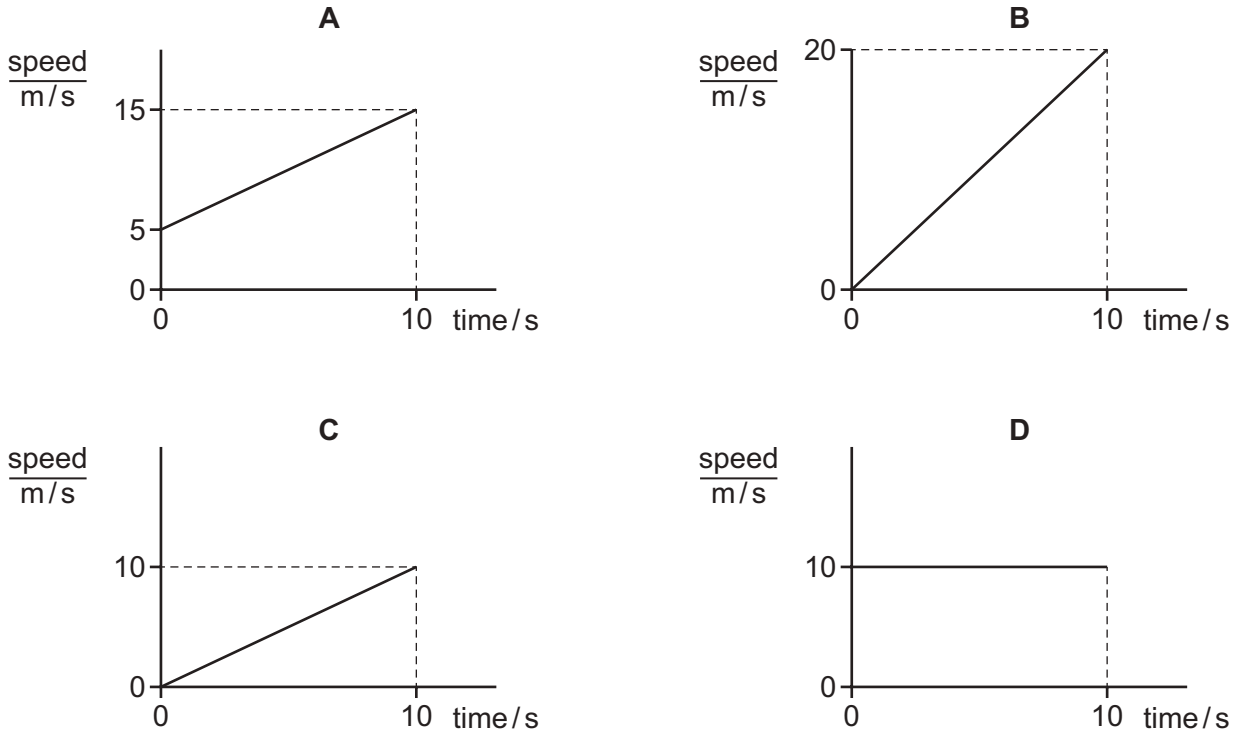


What is the volume of the piece of plastic?

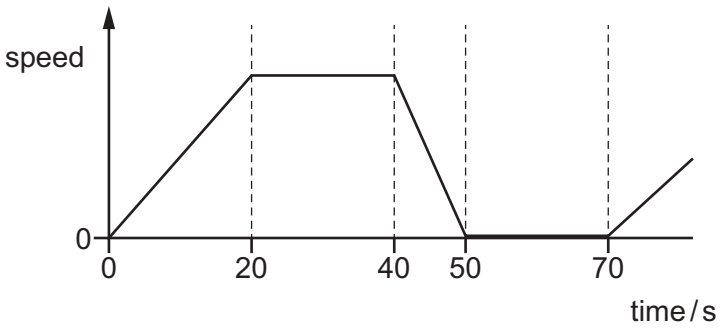
A 10 cm^3 **B** 25 cm^3 **C** 70 cm^3 **D** 80 cm^3

2 A car accelerates from rest and travels a distance of 100 m in 10 seconds.

Which speed-time graph represents the motion of this car?



3 The diagram is the speed-time graph for a bicycle journey.



When is the bicycle moving at a constant speed?

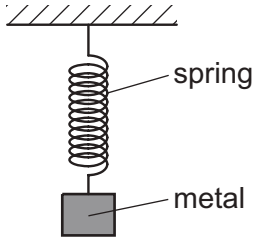
A between 0 and 20 s

B between 20 s and 40 s

C between 40 s and 50 s

D between 50 s and 70 s

4 A spring is stretched by hanging a piece of metal from it.



Which name is given to the force that stretches the spring?

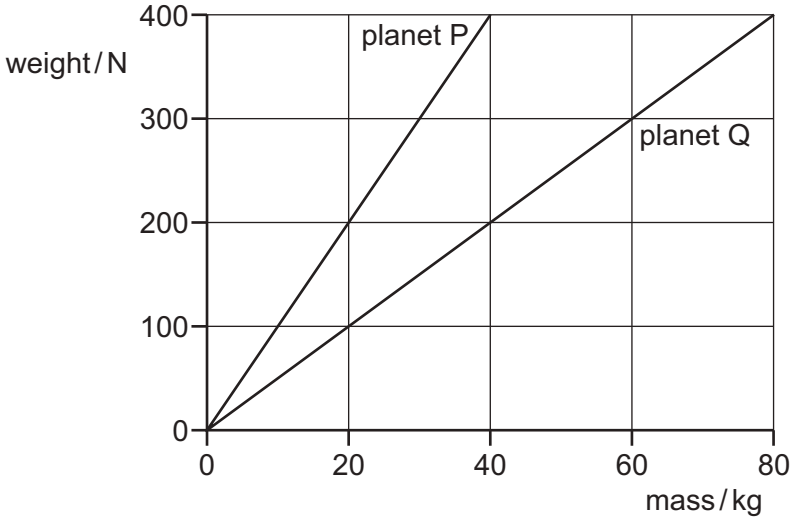
A friction

B mass

C pressure

D weight

5 The graph shows how weight varies with mass on planet P and on planet Q.



An object weighs 400 N on planet P. The object is taken to planet Q.

Which row is correct?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	40	200
B	40	400
C	80	200
D	80	400

6 What is needed to determine the density of a regularly shaped block?

A a balance and a beaker

B a balance and a ruler

C a measuring cylinder and a beaker

D a measuring cylinder and a ruler

7 A cart experiences a forward force of 500 N.

The cart also experiences a backward force of 200 N.

There are no other forward or backward forces on the cart.

What is the resultant force on the cart?

A 300 N backwards

B 300 N forwards

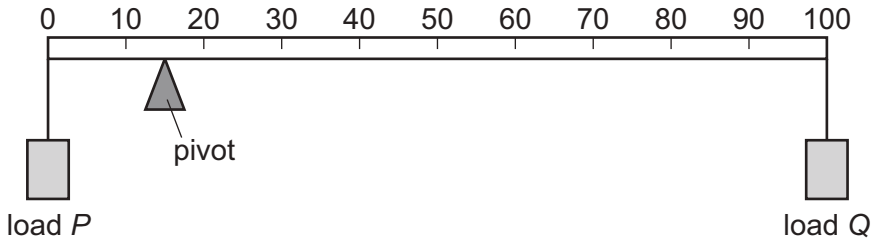
C 700 N backwards

D 700 N forwards

8 The diagram shows a beam with a pivot, a load *P* at one end and a load *Q* at the other end.

The pivot can be moved left or right and the loads can be increased or decreased.

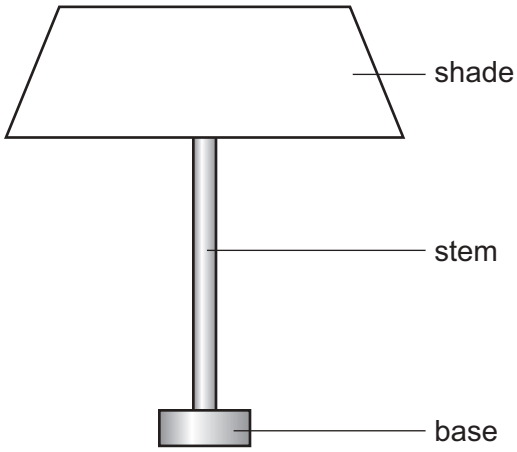
The weight of the beam can be ignored.



Which combination of pivot position and loads causes the beam to be in equilibrium?

	pivot position / cm	load *P* / N	load *Q* / N
A	30	6.0	4.0
B	40	6.0	4.0
C	50	5.0	9.0
D	60	3.0	9.0

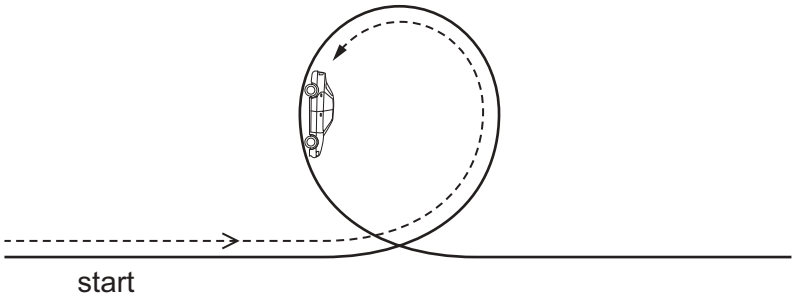
9 The lamp in the diagram is not very stable and falls over easily.



Which row shows changes that would definitely make the lamp more stable?

	base	centre of gravity
A	narrower	higher
B	narrower	lower
C	wider	higher
D	wider	lower

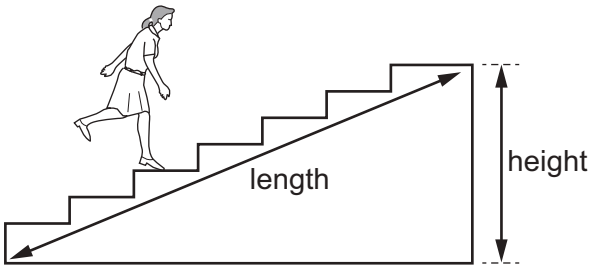
10 A toy car without a motor is moving at high speed along a track. The toy car follows a vertical loop as shown.



Which row describes the changes that are taking place in the kinetic energy and in the gravitational potential energy of the car in the position shown?

	kinetic energy	gravitational potential energy
A	decreasing	decreasing
B	decreasing	increasing
C	increasing	decreasing
D	increasing	increasing

11 A student runs up a flight of stairs.



Which information is **not** needed to calculate the rate at which the student is doing work against gravity?

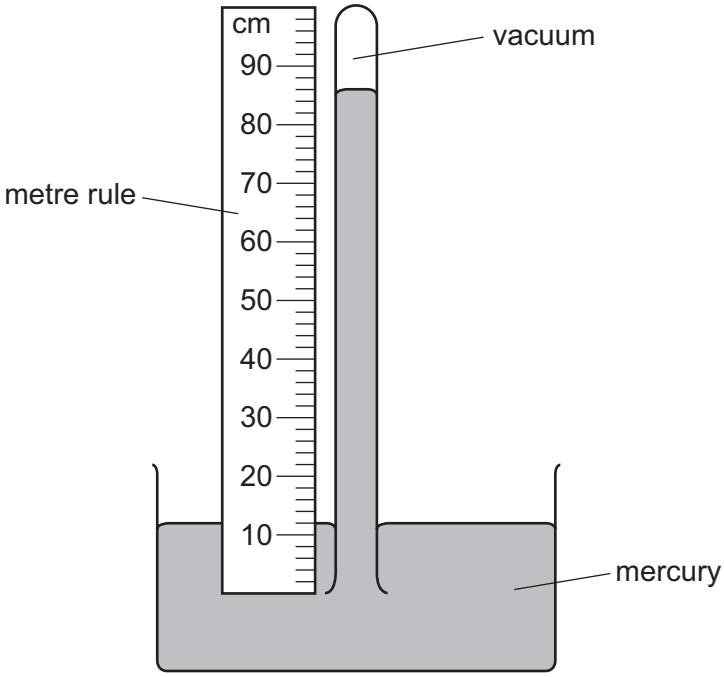
A the height of the flight of stairs

B the length of the flight of stairs

C the time taken to run up the stairs

D the weight of the student

12 The diagram shows a simple mercury barometer.



Which length is used to find the value of atmospheric pressure?

A 12 cm **B** 74 cm **C** 86 cm **D** 100 cm

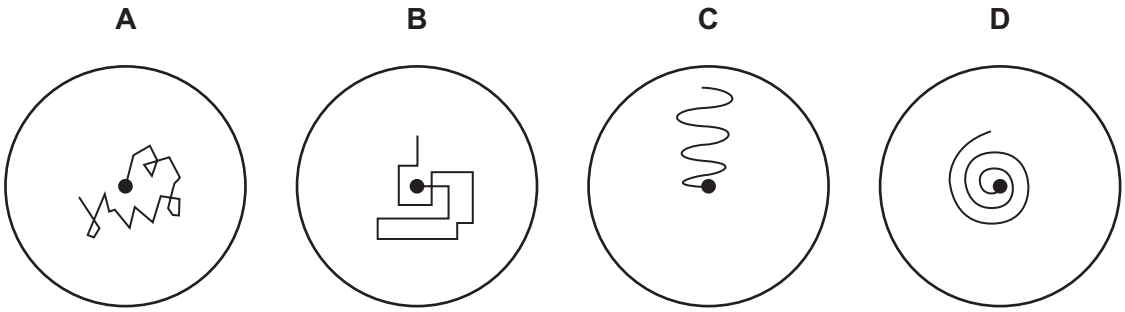
13 A polystyrene cube of mass 5.0 kg is placed on a horizontal surface. The pressure due to the cube is 89 N / m^2.

What is the length of the sides of the cube?

A 0.56 m **B** 0.75 m **C** 1.3 m **D** 1.8 m

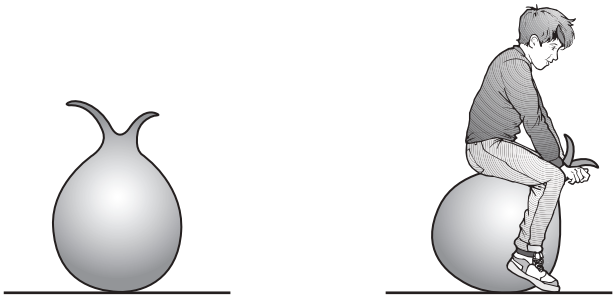
14 A pollen grain in a beaker of still water is viewed through a microscope.

Which diagram shows the most likely movement of the pollen grain?



15 The diagram shows an air-filled rubber toy. A child sits on the toy and its volume decreases.

The temperature of the air in the toy does not change.



How does the air pressure in the toy change and why?

	pressure	reason
A	decreases	air molecules move more slowly
B	decreases	air molecules strike the rubber less frequently
C	increases	air molecules move more quickly
D	increases	air molecules strike the rubber more frequently

16 Which property **cannot** be used for the measurement of temperature?

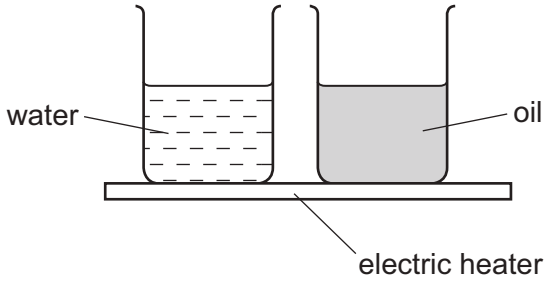
A half-life of a radioactive isotope

B length of a solid metal bar

C pressure of a gas

D volume of a liquid

17 The diagram shows an electric heater being used to heat a beaker of water and an identical beaker containing oil. Both are heated for one minute.



The temperature of the water and the temperature of the oil increase steadily. The increase in temperature of the oil is much greater than that of the water.

Why is this?

A Oil has a higher boiling point than water.

B Oil has a lower boiling point than water.

C The oil has a larger thermal capacity than the water.

D The oil has a smaller thermal capacity than the water.

18 Why is the heating coil of a domestic immersion heater placed at the bottom of the tank?

A Cold water is less dense than hot water and therefore sinks.

B Cold water is more dense than hot water and therefore rises.

C Hot water is less dense than cold water and therefore rises.

D Hot water is more dense than cold water and therefore sinks.

19 A plane wave in a shallow tank of water of uniform depth is incident normally on the small gap in a barrier.

What happens after the wave passes through the gap?

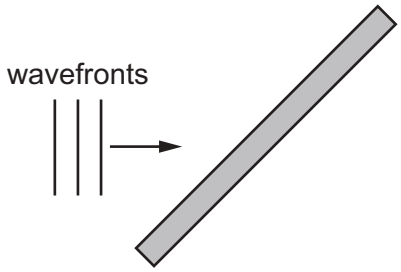
A The frequency increases.

B The speed decreases.

C The wavelength decreases.

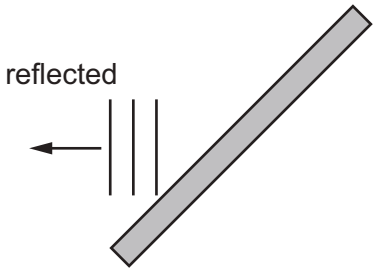
D The wave spreads out.

20 The diagram represents plane wavefronts of a water wave about to strike a solid barrier.

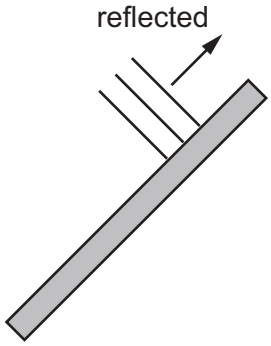


Which diagram shows the position of the wavefronts after reflection at the barrier?

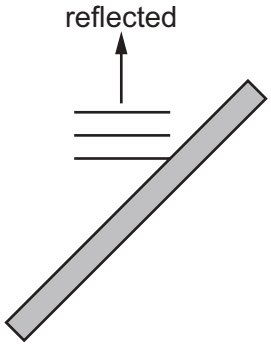
A



B



C



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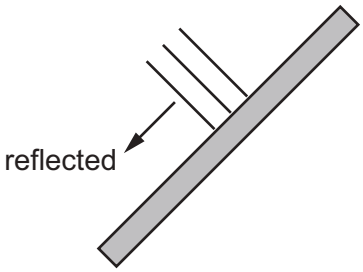
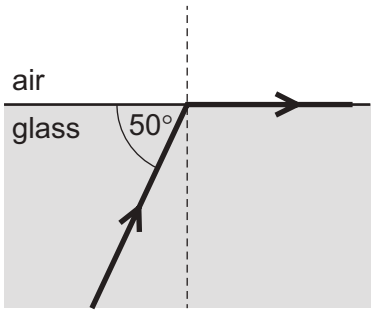


21 The diagram shows a ray of light in glass. The ray reaches a boundary with air.

One weak ray of light is missing from the diagram.



Which statement is correct?

A At the boundary, the speed of the light will become less.

B The critical angle for light at this boundary is 50°.

C The diagram shows an example of diffraction of light.

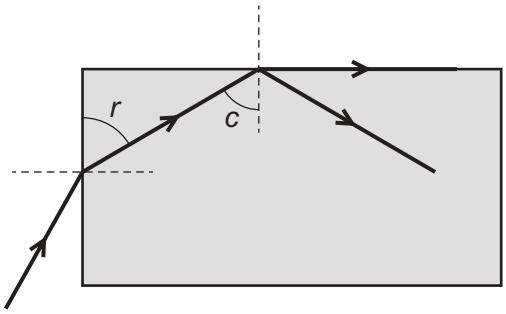
D The missing ray is a weak reflected ray.

22 Light enters a transparent block.

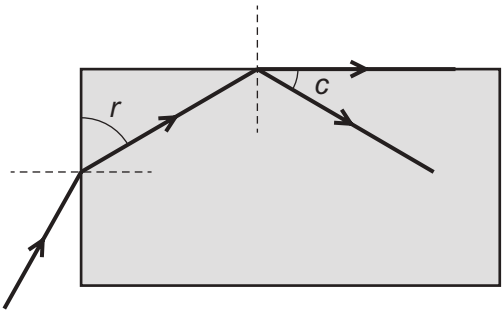
The light is refracted into the block and then strikes the top edge of the block at the critical angle.

Which diagram correctly shows the angle of refraction *r* and the critical angle *c*?

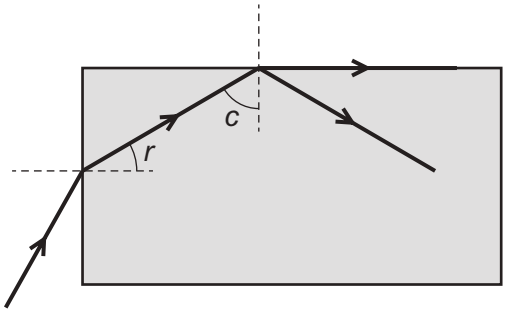
A



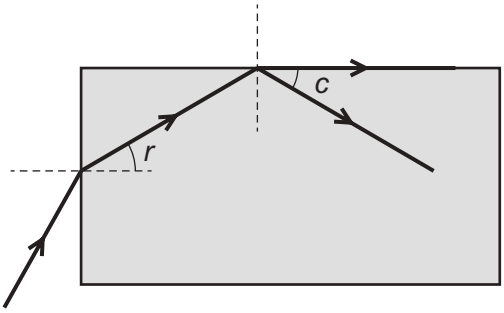
B



C



D



23 Which statement about radio waves is correct?

A They are used in television remote controllers.

B They can be detected by the human eye.

C They travel as longitudinal waves.

D They have the same speed in a vacuum as ultraviolet waves.

24 Which types of thermal energy transfer are due to electromagnetic waves?

A conduction and convection

B convection and radiation

C convection only

D radiation only

25 The speed of sound in air is 330 m / s.

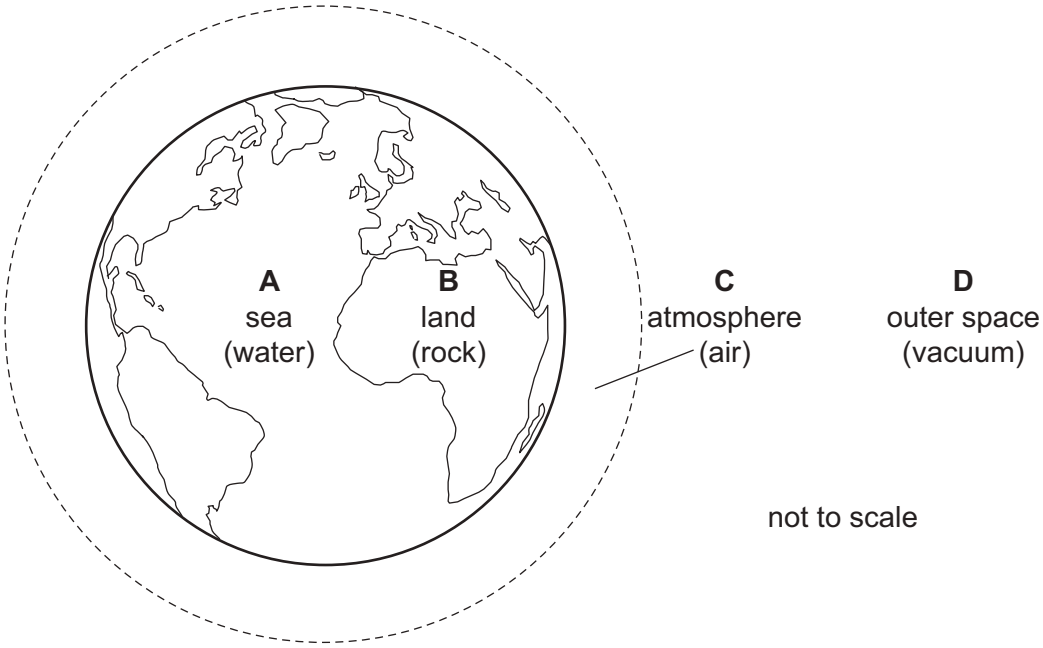
The speed of ultraviolet waves in air is 300 000 000 m / s.

Which row gives a possible frequency and speed of an ultrasound wave in air?

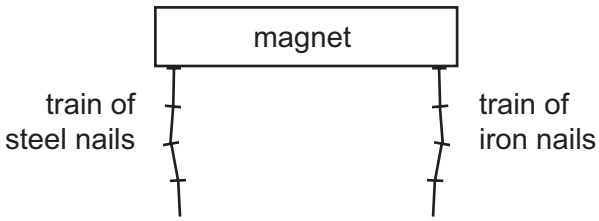
	frequency / Hz	speed / m / s
A	4000	330
B	4000	300 000 000
C	40 000	330
D	40 000	300 000 000

26 The diagram shows the Earth and its surroundings.

Through which labelled region can sound **not** be transmitted?



27 A train of steel nails and a train of iron nails hang from a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains?

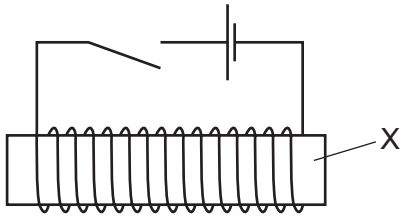
A Both trains fall apart.

B Both trains stay together.

C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

28 The diagram shows an electromagnet.



Which material is part X made from?

A copper

B iron

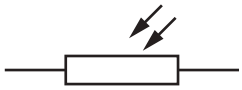
C steel

D tin

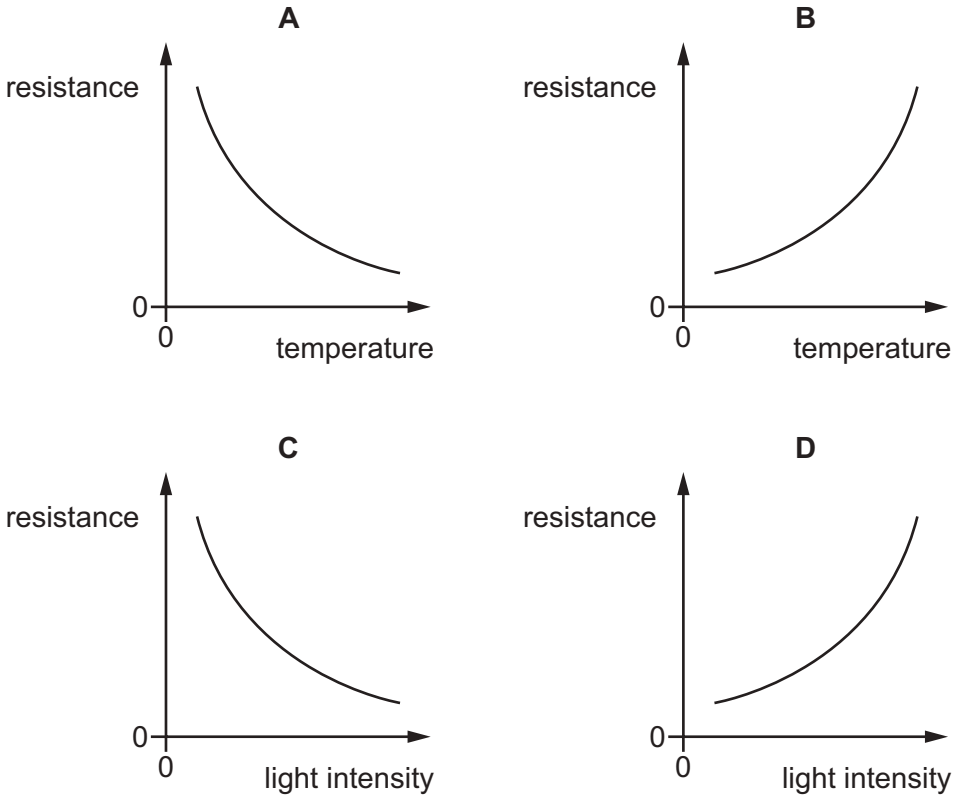
29 In which unit is the electromotive force (e.m.f.) of a battery measured?

A A **B** J **C** N **D** V

30 The diagram shows a circuit symbol for a component that can be used as an input transducer.



Which graph shows how the resistance of the component varies with its intended input variable?



31 Which statement is **not** correct for two identical lamps connected in parallel?

A The potential difference across each lamp is half the supply voltage.

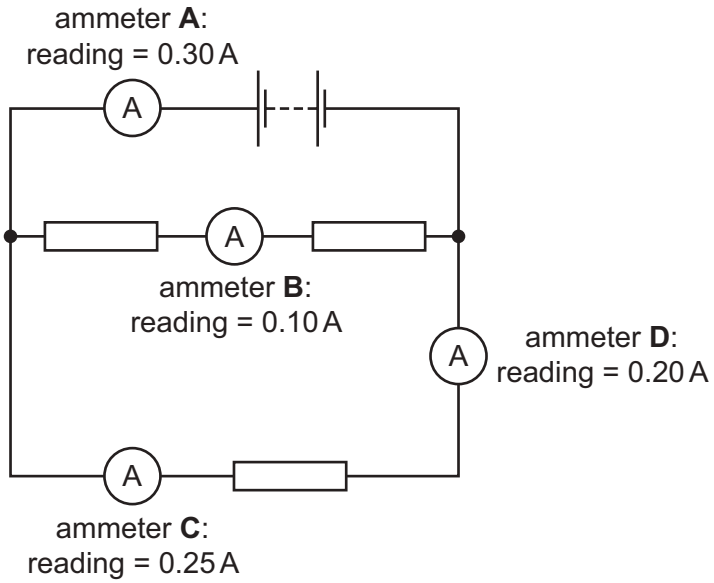
B The remaining lamp still operates when one lamp is removed.

C They can be switched on and off separately.

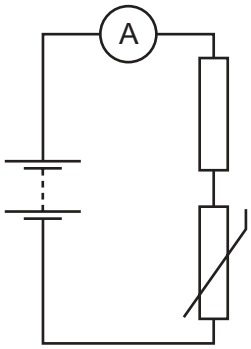
D They remain bright if another lamp is connected in parallel.

32 Only one of the ammeters in the circuit is showing an incorrect reading.

Which ammeter is showing the **incorrect** reading?



33 The diagram shows a circuit with a fixed resistor connected in series with a thermistor and an ammeter.

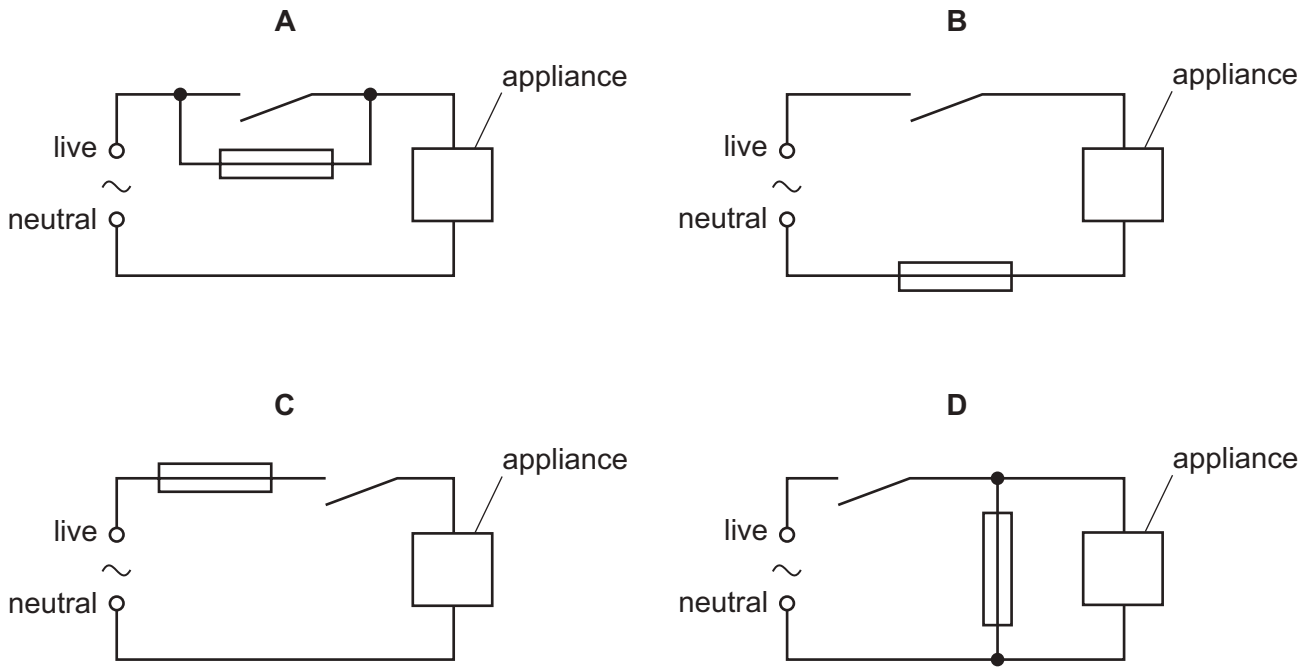


Which row shows how temperature change affects the resistance of the thermistor and the current in the circuit?

	temperature	resistance of thermistor	current in circuit
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

34 An appliance is connected to a mains supply. Its circuit also contains a switch and a fuse.

Which circuit shows the fuse in the correct position?



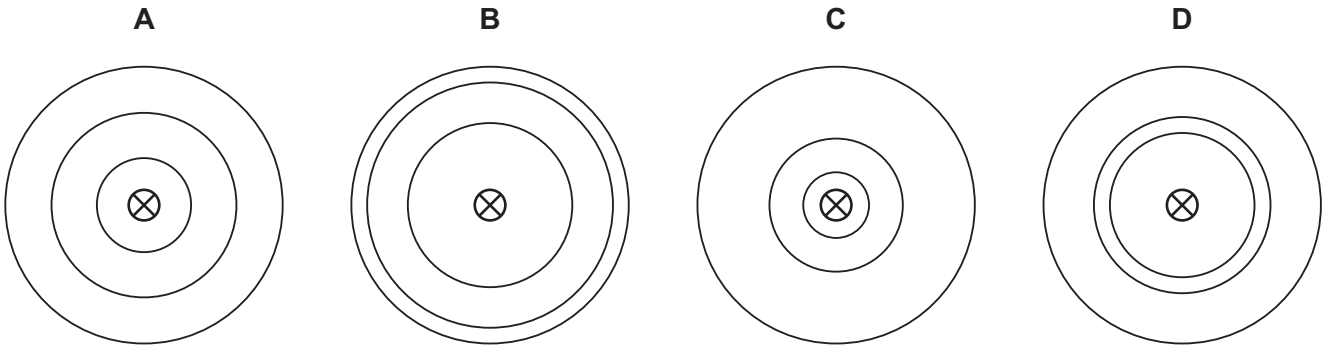
35 An electrical device requires a voltage of 5.0 V to operate normally. The mains supply voltage is 250 V.

Which row shows a transformer that provides output voltage that enables the device to operate normally when connected to the mains supply?

	number of turns on the primary coil	number of turns on the secondary coil
A	500	2500
B	500	25 000
C	2500	500
D	25 000	500

36 A straight current-carrying wire has a magnetic field around it.

Which diagram best shows the magnetic field pattern around the wire?



37 Which row states the charge on an electron and states whether electrons are located inside the nucleus of an atom?

	charge	located inside the nucleus
A	negative	no
B	negative	yes
C	positive	no
D	positive	yes

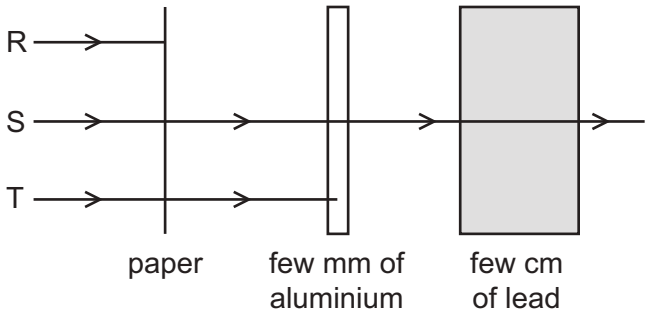
38 The element sodium, symbol Na, has a proton number of 11.

Which is a possible symbol for a sodium nuclide?

A $^{9}_{11}Na$ **B** $^{11}_{9}Na$ **C** $^{11}_{23}Na$ **D** $^{23}_{11}Na$

39 A radioactive source emits three types of radiation R, S and T.

The diagram shows an experiment set up to study the penetrating properties of R, S and T.



Which types of radiation are R, S and T?

	R	S	T
A	α-particles	β-particles	γ-rays
B	α-particles	γ-rays	β-particles
C	β-particles	α-particles	γ-rays
D	γ-rays	β-particles	α-particles

40 Radioactive iodine-131 emits β-particles and has a half-life of 8 days. It decays to produce xenon-131.

Which statement about this decay is correct?

A After 8 days no more β-particles are emitted.

B After 8 days the number of xenon-131 atoms has halved.

C After 16 days the iodine-131 has decayed completely.

D After 16 days the number of iodine-131 atoms has reduced to one quarter.

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/21**

Paper 2 Multiple Choice (Extended) **October/November 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **20** printed pages.

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1 A student measures the volume of a cork.

He puts some water into a measuring cylinder and then one glass ball. He puts the cork and then a second, identical glass ball into the water as shown.

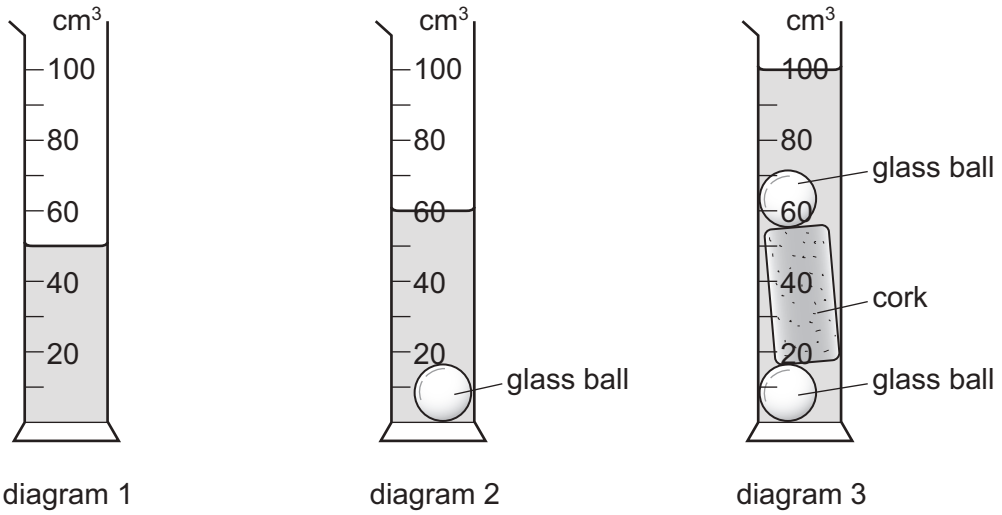


Diagram 1 shows the first water level.

Diagram 2 shows the water level after one glass ball is added.

Diagram 3 shows the water level after the cork and the second glass ball are added.

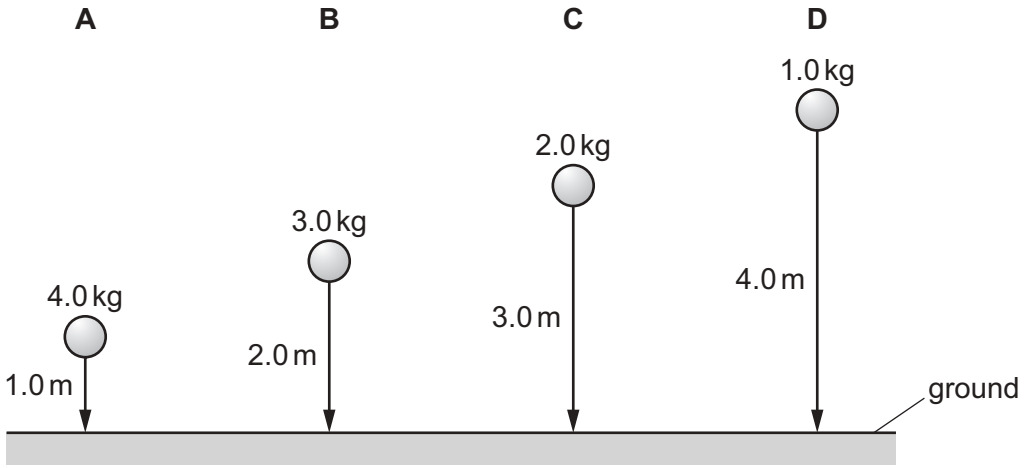
What is the volume of the cork?

A $30\,cm^3$ **B** $40\,cm^3$ **C** $50\,cm^3$ **D** $100\,cm^3$

2 Four balls with different masses are dropped from the heights shown.

Air resistance may be ignored.

Which ball has the smallest average speed?



3 An ice crystal falls vertically from a cloud.

What happens to the acceleration of the ice crystal as it falls?

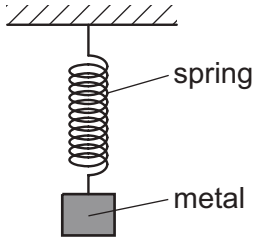
A It decreases because of air resistance.

B It decreases because of gravity.

C It increases because of air resistance.

D It increases because of gravity.

4 A spring is stretched by hanging a piece of metal from it.



Which name is given to the force that stretches the spring?

A friction

B mass

C pressure

D weight

5 Which object has the greatest weight?

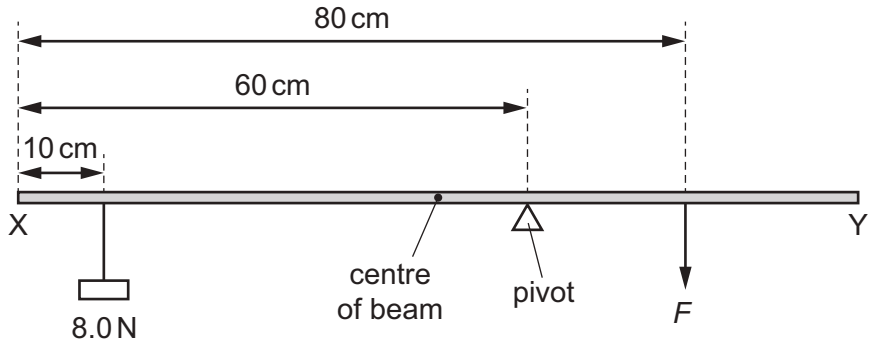
A an object of mass 10 kg in a 15 N / kg gravitational field

B an object of mass 15 kg in a 13 N / kg gravitational field

C an object of mass 20 kg in a 9.0 N / kg gravitational field

D an object of mass 50 kg in a 3.0 N / kg gravitational field

6 A uniform beam XY is 100 cm long and weighs 4.0 N.



The beam rests on a pivot 60 cm from end X.

A load of 8.0 N hangs from the beam 10 cm from end X.

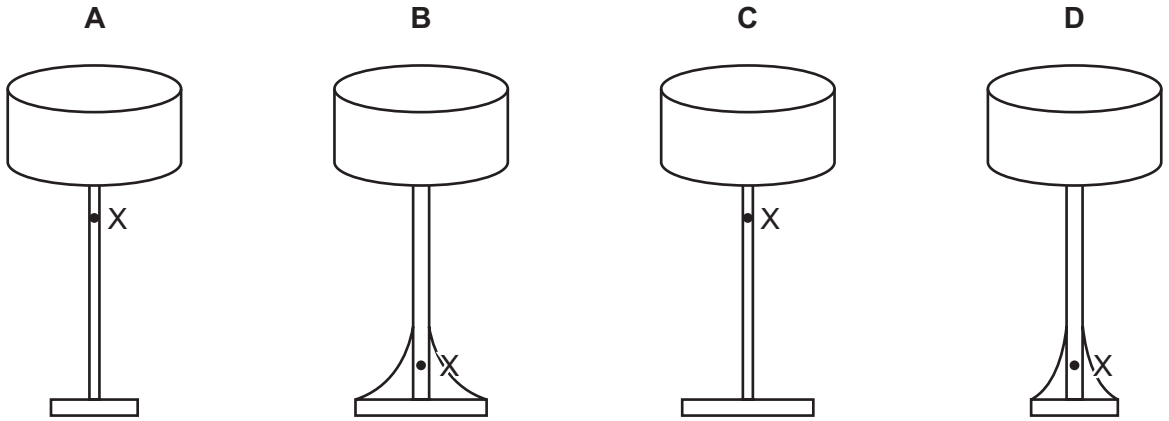
The beam is kept balanced by a force *F* acting on the beam 80 cm from end X.

What is the magnitude of force *F*?

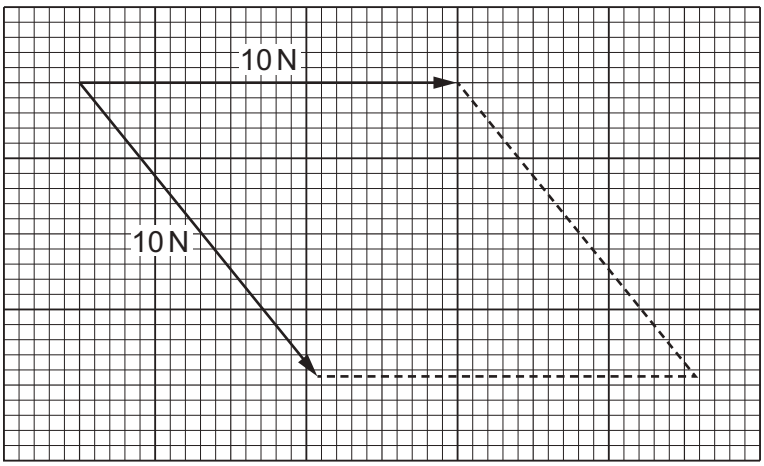
A 8.0 N **B** 18 N **C** 22 N **D** 44 N

7 The diagrams show four table lamps resting on a table. The position of the centre of mass of each lamp is labelled X.

Which lamp is the most stable?



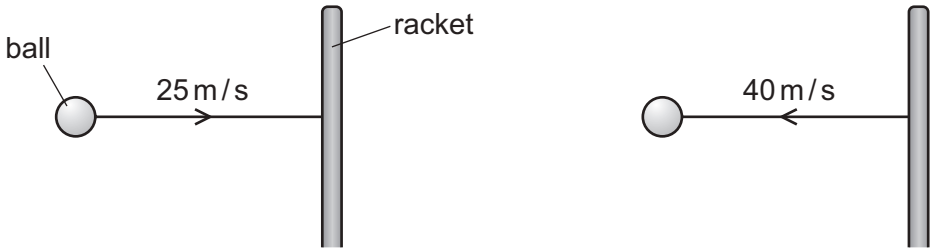
8 The diagram shows an incomplete scale drawing to find the resultant of two 10 N forces acting at a point in the directions shown.



What is the magnitude of the resultant force?

A 7.5 N **B** 8.6 N **C** 18 N **D** 20 N

9 A tennis ball of mass 0.060 kg travels horizontally at a speed of 25 m / s. The ball hits a tennis racket and rebounds horizontally at a speed of 40 m / s.



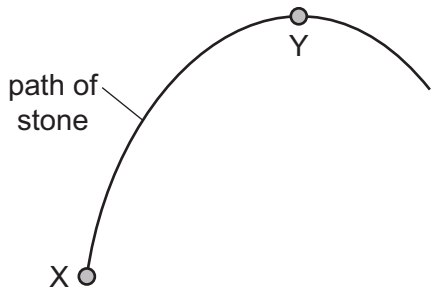
before hitting racket after hitting racket

The ball is in contact with the racket for 50 ms.

What force does the racket exert on the ball?

A 0.018 N **B** 0.078 N **C** 18 N **D** 78 N

10 The diagram shows the path of a stone that is thrown from X and reaches its maximum height at Y.



The stone gains 10 J of gravitational potential energy as it moves from X to Y.

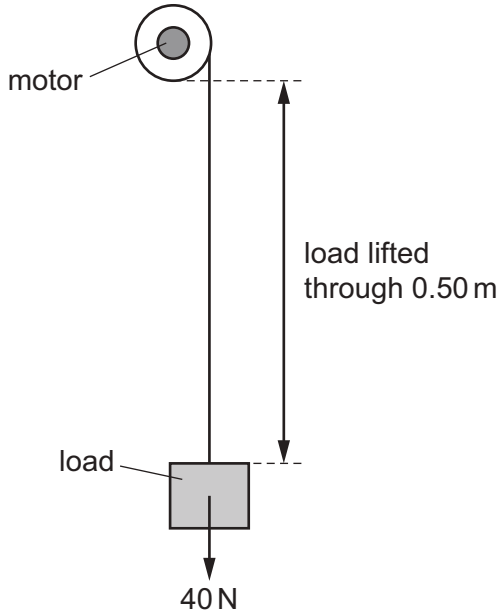
The stone has 2.0 J of kinetic energy at Y.

Air resistance can be ignored.

How much kinetic energy did the stone have immediately after it was thrown at X?

A 2.0 J **B** 8.0 J **C** 10 J **D** 12 J

11 A motor is used to lift a load of 40 N.

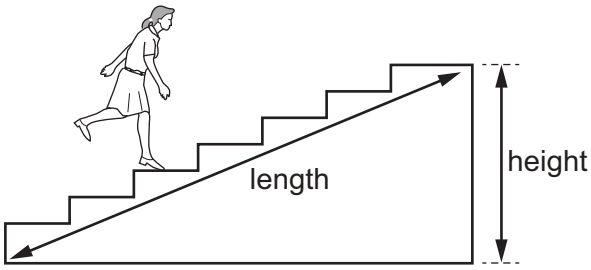


The power of the motor is 40 W and the system is 20% efficient.

How long does it take the motor to lift the load through 0.50 m?

A 0.50 s **B** 2.5 s **C** 5.0 s **D** 25 s

12 A student runs up a flight of stairs.



Which information is **not** needed to calculate the rate at which the student is doing work against gravity?

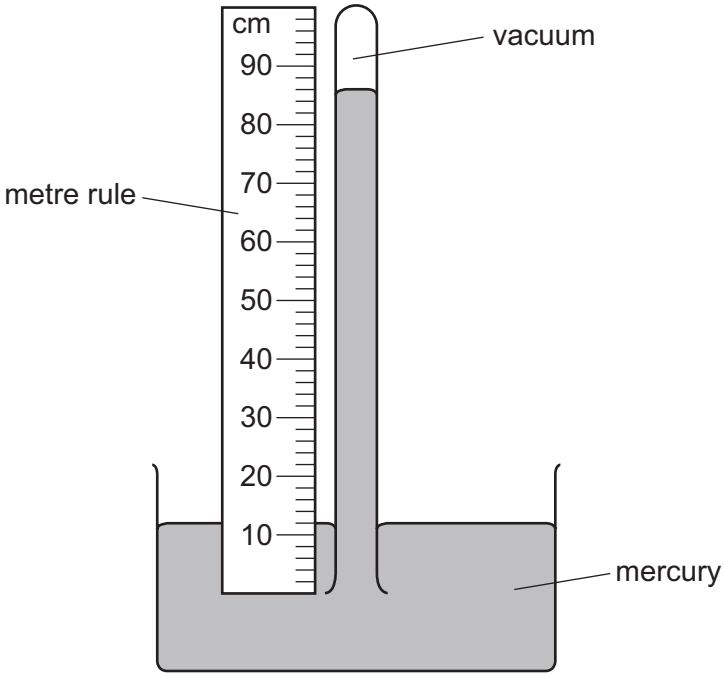
A the height of the flight of stairs

B the length of the flight of stairs

C the time taken to run up the stairs

D the weight of the student

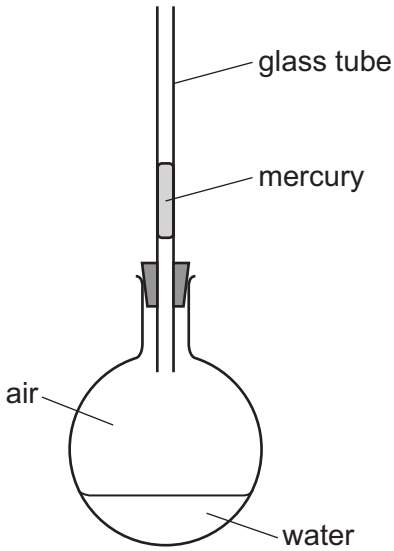
13 The diagram shows a simple mercury barometer.



Which length is used to find the value of atmospheric pressure?

A 12 cm **B** 74 cm **C** 86 cm **D** 100 cm

14 The diagram shows a glass flask, sealed with a small volume of mercury in a glass tube. When the flask is gently warmed the mercury rises up the tube.



What is the main cause of the movement of the mercury?

A expansion of air in the flask

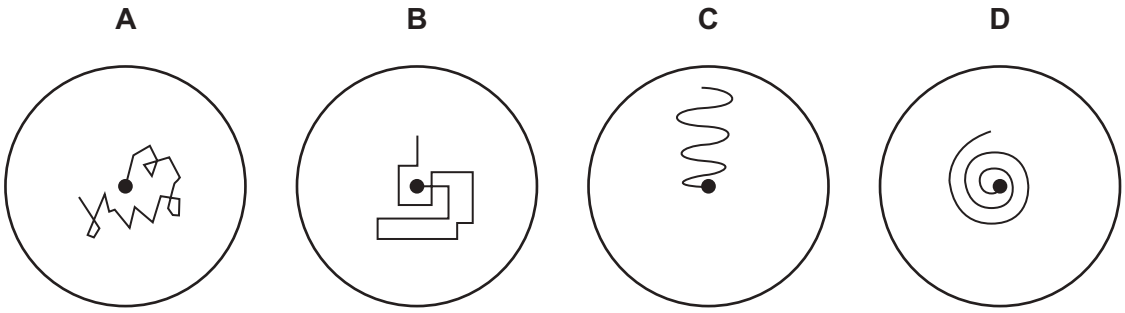
B expansion of the glass flask

C expansion of the glass tube

D expansion of the mercury

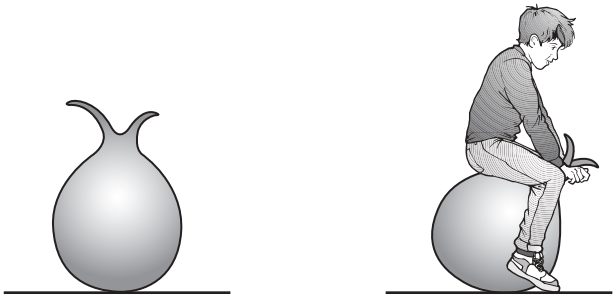
15 A pollen grain in a beaker of still water is viewed through a microscope.

Which diagram shows the most likely movement of the pollen grain?



16 The diagram shows an air-filled rubber toy. A child sits on the toy and its volume decreases.

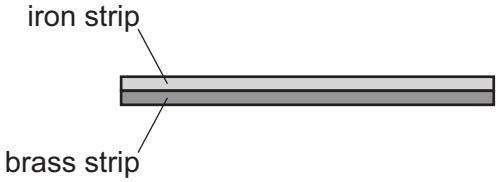
The temperature of the air in the toy does not change.



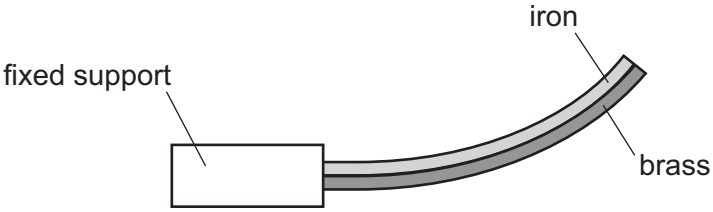
How does the air pressure in the toy change and why?

	pressure	reason
A	decreases	air molecules move more slowly
B	decreases	air molecules strike the rubber less frequently
C	increases	air molecules move more quickly
D	increases	air molecules strike the rubber more frequently

17 A strip of iron and a strip of brass are firmly attached to each other along their entire length. This combination is a bimetallic strip.



This bimetallic strip is heated and it bends as shown.



The bimetallic strip is now cooled and becomes straight again.

What causes the bimetallic strip to become straight again?

A The brass contracts more than the iron.

B The brass expands more than the iron.

C The iron contracts more than the brass.

D The iron expands more than the brass.

18 An aluminium block has a mass of 200 g.

The specific heat capacity of aluminium is 900 J / (kg °C).

How much energy is needed to raise the temperature of the block from 20 °C to 110 °C?

A 2.0 J **B** 200 J **C** 16 200 J **D** 16 200 000 J

19 Which statement about convection currents is correct?

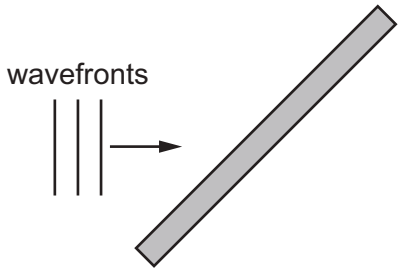
A Convection currents occur because, when cooled, liquids contract and become more dense.

B Convection currents occur because, when warmed, liquids expand and become more dense.

C Convection currents only occur in liquids.

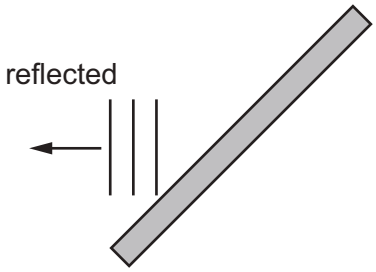
D Convection currents only occur in solids and liquids.

20 The diagram represents plane wavefronts of a water wave about to strike a solid barrier.

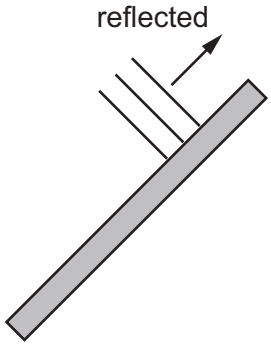


Which diagram shows the position of the wavefronts after reflection at the barrier?

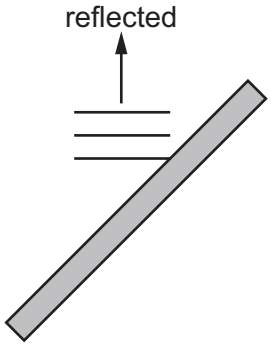
A



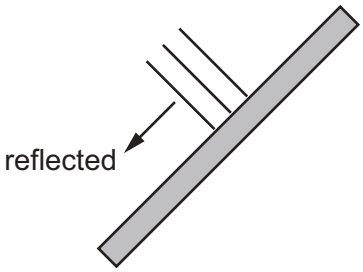
B



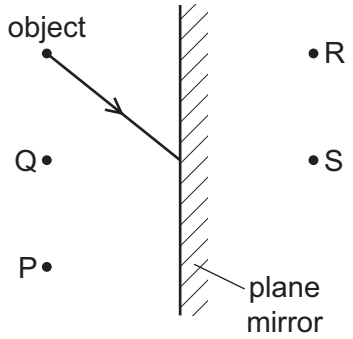
C



D



21 The diagram shows an object in front of a plane mirror. A ray of light from the object is incident on the mirror.



Through which point does the reflected ray pass, and at which point is the image of the object formed?

	point through which reflected ray passes	point at which image is formed
A	P	R
B	P	S
C	Q	R
D	Q	S

22 A laser is a source of light with a single frequency.

Which description of this type of light is correct?

A dispersed

B focused

C monochromatic

D refracted

23 Visible light, X-rays and microwaves are all components of the electromagnetic spectrum.

Which statement about the waves is correct?

A In a vacuum, microwaves travel faster than visible light and have a shorter wavelength.

B In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.

C In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.

D In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.

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24 The Moon is 380 000 km from the Earth. A laser light beam is directed from the Earth to the Moon. The beam is reflected back to the Earth.

How long does it take for the light to travel to the Moon and back to the Earth?

A 1.27 ms **B** 2.53 ms **C** 1.27 s **D** 2.53 s

25 Which wavefront is travelling at a speed closest to that of a sound wave through a solid?

A one that moves 10 m in 0.01 s

B one that moves 50 m in 0.5 s

C one that moves 1000 m in 100 s

D one that moves 2000 m in 2000 s

26 Different waves travel through air.

Which waves have the greatest difference in speed?

A ultrasound waves and sound waves

B ultrasound waves and ultraviolet waves

C ultraviolet waves and light waves

D ultraviolet waves and radio waves

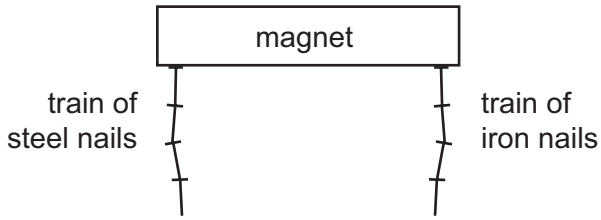
27 A student stands 180 m in front of a vertical, flat cliff and bangs together two pieces of wood to make a short, loud sound.

A timer records the echo of the sound 1.5 seconds after the pieces of wood are banged together.

Based on this result, what is the speed of sound?

A 120 m / s **B** 240 m / s **C** 270 m / s **D** 540 m / s

28 A train of steel nails and a train of iron nails hang from a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains?

A Both trains fall apart.

B Both trains stay together.

C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

29 How can a permanent magnet be demagnetised?

A Cool the magnet for a long time.

B Place it next to another magnet.

C Slowly pull it out of a coil connected to an a.c. supply.

D Slowly pull it out of a coil connected to a d.c. supply.

30 A positively-charged rod is held near to, but not touching, an uncharged metal sphere.

The sphere is briefly now connected to earth.

The rod is removed.

Which statement about the charge on the sphere is correct?

A It is charged negatively because negative charges have moved from earth to the sphere.

B It is charged negatively because positive charges have moved from the sphere to earth.

C It is charged positively because negative charges have moved from the sphere to earth.

D It is charged positively because positive charges have moved to earth from the sphere.

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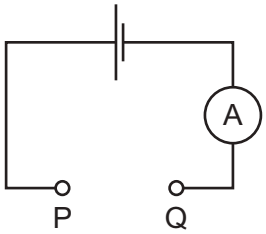
31 The diagram shows a circuit with a gap between points P and Q.

Four pieces of metal wire of the same material are connected, in turn, between points P and Q in the circuit.



The table gives the diameters and lengths of the wires.

In which wire is the current the largest?

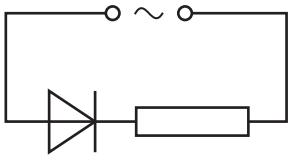
	diameter / mm	length / m
A	0.10	1.0
B	0.10	2.0
C	0.20	1.0
D	0.20	2.0

32 A torch has a simple circuit with a 3.0 V battery and a lamp. There is a 20 mA current in the lamp.

How much energy is transferred to the lamp in 5.0 minutes?

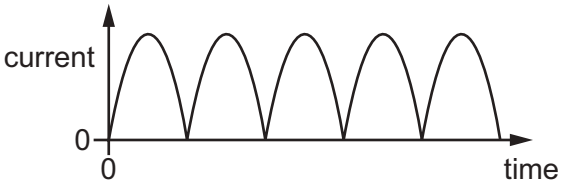
A 0.30 J **B** 18 J **C** 60 J **D** 0.30 kJ

33 A student connects the circuit shown.

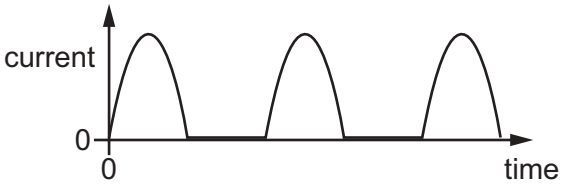


Which graph shows the variation with time of the current in the resistor?

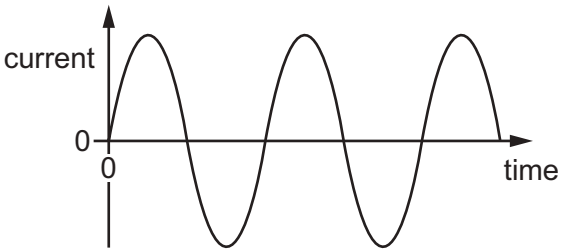
A



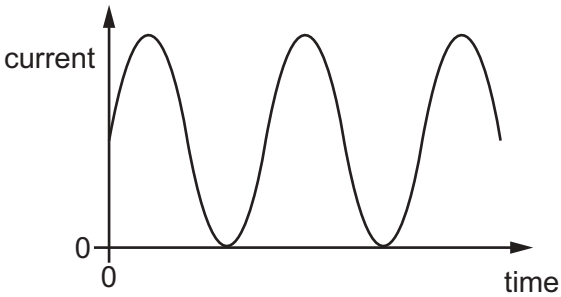
B



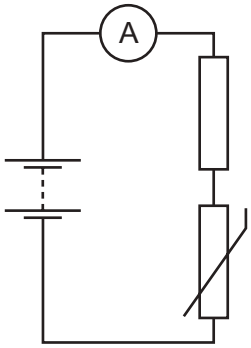
C



D



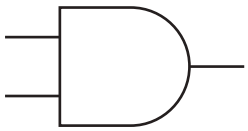
34 The diagram shows a circuit with a fixed resistor connected in series with a thermistor and an ammeter.



Which row shows how temperature change affects the resistance of the thermistor and the current in the circuit?

	temperature	resistance of thermistor	current in circuit
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

35 What does the symbol shown represent?



A an AND gate

B a NOR gate

C a NOT gate

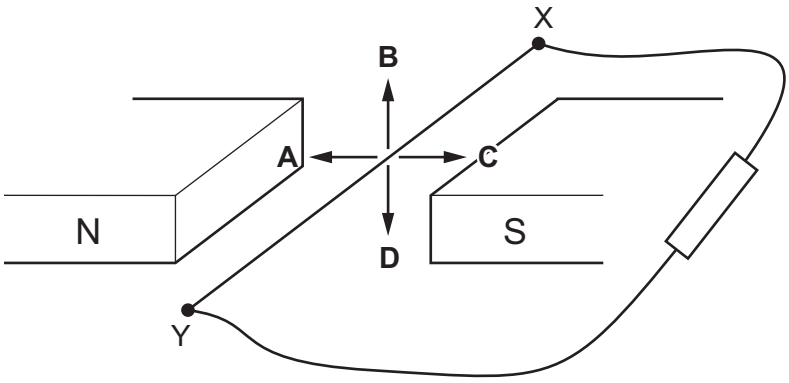
D an OR gate

36 The diagram shows a copper wire XY connected to a resistor.

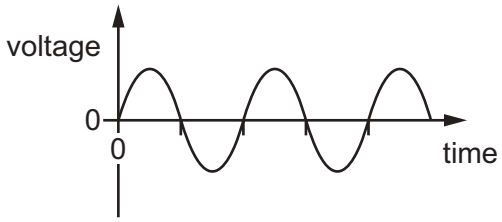
The wire is moved in the magnetic field between the poles of a magnet.

There is an induced current in the wire from X to Y.

In which labelled direction is the wire moving?



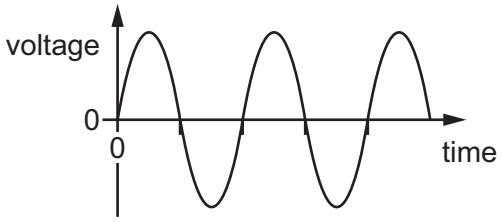
37 The graph shows how the voltage induced across a coil changes with time as the coil spins in a magnetic field.



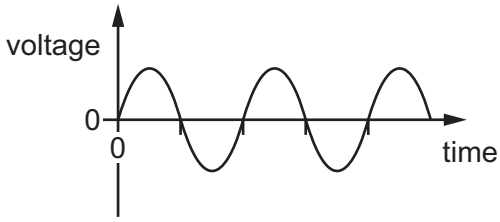
Which graph shows what happens when the coil spins more quickly?

(All graphs are drawn to the same scale.)

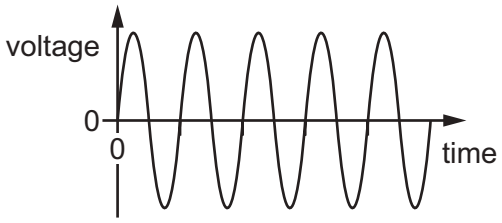
A



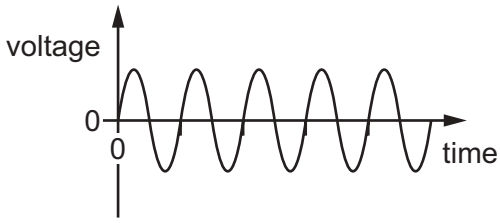
B



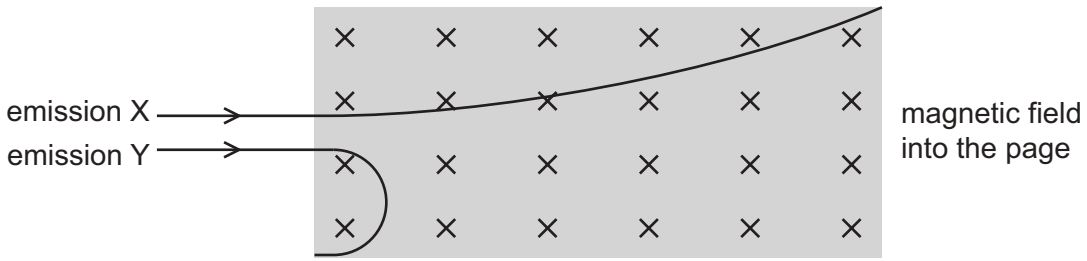
C



D



38 Emissions X and Y from radioactive material are passed through a magnetic field. The diagram shows the direction of the emissions, the direction of the magnetic field and the effect on the emissions.



Which type of emission is X, and which type of emission is Y?

	emission X	emission Y
A	α-particles	β-particles
B	α-particles	γ-rays
C	β-particles	α-particles
D	β-particles	γ-rays

39 What is meant by the *half-life* of a radioactive isotope?

A half of the time taken for all of the original nuclei to decay

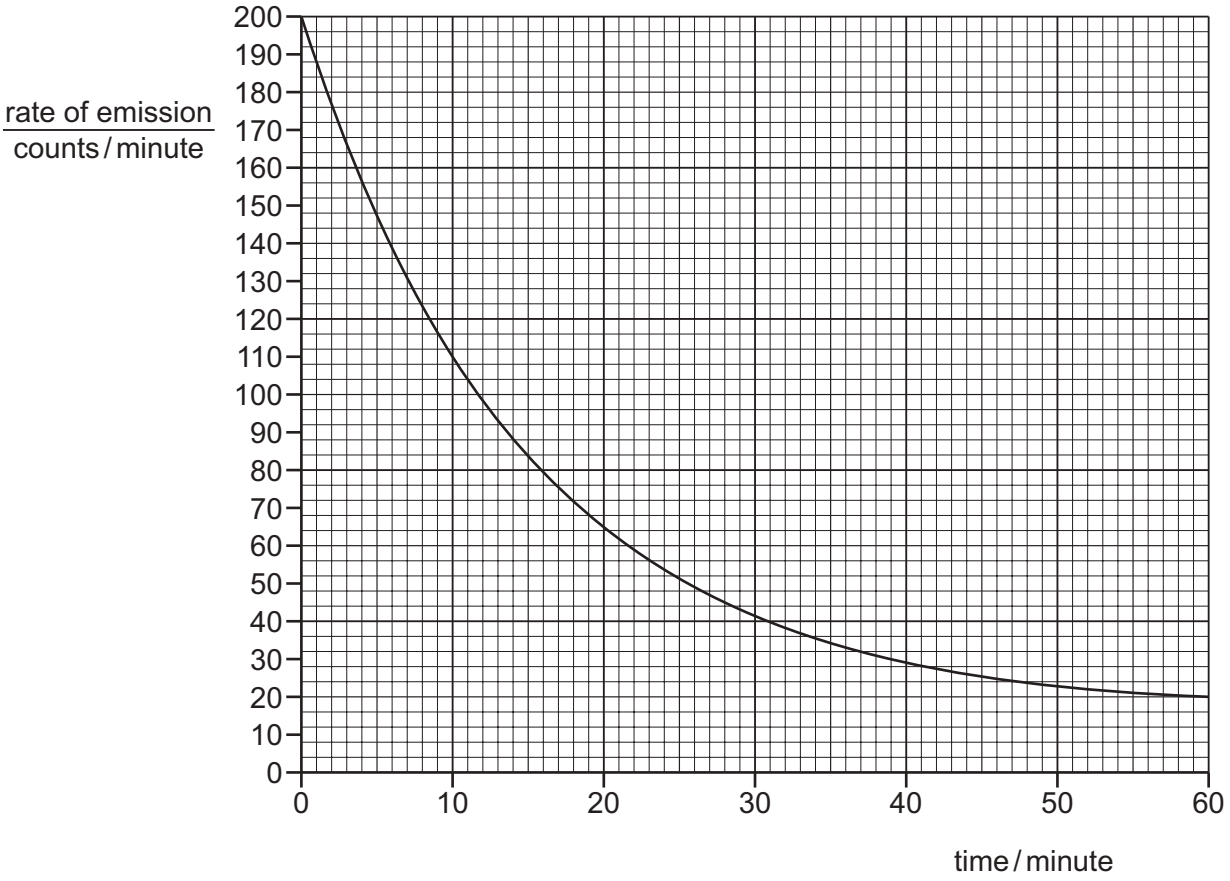
B the time taken for half of the original nuclei to decay

C the time taken for the charges on all the nuclei to halve

D the time taken for the mass of each nucleus to halve

40 The rate of emission of a radioactive source is measured until the reading reaches the background rate of 20 counts per minute.

The results are shown.



What is the best estimate of the half-life of the source?

A 10 minutes

B 12 minutes

C 14 minutes

D 30 minutes

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **October/November 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **18** printed pages and **2** blank pages.

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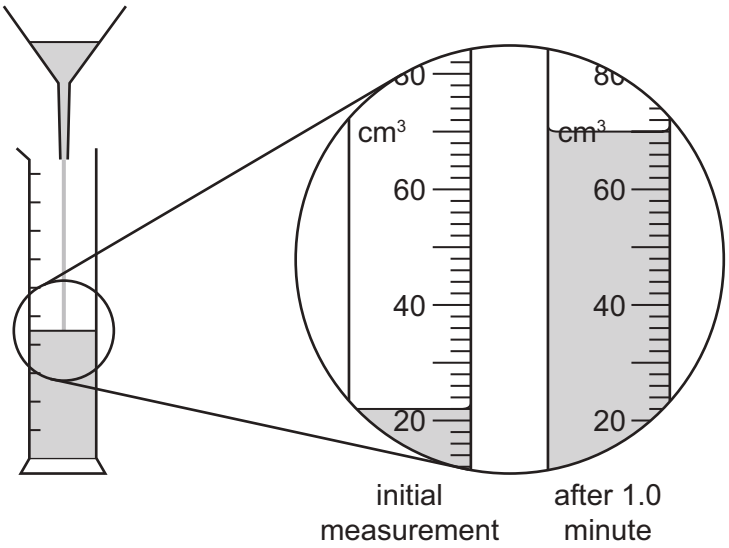
1 A student investigates the rate of flow of oil through a funnel.

The diagrams show the experiment and the volume of oil in the measuring cylinder at the start of the experiment, and one minute later.



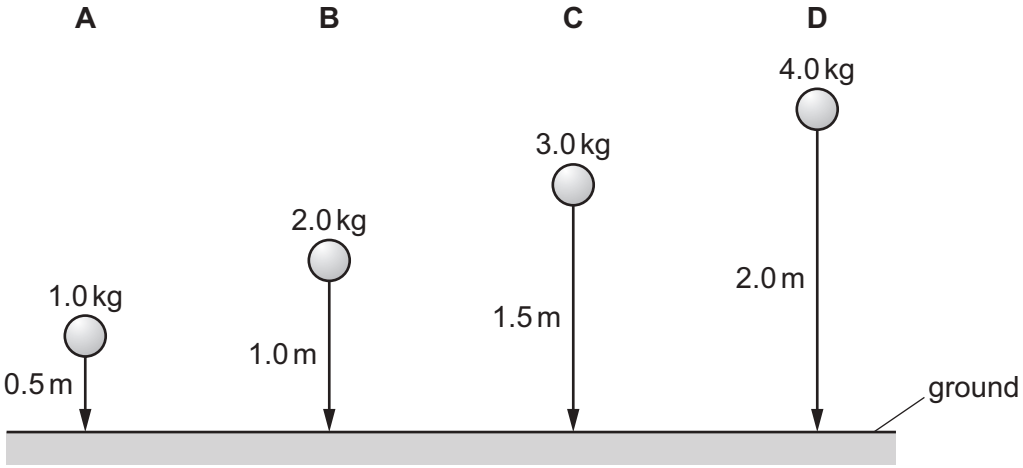
What is the rate of flow of oil through the funnel during the one minute?

A 0.73 cm^3/s **B** 0.80 cm^3/s **C** 44 cm^3/s **D** 48 cm^3/s

2 Four balls with different masses are dropped simultaneously from the heights shown.

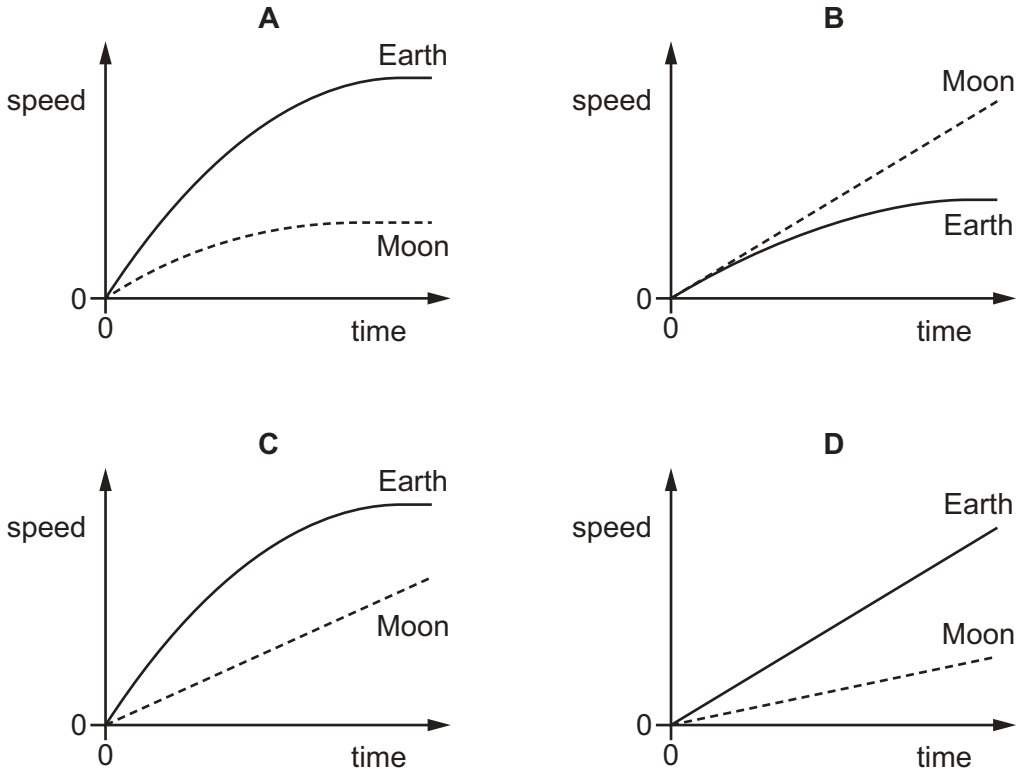
Air resistance may be ignored.

Which ball hits the floor last?

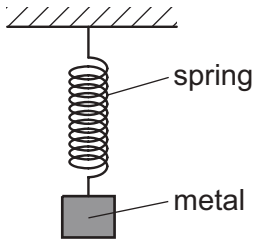


3 The gravitational field strength on the Earth is greater than the gravitational field strength on the Moon. The Earth has an atmosphere, but the Moon does not.

Which speed-time graph represents the motion of a light ball dropped from a great height near the surface of the Earth and near the surface of the Moon?



4 A spring is stretched by hanging a piece of metal from it.



Which name is given to the force that stretches the spring?

A friction

B mass

C pressure

D weight

5 A body of mass m has a weight W in a location where the gravitational field strength is g.

Which statement about these quantities is correct?

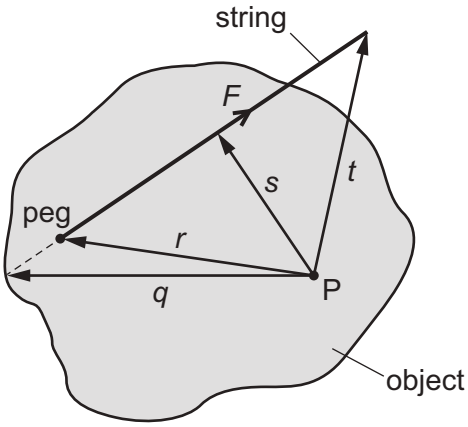
A m and W are both forces.

B m and W are both vector quantities.

C m and W are related by the equation $\frac{W}{m} = g$.

D m and W have the same unit.

6 An object is pivoted at point P. A student ties a length of string to a peg on the object. He pulls the string with a force F.



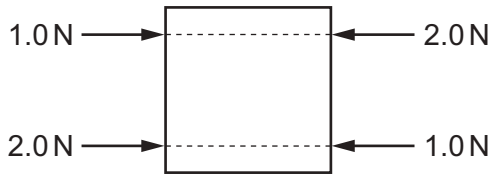
What is the moment of the force F about the point P?

A $F \times q$ **B** $F \times r$ **C** $F \times s$ **D** $F \times t$

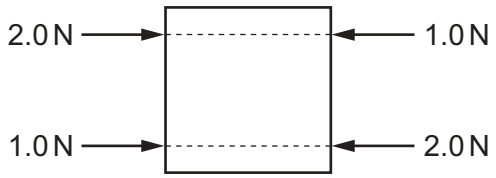
7 Each diagram shows a metal plate with four parallel forces acting on it. These are the only forces acting on the plates.

In which diagram is the plate in equilibrium?

A



B



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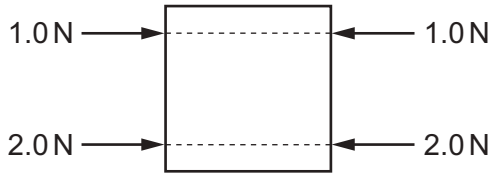

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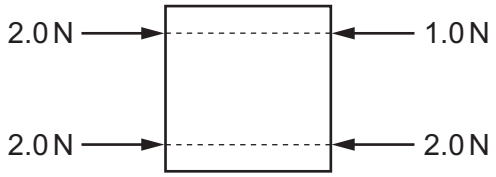
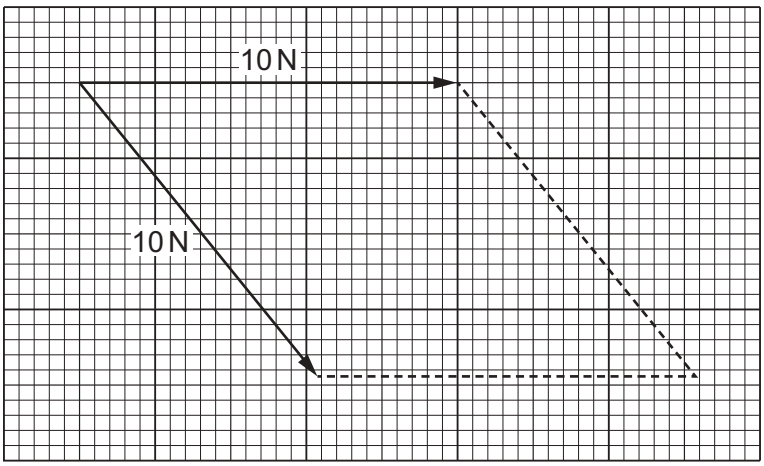


8 The diagram shows an incomplete scale drawing to find the resultant of two 10 N forces acting at a point in the directions shown.

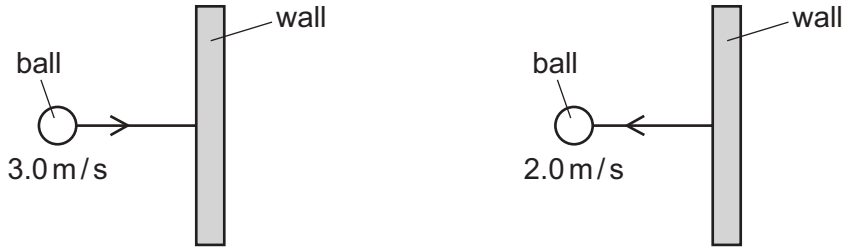


What is the magnitude of the resultant force?

A 7.5 N **B** 8.6 N **C** 18 N **D** 20 N

9 A ball has a mass of 0.30 kg. It moves horizontally with a speed of 3.0 m / s in the direction shown.

The ball hits a wall.



before hitting the wall after hitting the wall

The ball rebounds from the wall with a horizontal speed of 2.0 m / s.

What is the change in momentum of the ball?

A 0.30 kg m / s **B** 1.0 kg m / s **C** 1.5 kg m / s **D** 5.0 kg m / s

10 An object has a mass of 500 kg.

It moves with a speed of 30 m / s.

What is its kinetic energy?

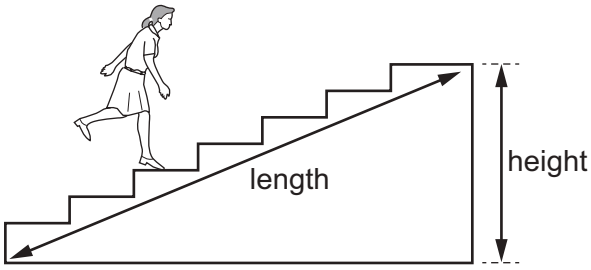
A 7.5 kJ **B** 15 kJ **C** 225 kJ **D** 450 kJ

11 Different processes have different efficiencies.

Which row shows the most efficient process?

	energy input / J	useful energy output / J
A	10	3
B	40	10
C	100	25
D	2000	250

12 A student runs up a flight of stairs.



Which information is **not** needed to calculate the rate at which the student is doing work against gravity?

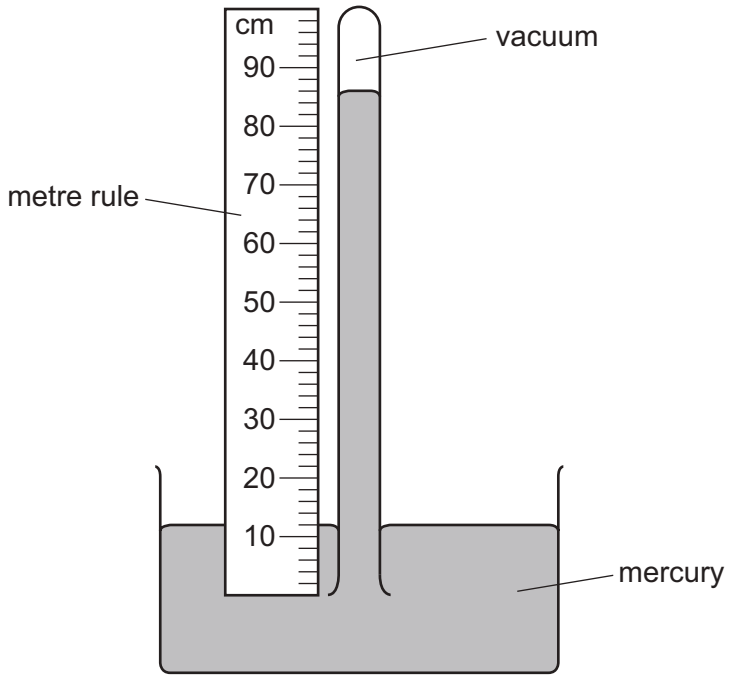
A the height of the flight of stairs

B the length of the flight of stairs

C the time taken to run up the stairs

D the weight of the student

13 The diagram shows a simple mercury barometer.

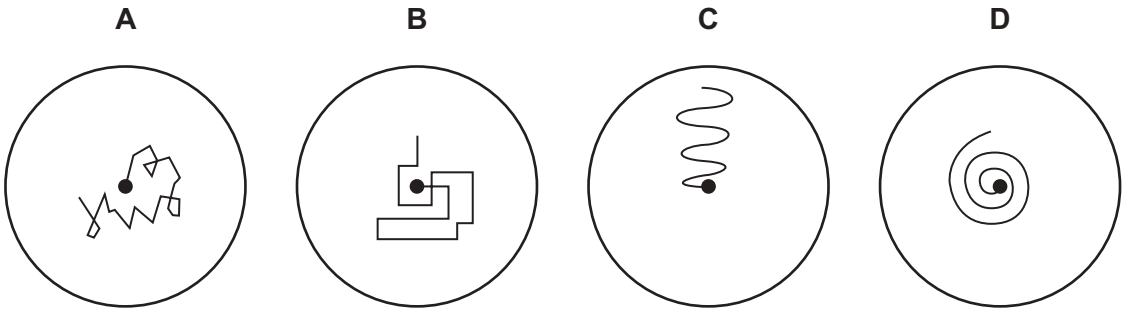


Which length is used to find the value of atmospheric pressure?

A 12 cm **B** 74 cm **C** 86 cm **D** 100 cm

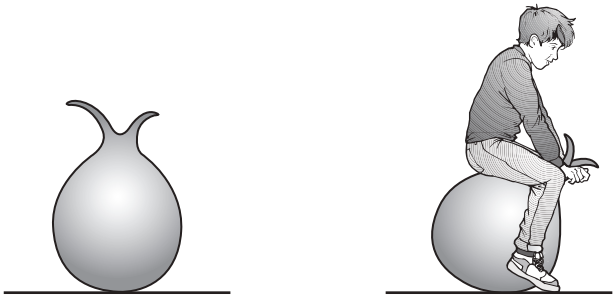
14 A pollen grain in a beaker of still water is viewed through a microscope.

Which diagram shows the most likely movement of the pollen grain?



15 The diagram shows an air-filled rubber toy. A child sits on the toy and its volume decreases.

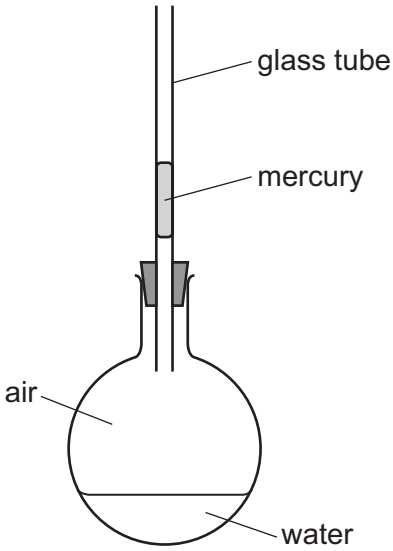
The temperature of the air in the toy does not change.



How does the air pressure in the toy change and why?

	pressure	reason
A	decreases	air molecules move more slowly
B	decreases	air molecules strike the rubber less frequently
C	increases	air molecules move more quickly
D	increases	air molecules strike the rubber more frequently

16 The diagram shows a glass flask, sealed with a small volume of mercury in a glass tube. When the flask is gently warmed the mercury rises up the tube.



What is the main cause of the movement of the mercury?

A expansion of air in the flask

B expansion of the glass flask

C expansion of the glass tube

D expansion of the mercury

17 Which row identifies the fixed points on the Celsius scale?

	lower fixed point	upper fixed point
A	boiling point of mercury	melting point of pure ice
B	boiling point of pure water	melting point of pure ice
C	melting point of mercury	boiling point of pure water
D	melting point of pure ice	boiling point of pure water

18 Aluminium has a specific heat capacity of 900 J / (kg °C).

The internal energy of a 2.0 kg block of aluminium increases by 13 500 J.

By how much does the temperature of the block increase?

A 0.067 °C **B** 0.13 °C **C** 7.5 °C **D** 15 °C

19 Why does a balloon filled with hot air rise?

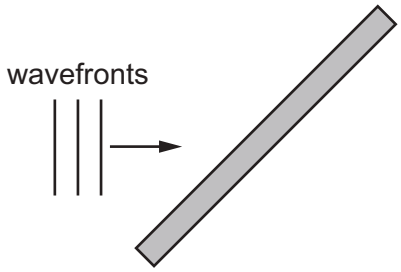
A Cold air is less dense than hot air.

B Cold air is more dense than hot air.

C Heat rises.

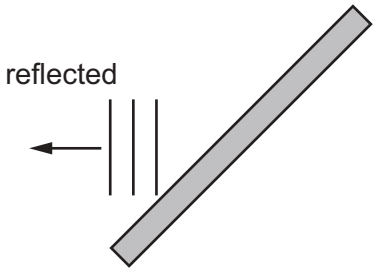
D The density of the balloon is greater than the density of the surrounding gas.

20 The diagram represents plane wavefronts of a water wave about to strike a solid barrier.

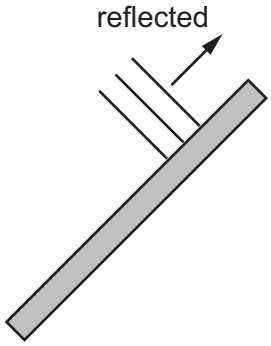


Which diagram shows the position of the wavefronts after reflection at the barrier?

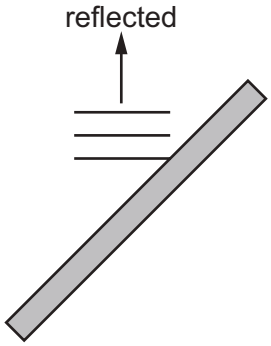
A



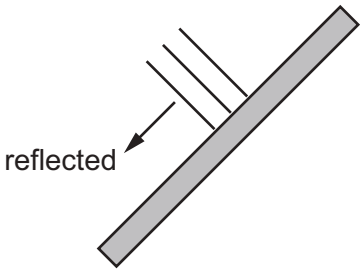
B



C

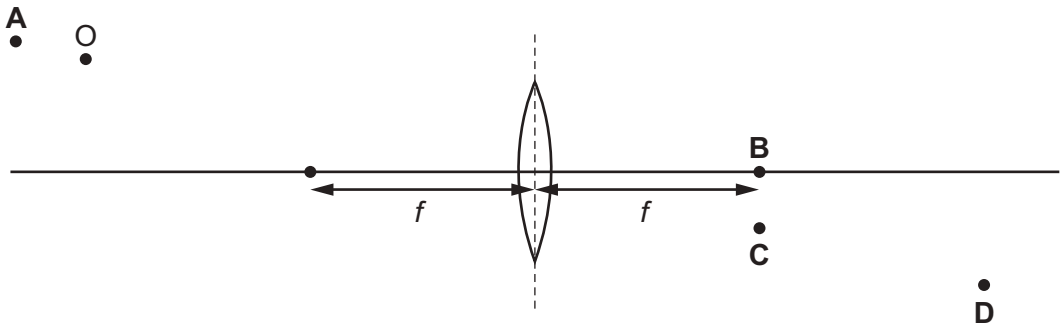


D

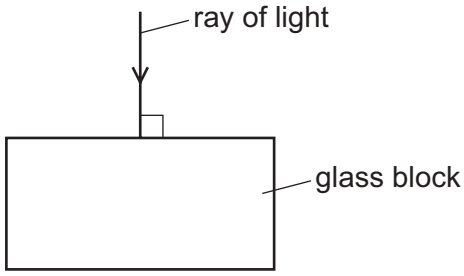


21 The diagram shows an object O in front of a thin converging lens of focal length *f*.

At which point will the lens form a sharp image of the object?



22 The diagram shows a ray of light incident on the surface of a rectangular glass block at 90° to the surface.



Which quantities remain unchanged as the light enters the glass block?

A direction and frequency

B direction and speed

C frequency and speed

D speed and wavelength

23 Which piece of equipment is designed to produce a type of electromagnetic wave?

A electric fire

B electric generator

C electric motor

D electromagnet

24 The Moon is 380 000 km from the Earth. A laser light beam is directed from the Earth to the Moon. The beam is reflected back to the Earth.

How long does it take for the light to travel to the Moon and back to the Earth?

A 1.27 ms **B** 2.53 ms **C** 1.27 s **D** 2.53 s

25 Different waves travel through air.

Which waves have the greatest difference in speed?

A ultrasound waves and sound waves

B ultrasound waves and ultraviolet waves

C ultraviolet waves and light waves

D ultraviolet waves and radio waves

26 The speed of sound is different in different states of matter.

The speed of sound in water is 1500 m / s.

Which row correctly compares the speed of sound in ice and the speed of sound in steam with the speed of sound in water?

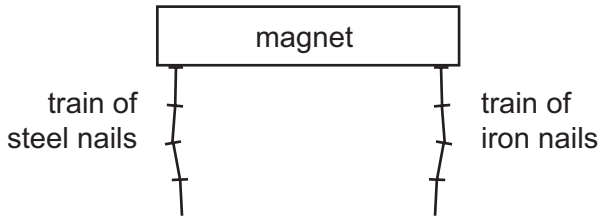
	speed of sound in ice m / s	speed of sound in steam m / s
A	less than 1500	less than 1500
B	less than 1500	more than 1500
C	more than 1500	less than 1500
D	more than 1500	more than 1500

27 A student finds that it takes sound 0.33 seconds to travel 100 metres.

From this information, what is the speed of sound?

A 30 m / s **B** 60 m / s **C** 300 m / s **D** 600 m / s

28 A train of steel nails and a train of iron nails hang from a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains?

A Both trains fall apart.

B Both trains stay together.

C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

29 An old and expensive steel watch becomes magnetised.

The owner wants to use the watch again. He must demagnetise the watch.

What is the **best** method to do this?

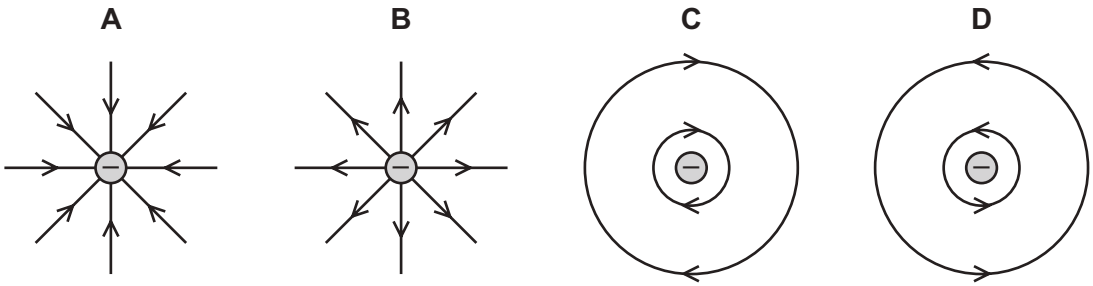
A Insert the watch in a solenoid that carries alternating current and then slowly remove it.

B Insert the watch in a solenoid that carries direct current and then slowly remove it.

C Pass alternating current through the watch.

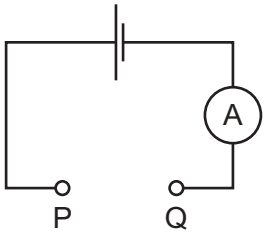
D Pass direct current through the watch.

30 Which diagram represents the electric field due to a negatively-charged conducting sphere?



31 The diagram shows a circuit with a gap between points P and Q.

Four pieces of metal wire of the same material are connected, in turn, between points P and Q in the circuit.

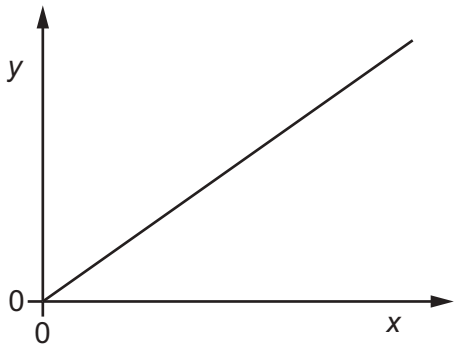


The table gives the diameters and lengths of the wires.

In which wire is the current the largest?

	diameter / mm	length / m
A	0.10	1.0
B	0.10	2.0
C	0.20	1.0
D	0.20	2.0

32 The graph shows the way in which one physical quantity *y* varies with another physical quantity *x*.



Which row gives suitable quantities for *y* and *x*?

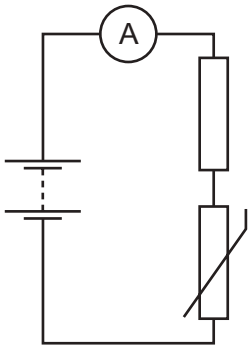
	y	*x*
A	the number of atoms of a radioactive isotope present	the time taken
B	the potential difference across a metallic conductor	the current in the metallic conductor
C	the resistance of a length of wire	the diameter of the wire
D	the volume of a 1.0 kg object	the density of the material from which the object is made

33 The potential difference across a car headlamp is 12 V. The current in the lamp is 2.5 A.

How much energy is transferred by the lamp in 1.0 hour?

A 1800 J **B** 1800 W **C** 108 000 J **D** 108 000 W

34 The diagram shows a circuit with a fixed resistor connected in series with a thermistor and an ammeter.



Which row shows how temperature change affects the resistance of the thermistor and the current in the circuit?

	temperature	resistance of thermistor	current in circuit
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

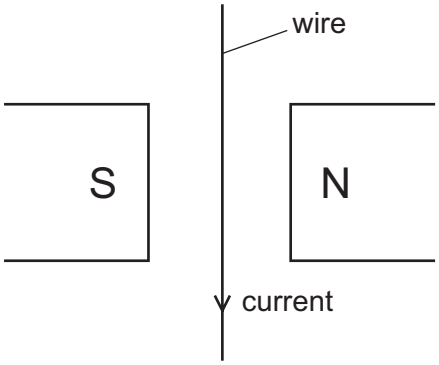
35 An incomplete truth table for a NAND gate is shown.

input P	input Q	output
0	0	W
0	1	X
1	0	Y
1	1	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	0	0	0	1
B	0	1	1	1
C	1	0	0	0
D	1	1	1	0

36 The diagram shows a wire hanging freely between the poles of a magnet. There is a current in the wire in the direction shown.



The magnet and current cause a force to act on the wire.

In which direction does this force act?

A into the page (away from you)

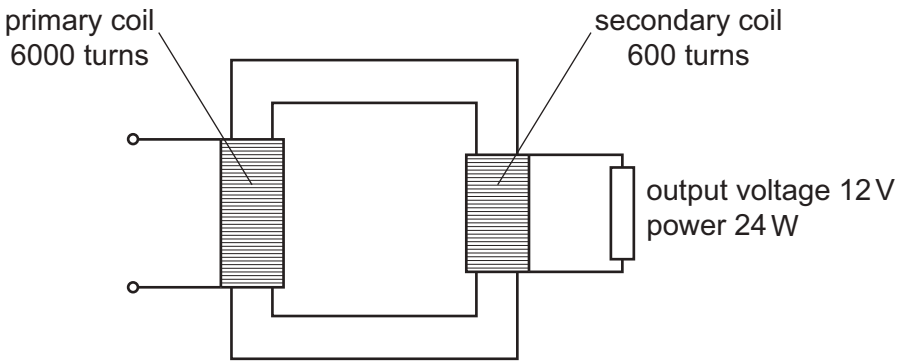
B out of the page (toward you)

C to the left

D to the right

37 A 100% efficient transformer has 6000 turns on its primary coil and 600 turns on its secondary coil. The output voltage of the transformer is 12 V.

A resistor is connected across the secondary coil and dissipates 24 W of power.

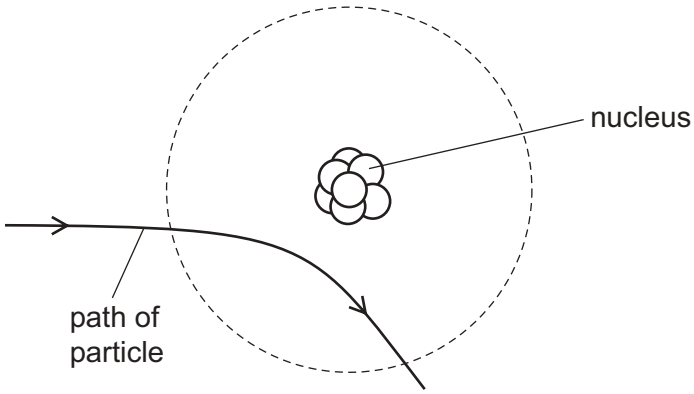


What is the current in the primary coil of the transformer?

A 0.050 A **B** 0.20 A **C** 5.0 A **D** 20 A

38 In the diagram, the circle represents an atom (not to scale) with the nucleus at its centre.

A particle is emitted by a radioactive source and approaches the nucleus of the atom. The curved arrow shows the path of the particle.



What is the nature and charge of the particle?

	nature of particle	charge of particle
A	α-particle	negative
B	α-particle	positive
C	β-particle	negative
D	β-particle	positive

39 Which row describes the behaviour of γ-rays in an electric field and in a magnetic field?

	electric field	magnetic field
A	deflected	deflected
B	deflected	undeflected
C	undeflected	deflected
D	undeflected	undeflected

40 A radioactive source has a half-life of 0.5 hours.

A detector near the source shows a reading of 6000 counts per second.

Background radiation can be ignored.

What is the reading on the detector 1.5 hours later?

A 750 counts per second

B 1500 counts per second

C 2000 counts per second

D 3000 counts per second

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/23**

Paper 2 Multiple Choice (Extended) **October/November 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = $10\,m/s^2$).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **18** printed pages and **2** blank pages.

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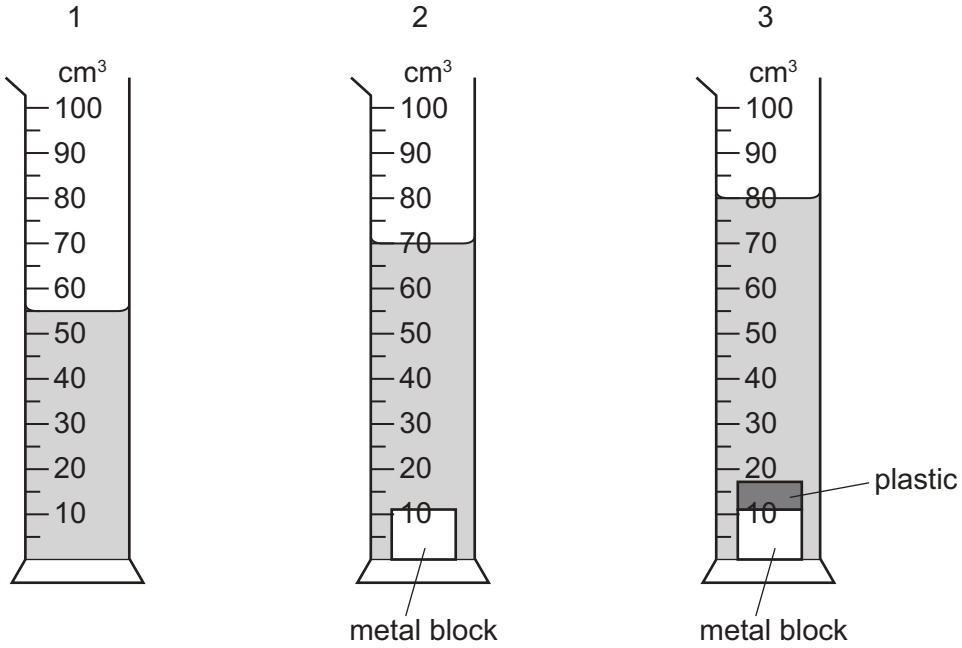
1 A measuring cylinder contains some water. A small metal block is slowly lowered into the water and is then removed.

Finally a piece of plastic is attached to the metal block and the block is again slowly lowered into the water.

The diagrams show the measuring cylinder at each stage of this process.



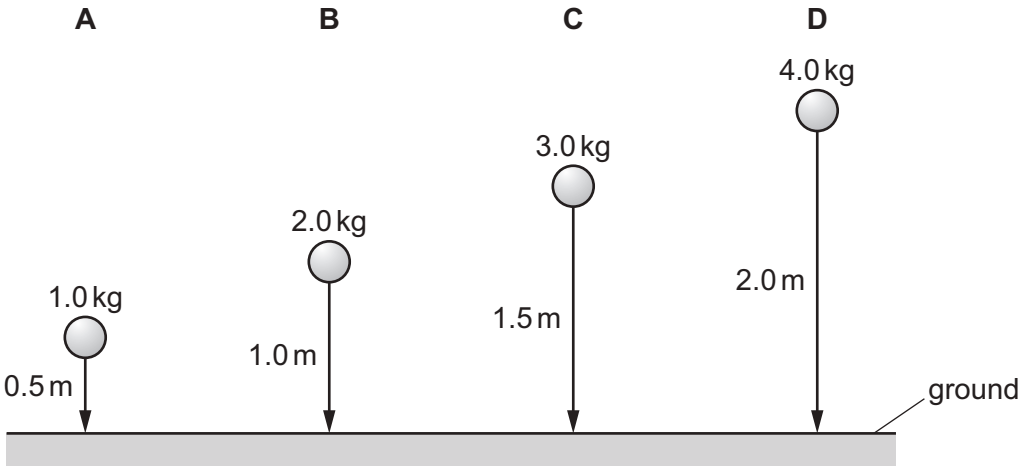
What is the volume of the piece of plastic?

A 10 cm^3 **B** 25 cm^3 **C** 70 cm^3 **D** 80 cm^3

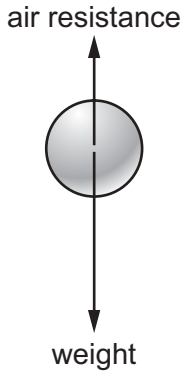
2 Four balls with different masses are dropped simultaneously from the heights shown.

Air resistance may be ignored.

Which ball hits the floor first?



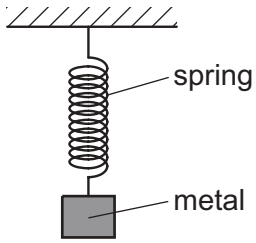
3 The diagram shows the vertical forces acting on a ball as it falls vertically through the air. The ball does not reach terminal velocity.



Which row describes what happens to the resultant force on the ball and what happens to the acceleration of the ball as it falls through the air?

	resultant force	acceleration
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

4 A spring is stretched by hanging a piece of metal from it.



Which name is given to the force that stretches the spring?

A friction

B mass

C pressure

D weight

5 On the Moon, all objects fall with the same acceleration.

Which statement explains this?

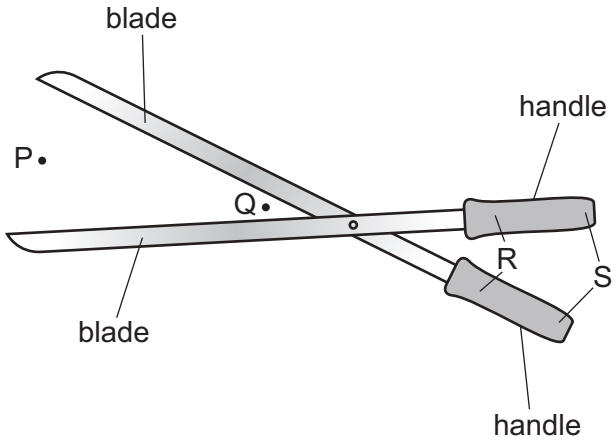
A On the Moon, all objects have the same weight.

B The Moon has a smaller gravitational field strength than the Earth.

C The weight of an object is directly proportional to its mass.

D The weight of an object is inversely proportional to its mass.

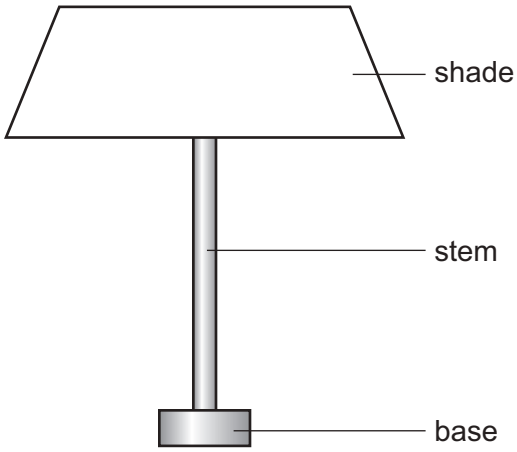
6 A pair of cutters is used to cut a rope.



Where should the rope be positioned and at which labelled points should the hands be positioned to produce the greatest cutting force?

	rope positioned	hands positioned
A	P	R
B	P	S
C	Q	R
D	Q	S

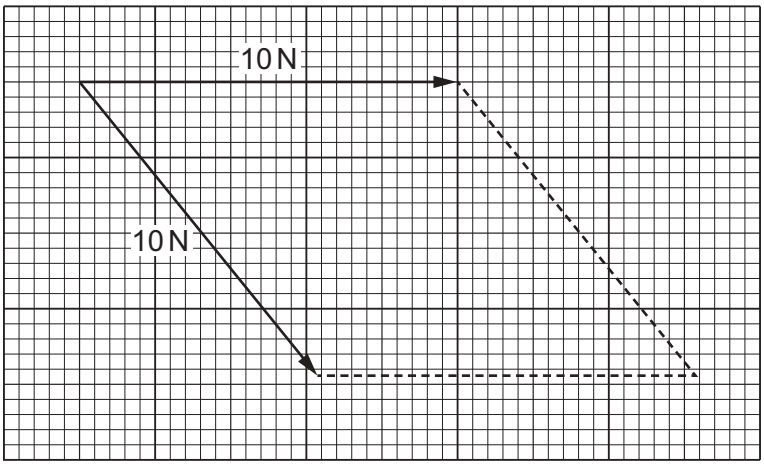
7 The lamp in the diagram is not very stable and falls over easily.



Which row shows changes that would definitely make the lamp more stable?

	base	centre of gravity
A	narrower	higher
B	narrower	lower
C	wider	higher
D	wider	lower

8 The diagram shows an incomplete scale drawing to find the resultant of two 10 N forces acting at a point in the directions shown.



What is the magnitude of the resultant force?

A 7.5 N **B** 8.6 N **C** 18 N **D** 20 N

9 An object has a mass of 60 kg.

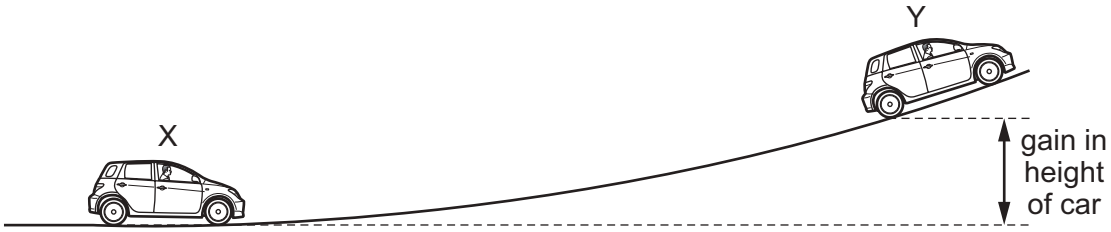
It decelerates from 50 m / s to 20 m / s when a resultant force of 300 N acts on it.

For how long does the force act?

A 0.071 s **B** 0.17 s **C** 6.0 s **D** 14 s

10 A car, starting from rest at position X, accelerates up a hill. The car reaches a speed of 10 m / s at position Y.

The kinetic energy of the car at position Y is equal to its gain in gravitational potential energy from X to Y.



Take the gravitational field strength *g* to be 10 N / kg.

What is the gain in height of the car between X and Y?

A 0.50 m **B** 5.0 m **C** 10 m **D** 50 m

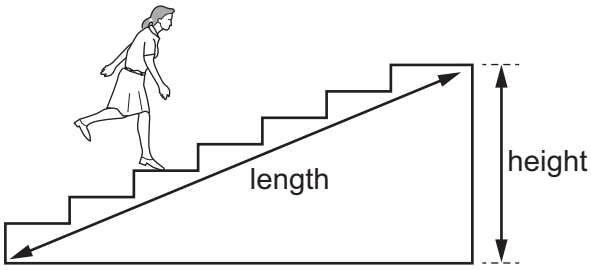
11 A 150 W filament lamp has an efficiency of 10%. A 40 W compact fluorescent lamp (CFL) has an efficiency of 30%.

Each lamp is switched on for the same amount of time.

Which lamp produces more light and which lamp converts more energy into other forms of energy?

	produces more light	converts more energy into other forms
A	CFL lamp	CFL lamp
B	CFL lamp	filament lamp
C	filament lamp	CFL lamp
D	filament lamp	filament lamp

12 A student runs up a flight of stairs.



Which information is **not** needed to calculate the rate at which the student is doing work against gravity?

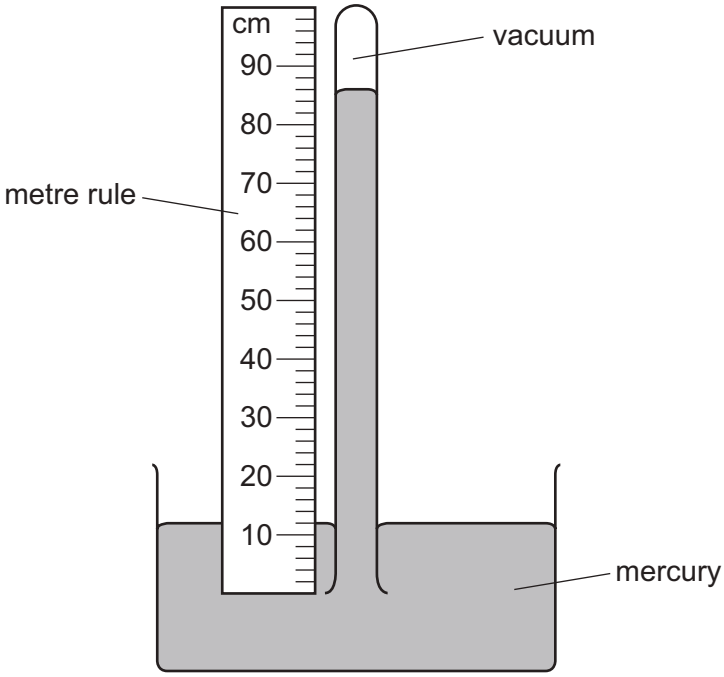
A the height of the flight of stairs

B the length of the flight of stairs

C the time taken to run up the stairs

D the weight of the student

13 The diagram shows a simple mercury barometer.

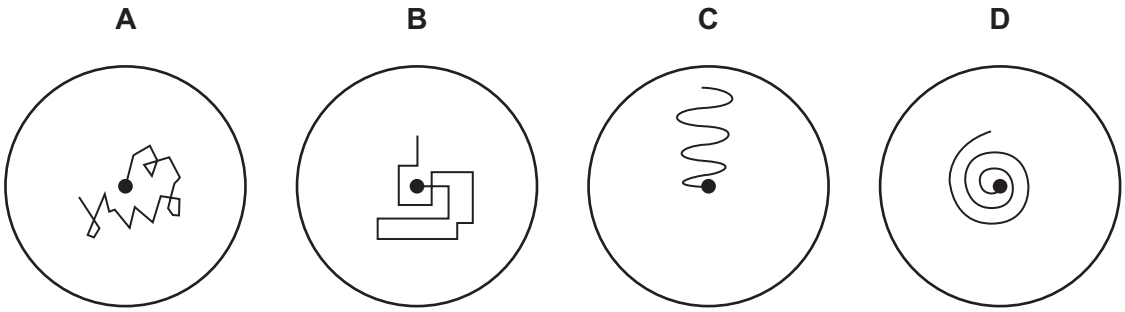


Which length is used to find the value of atmospheric pressure?

A 12 cm **B** 74 cm **C** 86 cm **D** 100 cm

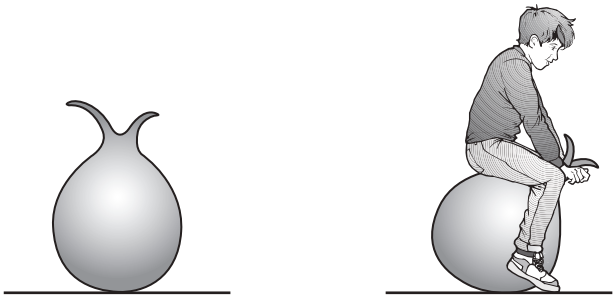
14 A pollen grain in a beaker of still water is viewed through a microscope.

Which diagram shows the most likely movement of the pollen grain?



15 The diagram shows an air-filled rubber toy. A child sits on the toy and its volume decreases.

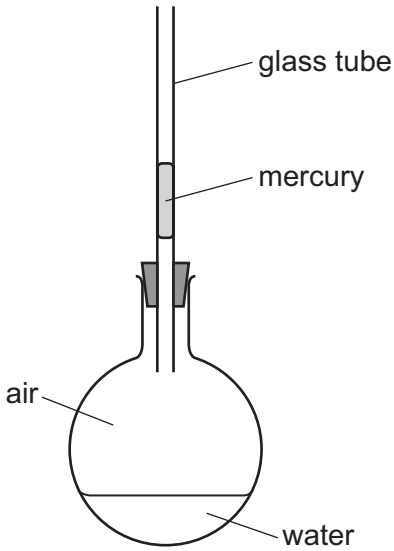
The temperature of the air in the toy does not change.



How does the air pressure in the toy change and why?

	pressure	reason
A	decreases	air molecules move more slowly
B	decreases	air molecules strike the rubber less frequently
C	increases	air molecules move more quickly
D	increases	air molecules strike the rubber more frequently

16 The diagram shows a glass flask, sealed with a small volume of mercury in a glass tube. When the flask is gently warmed the mercury rises up the tube.



What is the main cause of the movement of the mercury?

A expansion of air in the flask

B expansion of the glass flask

C expansion of the glass tube

D expansion of the mercury

17 Which property **cannot** be used for the measurement of temperature?

A half-life of a radioactive isotope

B length of a solid metal bar

C pressure of a gas

D volume of a liquid

18 A student uses an immersion heater to heat some water in a beaker.

The water is heated from 20 °C to 80 °C.

The energy supplied to the water is 60.0 kJ.

What is the thermal capacity of the water? (Ignore any heat loss.)

A 667 J / °C **B** 750 J / °C **C** 1000 J / °C **D** 3000 J / °C

19 Why is the heating coil of a domestic immersion heater placed at the bottom of the tank?

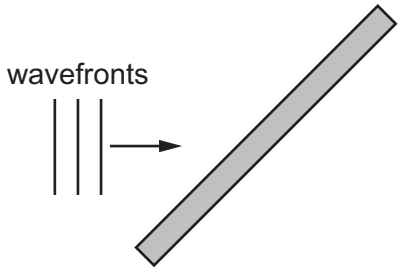
A Cold water is less dense than hot water and therefore sinks.

B Cold water is more dense than hot water and therefore rises.

C Hot water is less dense than cold water and therefore rises.

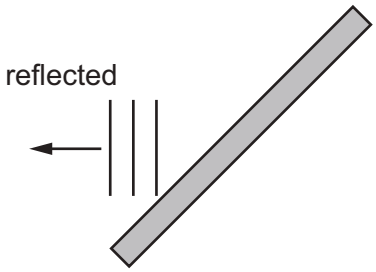
D Hot water is more dense than cold water and therefore sinks.

20 The diagram represents plane wavefronts of a water wave about to strike a solid barrier.

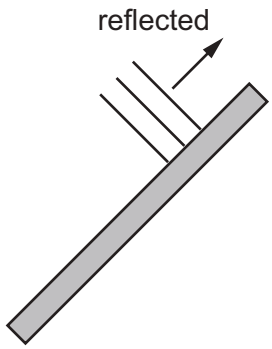


Which diagram shows the position of the wavefronts after reflection at the barrier?

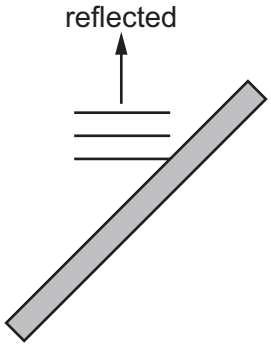
A



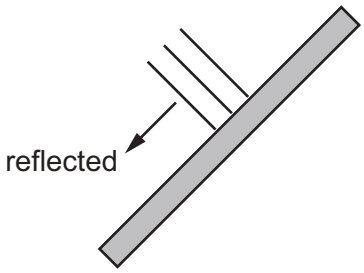
B



C

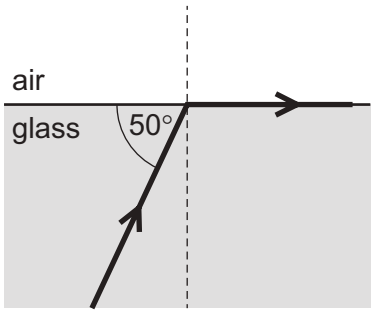


D



21 The diagram shows a ray of light in glass. The ray reaches a boundary with air.

One weak ray of light is missing from the diagram.



Which statement is correct?

A At the boundary, the speed of the light will become less.

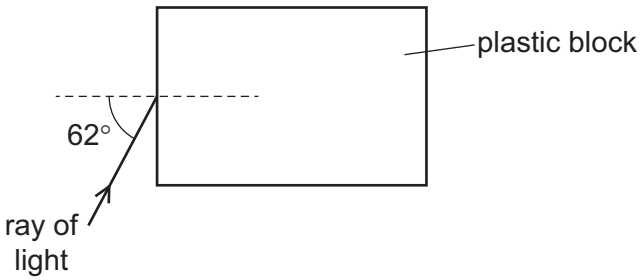
B The critical angle for light at this boundary is 50°.

C The diagram shows an example of diffraction of light.

D The missing ray is a weak reflected ray.

22 Light travelling in air enters a plastic block at an angle of incidence of 62°.

The plastic has a refractive index of 1.48.



What is the angle of refraction?

A 18° **B** 28° **C** 37° **D** 42°

23 A sound wave travels from a medium in one state into the same medium but in another state. This causes the speed of the wave to change from approximately 300 m / s to approximately 3000 m / s.

Between which two states is the sound wave travelling?

A gas to solid

B liquid to gas

C liquid to solid

D solid to liquid

24 The Moon is 380 000 km from the Earth. A laser light beam is directed from the Earth to the Moon. The beam is reflected back to the Earth.

How long does it take for the light to travel to the Moon and back to the Earth?

A 1.27 ms **B** 2.53 ms **C** 1.27 s **D** 2.53 s

25 Which statement about radio waves is correct?

A They are used in television remote controllers.

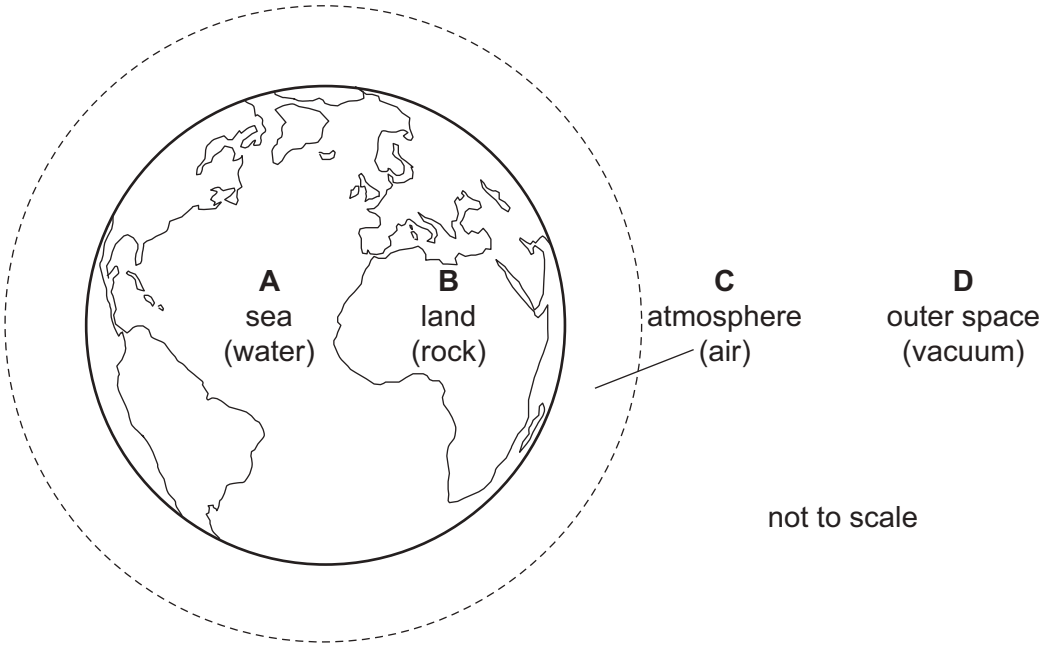
B They can be detected by the human eye.

C They travel as longitudinal waves.

D They have the same speed in a vacuum as ultraviolet waves.

26 The diagram shows the Earth and its surroundings.

Through which labelled region can sound **not** be transmitted?



27 Different waves travel through air.

Which waves have the greatest difference in speed?

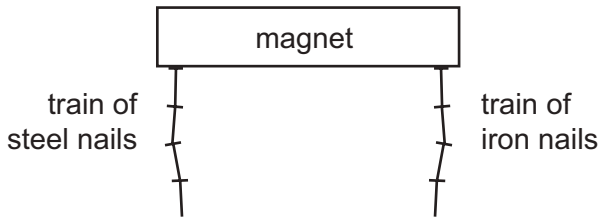
A ultrasound waves and sound waves

B ultrasound waves and ultraviolet waves

C ultraviolet waves and light waves

D ultraviolet waves and radio waves

28 A train of steel nails and a train of iron nails hang from a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains?

A Both trains fall apart.

B Both trains stay together.

C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

29 What is the best method to demagnetise a steel rod?

A Pass the rod through a coil connected to an a.c. supply.

B Pass the rod through a coil connected to a d.c. supply.

C Place the rod next to another magnet.

D Stroke the rod with another magnet.

30 There is a current in a metal wire.

Which particles in the wire move to cause this current?

A α-particles

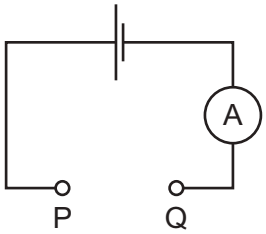
B electrons

C neutrons

D protons

31 The diagram shows a circuit with a gap between points P and Q.

Four pieces of metal wire of the same material are connected, in turn, between points P and Q in the circuit.



The table gives the diameters and lengths of the wires.

In which wire is the current the largest?

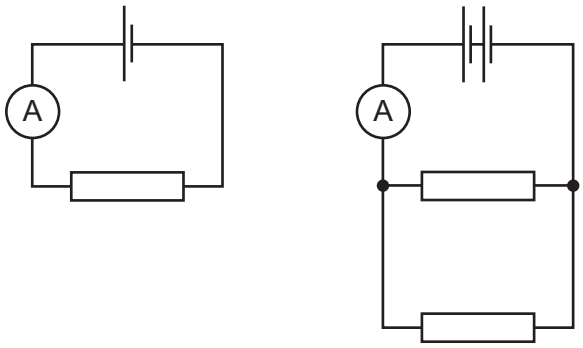
	diameter / mm	length / m
A	0.10	1.0
B	0.10	2.0
C	0.20	1.0
D	0.20	2.0

32 A battery is connected to a circuit. It is switched on for 1.0 minute. During that time, there is a current of 0.40 A in the circuit and the battery supplies a total of 48 J of energy.

Which row gives the charge that passes and the electromotive force (e.m.f.) of the battery?

	charge that passes in 1.0 minute / C	e.m.f. of the battery / V
A	0.40	2.0
B	0.40	120
C	24	2.0
D	24	120

33 Identical cells and identical resistors are used to make the circuits shown.



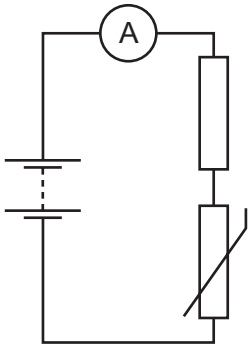
circuit 1 circuit 2

In circuit 1, the ammeter reads 2.0 A.

What is the ammeter reading in circuit 2?

A 1.0 A **B** 2.0 A **C** 4.0 A **D** 8.0 A

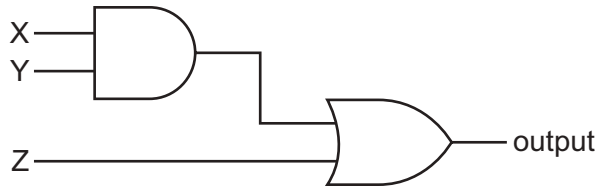
34 The diagram shows a circuit with a fixed resistor connected in series with a thermistor and an ammeter.



Which row shows how temperature change affects the resistance of the thermistor and the current in the circuit?

	temperature	resistance of thermistor	current in circuit
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	increases	increases

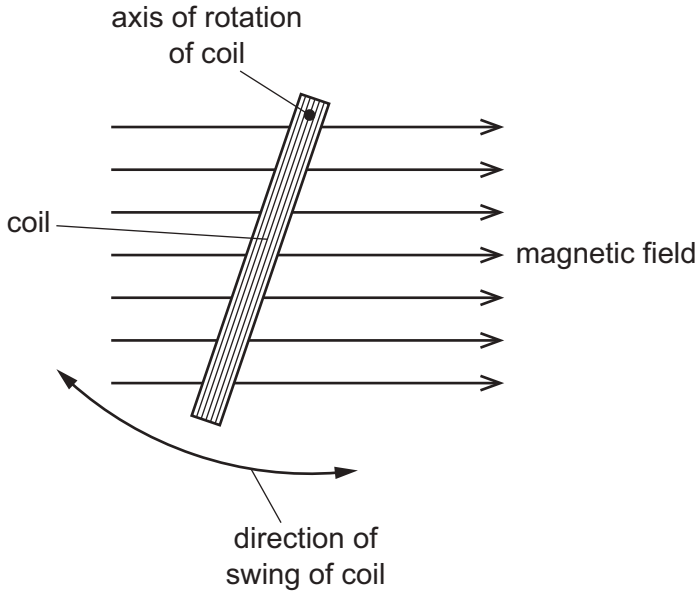
35 The diagram shows an AND gate and an OR gate connected together.



Which combination of inputs X, Y and Z gives an output of 0?

	X	Y	Z
A	0	0	1
B	0	1	1
C	1	0	0
D	1	1	0

36 The diagram shows a short-circuited copper coil swinging about an axis at right-angles to a strong magnetic field. The motion induces a current in the coil.



What is the effect, if any, of this induced current in the coil?

A The induced current has no effect on the movement of the coil because copper is non-magnetic.

B The induced current produces a magnetic field of constant magnitude in the coil.

C The induced current produces forces that assist the change causing it.

D The induced current produces forces that oppose the changes causing it.

37 Diagram 1 shows a magnet being pushed into a coil that is connected to a centre-zero galvanometer.

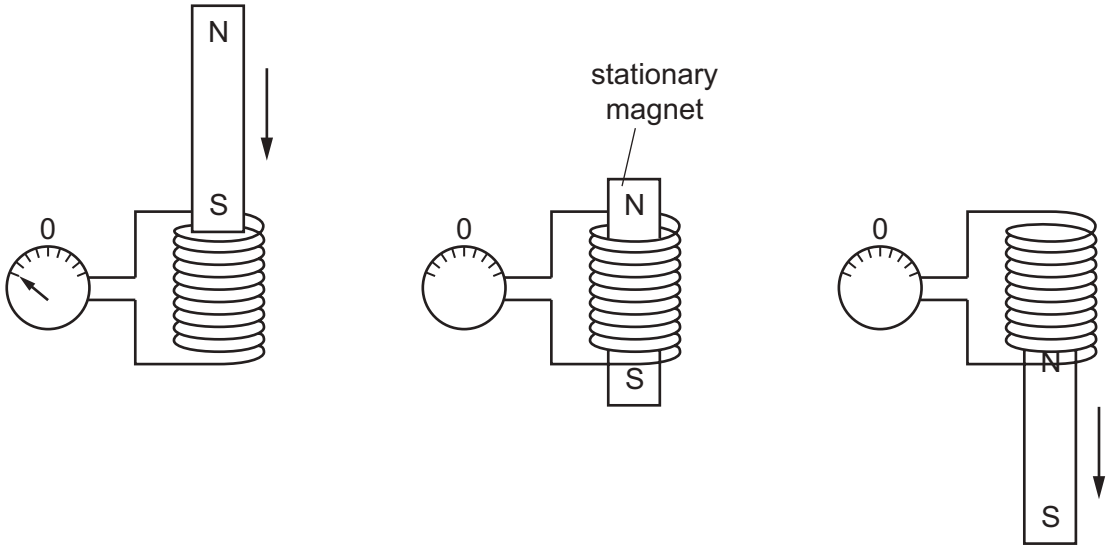


diagram 1 diagram 2 diagram 3

Which row shows the directions of the pointer when the magnet is as shown in diagrams 2 and 3?

	diagram 2	diagram 3
A		
B		
C		
D		

38 Radioactive carbon-14 decays to nitrogen-14 by the emission of a particle.

$$^{14}_{6}C \rightarrow ^{14}_{7}N + \text{particle}$$

Which particle has been emitted in this process?

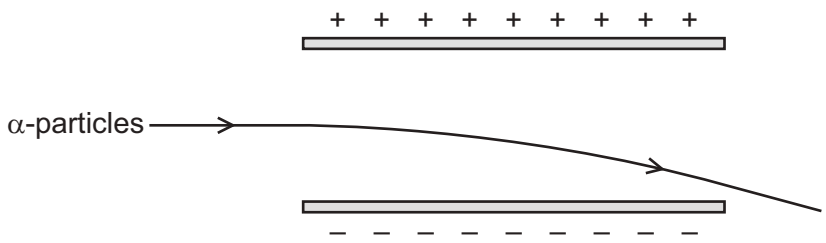
A a β-particle

B an α-particle

C a neutron

D a proton

39 As α-particles pass through the electric field between two charged plates, they are deflected downwards.



What happens to γ-rays passing through the same electric field?

A They are deflected downwards more than the α-particles.

B They are deflected upwards.

C They are not deflected at all.

D They follow the same path as the α-particles.

40 Radioactive iodine-131 emits β-particles and has a half-life of 8 days. It decays to produce xenon-131.

Which statement about this decay is correct?

A After 8 days no more β-particles are emitted.

B After 8 days the number of xenon-131 atoms has halved.

C After 16 days the iodine-131 has decayed completely.

D After 16 days the number of iodine-131 atoms has reduced to one quarter.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/31**

Paper 3 Theory (Core) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.

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CAMBRIDGE International Examinations

1 A student clamps a metre rule to the end of a bench, as shown in Fig. 1.1. He attaches a mass to the end of the rule.

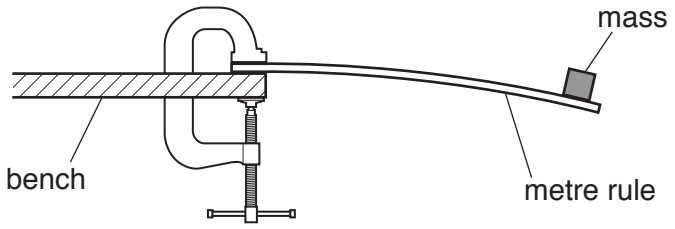

Fig. 1.1

The student displaces the end of the rule by a small distance. The rule oscillates up and down. The student measures the time for ten complete oscillations.

(a) State the name of a measuring device for timing the oscillations.

..... [1]

(b) State a reason why the student measures the time for ten oscillations, rather than for one.

..... [1]

(c) The student repeats the procedure. His results are shown in the table.

results	time for ten complete oscillations / seconds
1st	3.93
2nd	4.07
3rd	3.55
4th	3.99

(i) One of the results is incorrect. On the table, draw a ring around the incorrect result. [1]

(ii) Calculate the average value for the time for ten complete oscillations.

average time = ... s [2]

(iii) Determine the time for one complete oscillation. State your answer to two significant figures.

time = ... s [1]

[Total: 6]

2 Fig. 2.1 shows a river flowing through a village. There are two bridges across the river.

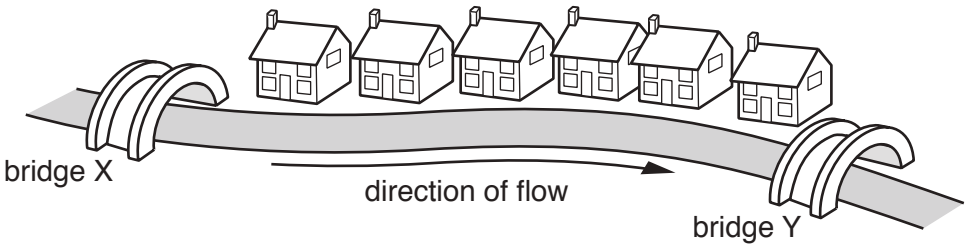

Fig. 2.1

Two students plan to measure the speed of a stick as it floats on the river between bridge X and bridge Y.

(a) The students plan to drop a stick into the middle of the river from bridge X. The stick moves with the water between bridge X and bridge Y.

Describe how the students can determine the average speed of the stick.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The stick moves with constant speed.
One statement correctly describes the horizontal forces acting on the stick.

Put a tick (✓) in the box next to the correct statement.

- [ ] Only a forward force acts.
- [ ] The forward force and the backward force are equal.
- [ ] The forward force is greater than the backward force.
- [ ] The backward force is greater than the forward force.

[1]

[Total: 5]

3 Fig 3.1 shows a warning marker floating on the surface of a lake.

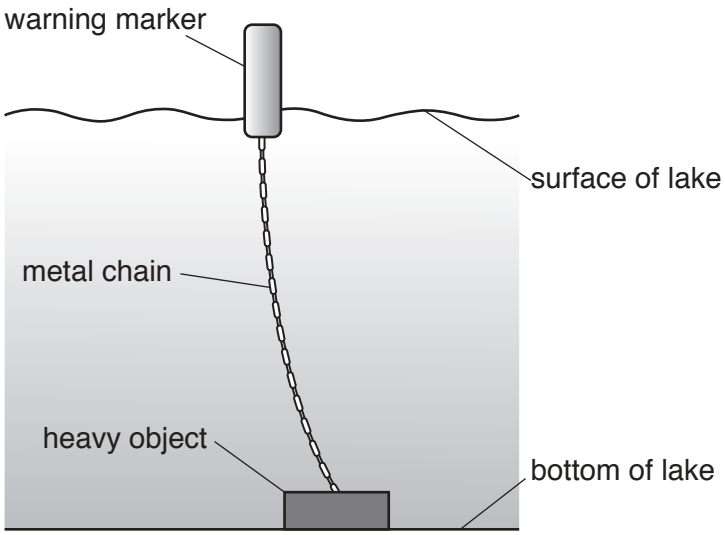

Fig. 3.1

The marker is attached by a metal chain to a heavy object on the bottom of the lake.

(a) Fig. 3.2 shows the forces acting on the marker at one moment in time.

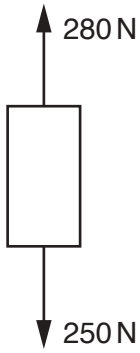

Fig. 3.2

Calculate the resultant force on the marker.

resultant force = ... N

direction = ...
[2]

(b) Fig. 3.3 shows part of the metal chain. It is made from small metal loops.

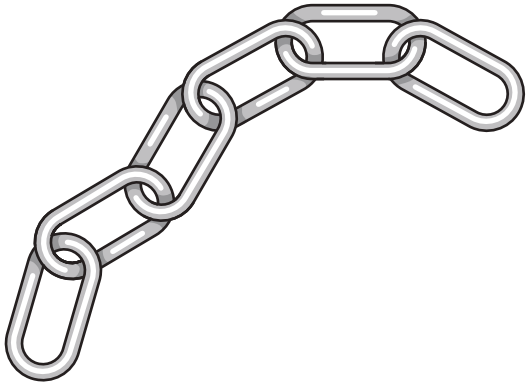

Fig. 3.3

A damaged loop is removed from the chain. Describe a method to determine the density of the metal from which the loops are made.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 7]

4 Fig. 4.1 shows two methods for generating electricity using renewable sources.

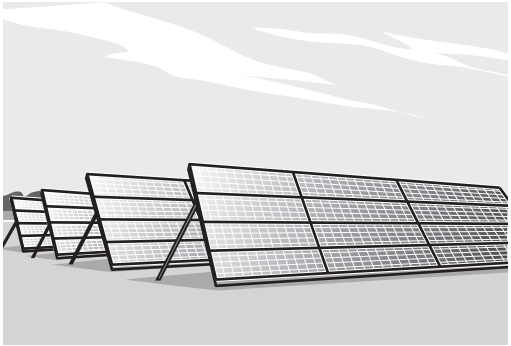

Fig. 4.1a

Fig. 4.1b

Fig. 4.1

(a) Name the energy source for each method.

In Fig. 4.1a, the energy source is .....

In Fig. 4.1b, the energy source is .....
[2]

(b) **(i)** State **two** advantages of using renewable sources for generating electricity compared to using a coal-fired power station.

1. .....

.....

2. .....

..... [2]

(ii) State **one** disadvantage of using renewable sources for generating electricity compared to using a coal-fired power station.

.....

..... [1]

[Total: 5]

5 Complete the sentences. Choose from the words in the box.

solid	liquid	gas

The words may be used once, more than once or not at all.

(a) The atoms are usually arranged in regular patterns in a ..... . [1]

(b) The state of matter with the lowest density is a ..... . [1]

(c) Evaporation takes place when the most energetic molecules leave the surface of a

..... . [1]

(d) A small force can change the volume of a ..... . [1]

[Total: 4]

6 **(a)** Fig. 6.1 shows a ray of light inside a semi-circular glass block.

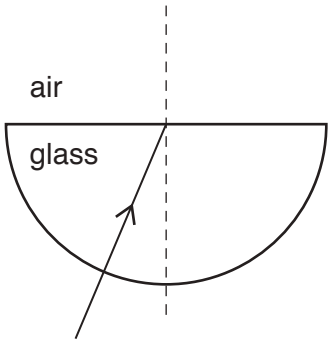

Fig. 6.1

The angle of incidence at the straight surface is **less** than the critical angle for the glass.

On Fig. 6.1, continue the path of the ray. [2]

(b) Fig. 6.2 shows another ray of light inside a semi-circular glass block.

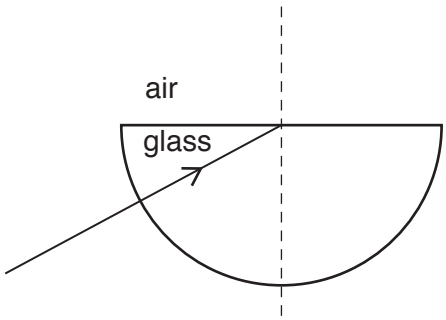

Fig. 6.2

The angle of incidence at the straight surface is **greater** than the critical angle for the glass.

(i) On Fig. 6.2, continue the path of the ray. [2]

(ii) State the term used to describe what happens to the light when it strikes the straight surface in Fig. 6.2.

..... [1]

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(c) A wave on the surface of water approaches a barrier. There is a small gap in the barrier, as shown in Fig. 6.3.

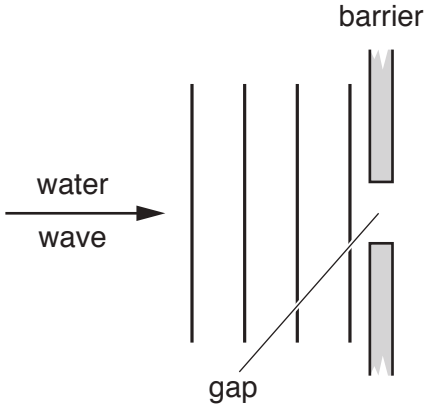


Fig. 6.3

On Fig. 6.3, draw **three** wavefronts that have passed through the gap. [2]

[Total: 7]

7 **(a)** Fig. 7.1 shows a man listening to a radio.

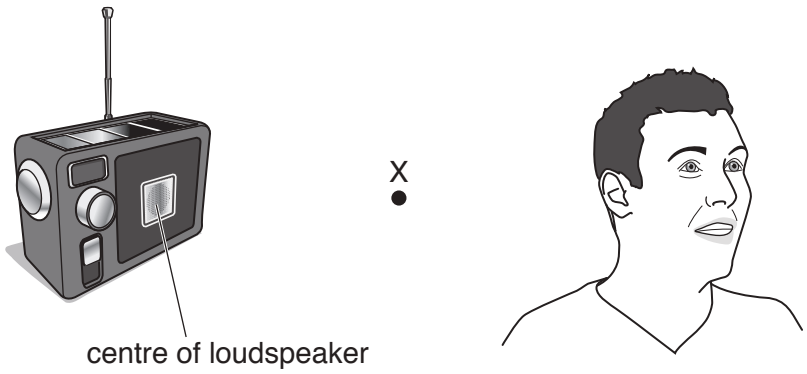


Fig. 7.1

(i) Sound from the radio makes an air particle at X vibrate.

On Fig. 7.1 draw two arrows on point X to show the directions of vibration of the air particle. [2]

(ii) Which of these terms correctly describes the sound wave?

Tick **one** box.

- ☐ transverse
- ☐ longitudinal
- ☐ electromagnetic [1]

(iii) Suggest a value for the frequency of the sound that the man can hear. State the unit.

frequency = ... [2]

(iv) Explain why the man cannot hear ultrasound.

.....

..... [1]

(b) Fig. 7.2 shows a distance-time graph for ultrasound travelling in sea-water.

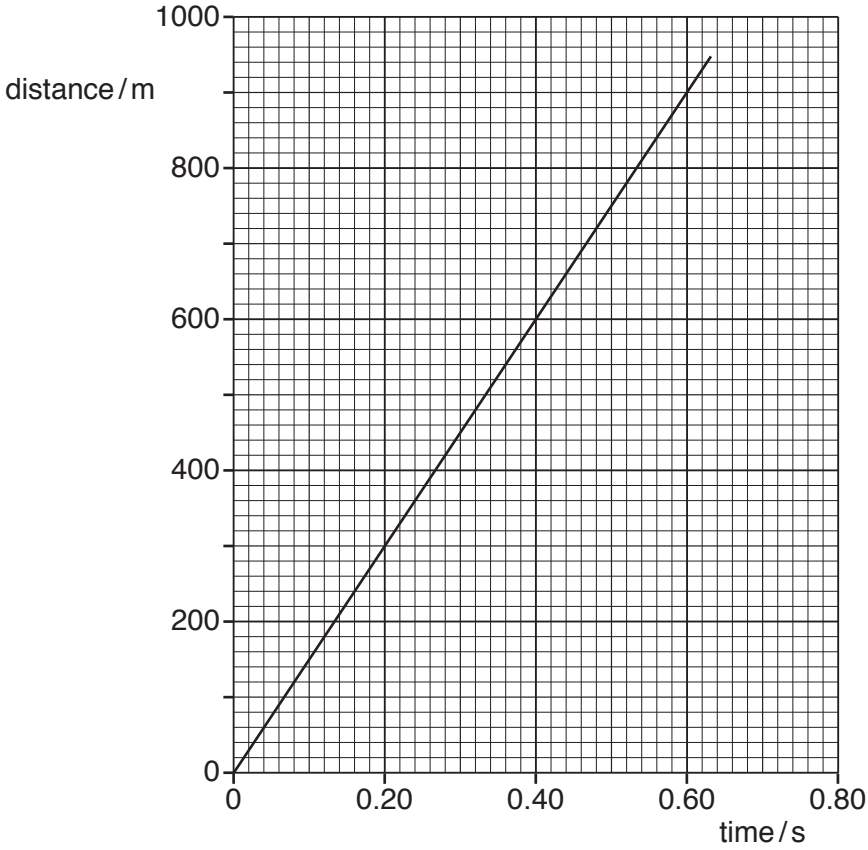


Fig. 7.2

(i) Use the graph to calculate the speed of ultrasound in sea-water.

speed = ... m / s [2]

(ii) A scientist measures the depth of the sea by using ultrasound. She sends a pulse of ultrasound from the ship to the seabed. It reflects from the seabed as shown in Fig. 7.3.

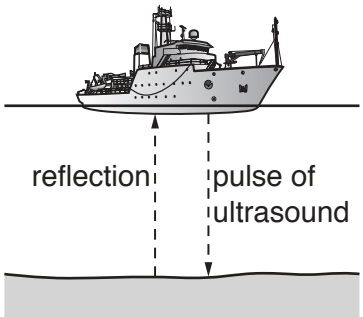


Fig. 7.3

The time taken between sending a pulse and receiving the echo is 0.60 s. Use the graph to determine the depth of the sea.

depth = ... m [2]

[Total: 10]

8 Fig. 8.1 shows a plotting compass and a bar magnet. The plotting compass consists of a small magnet in the shape of an arrow. The arrow can rotate freely on a pivot.

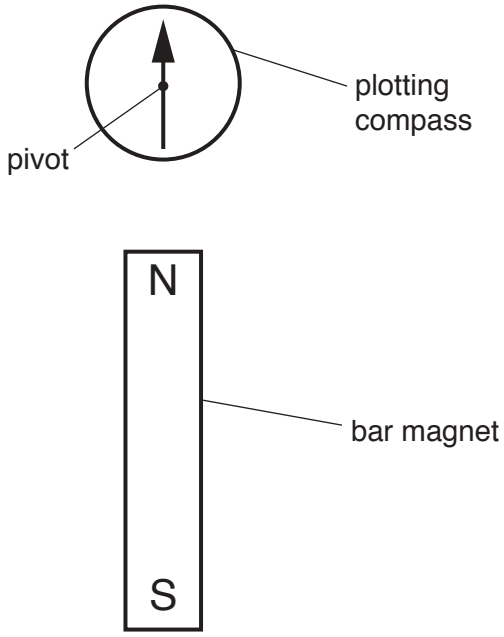


Fig. 8.1

(a) Describe how to use this apparatus to identify the magnetic field pattern of the bar magnet.

.....

.....

.....

.....

.....

..... [3]

(b) Fig. 8.2 shows a bar magnet.

Fig. 8.2

On Fig. 8.2 draw the magnetic field pattern around the bar magnet. Use arrows to show the direction of the field. [3]

[Total: 6]

9 A student investigates how the resistance of a thermistor changes with temperature.
Fig. 9.1 shows part of the circuit the student uses.

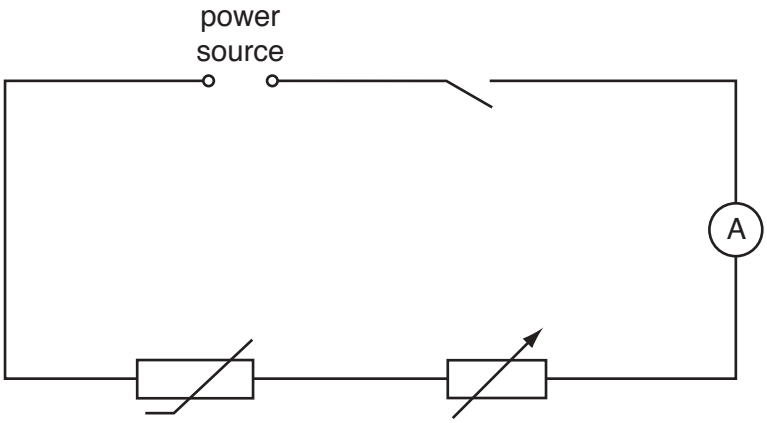


Fig. 9.1

(a) **(i)** On Fig. 9.1, label the thermistor. [1]

(ii) The student measures the potential difference (p.d.) across the thermistor.
On Fig. 9.1, draw a voltmeter symbol, correctly connected, to measure this potential difference. [2]

(b) The student varies the temperature of the thermistor and measures the current in it.
Some of the results are shown in the table.

temperature of thermistor / °C	20	40	60	80
current in thermistor / A	0.005	0.010	0.040	

(i) The potential difference across the thermistor is 6.0 V.

Calculate the resistance of the thermistor when its temperature is 40 °C.

resistance = ... Ω [3]

(ii) Describe and explain what happens to the current in the thermistor as the temperature of the thermistor rises.

.....

.....

..... [2]

(iii) Suggest a value for the current in the thermistor at 80 °C.

.....A [1]

(c) At a different temperature, the resistance of the thermistor is 300 Ω and the resistance of the variable resistor is 400 Ω.

Calculate the value of their combined resistance.

combined resistance = ...Ω [1]

[Total: 10]

10 (a) A student investigates electromagnetic induction.

Fig. 10.1 shows the arrangement she uses.

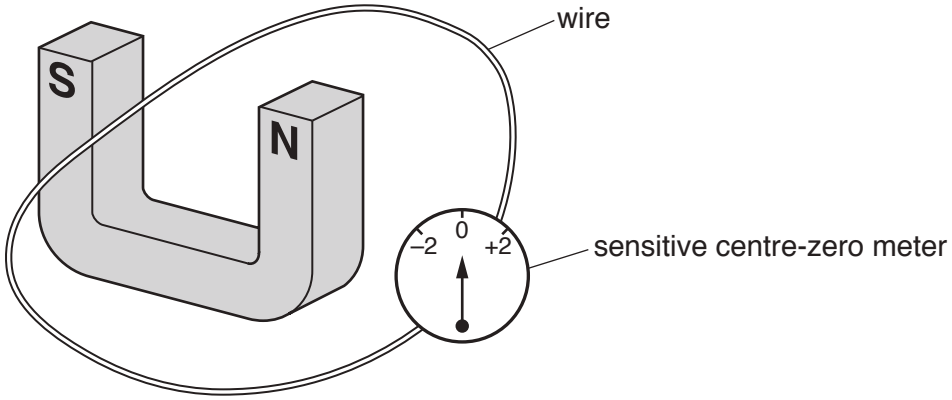
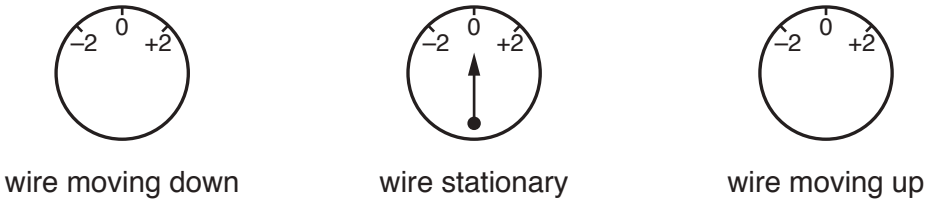


Fig. 10.1

When the student holds the wire stationary, as shown in Fig. 10.1, the reading on the meter is zero.
She moves the wire down between the poles of the magnet. Then she holds it stationary and then moves it up.

(i) The meter measures the size and direction of the induced electromotive force (e.m.f.). On Fig. 10.2, draw the position of the pointer on the meter at each stage.

One has been done for you.



[2]

Fig. 10.2

(ii) Describe how the student could increase the size of the induced electromotive force (e.m.f.).

.....

.....

..... [2]

(b) A transformer is used near a power station.
There are 60 turns on the input coil and 660 turns on the output coil.
The input voltage is 25 000 V.

Calculate the output voltage.

output voltage = ... V [3]

(c) State **two** advantages of high-voltage transmission of electrical energy.

1. .....

2. ..... [2]

[Total: 9]

11 A nucleus of polonium-210 can be represented as $^{210}_{84}Po$.

(a) **(i)** State the number of protons in a nucleus of polonium-210 ..... [1]

(ii) State the number of neutrons in a nucleus of polonium-210 ..... [1]

(iii) State the number of electrons in a neutral atom of polonium-210 ..... [1]

(b) Polonium-210 is radioactive. When polonium-210 decays it emits alpha radiation.

Name two other types of radiation emitted when radioactive elements decay.

..... and ..... [1]

(c) Polonium-210 has a half-life of 138 days.

A sample of polonium-210 has a mass of 0.4 g.

Calculate the time for the sample to decay until only 0.1 g of polonium-210 remains.

time = ... days [3]

[Total: 7]

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12 A scientist needs to reduce the risks when working with radioactive sources.

(a) Explain why radioactive sources can be dangerous.

.....

.....

..... [2]

(b) Describe how to reduce the risks when working with radioactive sources.

.....

.....

.....

..... [2]

[Total: 4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/32**

Paper 3 Theory (Core) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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CAMBRIDGE International Examinations

1 **(a)** Nuclear power stations generate electricity.

Which of these statements describe an advantage of using nuclear power stations, and which of them describe a disadvantage?

Put a tick (✓) in the correct column for each statement. The first one is done for you.

statement	advantage	disadvantage
nuclear power stations require high levels of security		✓
nuclear power stations produce small amounts of carbon dioxide		
nuclear power stations have a small effect on climate change		
waste radioactive material can take a very long time to decay		

[3]

(b) Describe how electricity may be generated using geothermal resources.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 6]

2 Fig. 2.1 shows a speed-time graph for a ship starting to move.

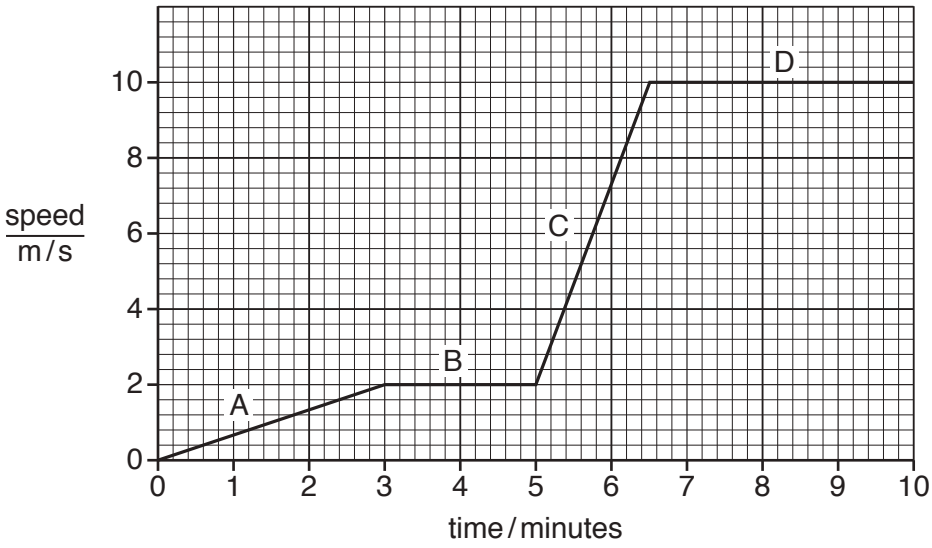

Fig. 2.1

(a) Describe the motion of the ship during each section of the graph.

A .....

.....

B .....

.....

C .....

.....

D .....

..... [4]

(b) Determine the distance travelled by the ship in section B of the graph.

distance = ... m [3]

[Total: 7]

3 Fig. 3.1 shows a glass vase used for displaying flowers.

Fig. 3.1

(a) The mass of the glass is 450 g. The volume of glass in the vase is 145 cm^3.

(i) Calculate the density of the glass.

density = ... g/cm^3 [3]

(ii) Calculate the weight of the glass.

weight = ... N [3]

(b) Another vase has a weight of 30 N. The area of the base in contact with a table is 80.0 cm^2.

Calculate the pressure this vase exerts on the table.

pressure = ... N/cm^2 [3]

[Total: 9]

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4 Fig. 4.1 shows a fairground ride.

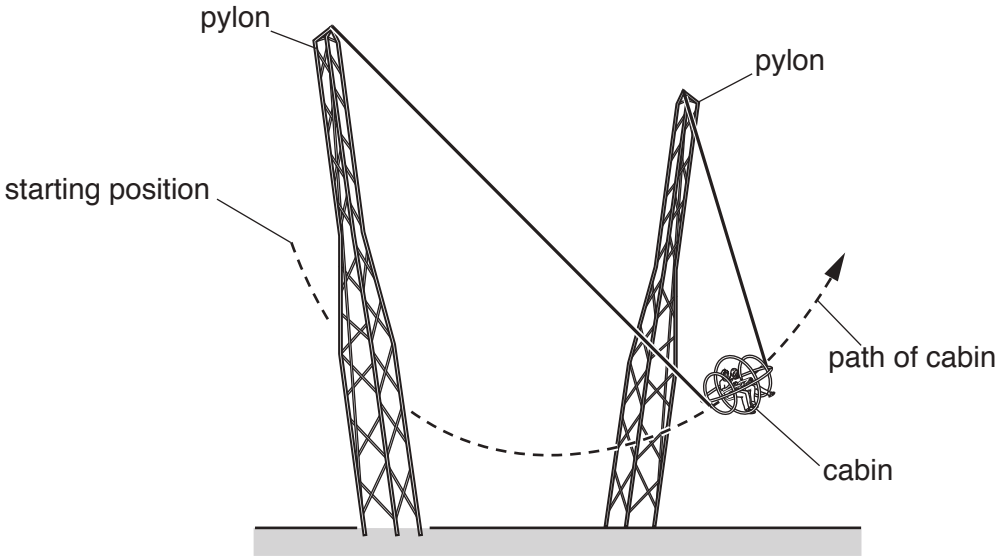

Fig. 4.1

People sit inside a cabin suspended between two pylons. The cabin is lifted to the starting position shown in Fig. 4.1.

(a) State the name of the type of energy gained by the cabin as it rises.

..... [1]

(b) The cabin is released and swings down between the two pylons. The path of the cabin is shown on Fig. 4.1. The cabin has maximum kinetic energy at one point on its path. Draw this point on Fig. 4.1 and label this point X. [1]

(c) A force opposes the motion of the cabin as it falls. State the name of this force.

..... [1]

(d) After a few swings, a brake system stops the cabin (not shown on the diagram).
Use ideas about energy transfer to suggest how the brake system stops the cabin.

.....

.....

.....

..... [3]

[Total: 6]

5 A cup made from plastic, containing a hot drink, is shown in Fig. 5.1.

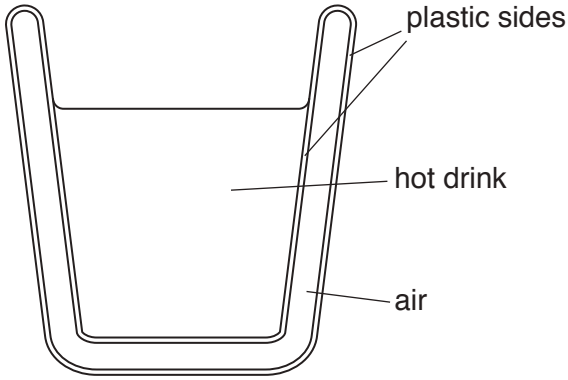

Fig. 5.1

(a) State the term given to materials that reduce the transfer of thermal energy.

..... [1]

(b) The hot drink gradually cools.

Describe and explain **two** processes by which thermal energy is transferred from the hot drink.

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 6]

6 Fig. 6.1 shows a ray of light reflected from mirror 1 at point P and striking mirror 2 at point Q.

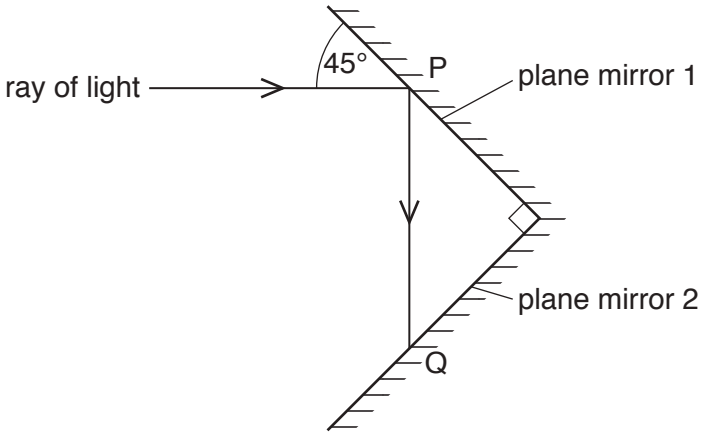

Fig. 6.1

(a) On Fig. 6.1,

- clearly mark the position of the normal at Q,
- draw the ray reflected from point Q,
- mark the angle of reflection at Q using the letter *r*,

State the law you used to draw the reflected ray.

.....

[4]

(b) Compare the direction of the ray reflected from mirror 2 at Q with the direction of the ray incident on mirror 1 at P. Tick **one** box.

The ray of light reflected from mirror 2 is

☐ parallel to the incident ray at P,

☐ perpendicular to the incident ray at P,

☐ at an angle of 45° to the incident ray at P. [1]

(c) A thin, converging lens forms an image, I, of an object, O, as shown in Fig. 6.2.

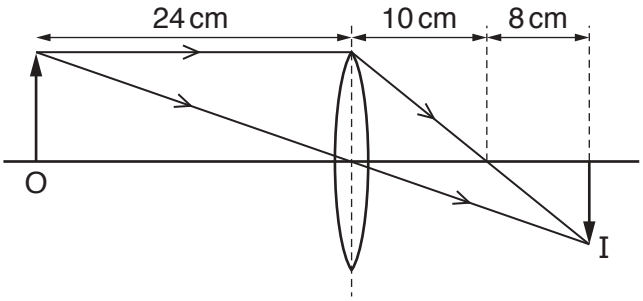

Fig. 6.2

(i) On Fig. 6.2, label a principal focus of the lens, using the letter **F**. [1]

(ii) State the focal length of the lens.

focal length = ... cm [1]

[Total: 7]

7 Fig. 7.1 shows the regions of the electromagnetic spectrum.

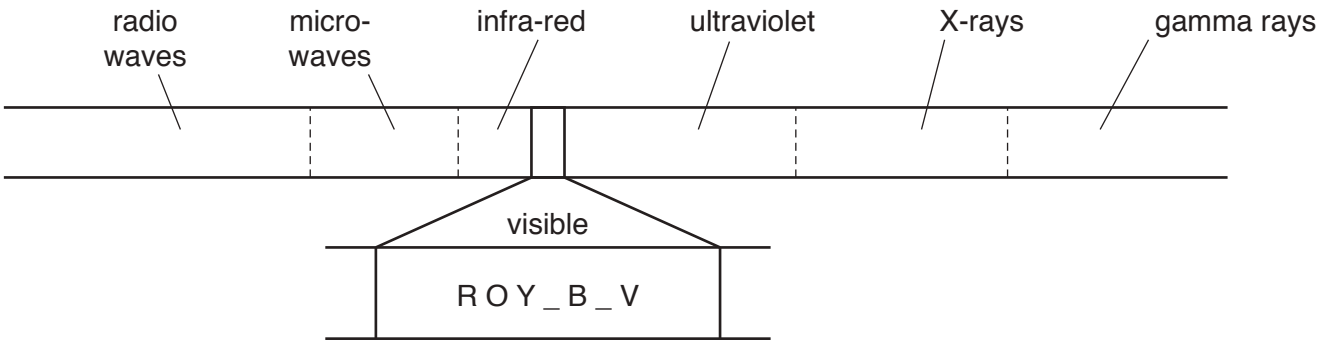

Fig. 7.1

(a) Fig. 7.1 shows the first letter of some colours in the visible part of the spectrum.

State which colours are missing.

..... and ..... [1]

(b) State the names of the regions of the electromagnetic spectrum that are used in

(i) communications,

..... and ..... [1]

(ii) remote controls for televisions and DVD players.

..... [1]

(c) Describe how high levels of microwave energy can be dangerous to people.

.....

..... [1]

(d) State **two** safety precautions required when using X-rays.

1. .....

2. ..... [2]

[Total: 6]

8 **(a)** An atom of carbon contains protons, neutrons and electrons.

Indicate where each particle is found in the atom. Place a tick in the appropriate box.

particle	in the nucleus	orbiting the nucleus
electron		
neutron		
proton		

[3]

(b) An atom of carbon contains 6 protons, 7 neutrons and 6 electrons.

(i) State the proton number of the carbon.

..... [1]

(ii) State the nucleon number of the carbon.

..... [1]

(c) Carbon has many different isotopes.

(i) Explain the meaning of the term *isotope*.

.....

.....

..... [2]

(ii) The nuclide notation for the carbon in **(b)** is $^{13}_{6}C$.

Suggest the nuclide notation for another possible isotope of carbon.

..... [1]

[Total: 8]

9 Some metals can be used to make permanent magnets.

(a) Identify the metal that can form a permanent magnet.
Tick **one** box.

☐ copper ☐ iron ☐ steel [1]

(b) Fig. 9.1 shows a circuit that is used to make a permanent magnet.

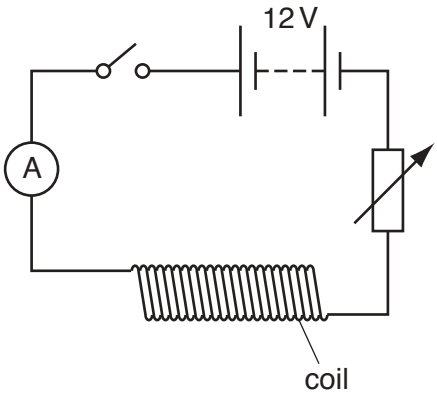

Fig. 9.1

(i) On Fig. 9.1, label the variable resistor with the letter X. [1]

(ii) Describe how the circuit is used to make a permanent magnet.

.....

.....

..... [3]

(c) Fig. 9.2 shows the coil from Fig. 9.1.

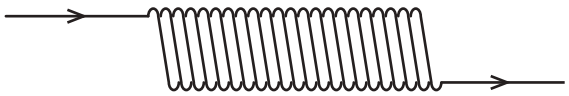

Fig. 9.2

On Fig. 9.2 carefully sketch the pattern of the magnetic field produced by the coil. [2]

[Total: 7]

10 Fig. 10.1 shows a series circuit.

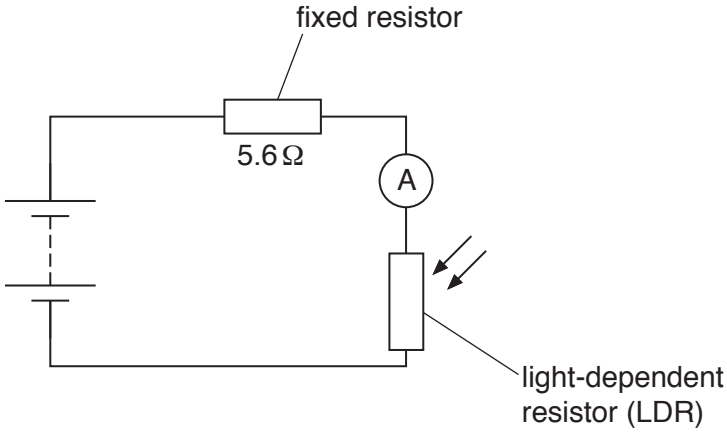

Fig. 10.1

(a) In dim light, the resistance of the LDR is 20.0 Ω.

(i) The resistance of the battery and ammeter can be ignored.

Calculate the resistance of the circuit.

resistance = ... Ω [1]

(ii) The current in the circuit is 0.23 A.

Calculate the potential difference across the fixed resistor.

potential difference (voltage) = ... V [3]

(b) A bright light shines on to the LDR.

State and explain what happens to the current in the circuit.

.....

..... [2]

[Total: 6]

11 Fig. 11.1 shows a charger for a mobile (cell) phone. The charger contains a transformer.

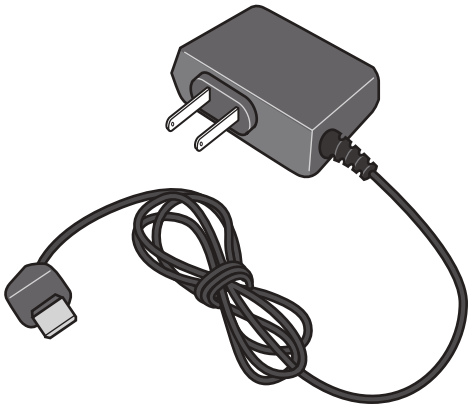

Fig. 11.1

(a) The primary coil of the transformer has 900 turns and the secondary coil has 49 turns. The input voltage to the transformer is 220 V.

Calculate the output voltage.

output voltage = ... V [3]

(b) State the name of the metal used to make the coils of the transformer.

..... [1]

(c) A transformer uses an alternating current (a.c.).

Describe the difference between alternating current (a.c.) and direct current (d.c.).

.....

.....

..... [1]

[Total: 5]

12 Fig. 12.1 shows some equipment used in a demonstration.

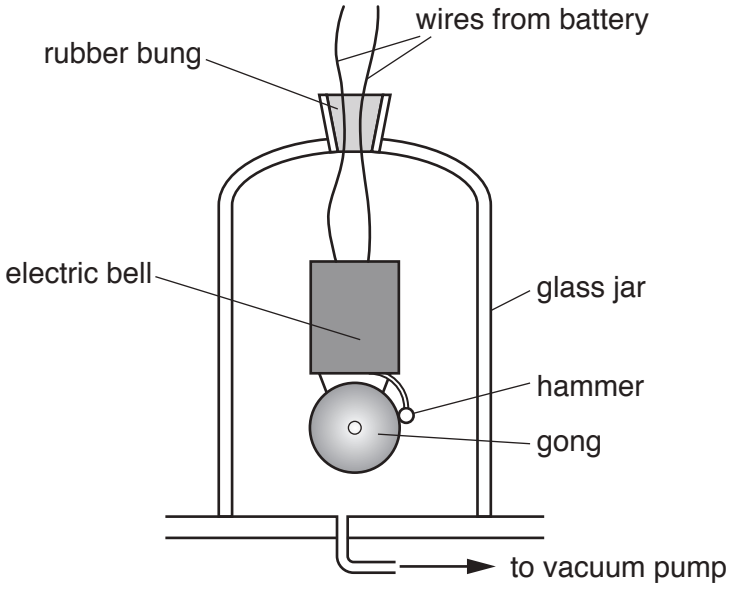

Fig. 12.1

The glass jar is connected to a vacuum pump. The electric bell is switched on. The observers see and hear the bell working.

(a) **(i)** The vacuum pump removes air from the glass jar. State what the observers see and what they hear after the air is removed.

observers see .....

.....

observers hear .....

..... [2]

(ii) State what the demonstration in **(a)(i)** shows about the transmission of sound waves.

.....

.....

..... [2]

(iii) When the bell is working, the hammer strikes the gong. Describe how the gong produces the sound.

.....

..... [1]

(b) Indicate the lowest and highest frequencies that can be heard by the human ear.

Tick **one** box from each column.

lowest frequency	highest frequency
☐ 2 Hz	☐ 20 kHz
☐ 20 Hz	☐ 200 kHz
☐ 200 Hz	☐ 2 MHz
☐ 2 kHz	☐ 20 MHz

[2]

[Total: 7]

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6324801284

PHYSICS **0625/33**

Paper 3 Theory (Core) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
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[Turn over

1 **(a)** A student determines the speed of three cars on a straight road.
The student measured the time for the cars to travel 50 m.

The table shows the measurements.

car	distance travelled / m	time taken / s
A	50	3.2
B	50	4.0
C	50	3.6

(i) Without calculation, identify the fastest car and the slowest car.

Complete the table.

	car
the fastest car	
the slowest car	

[2]

(ii) Calculate the speed of car **B**.

speed = ... m / s [3]

(b) **(i)** Estimate the time, in minutes, for car **C** to travel 5000 m.

estimated time = ... minutes [2]

(ii) Explain why your answer in **(b)(i)** may not be the same as the actual time taken for the car to travel 5000 m.

.....

..... [1]

[Total: 8]

2 Fig. 2.1 shows a metal object discovered by a scientist using a metal detector.

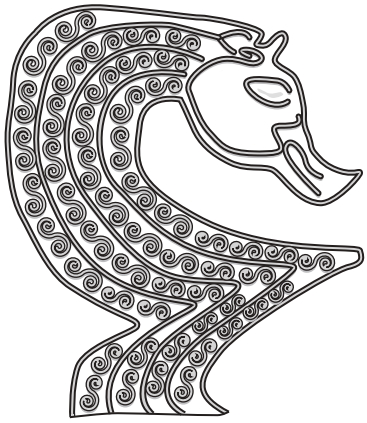


Fig. 2.1

The scientist wants to know the type of metal from which the object is made. She needs to find the density of the metal.

(a) Describe how the scientist can measure the volume of the object, using the method of displacement.

.....

.....

.....

.....

.....

..... [4]

(b) The mass of the metal object is 347 g and its volume is 18 cm^3.

Calculate the density of the metal.

density = ... g/cm^3 [3]

[Total: 7]

3 Fig. 3.1 shows a large box with a heavy lid.

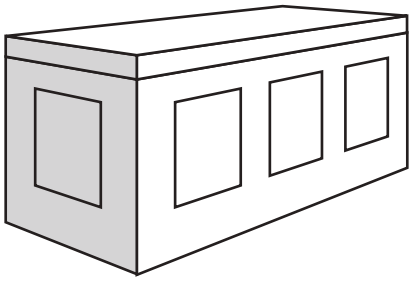


Fig. 3.1

(a) The weight of the box is 2250 N.

Calculate the mass of the box.

mass = ... kg [3]

(b) A man wants to lift the lid of the box. He puts a strong metal bar between the box and the lid. He applies a force to the bar as shown in Fig. 3.2.

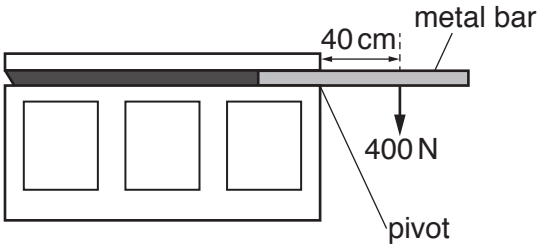


Fig. 3.2

(i) Calculate the moment of his force about the pivot. State the unit.

moment = ... [4]

(ii) The moment in **(b)(i)** is not sufficient to lift the lid. Describe how the man can increase the moment, using the same force.

.....

..... [1]

[Total: 8]

4 A catapult consists of a rubber band attached to a handle. A student uses the catapult to fire a ball towards a target. Fig. 4.1 shows the catapult just before the student releases the rubber band.

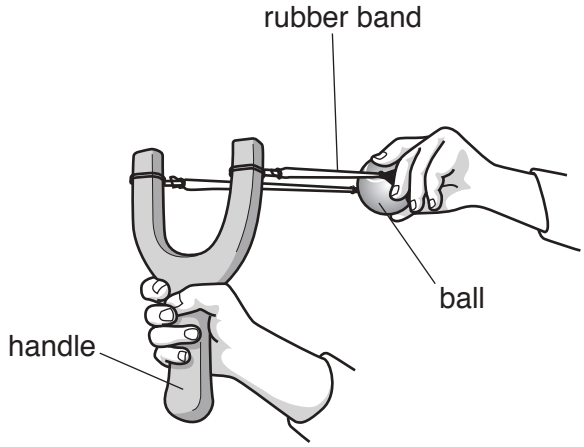


Fig. 4.1

(a) When the student releases the rubber band, the ball moves towards the target.

Complete the following sentences about energy transfers during this process. Use words from the box. You may use each word once, more than once or not at all.

elastic	force	friction	gravitational	kinetic	thermal

(i) As the rubber band is pulled back, the work done is transferred into ..... potential energy. [1]

(ii) When the student releases the rubber band, the ball moves forward horizontally. Stored

..... potential energy is transferred into ..... energy. [2]

(iii) As the ball travels through the air there is friction with air molecules. This causes some of

the ball's ..... energy to be transferred into ..... energy. [2]

(b) The ball does not reach the target, as shown in Fig. 4.2.

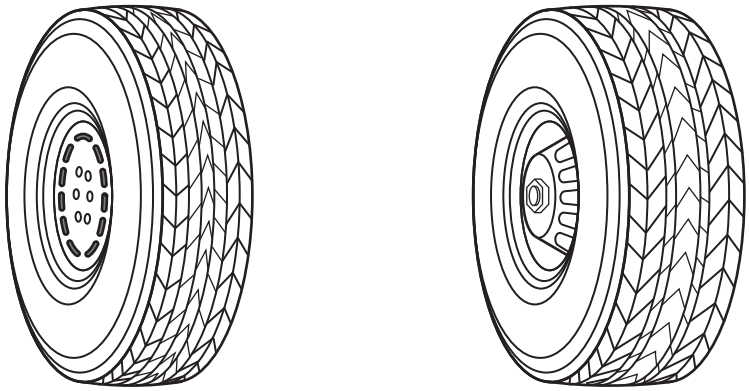
Fig. 4.2

Describe how the student can increase the energy of the ball, using the same catapult.

..... [1]

[Total: 6]

5 A vehicle may have tyres of type **A** or type **B**, as shown in Fig. 5.1.



type A **type B**

Fig. 5.1

(a) State and explain the type of tyre that is suitable for travelling over soft ground.

.....

.....

.....

..... [3]

(b) The temperature of the air in a tyre increases. This affects the motion of the air molecules in the tyre.

Describe and explain the changes.

.....

.....

.....

.....

..... [3]

[Total: 6]

6 Fig. 6.1 shows a liquid-in-glass thermometer.

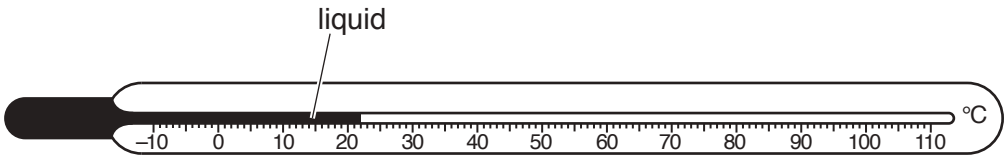


Fig. 6.1

(a) **(i)** Which of these metals is often used for the liquid in thermometers?
Tick the correct box.

☐ magnesium

☐ mercury

☐ silver [1]

(ii) The thermometer is placed inside a freezer containing ice.
Suggest the temperature of the ice. Draw an arrow on Fig. 6.1. [1]

(iii) A thermometer is calibrated using two fixed points. State the temperatures of the two fixed points.

lower fixed point = ... °C

upper fixed point = ... °C [1]

(b) The sentences are about thermal processes.
Complete each sentence. Use words from the box. Each word may be used once, more than once or not at all.

conductor	convection	emitter	insulator	radiation	reflection

- A dull black surface is a good .....
- Copper is used to make pans because it is a good thermal .....
- In fluids, thermal energy is transferred mainly by .....
- Thermal energy reaches Earth from the Sun by means of .....

[4]

[Total: 7]

7 Fig. 7.1 shows a floating plastic ball attached by a long rope to a weight on the bottom of a lake. A water wave on the surface of the lake causes the ball to move vertically up and down.

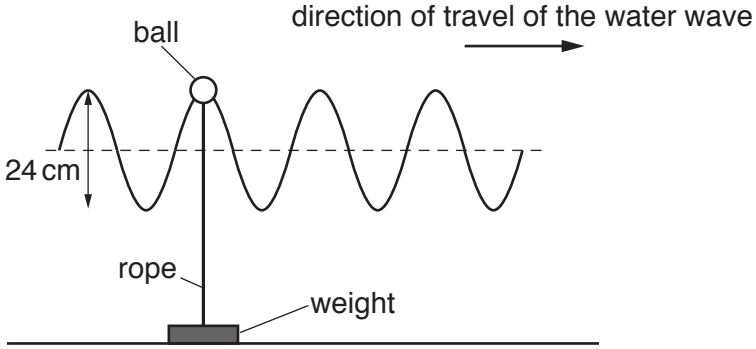


Fig. 7.1

(a) On Fig. 7.1, indicate the wavelength of the wave. Label the distance *W*. [1]

(b) Determine the amplitude of the wave.

amplitude = ... cm [1]

(c) The ball reaches its maximum height 40 times in 60 seconds. Calculate the frequency of the wave.

frequency = ... Hz [2]

(d) Explain how the motion of the ball shows that the water wave is transverse.

.....

.....

..... [1]

(e) State another example of a transverse wave.

..... [1]

[Total: 6]

8 Fig 8.1 shows two parallel rays of light that pass through a thin converging lens. The diagram is incomplete. There is a principal focus at f_1 and at f_2.

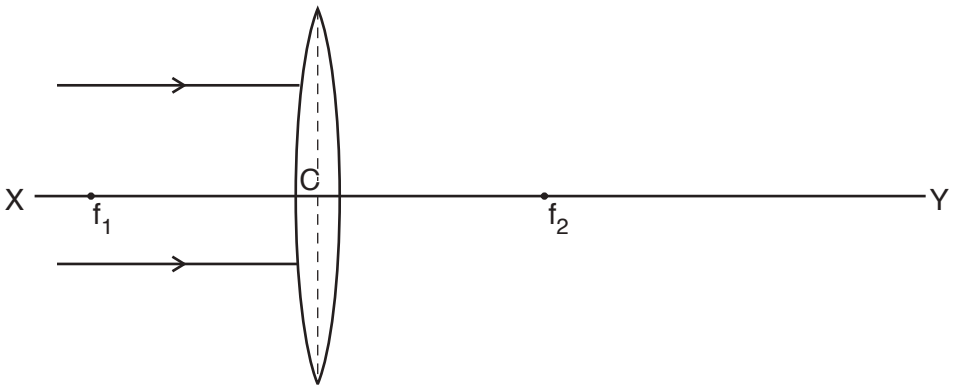


Fig. 8.1

(a) **(i)** On Fig. 8.1, complete the ray diagram to show how the lens focuses the light. [3]

(ii) Which distance on Fig. 8.1 is a focal length of the lens? Tick (✓) one box.

☐ C to f_2

☐ f_1 to f_2

☐ f_2 to Y [1]

(b) **(i)** A ray of light travels through a semicircular glass block, as shown in Fig. 8.2.

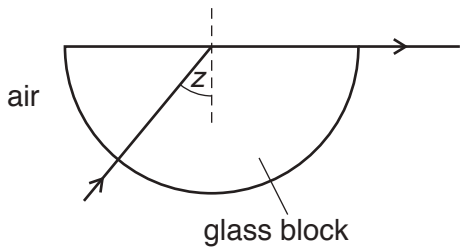


Fig. 8.2

State the term given to the angle of incidence labelled *z*.

..... [1]

(ii) Fig. 8.3 shows another ray of light travelling in the semicircular glass block.

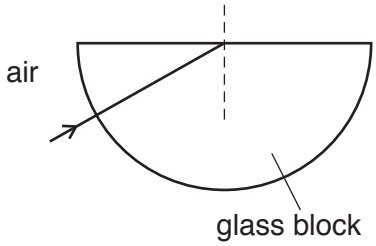


Fig. 8.3

The angle of incidence is greater than *z*. Continue the path of the ray of light until it leaves the block. [2]

[Total: 7]

9 A machine pushes a metal post into the ground using a hammer, as shown in Fig. 9.1. The hammer makes a loud noise when it hits the post.

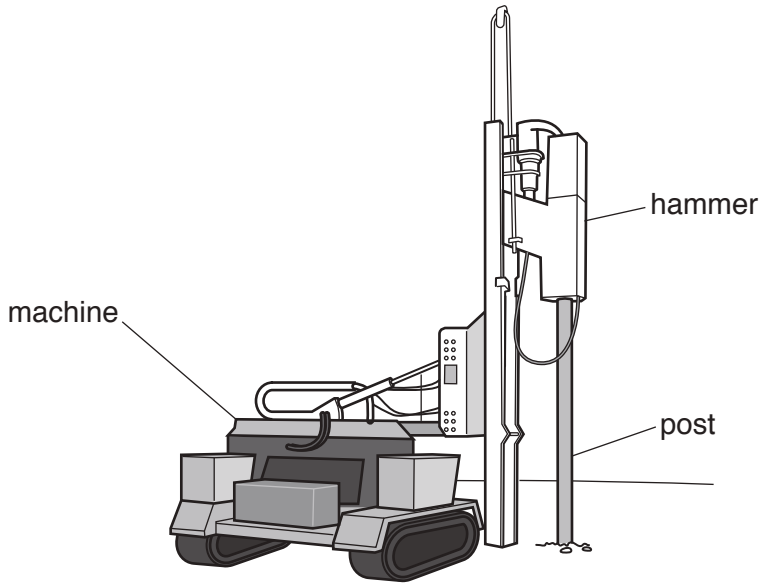


Fig. 9.1

A man stands 160 m from the hammer.

(a) A man sees the hammer hit the post and a short time later hears the sound of the post being hit. Explain the delay in hearing the sound.

.....

..... [1]

(b) **(i)** The hammer is 320 m from a large building as shown in Fig. 9.2.

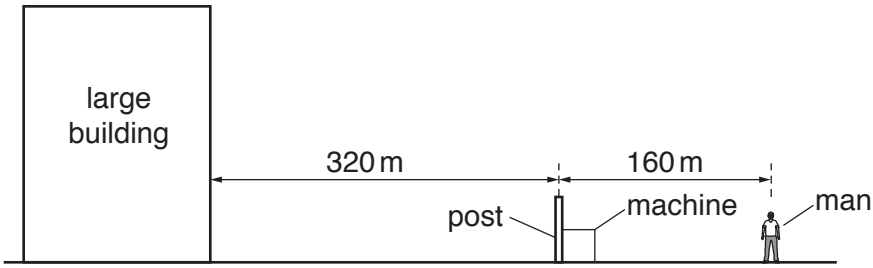


Fig. 9.2

The man hears the hammer hit the post and then hears an echo. Explain why he hears the echo.

.....

..... [1]

(ii) The speed of sound in air is 320 m / s.

Calculate the time difference between the man hearing the first sound and the time at which he hears the echo.

time difference = ... [3]

(c) Suggest how the sound of the echo is different from the first sound.

..... [1]

[Total: 6]

10 A student places a bar magnet onto a sheet of paper, as shown in Fig. 10.1.

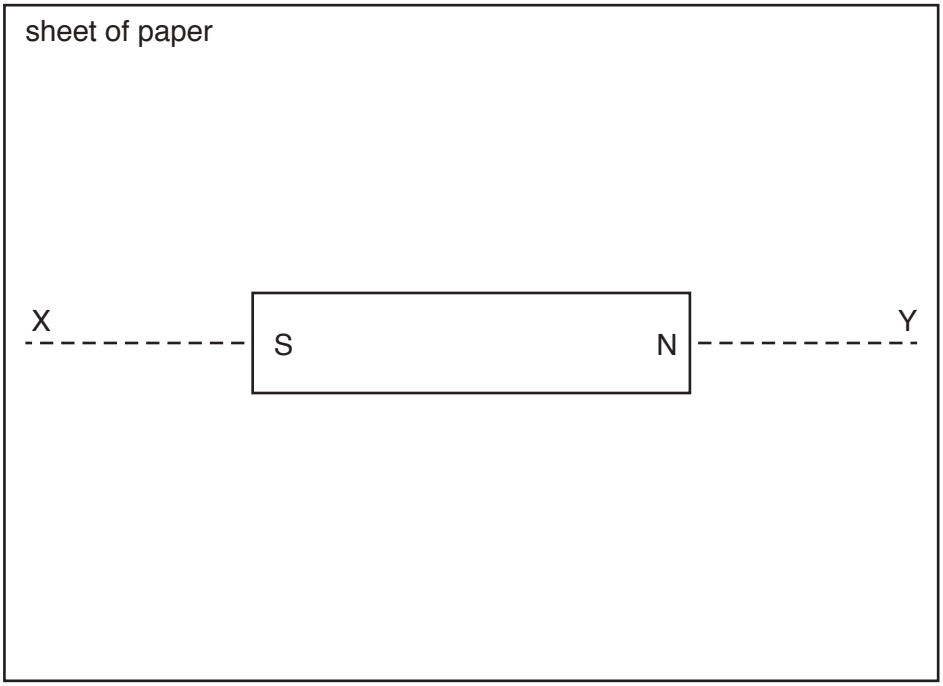


Fig. 10.1

(a) The student shows the pattern of the magnetic field lines around the magnet.

(i) On Fig. 10.1 carefully draw two magnetic field lines above the centre line XY and two magnetic field lines below XY. [2]

(ii) Indicate the direction of the magnetic field lines. Use an arrow. Mark one field line above XY and one field line below XY. [1]

(iii) State the name of a piece of equipment that can be used to determine the direction of the magnetic field.

..... [1]

(b) Describe how the student can use a bar magnet to test whether a metal rod is a magnet.

.....

.....

..... [2]

[Total: 6]

11 A student wants to find the resistance of a wire. He connects the circuit shown in Fig. 11.1.

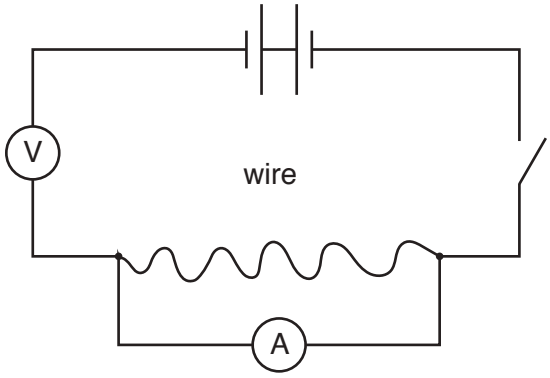


Fig. 11.1

(a) A teacher checks the circuit and identifies three errors.

Using the components given in Fig. 11.1, carefully draw the correct circuit diagram in the space below.

[3]

(b) The student uses the correct circuit. The student finds that the current is 0.3 A when the potential difference across the wire is 2.7 V.

Calculate the resistance of the wire.

resistance = ... Ω [3]

(c) The student tests two other pieces of wire made of the same metal. He compares each resistance value with that of the first wire.

State how the resistance compares with the first wire

(i) for a wire that is longer, but of the same thickness,

..... [1]

(ii) for a wire that is thicker, but of the same length.

..... [1]

[Total: 8]

12 This question is about radioactive materials.

(a) State the name of the electromagnetic radiation emitted by some nuclei when they decay.

..... [1]

(b) Describe the composition and the penetrating ability of an α-particle.

composition .....

.....

penetrating ability .....

..... [2]

(c) Americium-241 is a radioactive isotope. It has a half-life of 400 years.

A sample contains americium-241. Calculate the percentage of americium-241 that remains in the sample after 800 years have passed.

percentage remaining = ... % [2]

[Total: 5]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/41**

Paper 4 Theory (Extended) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1 Fig. 1.1 shows the speed-time graph for the motion of a car.

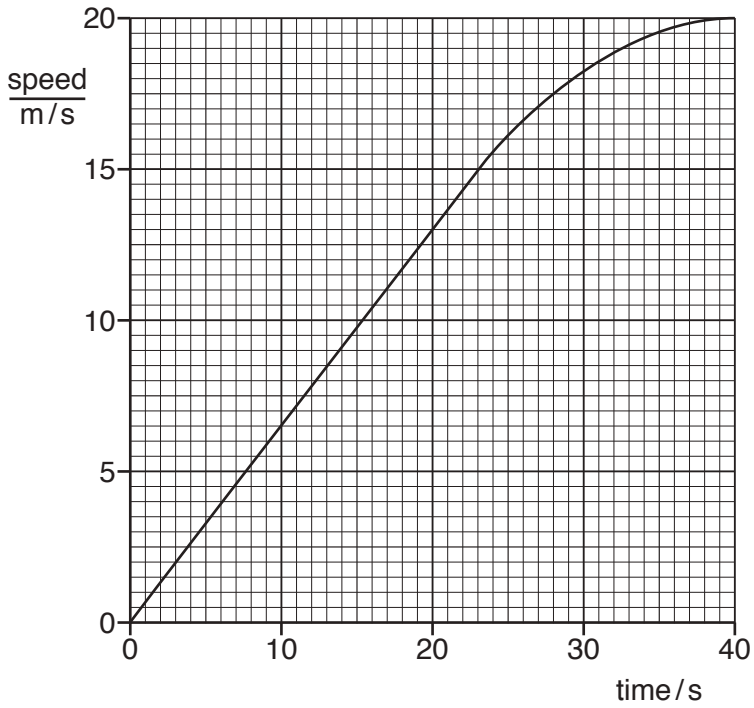

Fig. 1.1

The mass of the car is 1200 kg.

(a) Calculate, for the first 20 s of the motion,

(i) the distance travelled by the car,

distance = ...[2]

(ii) the acceleration of the car,

acceleration = ...[2]

(iii) the resultant force acting on the car.

resultant force = ...[2]

(b) Describe the motion of the car in the period of time from 25 s to 40 s.

.....

.....[1]

[Total: 7]

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2 **(a)** State Hooke's Law.

.....

.....[1]

(b) For forces up to 120 N, a spring obeys Hooke's Law.

A force of 120 N causes an extension of 64 mm.

(i) On Fig. 2.1, draw the force-extension graph for the spring for loads up to 120 N. [1]

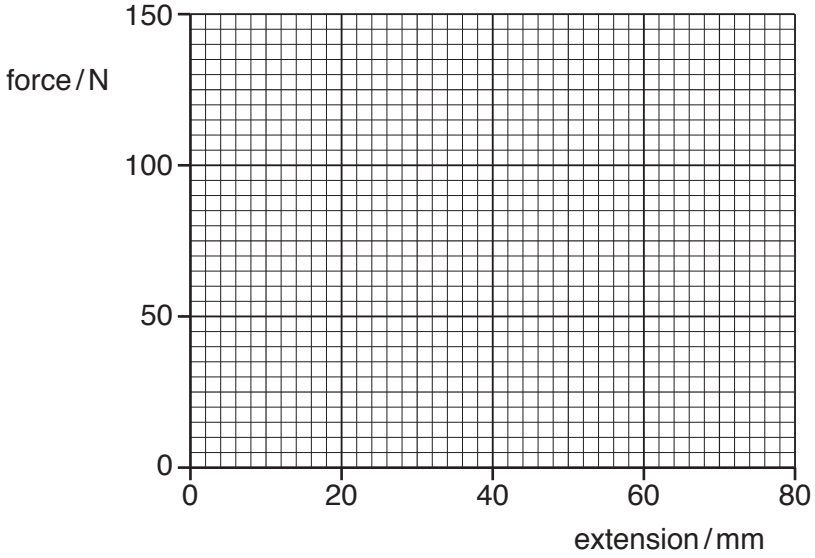

Fig. 2.1

(ii) Calculate the spring constant *k* of the spring.

k = ...[2]

(c) A student makes a spring balance using the spring in **(b)**. The maximum reading of this balance is 150 N.

The student tests his balance with a known weight of 140 N. He observes that the reading of the balance is not 140 N.

Suggest and explain why the reading is **not** 140 N.

.....

.....

.....[2]

[Total: 6]

3 All the sides of a plastic cube are 8.0 cm long. Fig. 3.1 shows the cube.

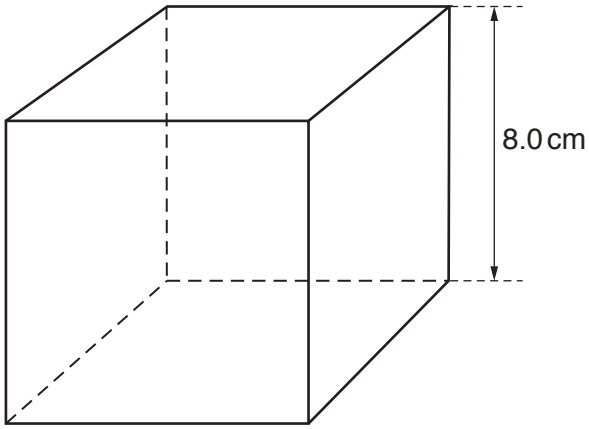

Fig. 3.1 (not to scale)

The mass of the cube is 0.44 kg.

(a) Explain what is meant by *mass*.

.....[1]

(b) **(i)** Calculate the density of the plastic from which the cube is made.

density = ...[2]

(ii) The density of one type of oil is 850 kg / m^3.

State and explain whether the cube floats or sinks when placed in a container of this oil.

.....

.....[1]

(c) On the Moon, the weight of the cube is 0.70 N.

(i) Calculate the gravitational field strength on the Moon.

gravitational field strength = ...[2]

(ii) In a laboratory on the Moon, the plastic cube is held stationary, using a clamp, in a beaker of the oil of density 850 kg / m^3.

The arrangement is shown in Fig. 3.2.

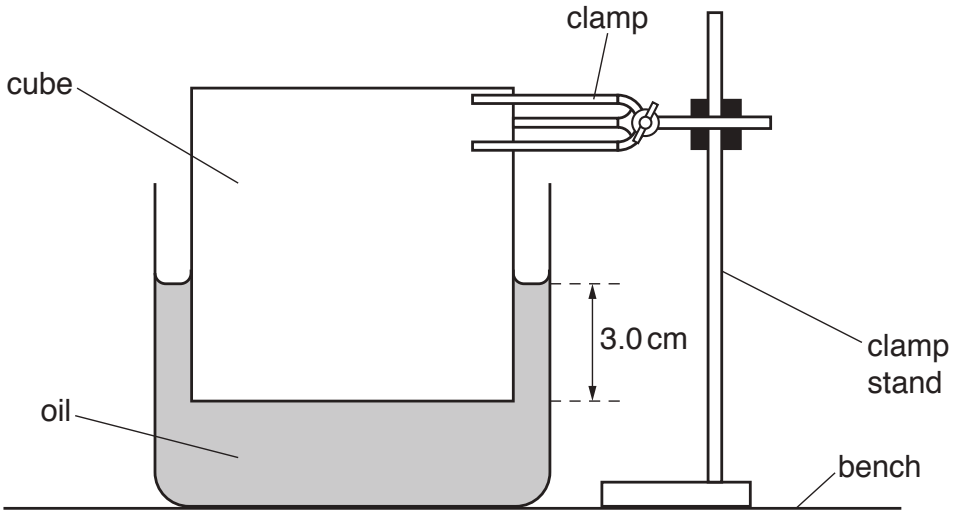

Fig. 3.2

The lower face of the cube is 3.0 cm below the surface of the oil.

Use your answer to **(c)(i)** to calculate the pressure due to the oil on the lower face of the cube.

pressure = ...[2]

[Total: 8]

4 Fig. 4.1 shows a balloon filled with helium that is used to lift measuring instruments to a great height above the Earth's surface.

Fig. 4.1

(a) Explain, in terms of momentum, how the atoms of helium produce a force on the wall of the balloon.

.....

.....

.....

.....[3]

(b) At ground level, the pressure of the helium in the balloon is 1.0×10^5 Pa. The volume occupied by the helium is $9.6\,m^3$.

The balloon is released and it rises quickly through the atmosphere. The volume occupied by the helium increases, but the temperature of the helium may be assumed to stay constant.

(i) Explain, in terms of the helium atoms in the balloon, why the pressure in the balloon is smaller than at ground level.

.....

.....

.....[2]

(ii) Calculate the pressure of the helium when it occupies a volume of $12\,m^3$.

pressure = ...[2]

[Total: 7]

5 **(a)** A wave passes through a gap in a barrier. The wavelength of the wave is the same magnitude as the width of the gap in the barrier.

Tick **one** box to indicate what happens to the wave.

diffraction and dispersion	
diffraction only	
dispersion only	
refraction and diffraction	
refraction and dispersion	
refraction only	

[1]

(b) Fig. 5.1 shows six wavefronts of a wave travelling on the surface of deep water. The wave is incident on a boundary with a region where the water is shallow.

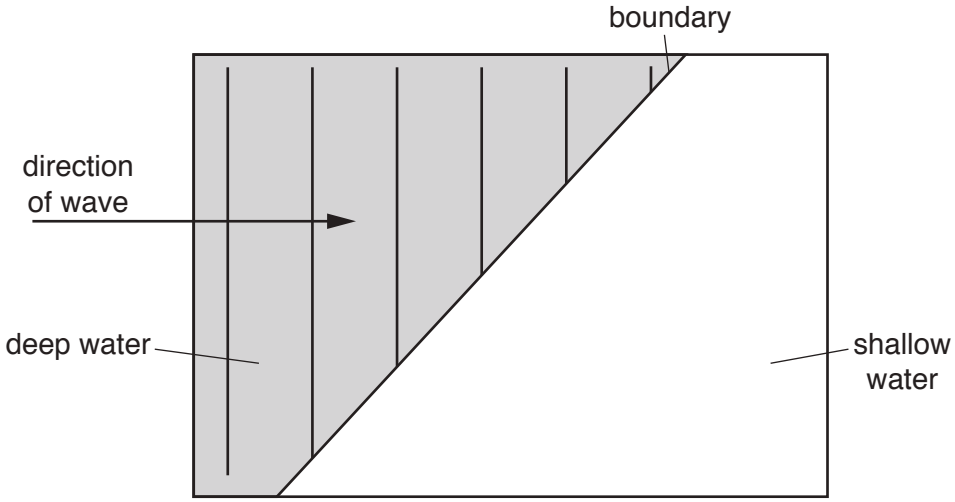

Fig. 5.1

(i) On Fig. 5.1, draw the wavefronts of the wave in the shallow water where the wave travels more slowly. [2]

(ii) The depth of the shallow water is now changed so that the speed of the wave in the shallow water is 0.60 m/s. The speed of the wave in the deep water is 0.80 m/s.
The distance between successive wavefronts in the deep water is 1.4 cm.

Calculate the wavelength of the wave in the shallow water.

wavelength = ...[4]

[Total: 7]

6 **(a)** The left-hand column of the table shows some possible speeds of a sound wave.

In the right-hand column, write down the medium in which a sound wave has this speed.

Choose from solid, liquid or gas.

speed of sound wave / m/s	medium
1500	
5000	
300	

[2]

(b) Fig. 6.1 represents a series of compressions and rarefactions of a sound wave.

Fig. 6.1

(i) On Fig. 6.1, mark, with the letters X and Y, the mid-points of **two** rarefactions. [1]

(ii) State, in terms of pressure, what is meant by a *rarefaction*.

.....

.....[1]

(c) Astronauts set up a mirror on the Moon's surface. A laser beam is transmitted from the Earth's surface to the mirror and is then reflected back to Earth.

On a certain day, the time between transmitting the beam from a point on the Earth's surface and receiving the reflected signal at the same point is 2.56 s.

The speed of the laser beam is 3.00×10^8 m/s.

Calculate the distance between the Earth's surface and the Moon's surface.

distance = ...[3]

[Total: 7]

7 **(a)** Fig. 7.1 shows a converging lens and its principal axis. The points labelled F are each a principal focus of the lens.

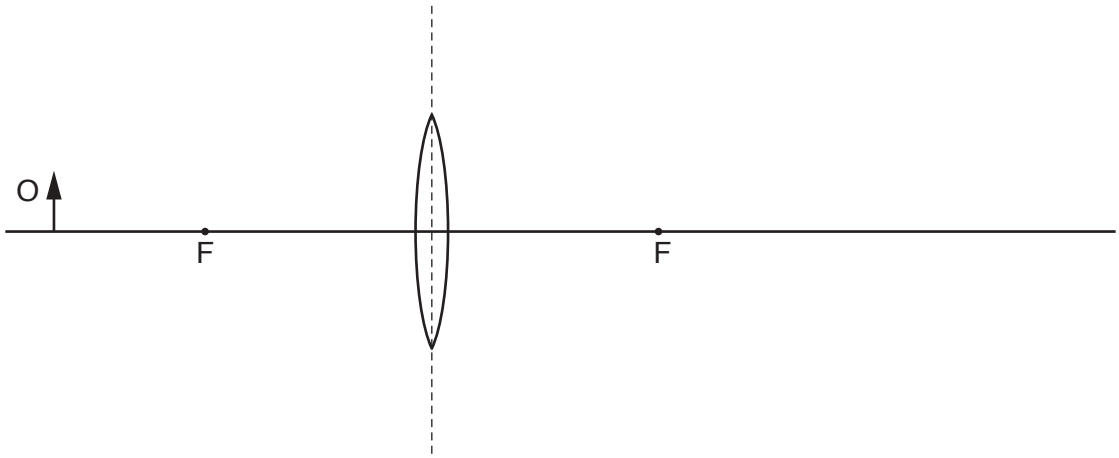

Fig. 7.1

On Fig. 7.1, draw **two** rays from the top of the object O, to locate the image of O.
Label the image I. [3]

(b) Underline **three** of the terms below to describe the nature of the image produced by a converging lens used as a magnifying glass.

diminished **enlarged** **inverted** **real** **same size** **upright** **virtual**

[2]

(c) Fig. 7.2 shows the path of a ray of red light passing through a glass prism.

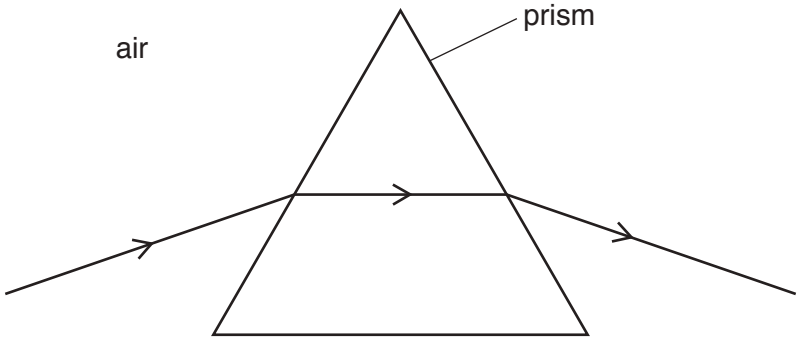

Fig. 7.2

A ray of green light enters the prism along the same path as the ray of red light.

On Fig. 7.2, draw the path of the ray of green light as it passes through the prism and emerges into the air. [2]

[Total: 7]

8 **(a)** Describe a renewable process by which electrical energy is obtained from the energy stored in water. You may draw a diagram in the space.

.....

.....

.....

.....

.....

.....[4]

(b) Explain why the process described in **(a)** can be regarded as renewable.

.....

.....

.....

.....[2]

(c) Explain whether the Sun is the source of the energy stored in the water in **(a)**.

.....

.....

.....

.....[2]

[Total: 8]

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9 Fig. 9.1 shows a circuit with three 1.5 V cells.

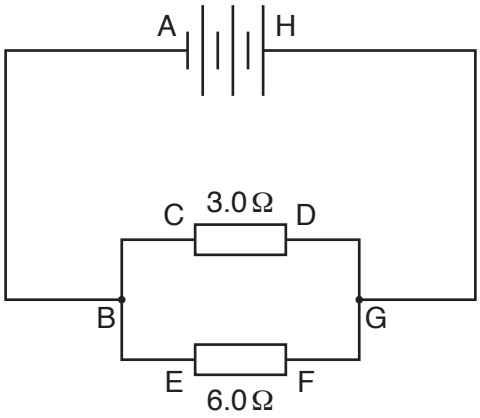

Fig. 9.1

(a) Calculate

(i) the total electromotive force (e.m.f.) of the cells,

e.m.f. = ...[1]

(ii) the total resistance of the circuit,

resistance = ...[3]

(iii) the current in the 3.0 Ω resistor.

current = ...[2]

(b) State, using the letters in Fig. 9.1, how you would connect

(i) an ammeter to measure the total current in the circuit,

.....

.....[1]

(ii) a voltmeter to measure the potential difference (p.d.) across the 6.0 Ω resistor.

.....

.....[1]

[Total: 8]

10 **(a)** **(i)** Draw the circuit symbol for a diode.

[1]

(ii) State the function of a diode.

.....[1]

(b) Fig. 10.1 shows the proposed system for charging the battery of an electric toothbrush.

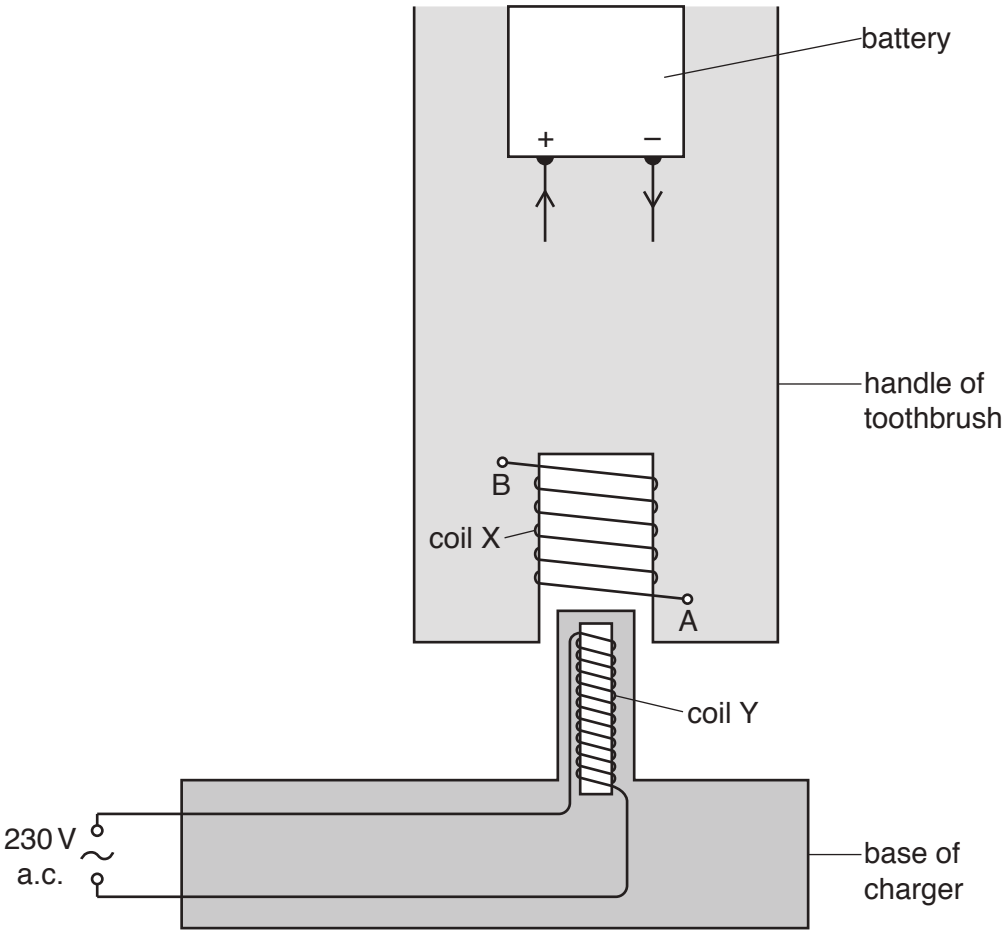

Fig. 10.1

The handle of the brush contains the battery and a coil X. The circuit from coil X to the battery is not shown.

The base of the charger contains a coil Y, wound on an iron core, connected to the a.c. mains supply.

To charge the battery, the handle is lowered so that coil Y is inside coil X.

Fig. 10.1 shows the direction needed for the charging current at the battery.

(i) On Fig. 10.1, complete the circuit from terminals A and B of coil X to the battery. Include a diode. [2]

(ii) Explain how an alternating voltage is produced in coil X.

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

11 The radioactive isotope carbon-14 ($^{14}_{6}C$) emits β-particles as it decays.

(a) The decay of carbon-14 produces an isotope of nitrogen (N).

(i) State the nature of a β-particle and state where it is produced.

.....

.....[2]

(ii) Complete the nuclide equation for the radioactive decay of carbon-14.

$$^{14}_{6}C \rightarrow \,^{\cdots\cdots}_{\cdots\cdots}N + \,^{\cdots\cdots}_{\cdots\cdots}\beta$$ [3]

(b) The half-life of carbon-14 is 5700 years.

Explain what is meant by the term *half-life*.

.....

.....[1]

(c) A workman operates a machine that uses β-particles to determine the level of liquid in a plastic water bottle that is being filled.

Suggest why

(i) α-particles are **not** suitable for the same purpose,

.....

.....[1]

(ii) γ-rays are **not** suitable for the same purpose.

.....

.....[1]

[Total: 8]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/42**

Paper 4 Theory (Extended) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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[Turn over

1 Fig. 1.1 shows a cylinder made from copper of density 9000 kg / m^3.

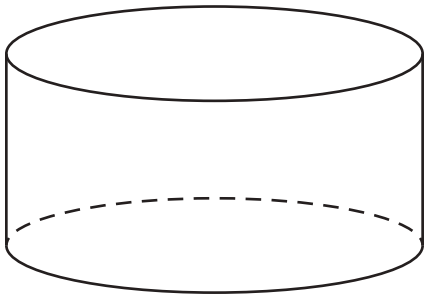

Fig. 1.1

The volume of the cylinder is 75 cm^3.

(a) Calculate the mass of the cylinder.

mass = ...[2]

(b) The gravitational field strength is 10 N / kg.

(i) Calculate the weight of the cylinder.

weight = ...[2]

(ii) State **one** way in which weight differs from mass.

.....

.....

.....[1]

(c) Fig. 1.2 shows the cylinder immersed in a liquid.

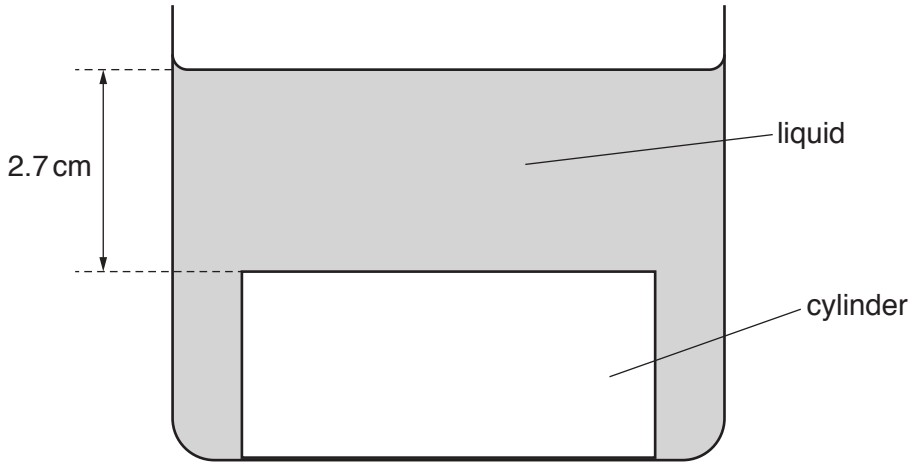

Fig. 1.2 (not to scale)

The upper face of the cylinder is at a depth of 2.7 cm below the surface of the liquid.

The pressure due to the liquid at the upper face of the cylinder is 560 Pa.

(i) Calculate the density of the liquid.

density = ...[2]

(ii) Explain why the cylinder does **not** float in this liquid.

.....

.....[1]

[Total: 8]

2 **(a)** An object is moving in a straight line at constant speed. A resultant force begins to act upon the object.

State the ways in which the force may change the motion of the object.

.....

.....

.....

.....[2]

(b) State **one** other effect a force could have on the object.

.....[1]

(c) The mass of a car is 1400 kg. The car, initially at rest, is moved along a level road by a resultant force of 3500 N. The car reaches a speed of 30 m / s.

(i) Calculate the average acceleration of the car.

acceleration = ...[2]

(ii) Calculate the time for which the force is applied.

time = ...[2]

(iii) State the name of a force which opposes the motion of the car.

.....[1]

[Total: 8]

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3 **(a)** State the name of a fuel that is burnt to produce large amounts of electrical energy.

Describe a process by which electrical energy is obtained from the chemical energy stored in this fuel.

Name of fuel: .....

Description of process: .....

.....

.....

.....

.....[4]

(b) Explain why the Sun is the source of the energy stored in the fuel in **(a)**.

.....

.....

.....

.....[2]

(c) Explain whether the process in **(a)** is renewable.

.....

.....

.....

.....[2]

[Total: 8]

4 A beaker contains water at room temperature. Fig. 4.1 shows the beaker placed on a tripod above a Bunsen burner.

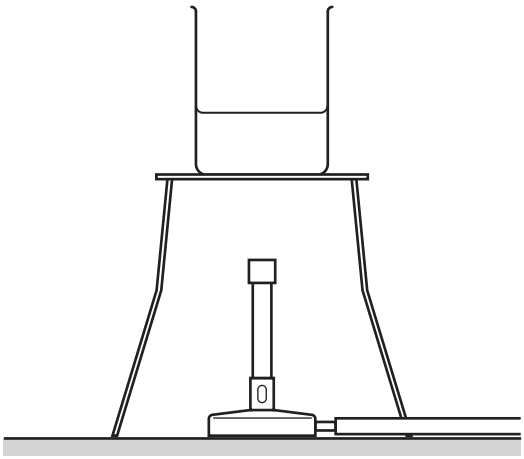

Fig. 4.1

The Bunsen burner is lit and the temperature of the water begins to increase.

(a) The water is evaporating.

(i) Describe **one** difference between evaporation and boiling.

.....

.....

.....[2]

(ii) State and explain what happens to the rate at which the water evaporates as its temperature increases.

.....

.....

.....[1]

(b) After a few minutes, the water reaches its boiling point temperature. The water continues to gain energy from the Bunsen burner.

(i) State what happens to the temperature of the water in the beaker.

.....

.....[1]

(ii) The specific latent heat of vaporisation of water is 2.3×10^6 J/kg. After the water reaches its boiling point, it takes 12 minutes for 0.095 kg of water to boil away.

Calculate the average rate at which energy is being supplied to the water by heating.

rate of energy supplied = ...[3]

[Total: 7]

5 **(a)** Explain why houses in hot countries are often painted white.
Use ideas about the transfer of thermal energy in your answer.

.....

.....

.....

.....[3]

(b) As a star approaches the end of its life, the amount of radiation emitted from it per second changes.

The star cools down.
State any effect on the rate of emission of radiation.

.....

.....[1]

[Total: 4]

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6 Fig. 6.1 represents wavefronts of a water wave on the surface of water approaching a gap in a barrier.

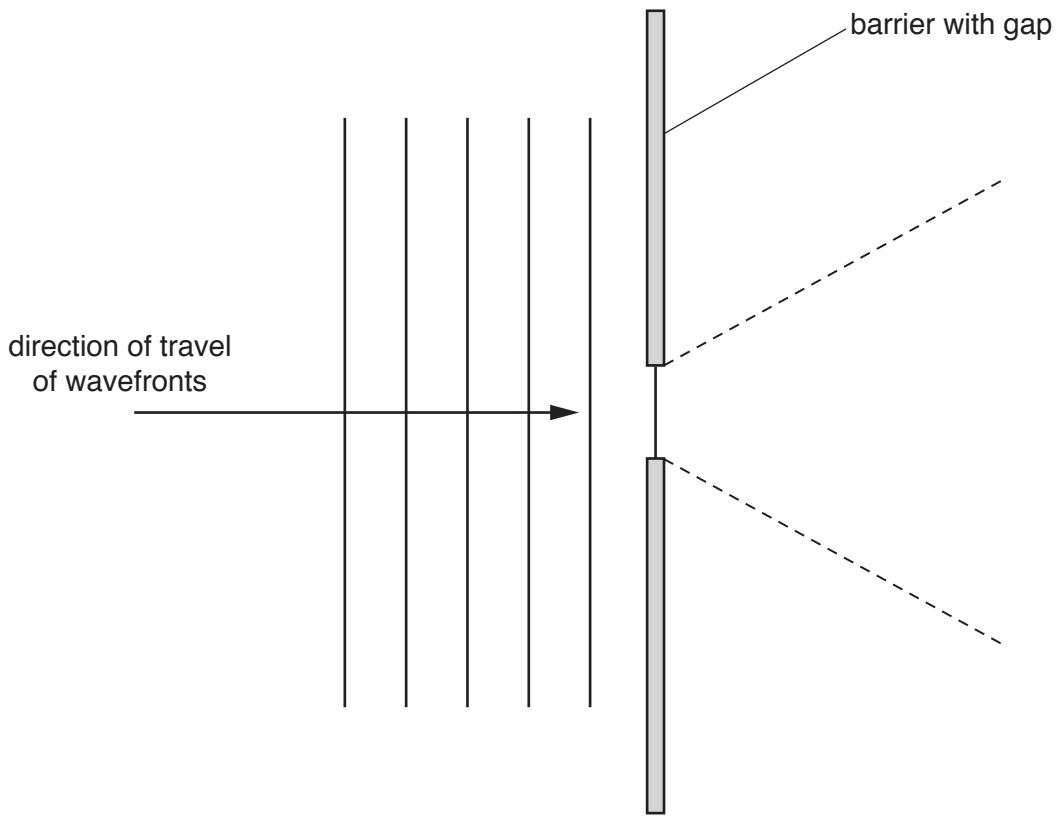

Fig. 6.1

(a) The wavefronts to the right of the barrier spread out as far as the dashed lines in Fig. 6.1.

(i) State the name of the process of spreading out.

.....[1]

(ii) Draw **four** wavefronts to the right of the barrier. [2]

(b) **(i)** State the effect of increasing the width of the gap in the barrier.

.....

.....[1]

(ii) State and explain the effect of decreasing the frequency of the water wave.

.....

.....

.....[2]

[Total: 6]

7 **(a)** Fig. 7.1 is a diagram of a converging lens used to produce an image of an object. Each point marked F is a principal focus.

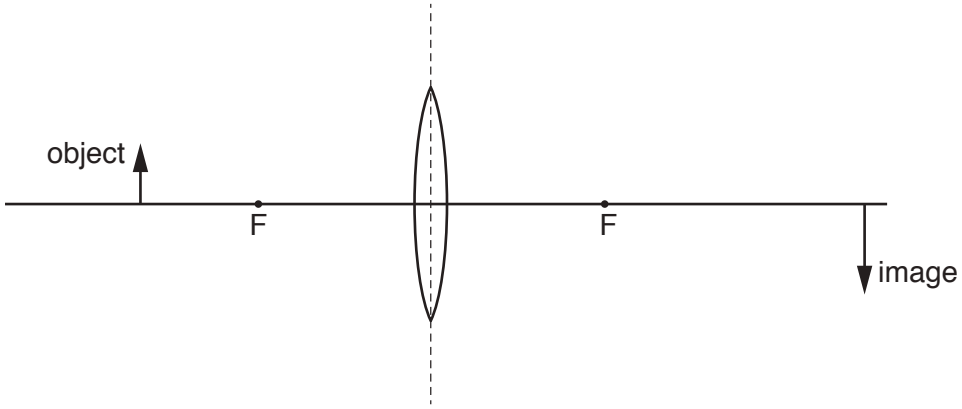

Fig. 7.1

Write down **three** terms that describe the image produced.

.....

.....

.....[3]

(b) Fig. 7.2 shows a plane mirror, a point object O and an observer's eye.

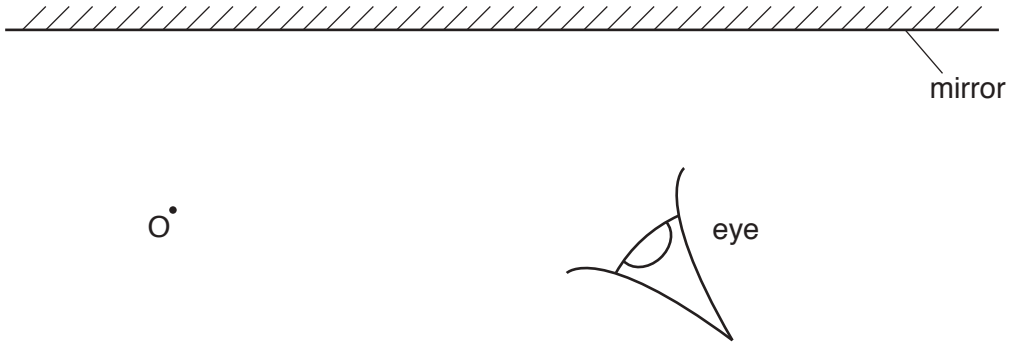

Fig. 7.2

(i) On Fig. 7.2, draw **two** rays from the object reflected to the observer's eye. [2]

(ii) On Fig. 7.2, complete your drawing to determine the position of the image of the object O. Label this image I.

[2]

[Total: 7]

8 Fig. 8.1 is a circuit diagram.

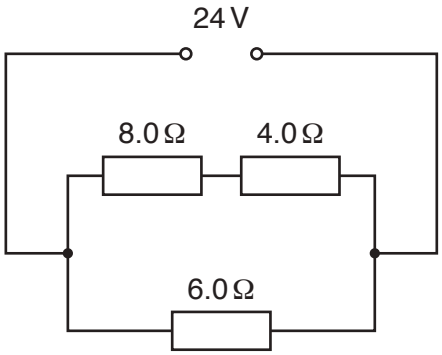

Fig. 8.1

Calculate

(a) the resistance of the circuit,

resistance = ...[4]

(b) the potential difference (p.d.) across the 8.0 Ω resistor.

p.d. = ...[2]

[Total: 6]

9 **(a)** Fig. 9.1 is a circuit diagram.

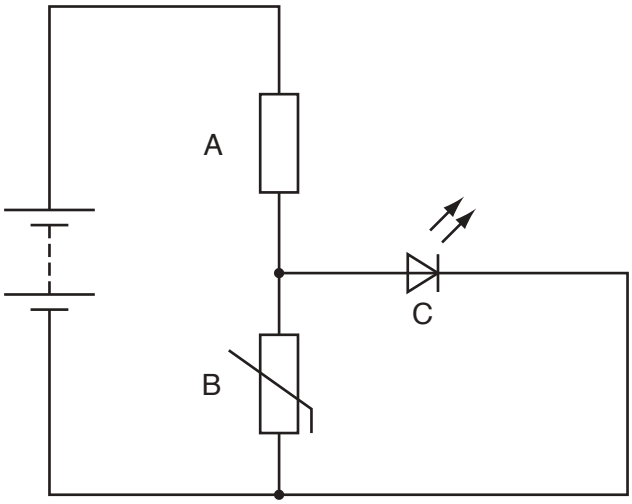

Fig. 9.1

(i) State the names of circuit components A, B and C.

component A .....

component B .....

component C .....
[2]

(ii) The circuit can be used to indicate a change in temperature.

State and explain what would be observed when the temperature changes from hot to cold.

.....

.....

.....

.....

.....

.....[4]

(b) Fig. 9.2 shows a digital circuit.

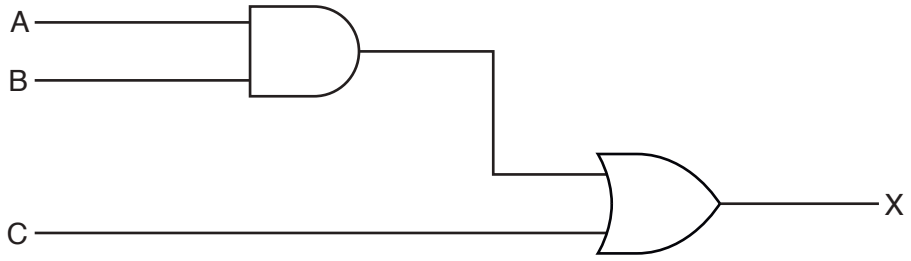

Fig. 9.2

Complete column X of the truth table for this circuit. Use the blank column for your working.

A	B	C		X
0	0	0		
0	1	0		
1	0	0		
1	1	0		
0	0	1		
0	1	1		
1	0	1		
1	1	1		

[3]

[Total: 9]

10 **(a)** Fig. 10.1 shows a wire that carries a current into the page.
The circles on Fig. 10.1 show the pattern of the magnetic field around the wire.

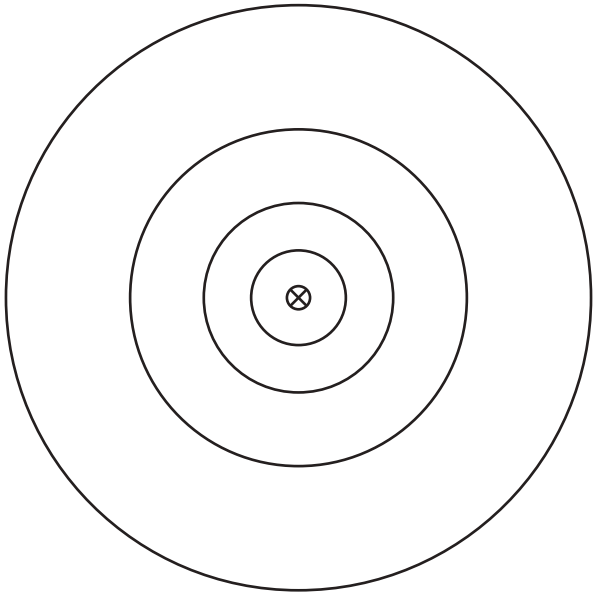

Fig. 10.1

(i) On Fig. 10.1, draw an arrow on each circle to show the direction of the magnetic field. [1]

(ii) State why the spacing of the circles increases as the distance from the wire increases.

.....

.....[1]

(b) Fig. 10.2 shows an electric door lock.

The slot in the door contains an unmagnetised iron bolt attached to a spring.
The slot in the door frame is empty. This slot is surrounded by the coils of a solenoid.

In Fig. 10.2 the door is unlocked. The spring is not stretched.

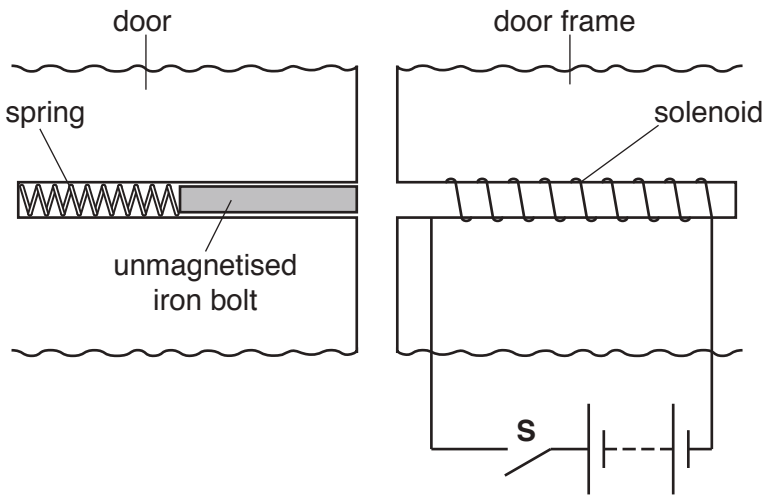

Fig. 10.2

In Fig. 10.3 the door is locked. The spring is now stretched.

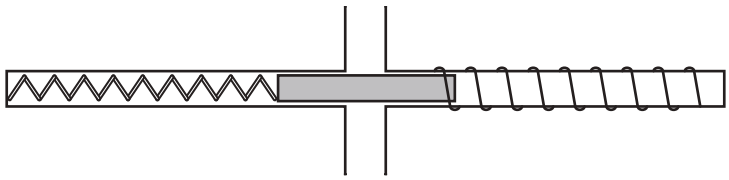

Fig. 10.3

The bolt is initially in the position shown in Fig. 10.2.

Describe and explain what happens when

(i) the switch **S** is closed,

.....

.....

.....

.....

.....[4]

(ii) the switch **S** is reopened.

.....

.....

.....[2]

[Total: 8]

11 The radioactive isotope bismuth-210 ($^{210}_{83}Bi$) decays by β-particle emission to an isotope of polonium (Po).

(a) Complete the nuclide equation that represents this decay.

$$^{210}_{83}Bi \rightarrow \,^{\cdots\cdots}_{\cdots\cdots}Po + \,^{\cdots\cdots}_{\cdots\cdots}\beta$$

[3]

(b) A radiation detector is placed on a bench in a laboratory where there are no artificial sources of radiation. The detector is switched on.

In seven one-minute periods, the detector displays these readings.

24 22 25 25 21 20 24

(i) Explain why, in the absence of any artificial source, there are readings on the detector. Suggest **one** origin of this effect.

.....

.....

.....[2]

(ii) Explain why the readings obtained are not all the same.

.....

.....[1]

(iii) The half-life of bismuth-210 is 5.0 days.
A sample of bismuth-210 is brought close to the detector and in one minute, the reading displayed is 487. The equipment is left in the same place for exactly 10 days.

Predict the reading in a one-minute period at the end of this time.

reading = ...[3]

[Total: 9]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/43**

Paper 4 Theory (Extended) **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

1 A truck accelerates uniformly along a straight, horizontal road. The mass of the truck is 2.0×10^4 kg.

(a) The speed of the truck increases from rest to 12 m / s in 30 s.

Calculate

(i) the distance travelled by the truck during this time,

distance = ...[2]

(ii) the resultant force on the truck.

resultant force = ...[4]

(b) To maintain a uniform acceleration, the forward force on the truck must change.
Explain why.

.....

.....

.....[2]

[Total: 8]

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2 Fig. 2.1 shows a measuring cylinder that contains a coloured liquid.

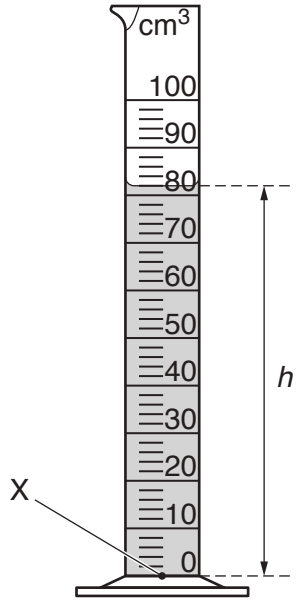

Fig. 2.1

The measuring cylinder contains 82 cm^3 of the liquid. The density of the liquid is 950 kg/m^3.

(a) Calculate the mass of the liquid.

mass = ...[3]

(b) The height *h* of the liquid in the measuring cylinder is 0.094 m.

(i) Calculate the pressure due to the liquid at point X in Fig. 2.1.

pressure = ...[2]

(ii) The true pressure at point X is different from the value calculated in **(b)(i)**.
Explain why.

.....

.....[1]

(c) A small object is made of steel. It is placed level with the top surface of the liquid in the measuring cylinder and then released. The object sinks in this liquid.

(i) Explain why the object sinks in this liquid.

.....

.....[1]

(ii) Describe how the volume of the object can now be determined.

.....

.....

.....[1]

[Total: 8]

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3 Fig. 3.1 shows solar cells that use radiation from the Sun to generate electricity.

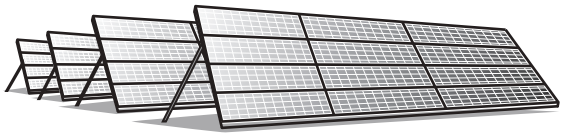

Fig. 3.1

(a) **(i)** State the name of the process which releases energy in the Sun.

.....[1]

(ii) A reaction takes place in the Sun as energy is released.

Describe what happens in this reaction.

.....

.....

.....[2]

(b) Apart from solar cells, there are other energy resources used on Earth for which the radiation from the Sun is the source.

State the name of **one** of these energy resources and explain whether it is renewable.

.....

.....

.....[2]

(c) State **two** advantages and **two** disadvantages of using solar cells to generate electricity.

advantage 1 .....

.....

advantage 2 .....

.....

disadvantage 1 .....

.....

disadvantage 2 .....

.....

[4]

[Total: 9]

4 **(a)** The molecules of most liquids are, on average, slightly further apart than the molecules of a solid.

State **one** other difference between the molecular structures of a solid and a liquid.

.....

.....[1]

(b) A glass tube passes through a stopper and into a glass flask. Fig. 4.1 shows that the flask is completely full of a liquid and that there is also some liquid in the tube.

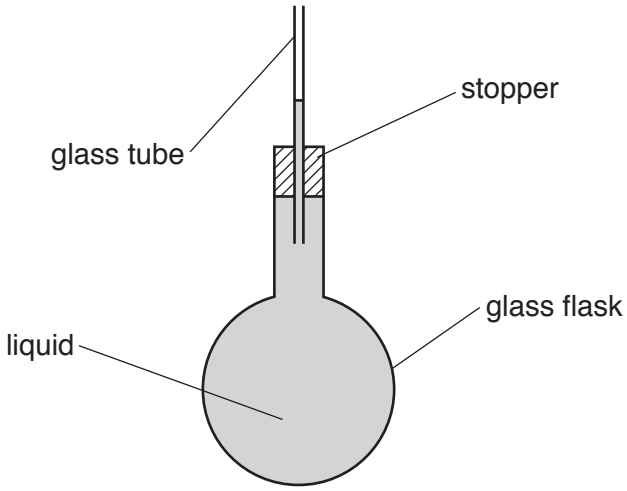

Fig. 4.1

The flask is immersed in a large beaker of very hot water. At first, the level of the liquid in the tube falls, but after a short time it rises.

(i) Explain why, at first, the level of the liquid in the tube falls.

.....

.....

.....

.....[3]

(ii) Explain why the liquid level in the tube stops falling and starts to rise.

.....

.....

.....[2]

[Total: 6]

5 A silver spoon has a thermal capacity of 7.2 J / °C.

(a) Explain what is meant by *thermal capacity*.

.....

.....

.....[2]

(b) The silver spoon is dropped into a saucepan of boiling water. The internal energy of the spoon increases as its temperature increases from 22 °C to 100 °C.

(i) Calculate the increase in the internal energy of the spoon.

increase in internal energy = ...[1]

(ii) State, in terms of the atoms, what is meant by *internal energy*.

.....

.....

.....[2]

(c) The spoon is removed from the boiling water and immediately it begins to transfer energy to the surroundings. The temperature of the surroundings is 22 °C.

On Fig. 5.1, sketch a graph to show how the temperature of the spoon changes with time from the instant that it is removed from the water. [3]

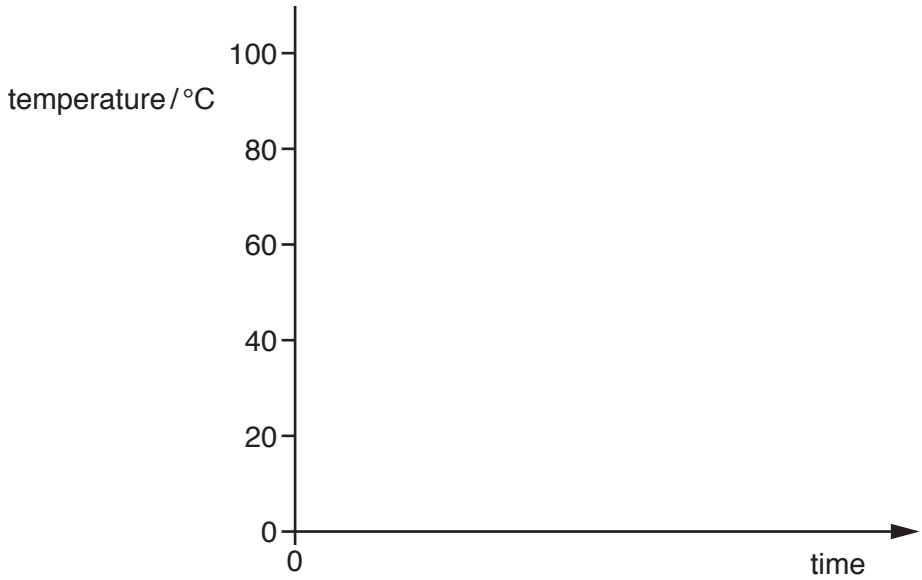

Fig. 5.1

[Total: 8]

6 Visible light is one component of the electromagnetic spectrum.

(a) **(i)** In the table, place a tick in the box next to the approximate value of the speed of light in air. [1]

speed / m/s	
3.0×10^{10}	
3.0×10^{8}	
3.0×10^{6}	
3.0×10^{4}	
3.0×10^{2}	

(ii) The frequency of a light wave is 4.8×10^{14} Hz.

Calculate the wavelength of this light in air.

wavelength = ...[2]

(b) Light is travelling in an optical fibre that is made of glass.

(i) The glass has a refractive index of 1.5.

1. Explain why the quantity *refractive index* does **not** have a unit.

.....

.....[1]

2. Calculate the speed of light in the glass.

speed = ...[2]

(ii) Describe **one** use of optical fibres in communication technology.

.....

.....

.....

.....

.....[3]

[Total: 9]

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7 **(a)** Fig. 7.1 shows a converging lens and its principal axis. The points F_1 and F_2 are each a principal focus of the lens.

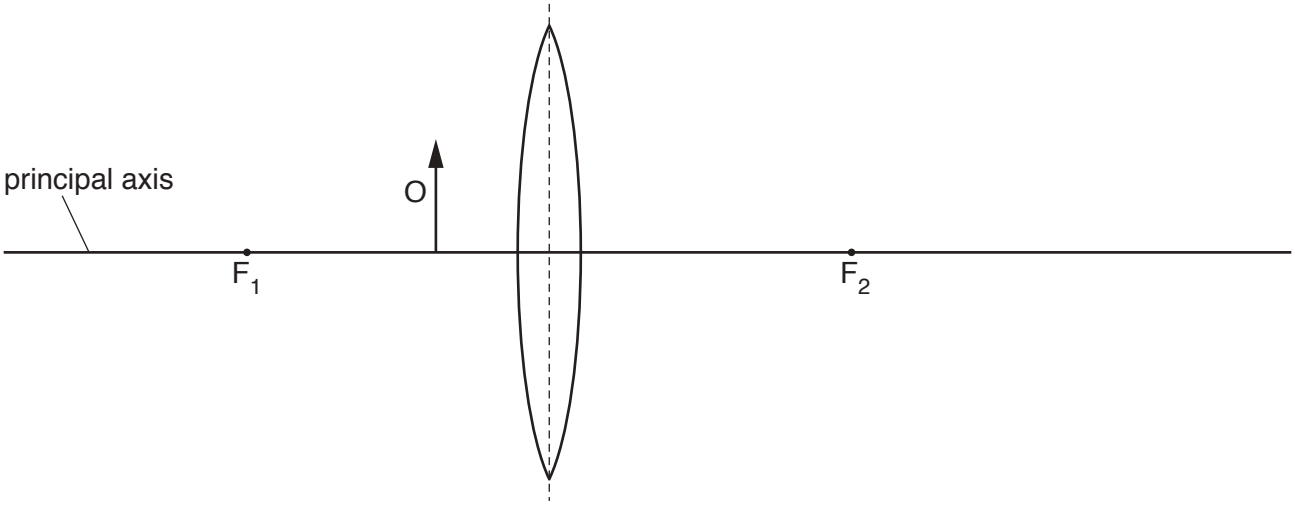

Fig. 7.1

An object O is placed between F_1 and the lens.

(i) On Fig. 7.1, draw **two** rays from the top of the object O to locate the image. Label the image I. [3]

(ii) The object O is moved to the left along the principal axis so that it is further from the lens than F_1.

Fig. 7.2 is a diagram of the new arrangement with the new image shown.

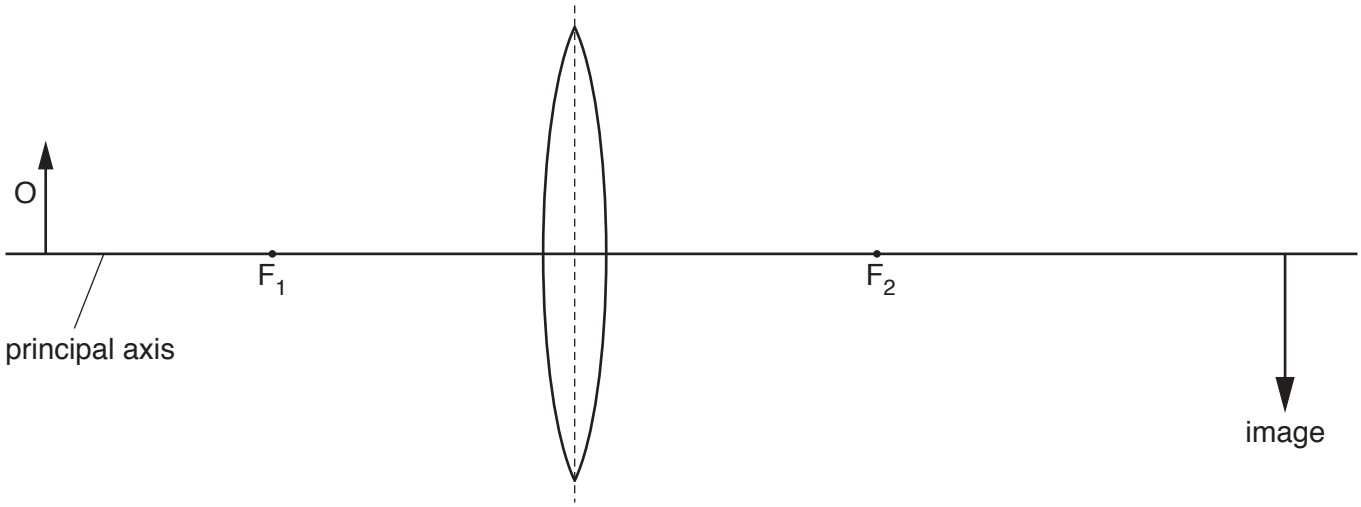

Fig. 7.2

Underline **three** of the terms below that describe the image shown in Fig. 7.2. [2]

diminished **enlarged** **inverted** **real** **same size** **upright** **virtual**

(b) Fig. 7.3 shows yellow light passing through a glass prism.

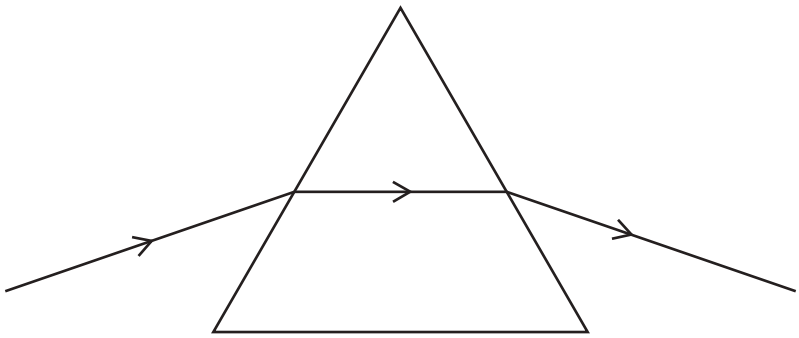

Fig. 7.3

Blue light enters the prism along the same path as the yellow light.

On Fig. 7.3, draw the path of the blue light as it enters, passes through and leaves the prism. [2]

[Total: 7]

8 **(a)** Fig. 8.1 shows an uncharged conducting sphere on an insulating stand placed close to a positively charged rod.

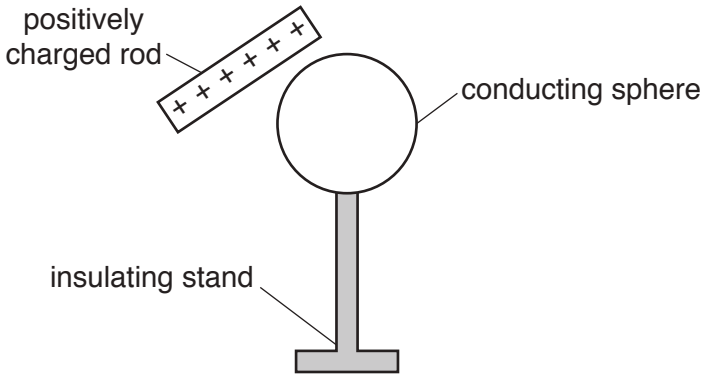

Fig. 8.1

The rod and the sphere are not moved.

Describe how to charge the sphere using a wire connected to earth and explain whether the sphere becomes positively charged or negatively charged.

.....

.....

.....

.....[3]

(b) Fig. 8.2 shows a small black circle that represents a positive charge.

On Fig. 8.2, draw the pattern and the direction of the electric field in the region around the charge. [2]

Fig. 8.2

(c) A charge of 7.0 C flows along a wire in 5.0 minutes.

Calculate the current in the wire.

current = ...[2]

[Total: 7]

9 **(a)** Fig. 9.1 shows the structure of an alternating current (a.c.) generator.

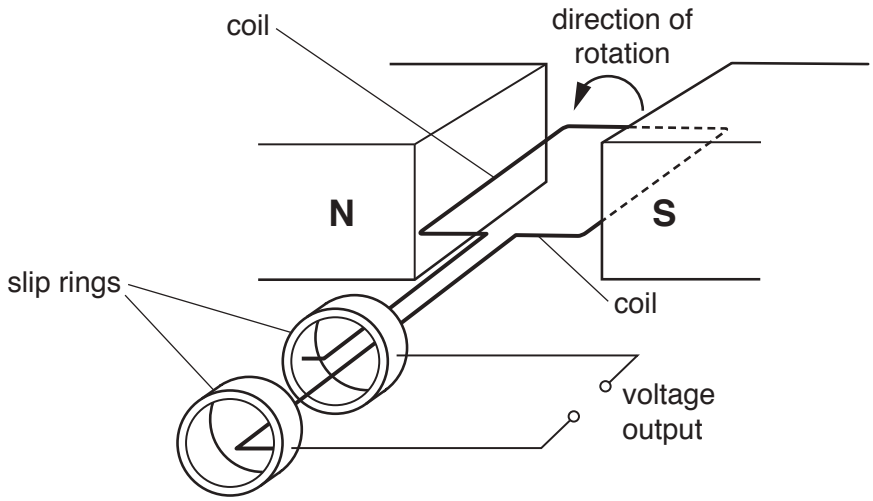

Fig. 9.1

The coil completes one rotation every 0.020 s.

(i) Using the axes in Fig. 9.2, sketch a graph to show how the voltage output of the generator varies with time during a period of 0.040 s. [2]

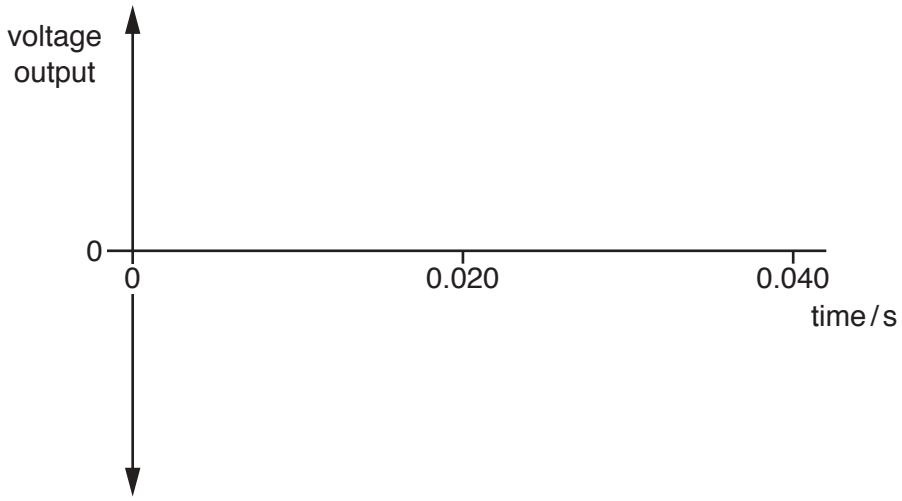

Fig. 9.2

(ii) On your graph in Fig. 9.2, mark a point labelled A to indicate a time when the coil is vertical. [1]

(b) There is an alternating current (a.c.) in a horizontal wire that is buried in a wall. A builder must miss this wire when drilling a hole in the wall.

The builder places an instrument against the wall that registers a reading when it is close to the wire. The instrument includes a long coil (solenoid) S that has an iron core and a sensitive voltmeter. Fig. 9.3 shows the circuit of the instrument close to the wire.

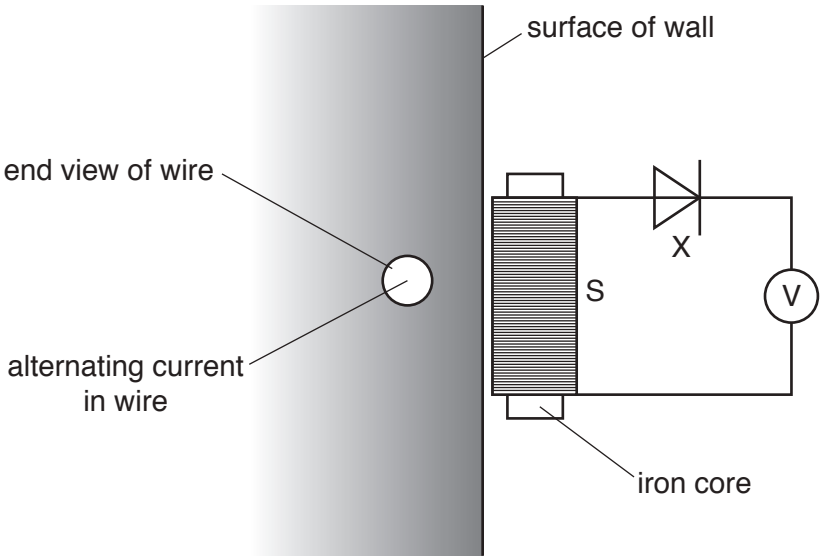

Fig. 9.3

(i) Explain why there is a reading on the voltmeter.

.....

.....

.....

.....[3]

(ii) State the name and the effect of the component labelled X in Fig. 9.3.

.....

.....

.....[2]

[Total: 8]

10 **(a)** State the nature of γ-rays.

.....

.....[2]

(b) A nucleus of technetium-99 ($^{99}_{43}Tc$) emits only a γ-ray.

State any effect of this on

(i) the proton number of the nucleus,

.....[1]

(ii) the nucleon number of the nucleus.

.....[1]

(c) In a laboratory a radiation detector displays a count rate of 16 counts / minute due to background radiation.

(i) State what is meant by *background radiation*.

.....

.....[1]

(ii) A sample of a radioactive isotope is placed near to the radiation detector and a count rate of 112 counts / minute is recorded.

After 18 hours, the count rate recorded is 28 counts / minute.

Determine the half-life of this isotope.

half-life = ...[3]

(d) Radioactive isotopes are stored in thick lead containers.

State **two** precautions to be taken when radioactive isotopes are **used**.

1. .....

2. .....
[2]

[Total: 10]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/51**

Paper 5 Practical Test **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of the page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You are advised to spend about 20 minutes on each of questions 1 to 3, and 15 minutes on question 4.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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[Turn over

1 In this experiment, you will determine the weight of a load using a balancing method.

Carry out the following instructions, referring to Fig. 1.1.

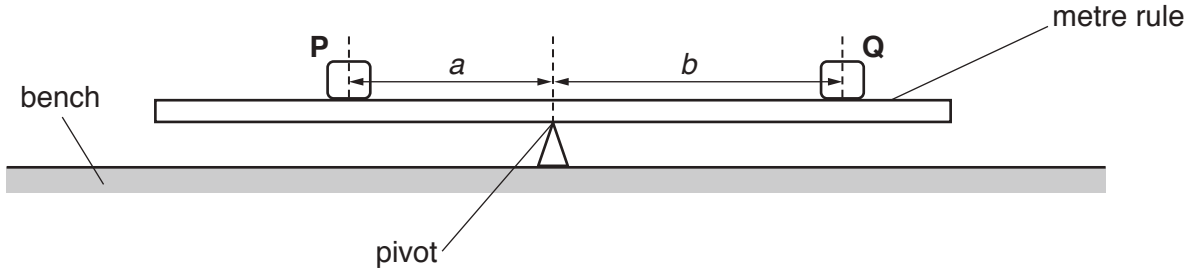


Fig. 1.1

(a) Place the metre rule on the pivot and adjust its position so that the metre rule is as near as possible to being balanced. The 30.0 cm mark must be on the left-hand side of the pivot. **The metre rule must remain at this position on the pivot throughout the experiment.**

Place the load **P** on the metre rule so that its centre is exactly at the 30.0 cm mark on the metre rule.

Record the distance *a* between the 30.0 cm mark and the pivot.

a = ... cm [1]

(b) Place a load **Q** on the metre rule and adjust the position of **Q** so that the metre rule is as near as possible to being balanced. Load **Q** has a weight *Q* of 1.0 N.

(i) Measure the distance *b* between the centre of load **Q** and the pivot. Record the weight *Q* and the distance *b* in Table 1.1.

(ii) Repeat the procedure, with the load **P** remaining at the 30.0 cm mark, using *Q* values of 2.0 N, 3.0 N, 4.0 N and 5.0 N. Record all the readings in the table.

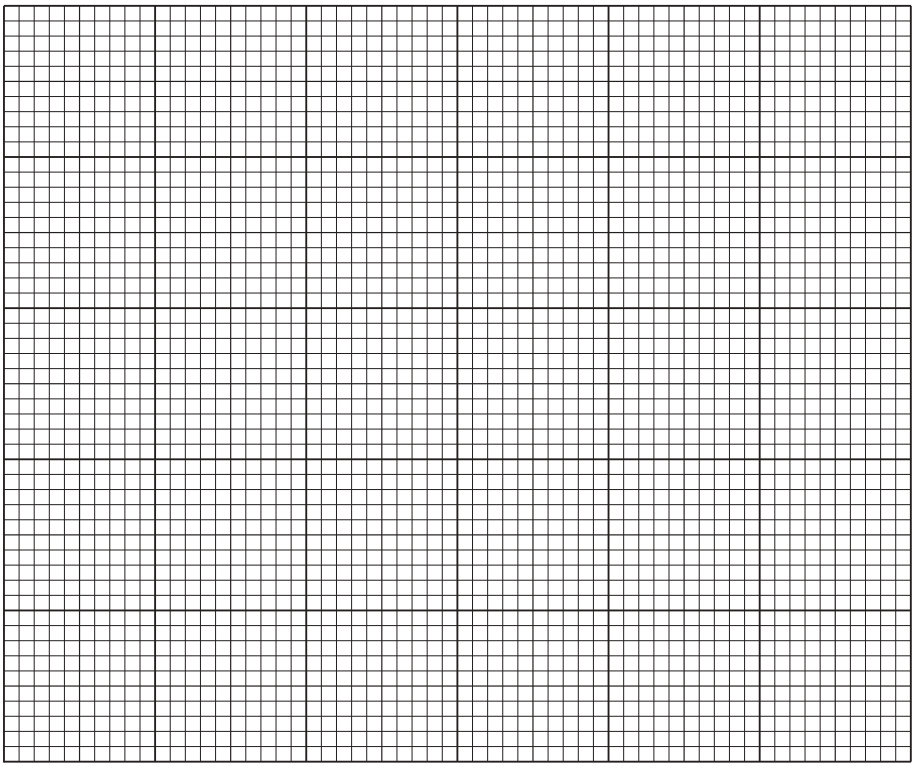
Table 1.1

Q / N	b / cm	$\frac{1}{Q}$ / $\frac{1}{\text{N}}$

(iii) For each value of *Q*, calculate $\frac{1}{Q}$ and record the result in the table.

[3]

(c) Plot a graph of b / cm (y-axis) against $\frac{1}{Q}\Big/\frac{1}{N}$ (x-axis).



[4]

(d) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ...[2]

(e) Calculate the weight P of load **P** using the equation $P = \frac{G}{a}$.

P = ...[1]

[Total: 11]

2 In this experiment, you will investigate resistance.

The circuit shown in Fig. 2.1 has been set up for you.

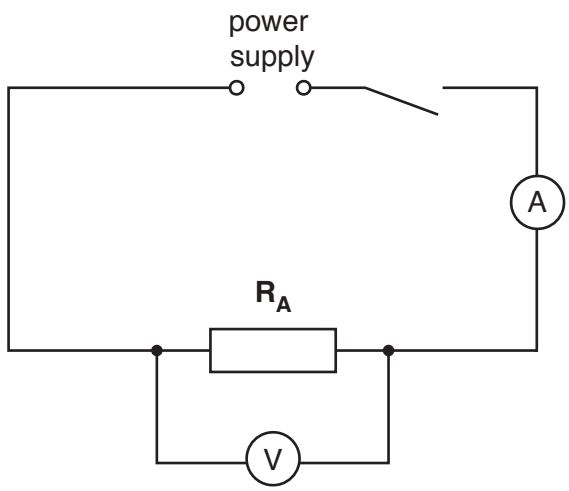


Fig. 2.1

(a) **(i)** Switch on. Measure and record the potential difference V_1 across the resistor $\mathbf{R_A}$ and the current I_1 in the circuit.

V_1 = ...

I_1 = ...
[2]

(ii) Switch off. Calculate the resistance R_1 of the resistor $\mathbf{R_A}$ using the equation $R_1 = \frac{V_1}{I_1}$.

R_1 = ...[1]

(b) Disconnect the voltmeter.

Connect the resistor $\mathbf{R_B}$ in series with $\mathbf{R_A}$.

Connect the voltmeter across the two resistors $\mathbf{R_A}$ and $\mathbf{R_B}$. Switch on.

(i) Measure and record the potential difference V_2 across resistors $\mathbf{R_A}$ and $\mathbf{R_B}$ combined and the current I_2 in the circuit.

V_2 = ...

I_2 = ...

(ii) Switch off. Calculate the resistance R_2 of resistors $\mathbf{R_A}$ and $\mathbf{R_B}$ combined in series, using the equation $R_2 = \frac{V_2}{I_2}$.

R_2 = ...
[1]

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(c) Disconnect the voltmeter.

Connect the resistor $\mathbf{R_C}$ in series with $\mathbf{R_A}$ and $\mathbf{R_B}$.

Connect the voltmeter across all three resistors. Switch on.

(i) Measure and record the potential difference V_3 across the three resistors and the current I_3 in the circuit.

V_3 = ...

I_3 = ...
[1]

(ii) Switch off. Calculate the resistance R_3 of resistors $\mathbf{R_A}$, $\mathbf{R_B}$ and $\mathbf{R_C}$ combined in series, using the equation $R_3 = \frac{V_3}{I_3}$.

R_3 = ...[1]

(d) A student suggests that $R_3 = 3 \times R_1$.

State whether your results agree with this suggestion. Justify your answer by reference to your results.

statement .....

justification .....

.....

.....
[1]

(e) Another student suggests that the three resistors, $\mathbf{R_A}$, $\mathbf{R_B}$ and $\mathbf{R_C}$, have the same value of resistance.

Explain how you could use the circuit shown in Fig. 2.1 to check this suggestion.

You are **not** required to carry out this experiment.

.....

.....[1]

(f) Complete the circuit diagram in Fig. 2.2 to show:

- the three resistors connected in parallel
- the voltmeter connected to measure the potential difference across the resistors
- a variable resistor connected to control the current in all three resistors.

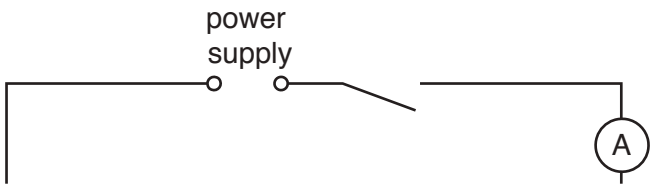

Fig. 2.2

[2]

(g) The circuit in Fig. 2.2 could be used to determine the combined resistance of three resistors connected in parallel.

Suggest a reason for connecting a variable resistor in the circuit.

.....

.....[1]

[Total: 11]

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3 In this experiment, you will determine the focal length *f* of a lens.

Carry out the following instructions, referring to Fig. 3.1.

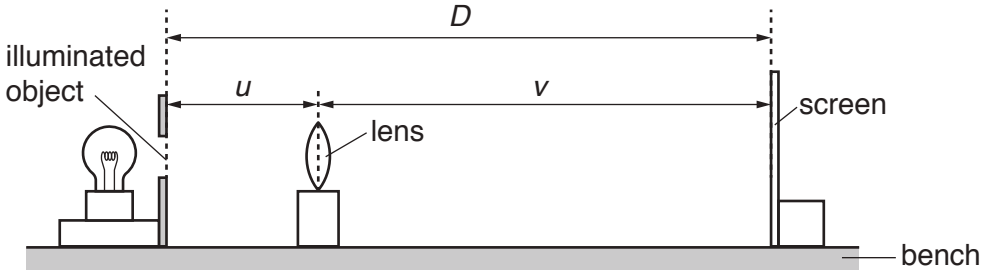

Fig. 3.1

(a) Place the centre of the lens at a distance $u = 20.0$ cm from the illuminated object.

Place the screen close to the lens and move it away from the lens until a sharply-focused image is formed on the screen.

- Measure the distance *v* from the centre of the lens to the screen. Record *v* in Table 3.1.
- Calculate *uv* and record the result in the table.
- Measure and record in the table the distance *D* from the illuminated object to the screen.

[3]

(b) Repeat the steps in **(a)** with the lens at a distance $u = 30.0$ cm from the illuminated object. Record all the readings in the table.

Table 3.1

u/cm	*v*/cm	*uv*/cm^2	*D*/cm
20.0			
30.0			

[2]

(c) State **one** difference that you observe between the image formed on the screen when $u = 20.0$ cm and when $u = 30.0$ cm.

.....

.....[1]

(d) **(i)** Use the results in the first row of the table to calculate a value f_1 for the focal length of the lens. Use the equation $f_1 = \frac{uv}{D}$.

f_1 = ...

(ii) Use the results in the second row of the table to calculate a value f_2 for the focal length of the lens. Use the equation $f_2 = \frac{uv}{D}$.

f_2 = ...
[1]

(iii) Calculate the average value f_A for the focal length of the lens. Give your answer to a suitable number of significant figures for this experiment.

f_A = ...
[2]

(e) Suggest **two** reasons why the results you have obtained may not be reliable.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

4 A student is investigating whether the diameter of a pendulum bob affects the period of a pendulum. The period is the time taken for one complete oscillation of the pendulum. Fig. 4.1 shows a pendulum.

Fig. 4.2 shows one complete oscillation.

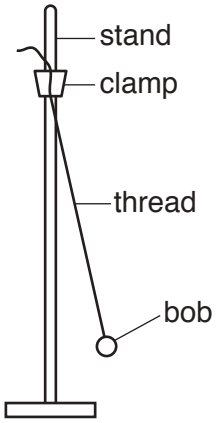

Fig. 4.1

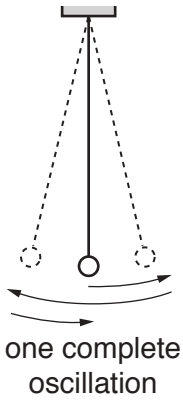

Fig. 4.2

The student has the following apparatus:

pendulum bobs made of polystyrene with diameters 1 cm, 2 cm, 3 cm, 4 cm and 5 cm
a supply of thread and a pair of scissors
clamp and stand

Plan an experiment to investigate whether the diameter of a pendulum bob affects the period of a pendulum. You are **not** required to carry out this experiment.

You should:

- list additional apparatus that you would require
- explain briefly how you would carry out the investigation
- state the key variables that you would control
- draw a table with column headings, to show how you would display your readings (You are **not** required to enter any readings in the table.)
- explain briefly how you would use your readings to reach a conclusion.

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.....[7]

[Total: 7]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/52**

Paper 5 Practical Test **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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[Turn over

1 In this experiment, you will compare the oscillations of two pendulums. Carry out the following instructions, referring to Figs. 1.1 and 1.2.

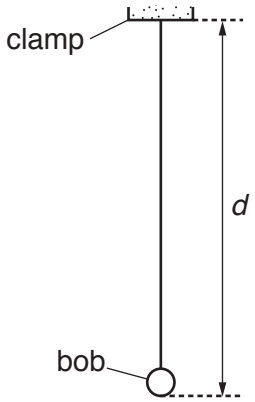

Fig. 1.1

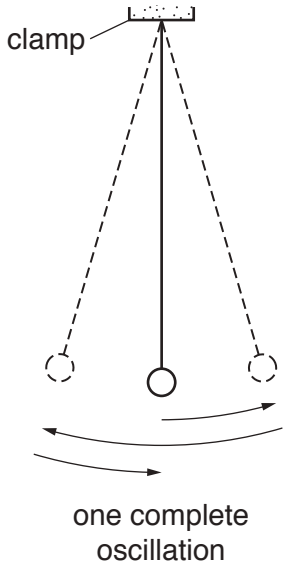

Fig. 1.2

A pendulum has been set up for you as shown in Fig. 1.1. This pendulum has a spherical pendulum bob.

(a) Adjust the pendulum until the distance *d* measured to the **bottom** of the bob is 50.0 cm.

Explain briefly how to use the set-square to avoid a parallax (line of sight) error when measuring the distance *d*. You may draw a diagram.

.....

.....[1]

(b) Move the bob slightly to the side and release it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.

(i) Measure the time t_1 for 20 complete oscillations.

t_1 = ...[1]

(ii) Calculate the period T_1 of the pendulum. The period is the time for one complete oscillation.

T_1 = ...[2]

(c) Remove the pendulum from the clamp and attach the second pendulum provided to the clamp. This has a long, thin bob. Adjust the pendulum until the distance *d* measured to the **bottom** of the bob is 50.0 cm.

Displace the bob slightly and release it so that it swings.

(i) Measure the time t_2 for 20 complete oscillations.

t_2 = ...[1]

(ii) Calculate the period T_2 of the pendulum.

T_2 = ...[1]

(d) A student suggests that the periods T_1 and T_2 should be equal.

State whether your results support this suggestion. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....[2]

(e) The period T of a pendulum can be determined by measuring the time t for 20 complete oscillations and then calculating the period. Some students are asked to explain the reason for this method being more accurate than measuring the time taken for one oscillation.

Tick the box next to the sentence that gives the best explanation.

- [ ] The method eliminates errors from the measurements.
- [ ] The method is more accurate because the experiment is repeated.
- [ ] The method includes more readings so there is less chance for errors.
- [ ] The method reduces the effect of errors when starting and stopping the stopwatch.

[1]

(f) A student plans to carry out more pendulum experiments. He considers possible variables, and precautions to improve accuracy.

In the following list, mark the possible variables with the letter **V** and the precautions with the letter **P**.

- [ ] amplitude of swing
- [ ] length of pendulum
- [ ] mass of pendulum bob
- [ ] shape of pendulum bob
- [ ] use of a reference point to aid counting
- [ ] viewing the rule at right angles when measuring the length

[2]

[Total: 11]

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2 In this experiment, you will investigate the cooling of water.

(a) Measure room temperature θ_R.

θ_R = ...[1]

(b)
- Pour 50 cm^3 of the hot water provided into beaker **A**.
- Measure the temperature θ_H of the water in beaker **A**.

  θ_H = ...
- Add 50 cm^3 of the cold water provided to the hot water in beaker **A**. Stir the water briefly.
- Measure the temperature θ_M of the water in beaker **A**.

  θ_M = ...
- Calculate the temperature fall θ_F using the equation $\theta_F = \theta_H - \theta_M$.

  θ_F = ...
- Empty beaker **A**. [3]

(c) Suggest **one** reason for stirring the water before reading θ_M.

.....

.....[1]

(d) Repeat the procedure in **(b)** using 75 cm^3 of hot water and 75 cm^3 of cold water.

θ_H = ...

θ_M = ...

θ_F = ...
[1]

(e) Repeat the procedure in **(b)** using 100 cm^3 of hot water and 100 cm^3 of cold water.

θ_H = ...

θ_M = ...

θ_F = ...
[1]

(f) Measure room temperature θ_R again.

θ_R = ...

Complete the appropriate sentence.

- Room temperature has remained constant at ..... .
- Room temperature has decreased by ..... .
- Room temperature has increased by ..... .

[1]

(g) A student states that the temperature fall θ_F should be the same each time because the proportions of hot and cold water are the same.

Suggest a reason why θ_F could be very different in **(b)**, **(d)** and **(e)**.

.....

.....

.....[1]

(h) Suggest an improvement to the apparatus to make it more likely that θ_F would be the same each time.

.....

.....

.....[1]

(i) Suggest a condition, not included in your answer to **(h)**, that could be controlled to make it more likely that θ_F would be the same each time.

.....

.....

.....[1]

[Total: 11]

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3 In this experiment, you will determine the focal length *f* of a lens.

Carry out the following instructions referring to Fig. 3.1.

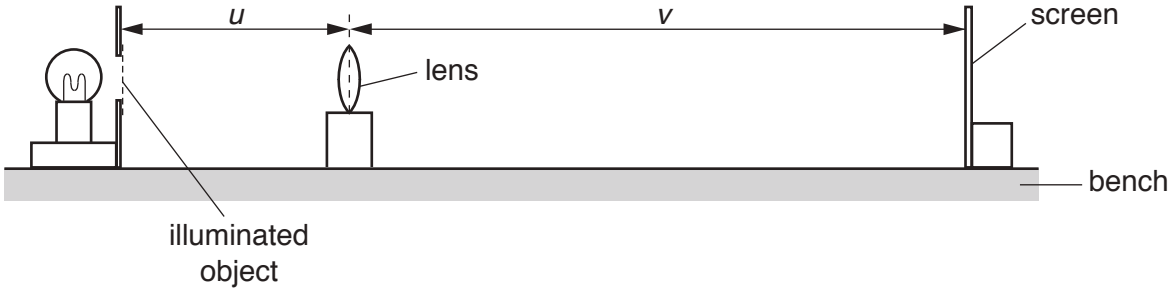


Fig. 3.1

(a) **(i)** Place the screen 100 cm from the illuminated object.

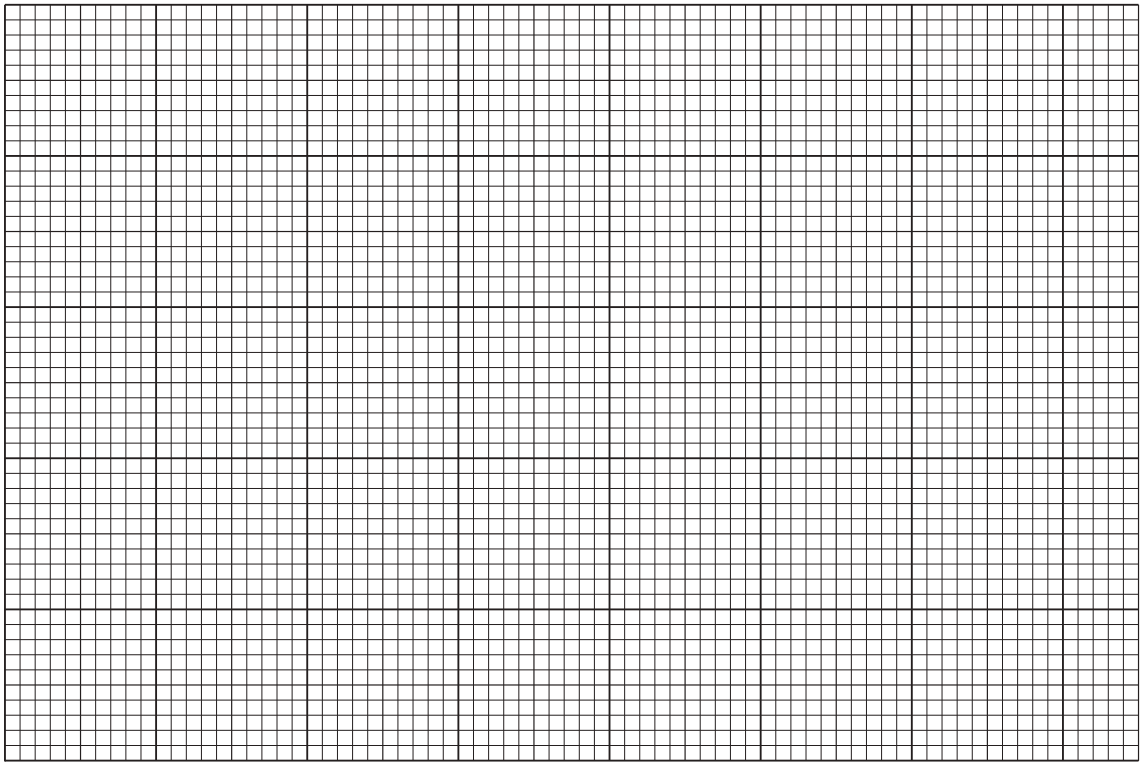
- Place the lens between the object and the screen so that the centre of the lens is at a distance $u = 20.0$ cm from the object.
- Adjust the position of the screen until a clearly focused image is formed on the screen.
- Measure the distance *v* between the centre of the lens and the screen. Record the values of *u* and *v* in Table 3.1.

Table 3.1

u / cm	*v* / cm

(ii) Repeat the procedure using values for *u* of 22.0 cm, 25.0 cm, 30.0 cm and 35.0 cm. [3]

(b) Plot a graph of v/cm (y-axis) against u/cm (x-axis). You do not need to start your axes at the origin (0, 0). Draw the best-fit curve.



[4]

(c) **(i)**
- Mark, with a cross, the point on the graph grid where $u = 25.0$ cm and $v = 25.0$ cm.
- Mark, with a cross, the point on the graph grid where $u = 35.0$ cm and $v = 35.0$ cm.
- Join these two points with a straight line. [1]

(ii)
- Record u_1, the value of u at the point where the straight line crosses your graph line.

u_1 = ... cm

- Record v_1, the value of v at the point where the straight line crosses your graph line.

v_1 = ... cm
[1]

(iii) Calculate the focal length f of the lens using the equation $f = \frac{(u_1 + v_1)}{4}$.

f = ... cm
[2]

[Total: 11]

4 A student has a selection of rubber bands of different thicknesses. He is investigating the amount of stretch produced by different loads. Fig. 4.1 shows the set-up used.

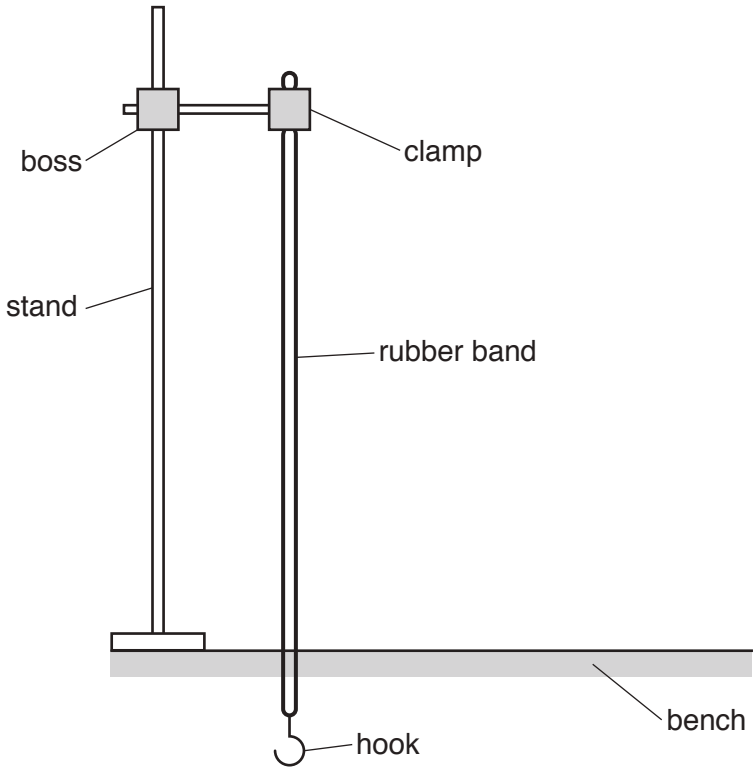


Fig. 4.1

In addition to the apparatus shown in Fig. 4.1, the following apparatus is available to the student:

metre rule
selection of different rubber bands
selection of loads.

Plan an experiment to investigate how rubber bands of different thicknesses stretch when loaded.

You are **not** required to carry out this experiment.

You should

- explain briefly how you would carry out the investigation
- state the key variables that you would control
- draw a table, or tables, with column headings to show how you would display your readings (You are **not** required to enter any readings in the table.)
- explain briefly how you would use your readings to reach a conclusion.

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[Total: 7]

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CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/53**

Paper 5 Practical Test **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

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1 In this experiment, you will investigate how the use of a lid affects the rate of cooling of water in a beaker.

Carry out the following instructions, referring to Fig. 1.1.

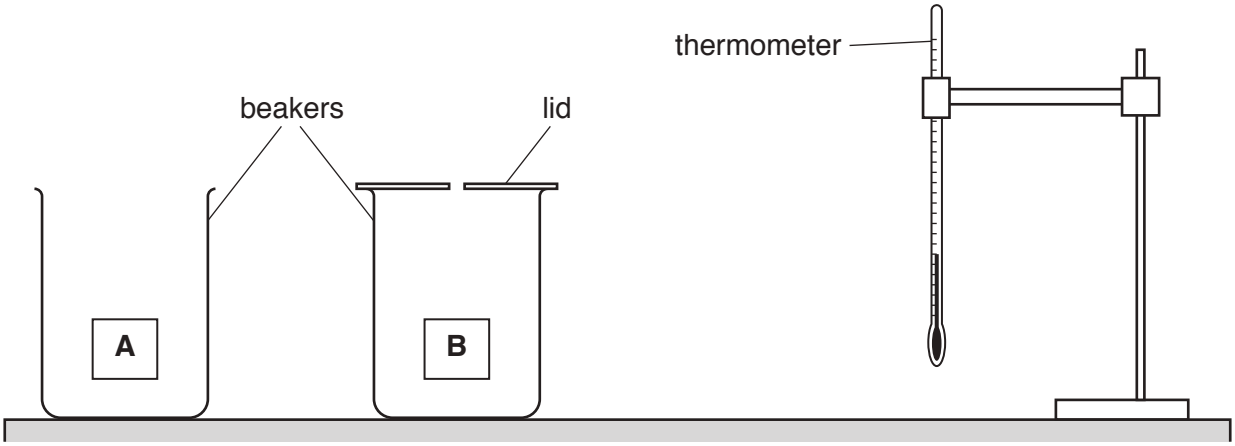

Fig. 1.1

(a)
- Pour 100 cm^3 of hot water into beaker **A**.
- Place the thermometer in the water in beaker **A**.
- In Table 1.1, record the temperature θ of the water at time $t = 0$ s and immediately start the stopclock.
- Record, in the table, the temperature θ of the water at times $t = 30$ s, 60 s, 90 s, 120 s, 150 s and 180 s.
- Remove the thermometer from the beaker. [1]

(b) (i) Remove the lid from beaker **B**.
Repeat the procedure in **(a)** for beaker **B**, using 75 cm^3 of hot water, and replace the lid immediately after pouring in the water. [1]

(ii) Complete the headings and the time column in Table 1.1. [2]

Table 1.1

	beaker **A** without a lid	beaker **B** with a lid
t/	θ/	θ/
0		

(c) Describe **two** precautions that you took to ensure that the temperature readings were as accurate as possible in the experiment.

1 .....

.....

2 .....

.....
[2]

(d) **(i)** Write a conclusion, stating how the use of the lid affects the rate of cooling of the water. Justify your answer by reference to your results.

.....

.....

.....

.....[2]

(ii) Suggest **one** change to the apparatus or procedure to make the comparison a fairer test. Explain why the change makes the test fairer.

change .....

.....

explanation .....

.....

.....
[2]

(iii) The temperature of the water in each beaker decreases.

Describe **one** other similarity in the pattern of cooling in beakers **A** and **B**.

.....

.....

.....[1]

[Total: 11]

2 In this experiment, you will investigate a circuit containing resistors.
The circuit has been set up for you.

Carry out the following instructions, referring to Fig. 2.1.

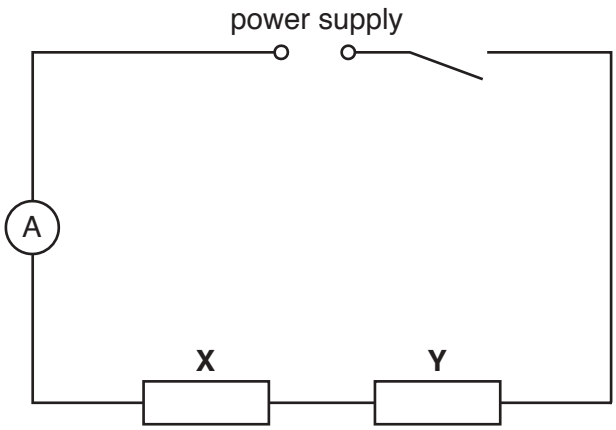

Fig. 2.1

(a) On Fig. 2.1, draw a voltmeter connected so that it measures the potential difference across resistor **X**. [1]

(b) **(i)** Switch on. Record the value of the current I_S in the circuit.

I_S = ...[1]

(ii) • Use the voltmeter to measure and record the value of the potential difference V_X across resistor **X**.

V_X = ...

Disconnect the voltmeter.

• Reconnect the voltmeter to measure and record the potential difference V_Y across resistor **Y**.

V_Y = ...
[1]

Disconnect the voltmeter.

(iii) Reconnect the voltmeter to measure and record the potential difference V_S across the combination of both resistors.

V_S = ...[1]

Switch off.

(iv) A student suggests that V_S should be equal to (V_X + V_Y).

State whether your readings support this suggestion. Justify your statement with reference to your results.

statement .....

justification .....

.....

.....
[2]

(c) Calculate the resistance R_S of the combination of resistors, using your readings from **(b)(i)** and **(b)(iii)** and the equation

$$R_S = \frac{V_S}{I_S}.$$

R_S = ...[2]

(d) The circuit components are to be rearranged so that:

- resistors **X** and **Y** are in parallel
- the ammeter will measure the total current in the circuit
- the voltmeter will measure the potential difference across both resistors.

In the space below, draw a diagram of this circuit using standard electrical symbols.

[2]

(e) Set up the circuit as described in **(d)**.

Switch on. Measure and record the total current I_P in the circuit and the potential difference V_P across the resistors.

I_P = ...

V_P = ...
[1]

Switch off.

[Total: 11]

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3 In this experiment, you will determine the weight of a metre rule.

Carry out the following instructions, referring to Fig. 3.1.

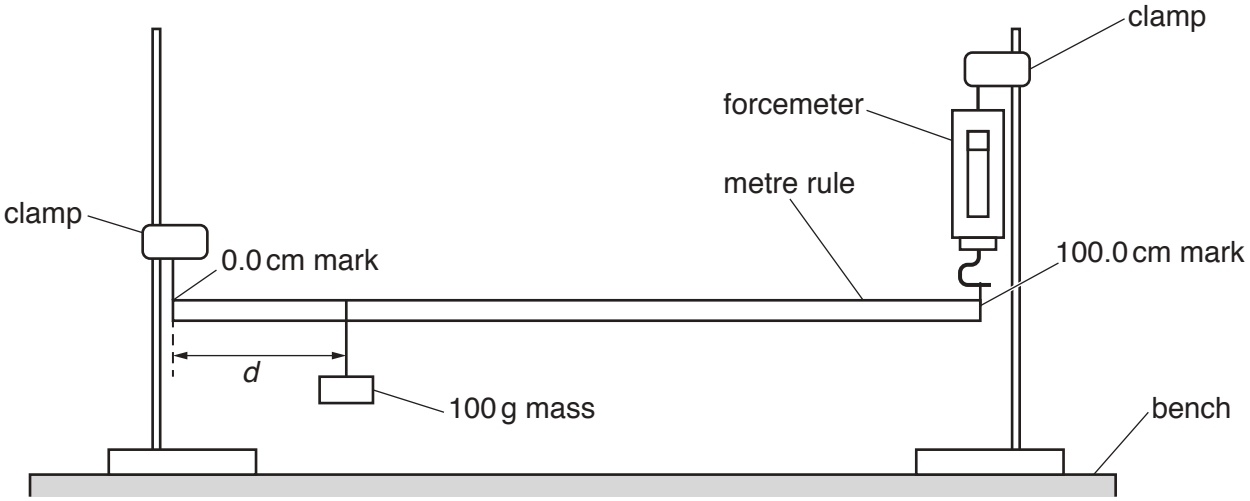


Fig. 3.1

(a) (i)
- Move the 100 g mass to a distance d = 10.0 cm from the 0.0 cm end of the rule.
- Adjust the height of the clamp holding the forcemeter so that the rule is horizontal.
- Read, and record in Table 3.1, the forcemeter reading F.
- Repeat this procedure for values of d = 30.0 cm, 50.0 cm, 70.0 cm and 90.0 cm.

Table 3.1

d / cm	F / N
10.0	
30.0	
50.0	
70.0	
90.0	

[2]

(ii) Explain how you made sure that the rule was horizontal before each reading.
You may draw a diagram.

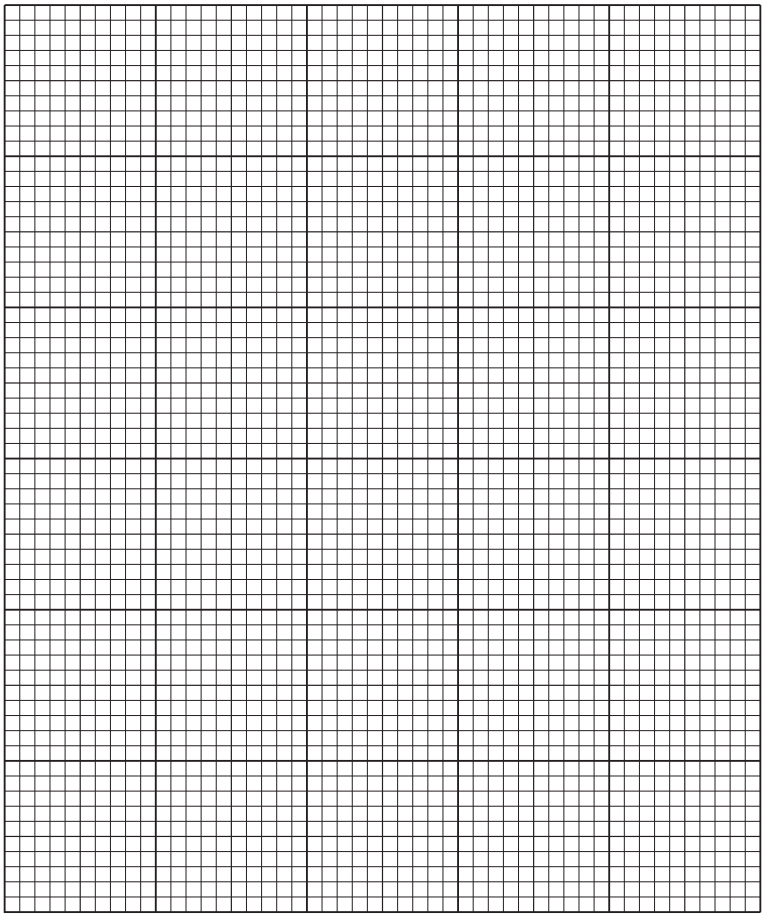
.....

.....

.....[1]

(b) Plot a graph of F/N (y-axis) against d/cm (x-axis).
Start your axes from the origin (0,0).

Draw a best-fit line.



[4]

(c) **(i)** From your graph, determine F_0, the value of F when $d = 0.0$ cm.

F_0 .....

(ii) Calculate the weight W_R of the metre rule, using the equation $W_R = 2 \times F_0$.
Give W_R to a suitable number of significant figures for this experiment.

W_R = ...
[2]

(d) A student correctly plots your data points on another sheet of graph paper.

State and explain whether his best-fit line is likely to be the same as yours.
Justify your answer with reference to the plots.

statement .....

explanation .....

.....

.....[1]

(e) Another student, carrying out the same experiment, is not sure if some of his values of *F* are correct.

Suggest **one** improvement to the procedure which would help him to obtain more reliable *F* values.

.....

.....

.....[1]

[Total: 11]

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4 A student has a box of converging lenses, but does not know their focal lengths.

Plan an experiment that will enable her to determine an accurate value for the focal length *f* of one of the lenses, using the equation

$$f = \frac{uv}{(u + v)}$$

where *u* is the distance between an object and the lens and *v* is the distance between the lens and the focused image of the object.

The apparatus available includes:

a lens holder
a 12 V lamp in a holder, with a power supply
a card with a triangular hole covered with tracing paper.

Write a plan for the experiment.

You should:

- list any additional apparatus needed
- draw a diagram of how the apparatus would be arranged, clearly labelling *u* and *v*
- write a method for carrying out the experiment including how *f* would be determined
- state the precautions which should be taken to obtain a clear, focused image
- state the precautions which should be taken to ensure that measurements are accurate once a focused image has been obtained.

You are **not** required to carry out the experiment.

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.....[7]

[Total: 7]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1 A student is investigating resistance using the circuit shown in Fig. 1.1.

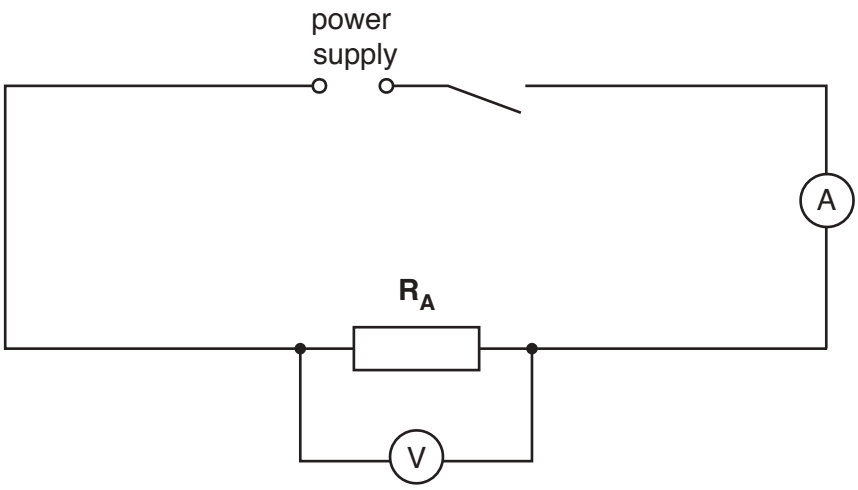


Fig. 1.1

(a) The student measures the potential difference V_1 across the resistor $\mathbf{R_A}$ and the current I_1 in the circuit. Figs. 1.2 and 1.3 show the voltmeter and ammeter scales.

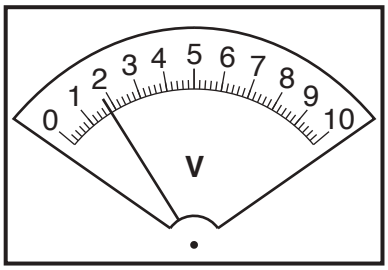


Fig. 1.2

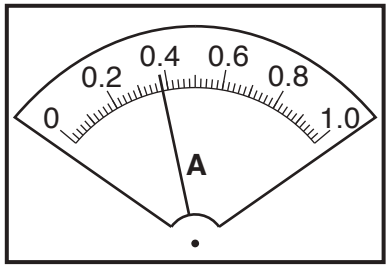


Fig. 1.3

(i) Write down the readings shown on the scales in Figs. 1.2 and 1.3.

V_1 = ...

I_1 = ...
[2]

(ii) Calculate the resistance R_1 of the resistor $\mathbf{R_A}$ using the equation $R_1 = \frac{V_1}{I_1}$.

R_1 = ... [1]

(b) The student connects a resistor $\mathbf{R_B}$ in series with $\mathbf{R_A}$.

She measures the potential difference V_2 across the two resistors $\mathbf{R_A}$ and $\mathbf{R_B}$ combined and the current I_2 in the circuit.

V_2 = ...1.8 V.....

I_2 = ...0.19 A.....

Calculate the resistance R_2 of resistors $\mathbf{R_A}$ and $\mathbf{R_B}$ combined in series, using the equation $R_2 = \frac{V_2}{I_2}$.

R_2 = ...[1]

(c) The student connects a third resistor $\mathbf{R_C}$ in series with $\mathbf{R_A}$ and $\mathbf{R_B}$.

She measures the potential difference V_3 across the three resistors and the current I_3 in the circuit.

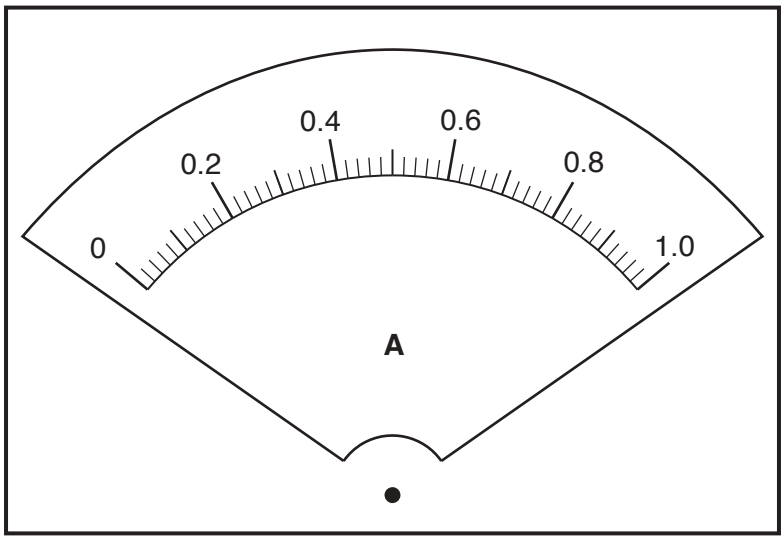
V_3 = ...1.7 V.....

I_3 = ...0.13 A.....

(i) Calculate the resistance R_3 of resistors $\mathbf{R_A}$, $\mathbf{R_B}$ and $\mathbf{R_C}$ combined in series, using the equation $R_3 = \frac{V_3}{I_3}$.

R_3 = ...

(ii) On Fig. 1.4, draw a line for the needle on the ammeter to show the reading of 0.13 A.



[1]

Fig. 1.4

(d) A student suggests that $R_3 = 3 \times R_1$.

State whether the results agree with this suggestion. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....
[1]

(e) Another student suggests that the three resistors $\mathbf{R_A}$, $\mathbf{R_B}$ and $\mathbf{R_C}$ each have the same value of resistance.

Explain how you could use the circuit shown in Fig. 1.1 to check this suggestion.

.....

.....[1]

(f) Complete the circuit diagram in Fig. 1.5 to show:

- the three resistors connected in parallel
- the voltmeter connected to measure the potential difference across the resistors
- a variable resistor connected to control the current in all three resistors.

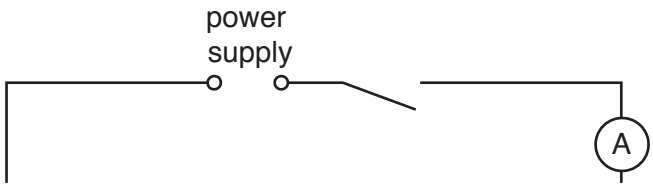


Fig. 1.5

[2]

(g) The circuit in Fig. 1.5 could be used to determine the combined resistance of three resistors connected in parallel.

Suggest a reason for connecting a variable resistor in the circuit.

.....

.....[1]

[Total: 10]

2 A student is determining the focal length *f* of a lens.
Fig. 2.1 shows the apparatus used.

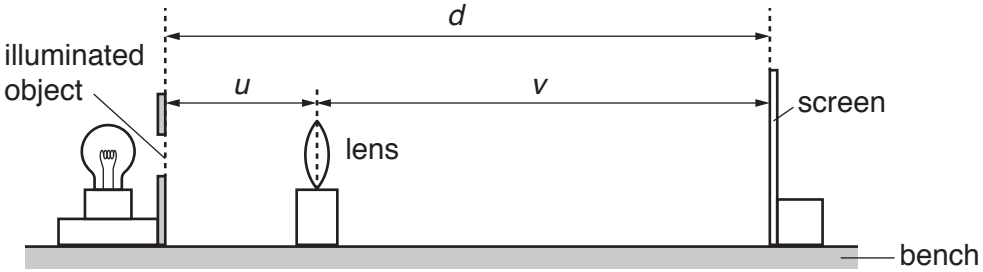


Fig. 2.1

(a) The student obtains a sharply-focused image on the screen.

(i) On Fig. 2.1, measure the distance *v* from the lens to the screen.

v = ...

(ii) On Fig. 2.1, measure the distance *d* from the illuminated object to the screen.

d = ...
[2]

(b) Fig. 2.1 is drawn 1/10th actual size.

(i) Calculate *V*, the actual distance from the lens to the screen. Record the value of *V* in the first row of Table 2.1.

(ii) Calculate *D*, the actual distance from the illuminated object to the screen. Record the value of *D* in the first row of the table.

(iii) Calculate *UV* and record the result in the table.

[2]

(c) The student repeated the procedure with the lens at a distance *U* = 30.0 cm from the illuminated object. All the readings are recorded in the table.

Table 2.1

U / cm	*V* / cm	*UV* / cm^2	*D* / cm
20.0			
30.0	29.5	885	59.5

State **one** difference that you would expect to observe between the image formed on the screen when *U* = 20.0 cm and when *U* = 30.0 cm.

.....

.....[1]

(d) **(i)** Use the results in the first row of the table to calculate a value f_1 for the focal length of the lens. Use the equation $f_1 = \frac{UV}{D}$.

f_1 = ...

(ii) Use the results in the second row of the table to calculate a value f_2 for the focal length of the lens. Use the equation $f_2 = \frac{UV}{D}$.

f_2 = ...

(iii) Calculate the average value f_A for the focal length of the lens. Give your answer to a suitable number of significant figures for this experiment.

f_A = ...
[3]

(e) Suggest **two** reasons why it may be difficult to obtain reliable results in this experiment.

1. .....

.....

2. .....

.....
[2]

(f) A student states that a more reliable value for the focal length is obtained if more values of *U*, *V* and *D* are collected, enabling a graph to be drawn of *UV* against *D*.

(i) Suggest a suitable number of values for *U*.

.....

(ii) Suggest a suitable range of values for *U*.

.....
[2]

[Total: 12]

3 A student is investigating whether the diameter of a pendulum bob affects the period of a pendulum. The period is the time taken for one complete oscillation of the pendulum. Fig. 3.1 shows a pendulum.

Fig. 3.2 shows one complete oscillation.

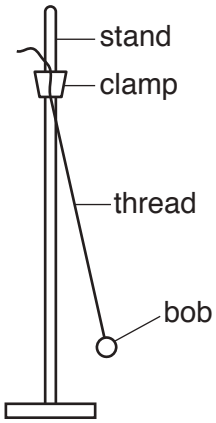


Fig. 3.1

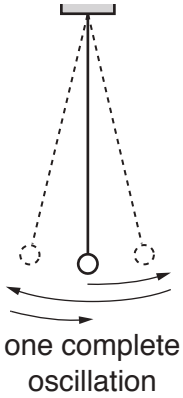


Fig. 3.2

The student has the following apparatus:

pendulum bobs made of polystyrene with diameters 1 cm, 2 cm, 3 cm, 4 cm and 5 cm
a supply of thread and a pair of scissors
clamp and stand.

Plan an experiment to investigate whether the diameter of a pendulum bob affects the period of a pendulum.

You should:

- list additional apparatus that you would require
- explain briefly how you would carry out the investigation
- state the key variables that you would control
- draw a table with column headings, to show how you would display your readings (You are **not** required to enter any readings in the table.)
- explain briefly how you would use your readings to reach a conclusion.

.....

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.....[7]

[Total: 7]

4 A student is determining the weight of a load using a balancing method.

Fig. 4.1 shows the apparatus used.

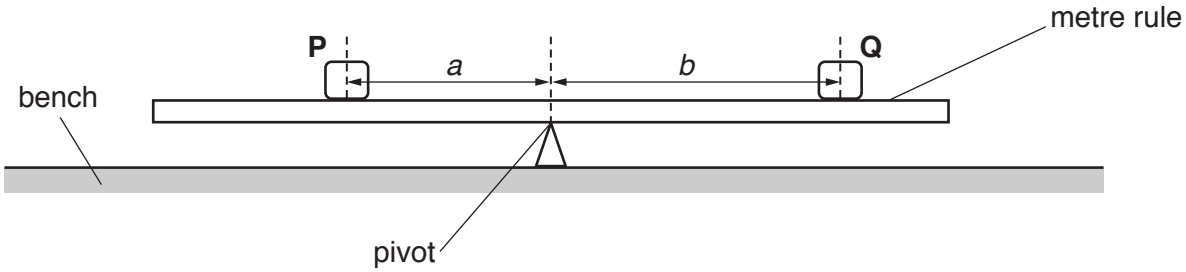


Fig. 4.1

The student places the metre rule on the pivot and adjusts its position so that the metre rule is as near as possible to being balanced.

He places a load **P** on the metre rule so that its centre is exactly at the 30.0 cm mark.

He records the distance *a* between **P** and the pivot.

a = ...19.8 cm.....

He places a load **Q** of weight *Q* = 1.0 N on the metre rule and adjusts the position of **Q** so that the metre rule is as near as possible to being balanced.

He measures the distance *b* between the centre of load **Q** and the pivot.

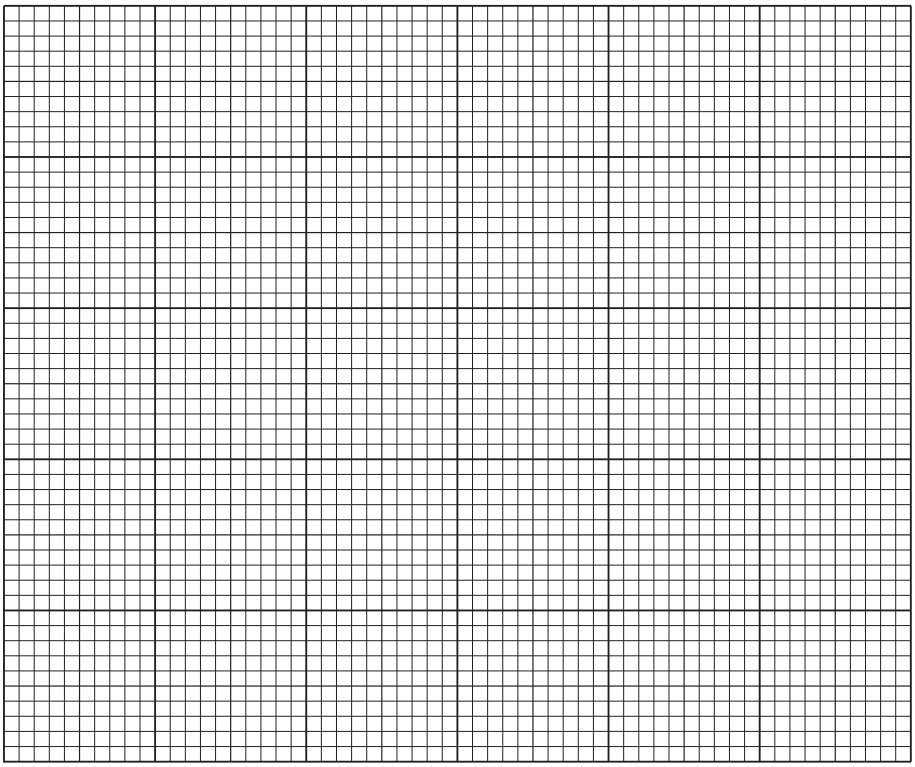
He repeats the procedure, with the load **P** remaining at the 30.0 cm mark, using *Q* values of 2.0 N, 3.0 N, 4.0 N and 5.0 N. All the readings are recorded in Table 4.1.

Table 4.1

Q/N	b/cm	$\frac{1}{Q}$/$\frac{1}{N}$
1.0	40.0	
2.0	19.5	
3.0	13.5	
4.0	10.5	
5.0	7.5	

(a) For each value of *Q*, calculate $\frac{1}{Q}$ and record the result in the table. [1]

(b) Plot a graph of b/cm (y-axis) against $\frac{1}{Q}\Big/\frac{1}{N}$ (x-axis).



[4]

(c) **(i)** Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ...[2]

(ii) Calculate the weight P of load **P** using the equation $P = \frac{G}{a}$, where a = 19.8 cm.

P = ...[1]

(d) The student measures the weight *P* of load **P** using a forcemeter. Fig. 4.2 shows the forcemeter.

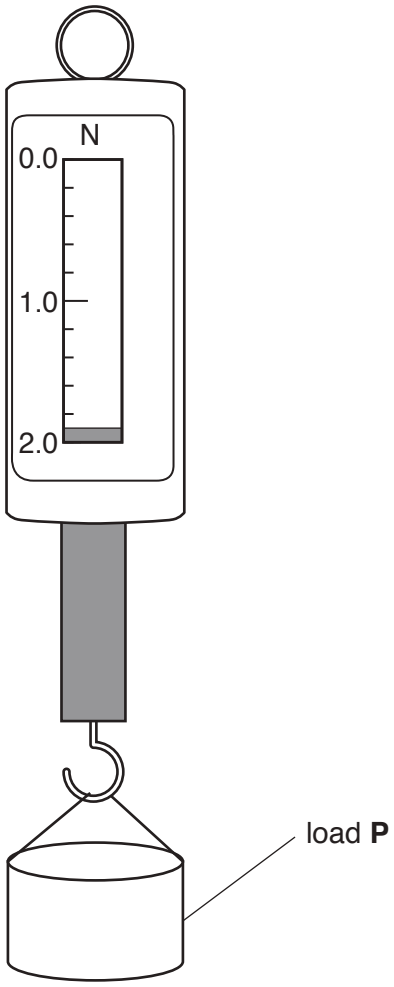


Fig. 4.2

Write down the reading *P* shown on the forcemeter.

P = ... N [1]

(e) The student has carried out the experiment with care and is expecting the two values of *P* in **(c)** and **(d)** to be the same.

Suggest **two** reasons why the values of *P* may be different.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1 A student is comparing the oscillations of two pendulums. Fig. 1.1 shows the first pendulum.

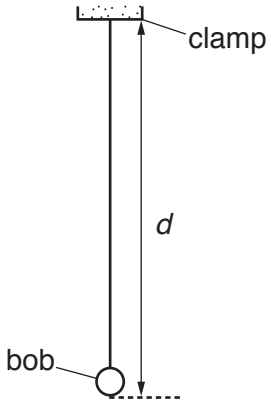

Fig. 1.1

(a) **(i)** On Fig. 1.1, measure the distance *d*, from the bottom of the clamp to the bottom of the bob.

d = ...cm [1]

(ii) Fig. 1.1 is drawn 1/10th actual size. Calculate the actual distance *D* from the bottom of the clamp to the bottom of the bob.

D = ...cm [1]

(iii) Explain briefly how to use a set-square to avoid a parallax (line-of-sight) error when measuring the length of this pendulum. You may draw a diagram.

.....

.....[1]

(b) The student displaces the bob slightly and releases it so that it swings. She measures the time t for 20 complete oscillations. The time t is shown on the stopwatch in Fig. 1.2.

Fig. 1.2

(i) Write down the time t shown in Fig. 1.2.

t = ...[1]

(ii) Calculate the period T_1 of the pendulum. The period is the time for one complete oscillation.

T_1 = ...[2]

(c) The student repeats the procedure using another pendulum as shown in Fig. 1.3. This has a long, thin pendulum bob. The distance *D* from the bottom of the clamp to the bottom of the pendulum bob is the same as for the first pendulum.

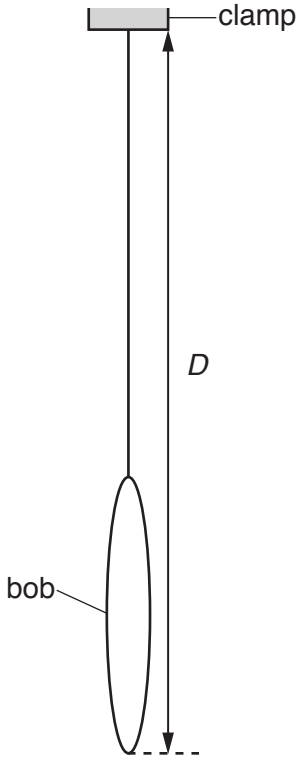

Fig. 1.3

She determines the period T_2 of this pendulum.

T_2 = ...1.37 s.....

In this experiment, both pendulum bobs have the same mass. A student suggests that since both pendulums have the same overall length *D* and mass, the periods T_1 and T_2 should be equal. State whether the results support this suggestion. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....[2]

(d) The period T of a pendulum can be determined by measuring the time t for 20 complete oscillations and then calculating the period. Some students are asked to explain the reason for this method being more accurate than measuring the time taken for a single oscillation.

Tick the box next to the sentence that gives the best explanation.

- [ ] The method eliminates errors from the measurements.
- [ ] The method is more accurate because the experiment is repeated.
- [ ] The method includes more readings so there is less chance for errors.
- [ ] The method reduces the effect of errors when starting and stopping the stopwatch.

[1]

(e) A student plans to carry out more pendulum experiments. He considers possible variables and precautions to improve accuracy.

In the following list, mark the possible variables with the letter **V** and the precautions with the letter **P**.

- [ ] amplitude of swing
- [ ] length of pendulum
- [ ] mass of pendulum bob
- [ ] shape of pendulum bob
- [ ] use of a reference point to aid counting
- [ ] viewing the rule at right-angles when measuring the length

[2]

[Total: 11]

2 A student is investigating the cooling of water.

(a) The thermometer in Fig. 2.1 shows room temperature θ_R at the beginning of the experiment. Record θ_R.

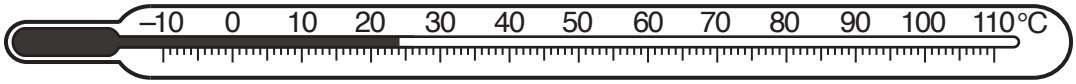

Fig. 2.1

θ_R = ... °C [1]

(b) The student pours 50 cm^3 of hot water into a beaker.

He measures the temperature θ_H of the hot water.

θ_H = ...86 °C.....

He adds 50 cm^3 of cold water to the beaker. He stirs the water briefly.

He measures the new temperature θ_M of the water in the beaker.

θ_M = ...52 °C.....

Calculate the temperature fall θ_F using the equation $\theta_F = (\theta_H - \theta_M)$.

θ_F = ...
[1]

(c) He repeats the procedure in **(b)** using 100 cm^3 of hot water and 100 cm^3 of cold water.

θ_H = ...84 °C.....

θ_M = ...54 °C.....

Calculate the temperature fall θ_F using the equation $\theta_F = (\theta_H - \theta_M)$.

θ_F = ...[1]

(d) Suggest **one** reason for stirring the water before reading θ_M.

.....

.....[1]

(e) A student states that the temperature fall θ_F should be the same each time because the proportions of hot and cold water are the same.

Suggest **one** reason why θ_F could be significantly different in **(b)** and **(c)**.

.....

.....

.....[1]

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(f) Suggest an improvement to the apparatus to make it more likely that θ_F would be the same each time.

.....

.....

.....[1]

(g) Suggest a condition, not included in your answer to **(f)**, that you would control to make it more likely that θ_F would be the same each time.

.....

.....

.....[1]

(h) The student uses a measuring cylinder to measure the volume of water he uses. Draw a measuring cylinder about half-full of water. Show clearly on your diagram the line-of-sight required for obtaining a correct reading for the volume of water.

[3]

[Total: 10]

3 A student is determining the focal length *f* of a lens.

Fig. 3.1 shows the apparatus used.

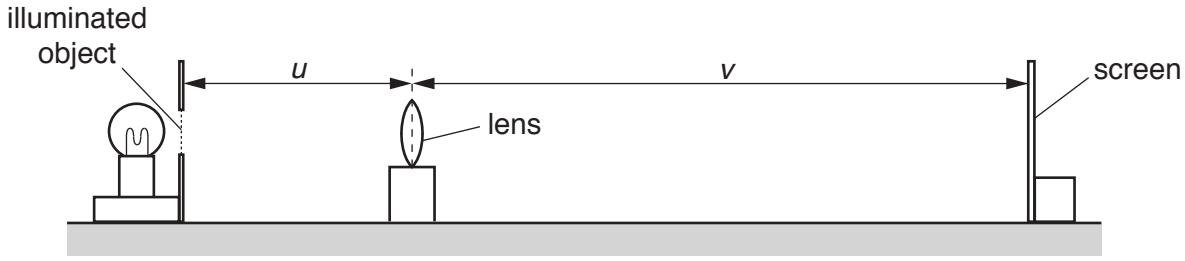

Fig. 3.1

(a)
- The student places the screen about 100 cm from the illuminated object.
- She places the lens between the object and the screen so that the centre of the lens is at a distance $u = 20.0$ cm from the object.
- She adjusts the position of the screen until a clearly focused image is formed on the screen.
- She measures the distance *v* between the centre of the lens and the screen.
- She repeats the procedure using values for *u* of 22.0 cm, 25.0 cm, 30.0 cm and 35.0 cm.
- The readings are shown in Table 3.1.

Table 3.1

u / cm	*v* / cm
20.0	60.0
22.0	47.1
25.0	37.5
30.0	29.8
35.0	26.3

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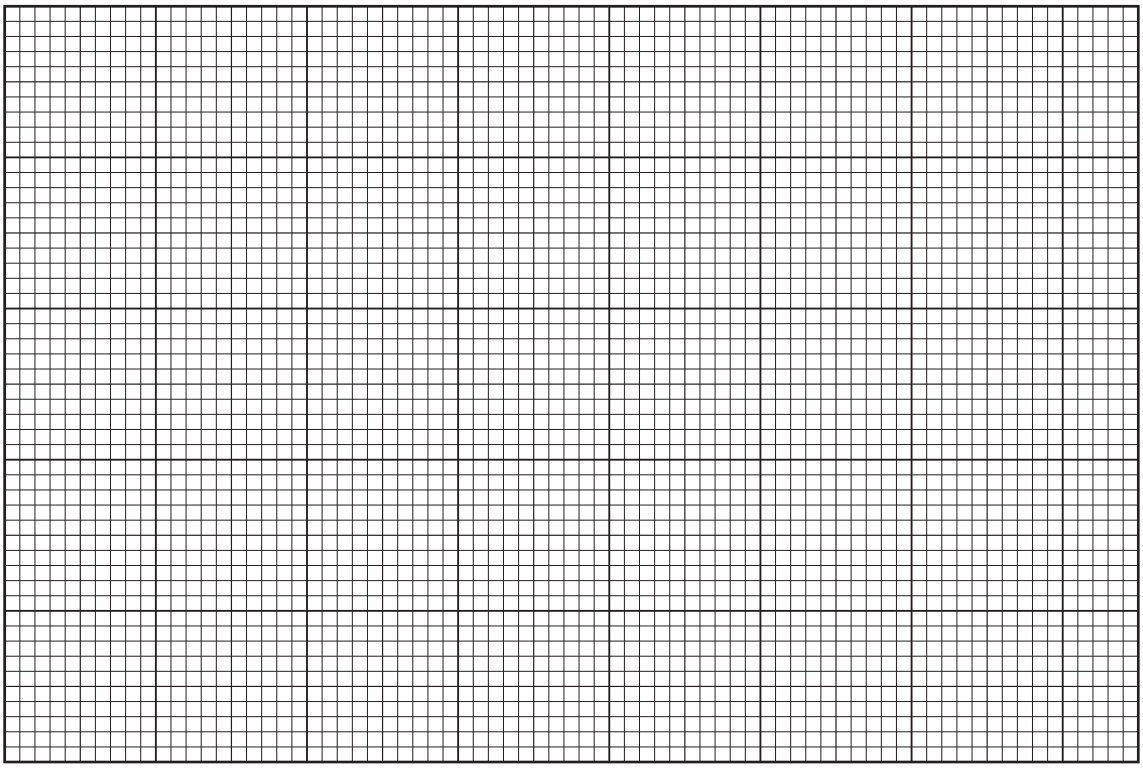
Plot a graph of v/cm (y-axis) against u/cm (x-axis). You do not need to start your axes at the origin (0, 0). Draw the best-fit curve.



[4]

(b) **(i)**
- Mark, with a cross, the point on the graph grid where $u = 25.0$ cm and $v = 25.0$ cm.
- Mark with a cross, the point on the graph grid where $u = 35.0$ cm and $v = 35.0$ cm.
- Join these two points with a straight line. [1]

(ii)
- Record u_1, the value of u at the point where the straight line crosses your graph line.

u_1 = ... cm

- Record v_1, the value of v at the point where the straight line crosses your graph line.

v_1 = ... cm
[1]

(iii) Calculate the focal length f of the lens using the equation $f = \frac{(u_1 + v_1)}{4}$.

f = ... cm
[2]

(c) Suggest **two** differences that you would expect to see between the appearance of the illuminated object and the image on the screen.

1. .....

2. .....
[2]

(d) Suggest **two** precautions that you would take in order to obtain reliable readings in this experiment.

1. .....

2. .....
[2]

[Total: 12]

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4 A student has a selection of rubber bands of different widths. He is investigating the extension produced by adding loads. Fig. 4.1 shows the set-up used.

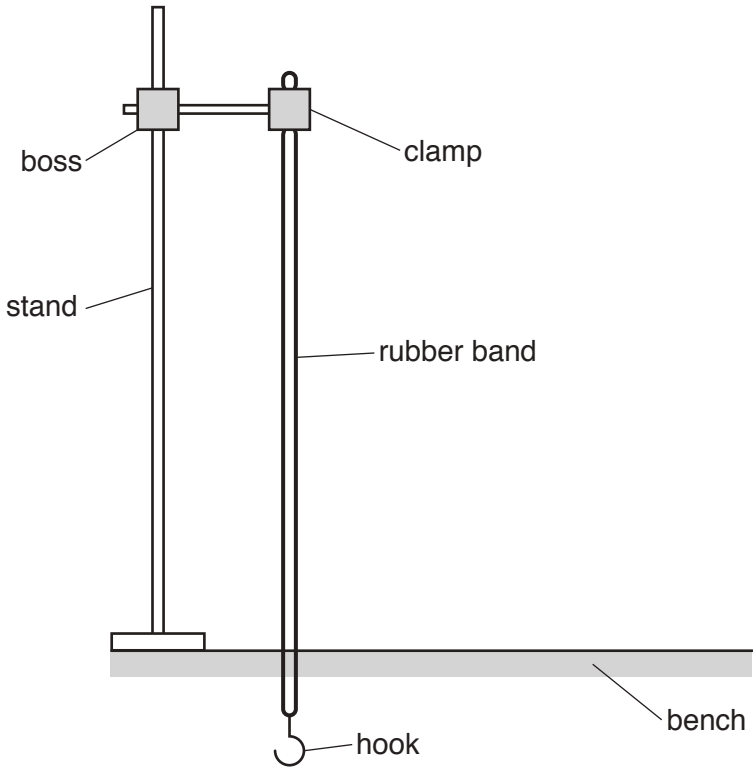

Fig. 4.1

In addition to the apparatus shown in Fig. 4.1, the following apparatus is available to the student:

A metre rule
A selection of different rubber bands
A selection of loads.

Plan an experiment to investigate how strips of rubber of different widths stretch when loaded.

You should

- explain briefly how you would carry out the investigation
- state the key variables that you would control
- draw a table, or tables, with column headings to show how you would display your readings (You are **not** required to enter any readings in the table.)
- explain briefly how you would use your readings to reach a conclusion.

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.....[7]

[Total: 7]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/63**

Paper 6 Alternative to Practical **October/November 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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This document consists of **14** printed pages and **2** blank pages.

DC (NH/CGW) 132967/3
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CAMBRIDGE International Examinations

1 Some students are investigating how the use of a lid affects the rate of cooling of water in a beaker.

They are using the apparatus shown in Fig. 1.1.

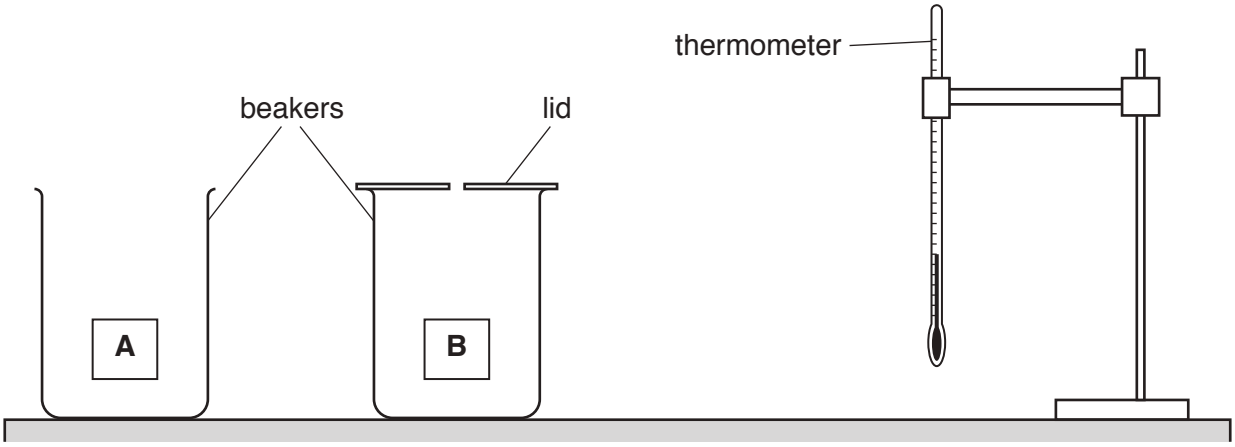

Fig. 1.1

- A student pours 100 cm^3 of hot water into beaker **A**.
- He records the temperature of the water in beaker **A** and immediately starts a stopclock.
- The student records the temperature θ of the water every 30 s. His readings are shown in Table 1.1.
- The student repeats the procedure for beaker **B** using 75 cm^3 of hot water.

(a) Complete the headings and the time column in Table 1.1. [2]

Table 1.1

	beaker **A** without a lid	beaker **B** with a lid
t/	θ/	θ/
	80.0	81.0
	77.0	79.0
	74.5	77.5
	72.5	76.0
	70.5	75.0
	69.0	74.0
	68.0	73.5

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(b) Describe **two** precautions which should be taken to ensure that the temperature readings are as accurate as possible in the experiment.

1 .....

.....

2 .....

.....
[2]

(c) **(i)** Write a conclusion, stating how the use of the lid affects the rate of cooling of the water. Justify your answer by reference to the results.

.....

.....

.....

.....[2]

(ii) Suggest **one** change to the apparatus or procedure to make the comparison a fairer test. Explain why the change makes the test fairer.

change .....

.....

explanation .....

.....

.....
[2]

(iii) The temperature of the water in each beaker decreases.

Describe **one** other similarity in the pattern of cooling in beakers **A** and **B**.

.....

.....[1]

(d)

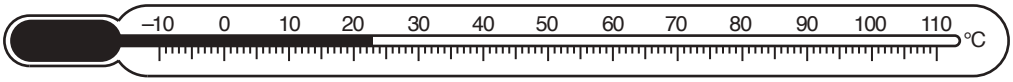


Fig. 1.2

(i) Record the room temperature θ_R, shown on the thermometer in Fig. 1.2.

θ_R = ... [1]

(ii) Another student is carrying out the same experiment in a room with a room temperature that is much higher than θ_R.

Suggest whether this might affect the cooling of the water in beaker **A** in her experiment. Briefly explain your answer.

suggestion .....

explanation .....

.....

.....
[1]

[Total: 11]

2 A student is investigating a circuit containing resistors.

She is using the circuit shown in Fig. 2.1.

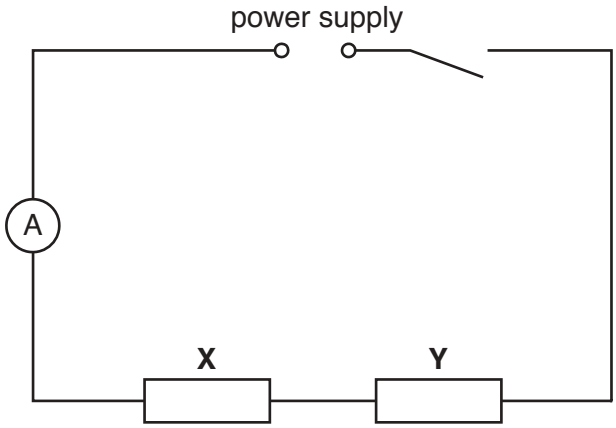


Fig. 2.1

(a) On Fig. 2.1, show a voltmeter connected so that it measures the potential difference across resistor **X**. [1]

(b) The student uses the ammeter to measure the current I_S in the circuit.

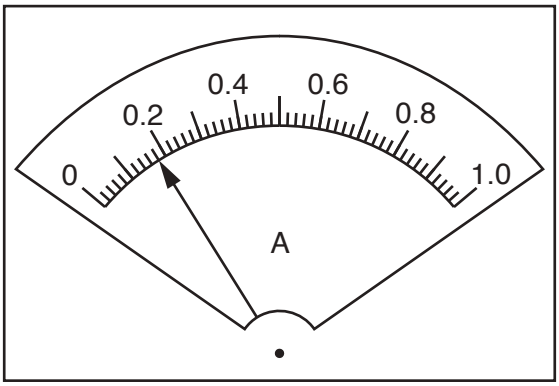


Fig. 2.2

Record the current I_S, as shown on the ammeter in Fig. 2.2.

I_S = ...[1]

(c) **(i)** The student uses the voltmeter to measure the potential difference V_X across resistor **X** and then reconnects it to measure the potential difference V_Y across resistor **Y**.

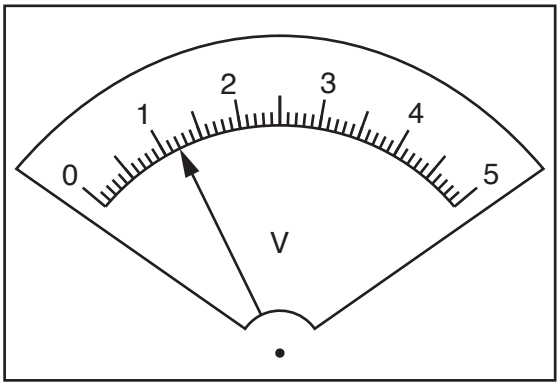


Fig. 2.3

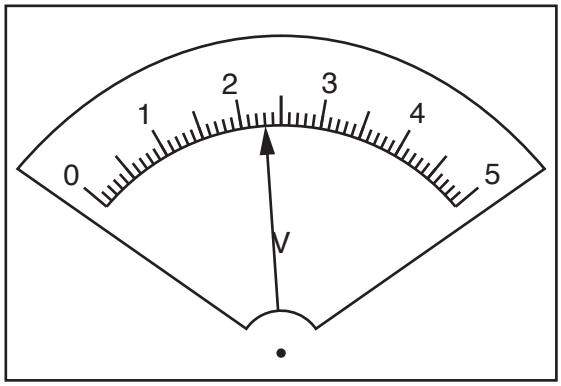


Fig. 2.4

- Record the value of the potential difference V_X across resistor **X**, shown in Fig. 2.3.

V_X = ...

- Record the value of the potential difference V_Y across resistor **Y**, shown in Fig. 2.4.

V_Y = ...
[1]

(ii) She then measures the potential difference V_S across the combination of both resistors.

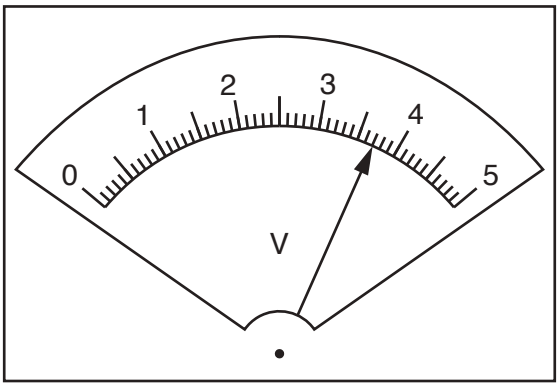


Fig. 2.5

Record the value of the potential difference V_S across the combination of both resistors, shown in Fig. 2.5.

V_S = ...[1]

(iii) A student suggests that V_S should be equal to $(V_X + V_Y)$.

State whether the readings support this suggestion. Justify your statement with reference to the results.

statement .....

justification .....

.....

.....
[2]

(d) Calculate the resistance R_S of the combination of resistors, using the readings from **(b)** and **(c)(ii)** and the equation

$$R_S = \frac{V_S}{I_S}.$$

R_S = ...[2]

(e) **(i)** The circuit components are to be rearranged so that:

- resistors **X** and **Y** are in parallel
- the ammeter will measure the total current in the circuit
- the voltmeter will measure the potential difference across both resistors.

In the space below, draw a diagram of this circuit using standard electrical symbols.

[2]

(ii) The student sets up the circuit as described in **(e)(i)**.

She measures and records the total current I_P in the circuit and the potential difference V_P across the resistors.

I_P = 0.81 A

V_P = 3.6 V

The resistance of two resistors connected in parallel is less than the resistance of the same two resistors connected in series.

State whether the readings indicate that she has set up the circuit correctly.
Explain your answer.

suggestion .....

explanation .....

.....

.....
[1]

[Total: 11]

3 Some students are determining the weight of a metre rule.
They use the apparatus shown in Fig. 3.1.

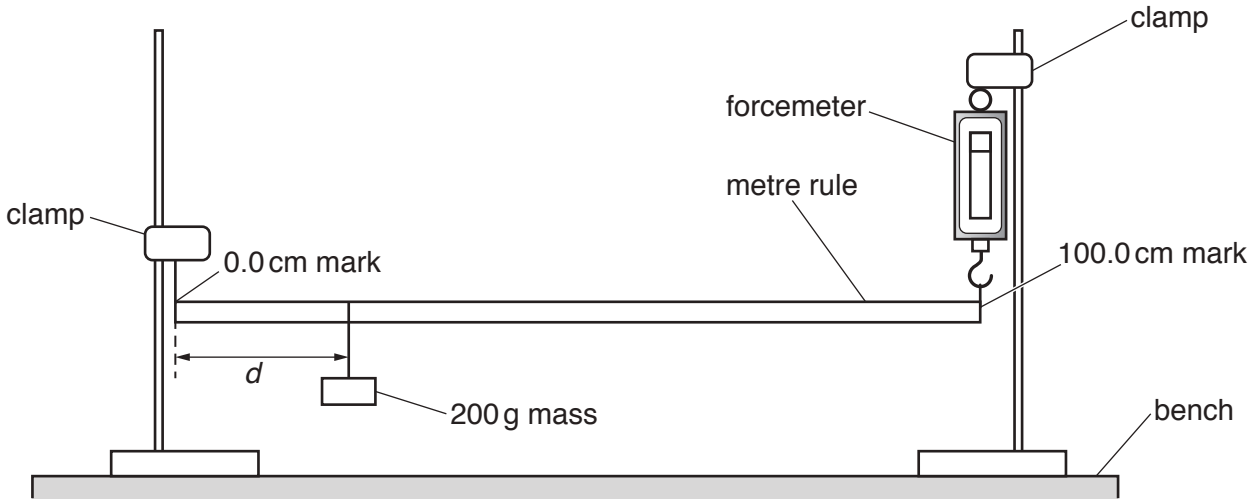


Fig. 3.1

(a) **(i)** The students suspend a 200 g mass at a distance *d* from the end of the rule.
They then adjust the height of the clamp holding the forcemeter so that the rule is horizontal.

Fig. 3.2 shows the forcemeter when the value of *d* is 10.0 cm.

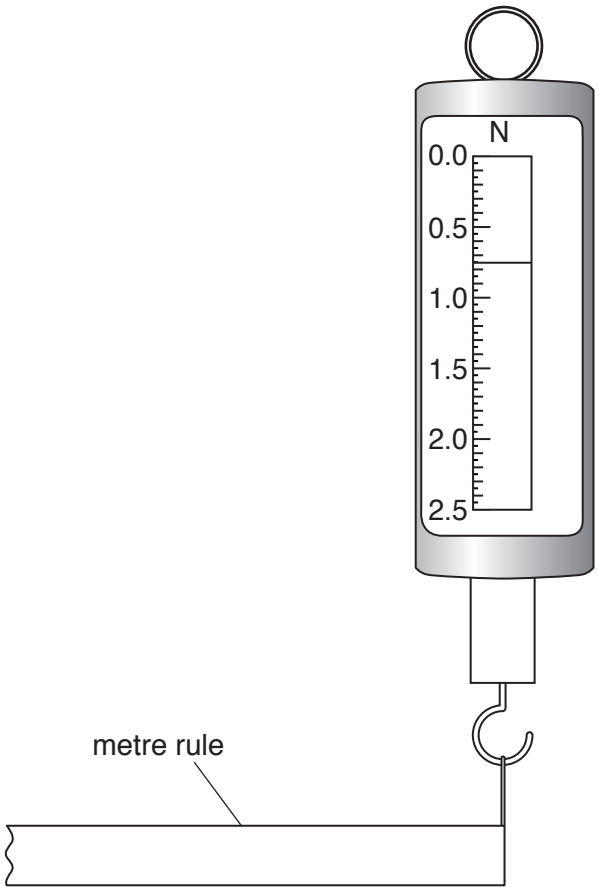


Fig. 3.2

In Table 3.1, record the forcemeter reading *F*, as shown in Fig. 3.2. [1]

Table 3.1

d / cm	*F* / N
10.0	
30.0	1.05
50.0	1.65
70.0	1.95
90.0	2.25

(ii) The students repeat the procedure for values of d = 30.0 cm, 50.0 cm, 70.0 cm and 90.0 cm. Their readings are shown in Table 3.1.

Explain how the students could make sure that the rule is horizontal before each reading. You may draw a diagram.

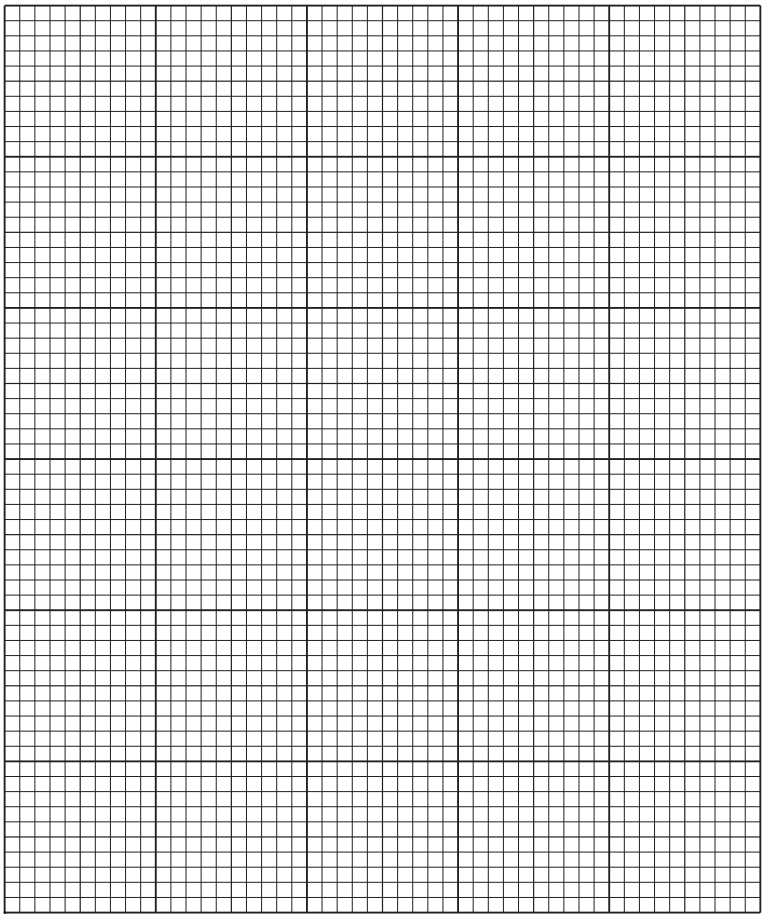
.....

.....

.....[1]

(b) Plot a graph of F/N (y-axis) against d/cm (x-axis).
Start your axes from the origin (0, 0).

Draw a best-fit line.



[4]

(c) **(i)** From your graph, determine F_0, the value of F when $d = 0.0$ cm.

F_0 = ...[1]

(ii) Calculate the weight W_R of the metre rule, using the equation $W_R = 2 \times F_0$.
Give W_R to a suitable number of significant figures for this experiment.

W_R = ...[2]

(d) A student correctly plots your data points on another sheet of graph paper.

State and explain whether his best-fit line is likely to be the same as yours.
Justify your answer with reference to the plots.

statement .....

explanation .....

.....

.....
[1]

(e) Another student, carrying out the same experiment, is not sure if some of his values of *F* are correct.

Suggest **one** improvement to the procedure which would help him to obtain more reliable *F* values.

.....

.....

.....[1]

[Total: 11]

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4 A student has a box of converging lenses but does not know their focal lengths.

Plan an experiment which will enable her to determine an accurate value for the focal length *f* of one of the lenses, using the equation

$$f = \frac{uv}{(u + v)}$$

where *u* is the distance between an object and the lens and *v* is the distance between the lens and the focused image of the object.

The apparatus available includes:

a lens holder
a 12 V lamp in a holder, with a power supply
a card with a triangular hole covered with tracing paper.

Write a plan for the experiment.

You should:

- list any additional apparatus needed
- draw a diagram of how the apparatus will be arranged, clearly labelling *u* and *v*
- write a method for carrying out the experiment including how *f* will be determined
- state the precautions which should be taken to obtain a clear, focused image
- state the precautions which should be taken to ensure that measurements are accurate once a focused image has been obtained.

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.....[7]

[Total: 7]

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Grade thresholds – March 2018

Cambridge IGCSE Physics (0625)

Grade thresholds taken for Syllabus 0625 (Physics) in the March 2018 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 12	40	–	–	25	22	19	16	13
Component 22	40	27	24	22	18	15	13	11
Component 32	80	–	–	49	40	30	21	12
Component 42	80	50	41	31	27	21	15	9
Component 52	40	26	23	21	18	16	13	10
Component 62	40	23	21	19	16	14	11	8

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **200**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
BY	22, 42, 52	146	128	110	93	79	65	51	37
CY	22, 42, 62	142	125	108	91	77	63	49	35
FY	12, 32, 52	–	–	–	119	100	82	63	44
GY	12, 32, 62	–	–	–	117	98	80	61	42

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PHYSICS **0625/12**

Paper 1 Multiple Choice (Core) **March 2018**

MARK SCHEME

Maximum Mark: 40

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Answer	Marks
1	D	**1**
2	A	**1**
3	C	**1**
4	C	**1**
5	D	**1**
6	C	**1**
7	C	**1**
8	B	**1**
9	B	**1**
10	B	**1**
11	A	**1**
12	B	**1**
13	B	**1**
14	C	**1**
15	D	**1**
16	D	**1**
17	A	**1**
18	C	**1**
19	C	**1**
20	D	**1**
21	B	**1**
22	D	**1**
23	B	**1**
24	A	**1**
25	D	**1**
26	C	**1**
27	C	**1**
28	A	**1**

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Question	Answer	Marks
29	B	**1**
30	B	**1**
31	A	**1**
32	A	**1**
33	D	**1**
34	A	**1**
35	C	**1**
36	A	**1**
37	A	**1**
38	A	**1**
39	D	**1**
40	B	**1**

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PHYSICS **0625/12**

Paper 1 Multiple Choice (Core) **February/March 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

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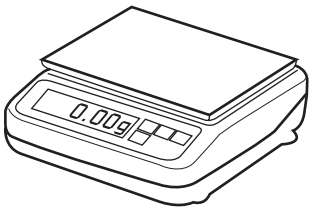
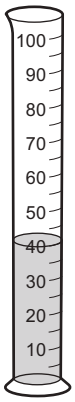
1 A student is asked to find the volume of a small irregularly-shaped piece of rock.

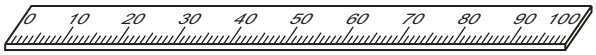
He has the following apparatus available.



balance



measuring cylinder containing water



rule

Which apparatus must the student use to find the volume of the small piece of rock?

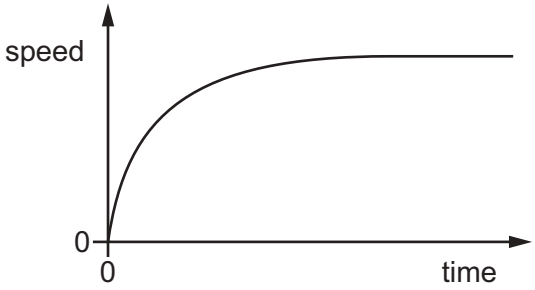
A balance and rule

B rule only

C balance and measuring cylinder

D measuring cylinder only

2 The speed-time graph represents the motion of a car travelling along a straight level road.



Which statement describes the motion of the car?

A It accelerates and reaches a constant speed.

B It accelerates and then stops moving.

C It decelerates and then reaches a constant speed.

D It decelerates and then stops moving.

3 An athlete runs 300 metres up a hill at a steady speed of 3.0 m/s.

She then immediately runs the same distance down the hill at a steady speed of 6.0 m/s.

What is her average speed for the 600 metre run?

A 2.0 m/s **B** 3.0 m/s **C** 4.0 m/s **D** 4.5 m/s

4 Which statement is correct?

A Mass is a gravitational force but weight is not a gravitational force.

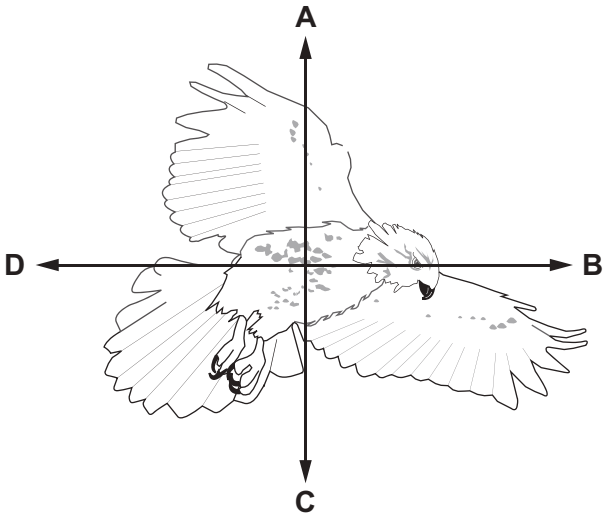
B Mass is not a gravitational force and weight is not a gravitational force.

C The unit of mass is the kilogram and the unit of weight is the newton.

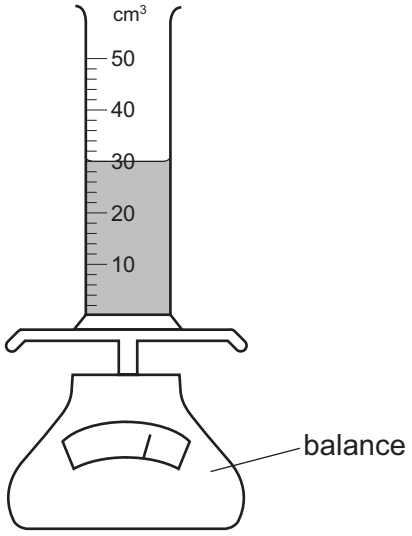
D The unit of mass is the newton and the unit of weight is the kilogram.

5 The diagram shows a bird in flight. The bird is flying in a horizontal direction to the right.

In which direction does air resistance act on the bird?



6 A measuring cylinder contains 30 cm^3 of a liquid.



Some more of the liquid is added until the liquid level reaches the 50 cm^3 mark.

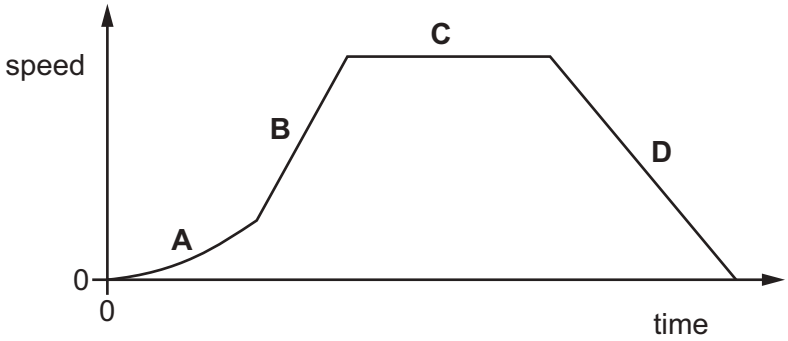
The reading on the balance increases by 30 g.

What is the density of the liquid?

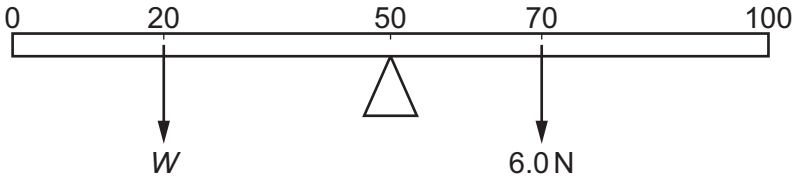
A 0.60 g / cm^3 **B** 0.67 g / cm^3 **C** 1.5 g / cm^3 **D** 1.7 g / cm^3

7 A car is travelling along a straight horizontal road. The speed-time graph is shown.

In which labelled part of the journey is the resultant force on the car zero?



8 The diagram shows a uniform metre rule balanced at its mid-point.

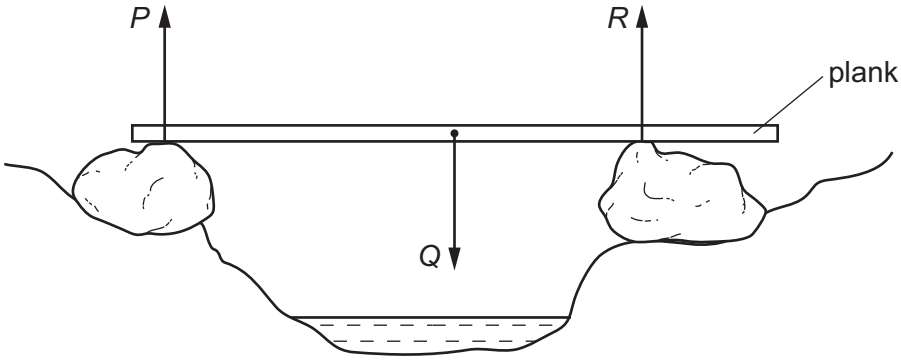


What is the weight *W* placed at the 20 cm mark?

A 0.25 N **B** 4.0 N **C** 9.0 N **D** 21 N

9 A wooden plank rests in equilibrium on two rocks on opposite sides of a narrow stream.

Three forces *P*, *Q* and *R* act on the plank.



How are the sizes of the forces related?

A $P + Q = R$

B $P + R = Q$

C $P = Q = R$

D $P = Q + R$

10 A ball is at rest at the top of a hill. It rolls down the hill. At the bottom of the hill the ball hits a wall and stops.

Which energy changes occur?

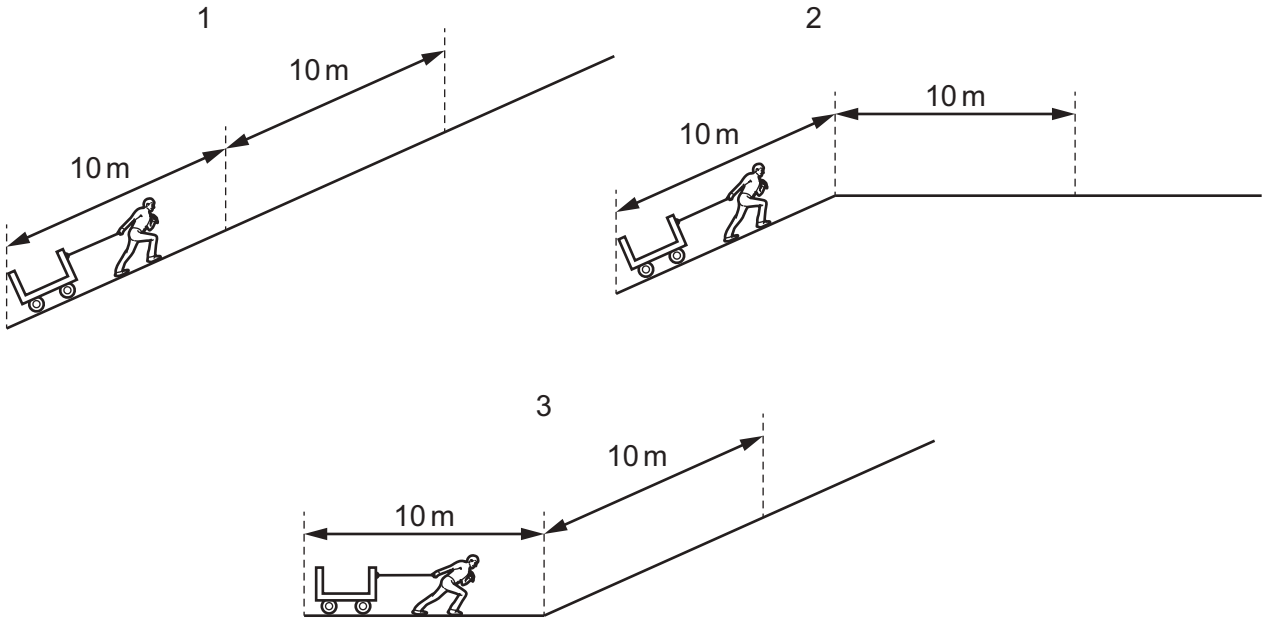
A gravitational potential energy → internal energy → kinetic energy

B gravitational potential energy → kinetic energy → internal energy

C kinetic energy → gravitational potential energy → internal energy

D kinetic energy → internal energy → gravitational potential energy

11 A man pulls a truck a distance of 20 m, as shown in the three diagrams.



Which statement concerning the work done against gravity is correct?

A Most work is done in 1.

B No work is done in 3.

C The work done in all three is equal.

D The work done in 1 and 2 is equal.

12 Which source of energy is used in a nuclear power station to generate electrical energy?

A different types of atom regrouping

B heavy nuclei splitting

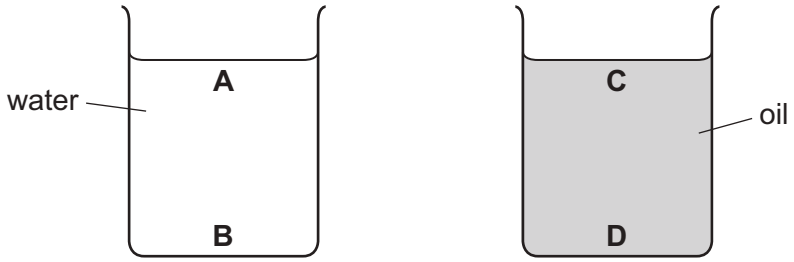
C radioactive isotopes decaying

D radioactive atoms emitting β-particles

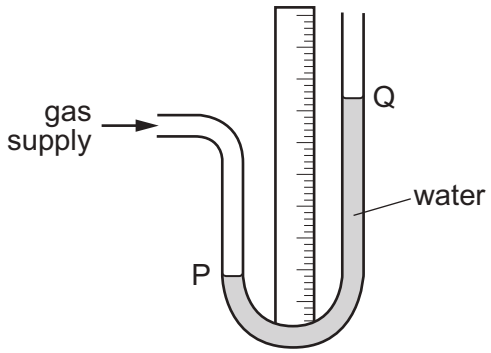
13 Two beakers are filled to the same depth, one with water and one with oil.

The density of water is 1000 kg / m^3 and the density of oil is 920 kg / m^3.

In which position is the pressure the greatest?



14 A water manometer is connected to a gas supply.

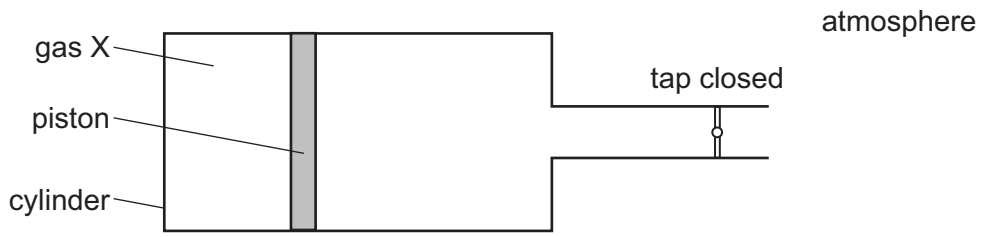


There is a gas leak and the pressure of the gas supply falls.

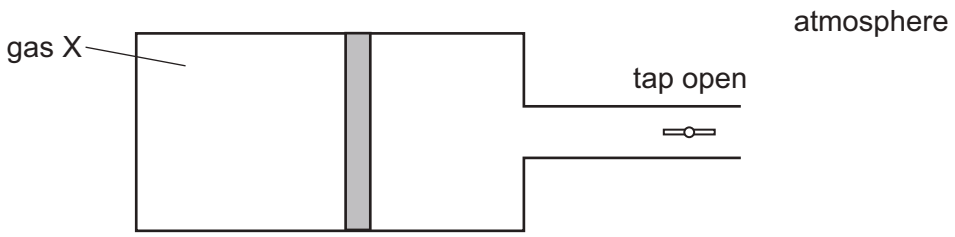
What happens to the water level at P and what happens to the water level at Q?

	water level at P	water level at Q
A	falls	falls
B	falls	rises
C	rises	falls
D	rises	rises

15 A cylinder with a tap contains a fixed mass of gas X. The gas is contained by a piston which can move freely towards or away from the tap.



When the tap is opened, the piston moves slightly to the right, towards the tap.



What can be deduced about the pressure of gas X?

	before opening tap	after opening tap
A	less than atmospheric pressure	more than atmospheric pressure
B	same as atmospheric pressure	more than atmospheric pressure
C	more than atmospheric pressure	less than atmospheric pressure
D	more than atmospheric pressure	same as atmospheric pressure

16 Which quantity does **not** change when there is an increase in temperature?

A the density of a steel block

B the diameter of the hole in a metal nut

C the length of an iron rod

D the mass of a metal coin

17 A thermometer has a low thermal capacity.

Why is this an advantage?

A The thermometer does not absorb much thermal energy to raise its own temperature.

B The thermometer does not conduct much thermal energy to the surroundings.

C The thermometer does not melt when it gets hot.

D The thermometer does not radiate much thermal energy to the surroundings.

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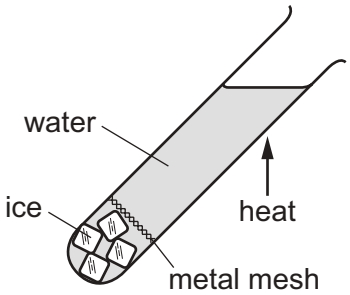
18 In an experiment, a thermometer is placed in a test-tube of hot liquid. The temperature reading of the liquid is recorded every half minute. The table shows the results.

time / minutes	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
temperature / °C	73	65	59	55	55	55	51	48	45	42	40	38	36	35	34	33

What is the melting point of the substance?

A 0 °C **B** 33 °C **C** 55 °C **D** 73 °C

19 A teacher demonstrates an experiment to a class. A boiling tube is filled with water and some ice cubes are trapped at the bottom of the tube. The teacher then heats the boiling tube in the position shown until the water at the top boils.



The ice does not melt.

What does this demonstrate?

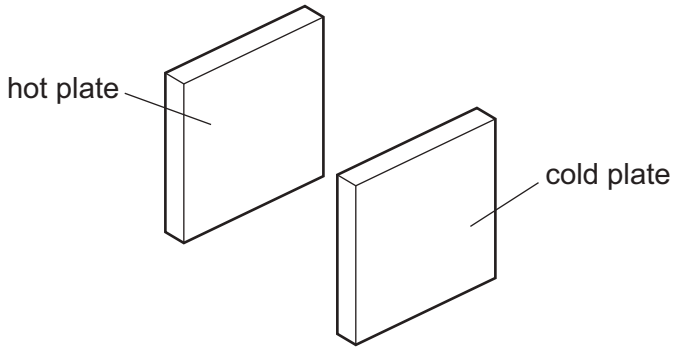
A Water is a good conductor of thermal energy.

B Water is a good convector of thermal energy.

C Water is a poor conductor of thermal energy.

D Water is a poor convector of thermal energy.

20 A hot metal plate is placed near to a cold metal plate. Infra-red radiation transfers thermal energy between the two plates.



Which choice of colour causes the temperature of the cold plate to increase most slowly?

	hot plate	cold plate
A	matt black	matt black
B	matt black	shiny white
C	shiny white	matt black
D	shiny white	shiny white

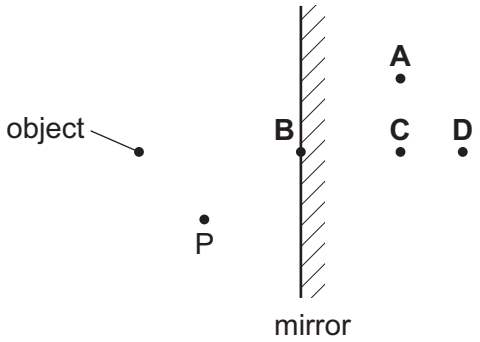
21 Which row shows an example of a transverse wave and an example of a longitudinal wave?

	transverse	longitudinal
A	light	radio
B	radio	sound
C	sound	water
D	water	light

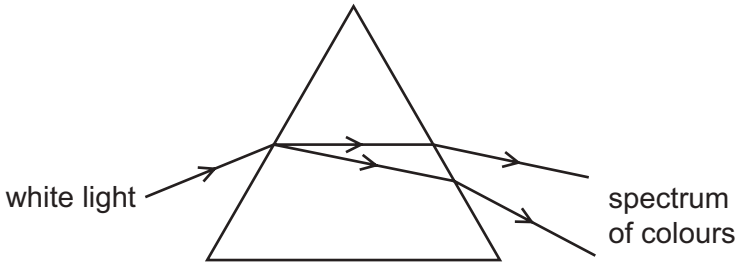
22 An object is placed before a plane mirror as shown.

A student views the image of the object in the mirror from point P.

Where does she see the image?



23 Light passes through a prism as shown. The light changes direction and produces a spectrum of colours.



Which term is used to describe the production of the spectrum of colours?

A diffraction

B dispersion

C refraction

D total internal reflection

24 Which type of waves are produced by a television remote controller?

A infra-red waves

B radio waves

C ultraviolet waves

D visible light

25 Both the amplitude and the frequency of a sound wave decrease.

What happens to the sound heard?

A The sound is louder and has a higher pitch.

B The sound is louder and has a lower pitch.

C The sound is quieter and has a higher pitch.

D The sound is quieter and has a lower pitch.

26 An electromagnet is used to remove a splinter from an eye.

What material is the splinter made from?

A aluminium

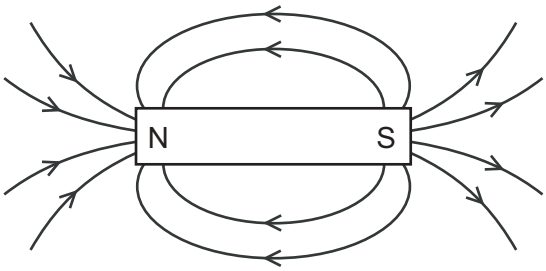
B glass

C iron

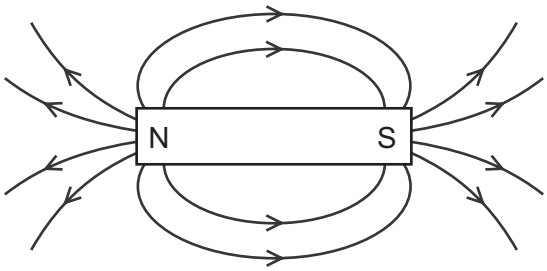
D wood

27 Which diagram shows the magnetic field around a bar magnet?

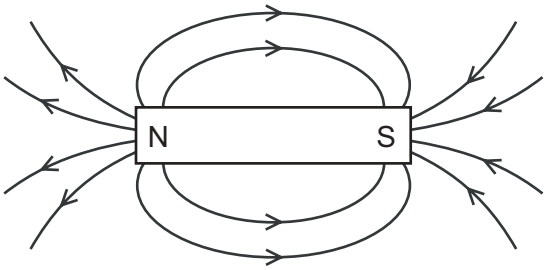
A



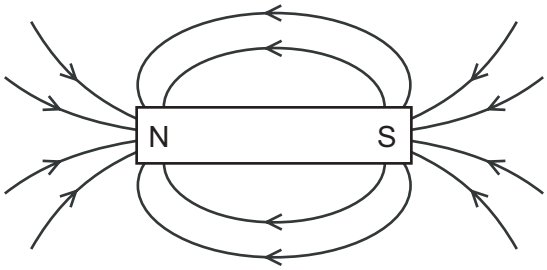
B



C



D



28 A metal conductor is connected to a battery.

Which statement describes the current in the metal conductor?

A It is a flow of electrons from the negative to the positive terminal.

B It is a flow of electrons from the positive to the negative terminal.

C It is a flow of protons from the negative to the positive terminal.

D It is a flow of protons from the positive to the negative terminal.

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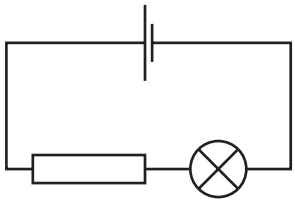
29 A student sets up the circuit shown to measure three quantities.

1 the current in the circuit

2 the electromotive force (e.m.f.) of the cell

3 the potential difference across the lamp



How many ammeters and how many voltmeters are needed?

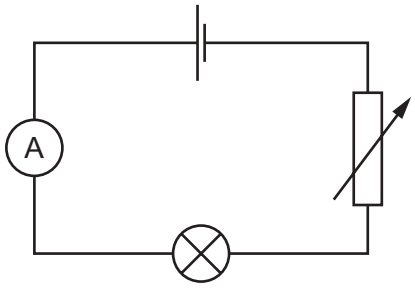
	ammeters	voltmeters
A	0	3
B	1	2
C	2	1
D	3	0

30 The current in a car headlamp is 3.0 A when connected to a 12 V battery.

What is the resistance of the lamp when it is lit?

A 0.25 Ω **B** 4.0 Ω **C** 15 Ω **D** 36 Ω

31 The diagram shows a circuit containing a cell, an ammeter, a lamp and a variable resistor.



The resistance of the variable resistor is increased.

What happens to the ammeter reading and what happens to the brightness of the lamp?

	ammeter reading	lamp brightness
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

32 Diagram 1 shows two identical lamps connected in series with a cell. Diagram 2 shows the same two lamps connected in parallel with an identical cell.

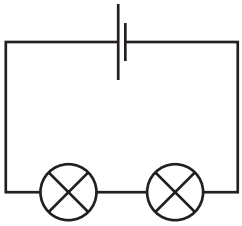


diagram 1

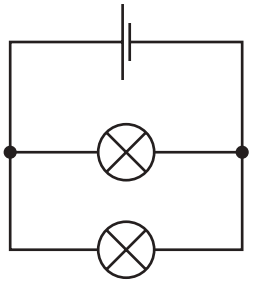


diagram 2

Which statement is correct?

A The cell in diagram 1 can supply current to the lamps for longer than the cell in diagram 2.

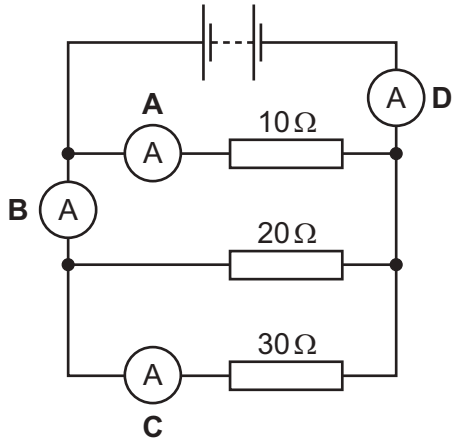
B The current in the cell in diagram 1 is greater than the current in the cell in diagram 2.

C The lamps in diagram 1 are brighter than the lamps in diagram 2.

D The voltage across each lamp in diagram 1 is greater than the voltage in diagram 2.

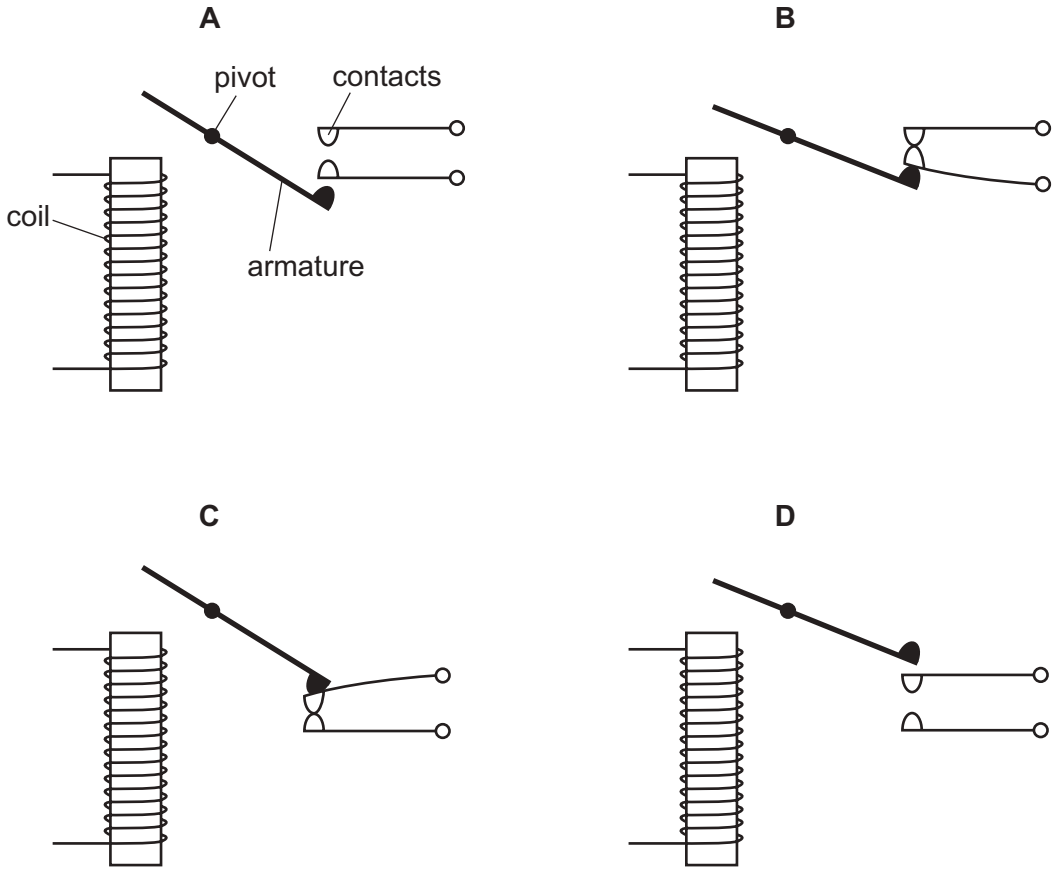
33 A circuit contains four ammeters and three resistors with different values.

Which ammeter shows the largest reading?

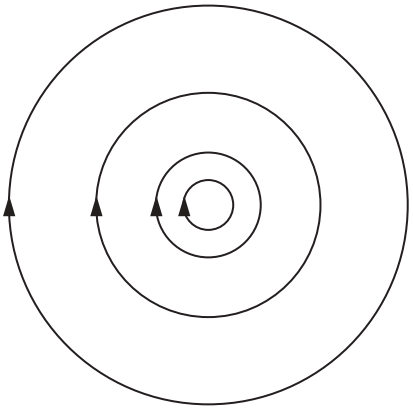


34 The diagram shows the arrangement of the coil, armature and contacts of a relay.

Which diagram shows this arrangement when there is no current in the coil?



35 The diagram represents a magnetic field.



What causes this field?

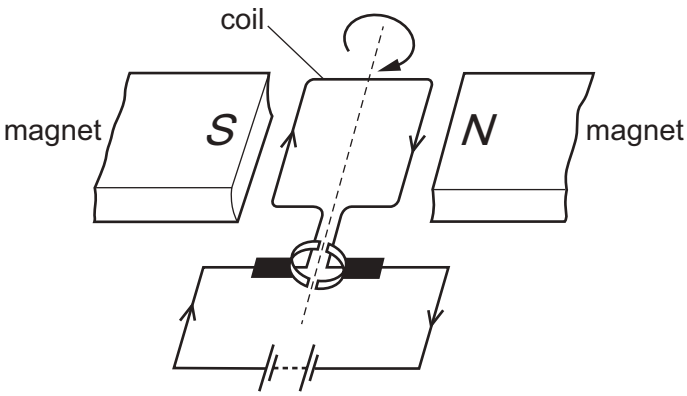
A a bar magnet

B a solenoid carrying a current

C a straight wire carrying a current

D two north poles close together

36 The diagram shows a simple d.c. electric motor which is rotating.



Which change makes the motor rotate more quickly?

A increasing the number of turns on the coil

B removing the magnets

C reversing the battery

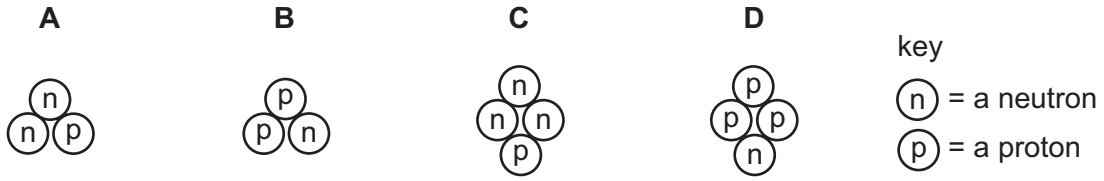
D reversing the polarity of the magnets

37 The notation for an isotope of sodium is $^{23}_{11}Na$.

Which row gives the composition of a neutral atom of this isotope of sodium?

	number of protons	number of neutrons	number of electrons
A	11	12	11
B	11	12	12
C	11	23	11
D	12	11	12

38 Which diagram represents a nucleus of $^{3}_{1}H$?



39 When measuring the emissions from a radioactive rock brought into the laboratory, a teacher mentions that background radiation must be taken into account.

What is this background radiation?

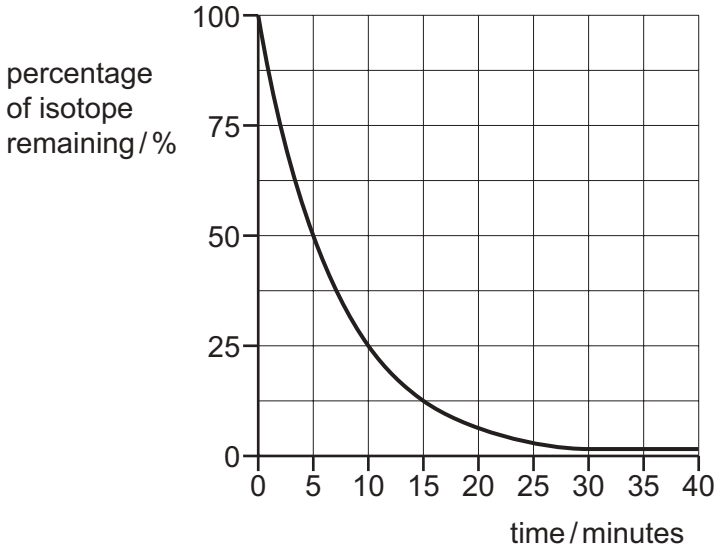
A infra-red radiation from warm objects in the laboratory

B infra-red radiation from the Sun

C ionising radiation from the radioactive rock brought into the laboratory

D ionising radiation in the laboratory when the radioactive rock is not present

40 The graph shows the percentage of a radioactive isotope that remains as time passes.



A student measures the initial rate of emission of this isotope as 40 000 emissions per second.

How long does it take for the rate of emission to fall to 5000 emissions per second?

A 5 minutes **B** 15 minutes **C** 20 minutes **D** 40 minutes

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **March 2018**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1	D	**1**
2	C	**1**
3	D	**1**
4	D	**1**
5	C	**1**
6	C	**1**
7	A	**1**
8	D	**1**
9	B	**1**
10	B	**1**
11	B	**1**
12	A	**1**
13	C	**1**
14	B	**1**
15	D	**1**
16	A	**1**
17	D	**1**
18	B	**1**
19	A	**1**
20	C	**1**
21	D	**1**
22	B	**1**
23	A	**1**
24	D	**1**
25	C	**1**
26	B	**1**
27	D	**1**
28	C	**1**

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Question	Answer	Marks
29	C	**1**
30	A	**1**
31	B	**1**
32	D	**1**
33	A	**1**
34	D	**1**
35	D	**1**
36	A	**1**
37	A	**1**
38	C	**1**
39	D	**1**
40	A	**1**

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **February/March 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = $10\,m/s^2$).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **15** printed pages and **1** blank page.

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1 Which instrument is used to measure accurately the diameter of a thin metal wire?

A 30 cm ruler

B measuring tape

C metre rule

D micrometer screw gauge

2 A parachutist is falling through the air at terminal velocity.

Which statement about the parachutist is correct?

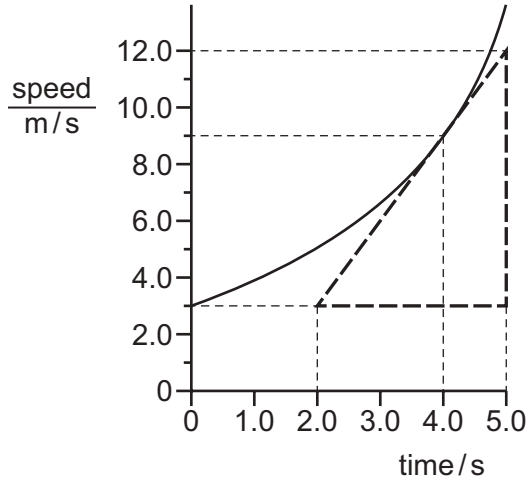
A Every force acting on the parachutist is equal to zero and his acceleration is equal to zero.

B Every force acting on the parachutist is equal to zero and his velocity is equal to zero.

C The resultant force acting on the parachutist is equal to zero and his acceleration is equal to zero.

D The resultant force acting on the parachutist is equal to zero and his velocity is equal to zero.

3 The curved line on the graph shows the motion of a car.

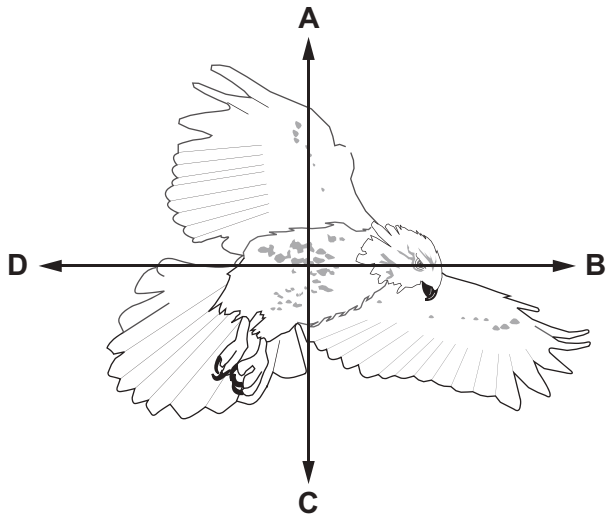


What is the acceleration of the car at the time of 4.0 s?

A 0.33 m / s^2 **B** 0.44 m / s^2 **C** 2.3 m / s^2 **D** 3.0 m / s^2

4 The diagram shows a bird in flight. The bird is flying in a horizontal direction to the right.

In which direction does air resistance act on the bird?



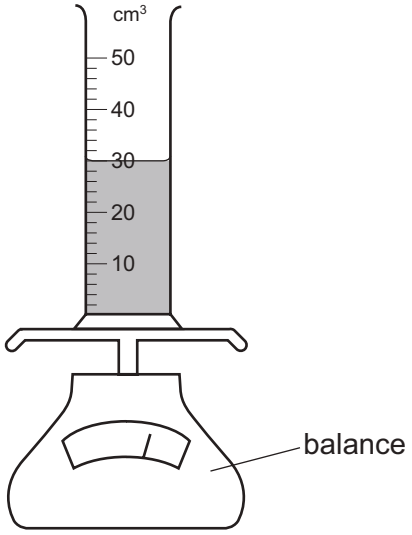
5 The gravitational field strength on the Moon is 1.6 N / kg.

An astronaut has a mass of 75 kg.

What is the weight of the astronaut on the Moon?

A 47 N **B** 75 N **C** 120 N **D** 750 N

6 A measuring cylinder contains 30 cm^3 of a liquid.



Some more of the liquid is added until the liquid level reaches the 50 cm^3 mark.

The reading on the balance increases by 30 g.

What is the density of the liquid?

A 0.60 g / cm^3 **B** 0.67 g / cm^3 **C** 1.5 g / cm^3 **D** 1.7 g / cm^3

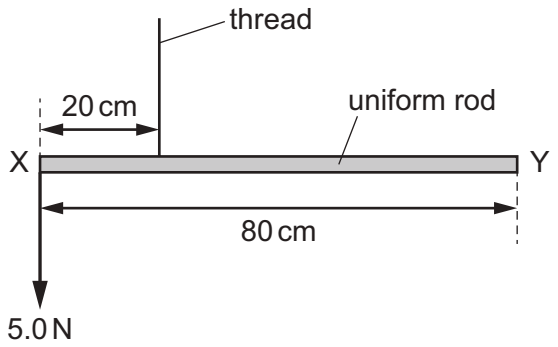
7 A stone of mass 0.12 kg is fired from a catapult. The velocity of the stone changes from 0 to 5.0 m / s in 0.60 s.

What is the average resultant force acting on the stone while it is being fired?

A 1.0 N **B** 2.5 N **C** 3.6 N **D** 8.3 N

8 A uniform rod XY of weight 2.0 N has a length of 80 cm.

The rod is suspended by a thread 20 cm from end X. A weight of 5.0 N is suspended from end X.



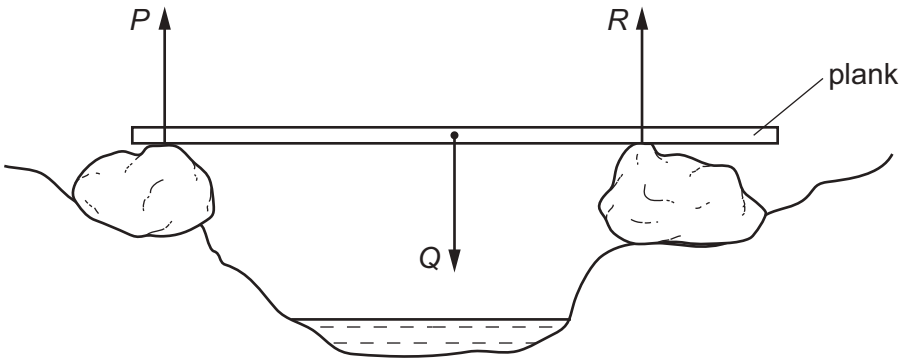
A student hangs a 6.0 N weight on the rod so that it is in equilibrium.

What is the distance of the 6.0 N weight from end X?

A 6 cm **B** 10 cm **C** 26 cm **D** 30 cm

9 A wooden plank rests in equilibrium on two rocks on opposite sides of a narrow stream.

Three forces *P*, *Q* and *R* act on the plank.



How are the sizes of the forces related?

A $P + Q = R$

B $P + R = Q$

C $P = Q = R$

D $P = Q + R$

10 A ball of mass 0.16 kg is moving forwards at a speed of 0.50 m / s. A second ball of mass 0.10 kg is stationary. The first ball strikes the second ball. The second ball moves forwards at a speed of 0.50 m / s.

What is the speed of the first ball after the collision?

A 0.0 m / s **B** 0.19 m / s **C** 0.31 m / s **D** 0.50 m / s

11 A ball is at rest at the top of a hill. It rolls down the hill. At the bottom of the hill the ball hits a wall and stops.

Which energy changes occur?

A gravitational potential energy → internal energy → kinetic energy

B gravitational potential energy → kinetic energy → internal energy

C kinetic energy → gravitational potential energy → internal energy

D kinetic energy → internal energy → gravitational potential energy

12 A student cycles along a level road at a speed of 5.0 m / s.

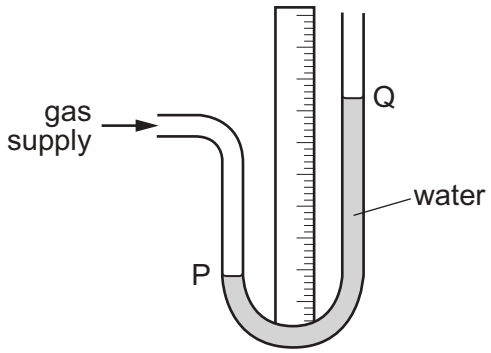
The total mass of the student and bicycle is 120 kg.

The student applies the brakes and stops. The braking distance is 10 m.

What is the average braking force?

A 150 N **B** 300 N **C** 15 000 N **D** 30 000 N

13 A water manometer is connected to a gas supply.



There is a gas leak and the pressure of the gas supply falls.

What happens to the water level at P and what happens to the water level at Q?

	water level at P	water level at Q
A	falls	falls
B	falls	rises
C	rises	falls
D	rises	rises

14 A submarine is 20 m below the surface of the sea. The pressure due to the water at this depth is *P*.

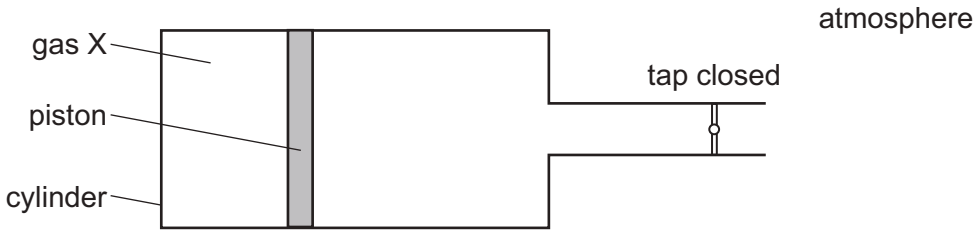
On another day, the submarine is 26 m below the surface of fresh water.

The density of sea water is 1.3 times the density of fresh water.

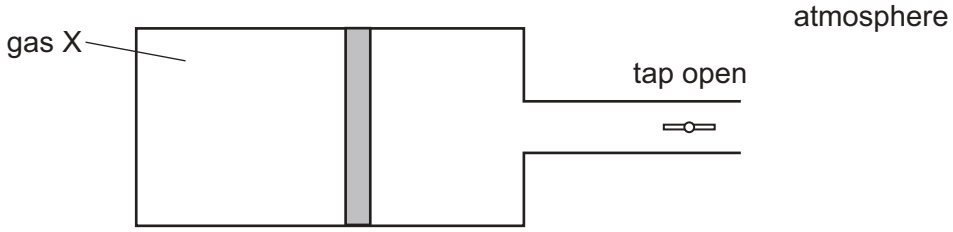
What is the pressure due to the fresh water at a depth of 26 m?

A $\frac{P}{1.3}$ **B** P **C** $1.3P$ **D** $1.7P$

15 A cylinder with a tap contains a fixed mass of gas X. The gas is contained by a piston which can move freely towards or away from the tap.



When the tap is opened, the piston moves slightly to the right, towards the tap.



What can be deduced about the pressure of gas X?

	before opening tap	after opening tap
A	less than atmospheric pressure	more than atmospheric pressure
B	same as atmospheric pressure	more than atmospheric pressure
C	more than atmospheric pressure	less than atmospheric pressure
D	more than atmospheric pressure	same as atmospheric pressure

16 Liquid evaporates from a beaker.

What happens to the temperature of the remaining liquid and how does this temperature change affect the rate of evaporation?

	temperature	rate of evaporation
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

17 Which quantity does **not** change when there is an increase in temperature?

A the density of a steel block

B the diameter of the hole in a metal nut

C the length of an iron rod

D the mass of a metal coin

18 A thermocouple is used to measure temperature.

Which is an advantage of using a thermocouple instead of a liquid-in-glass thermometer?

A It can measure temperature in the range –10 °C to 110 °C.

B It can measure temperature that changes rapidly.

C It has a linear scale.

D It is more sensitive.

19 A block of copper has a mass of 2.0 kg.

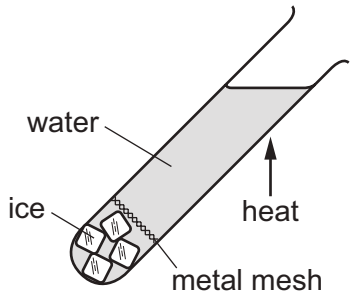
The block of copper absorbs 12 000 J thermal energy.

The specific heat capacity of copper is 385 J / (kg °C).

What is the temperature rise of the copper?

A 15.6 °C **B** 31.2 °C **C** 46.8 °C **D** 62.4 °C

20 A teacher demonstrates an experiment to a class. A boiling tube is filled with water and some ice cubes are trapped at the bottom of the tube. The teacher then heats the boiling tube in the position shown until the water at the top boils.



The ice does not melt.

What does this demonstrate?

A Water is a good conductor of thermal energy.

B Water is a good convector of thermal energy.

C Water is a poor conductor of thermal energy.

D Water is a poor convector of thermal energy.

21 A metal cup has a plastic lining. The cup is filled with hot water and held by a hand.

Which statement about the transfer of thermal energy from the water to the hand is correct?

A In the plastic, no energy is transferred directly between adjacent molecules.

B In the plastic, fast moving molecules interact with free electrons, making the electrons move very quickly.

C In the metal, energy is transferred only by electrons.

D In the metal, energy is transferred by electrons and by vibrations of the lattice.

22 Which row shows an example of a transverse wave and an example of a longitudinal wave?

	transverse	longitudinal
A	light	radio
B	radio	sound
C	sound	water
D	water	light

23 A wave passes through a gap and diffraction causes the wave to spread out.

Which wave spreads out the most?

A large wavelength through a gap slightly larger than the wavelength

B large wavelength through a gap much smaller than the wavelength

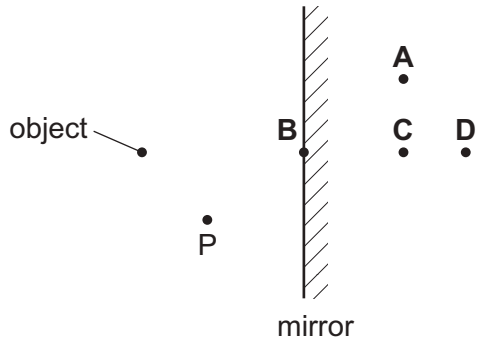
C small wavelength through a gap much larger than the wavelength

D small wavelength through a gap much smaller than the wavelength

24 An object is placed before a plane mirror as shown.

A student views the image of the object in the mirror from point P.

Where does she see the image?



25 Light has a speed of 1.24×10^8 m / s in diamond.

What is the refractive index of diamond?

A 0.41 **B** 1.54 **C** 2.42 **D** 3.72

26 Which statement describes monochromatic light?

A light that does not diffract

B light that has a single frequency

C light that spreads out when shone through a glass prism

D light that travels at the same speed in all materials

27 Both the amplitude and the frequency of a sound wave decrease.

What happens to the sound heard?

A The sound is louder and has a higher pitch.

B The sound is louder and has a lower pitch.

C The sound is quieter and has a higher pitch.

D The sound is quieter and has a lower pitch.

28 A sound wave is travelling through water.

What is a possible speed for the wave?

A 150 m / s **B** 300 m / s **C** 1500 m / s **D** 5000 m / s

29 An electromagnet is used to remove a splinter from an eye.

What material is the splinter made from?

A aluminium

B glass

C iron

D wood

30 A metal conductor is connected to a battery.

Which statement describes the current in the metal conductor?

A It is a flow of electrons from the negative to the positive terminal.

B It is a flow of electrons from the positive to the negative terminal.

C It is a flow of protons from the negative to the positive terminal.

D It is a flow of protons from the positive to the negative terminal.

31 In an electric circuit, 40 C of electric charge pass a point in 5.0 s.

What is the current in the circuit?

A 0.13 A **B** 8.0 A **C** 45 A **D** 200 A

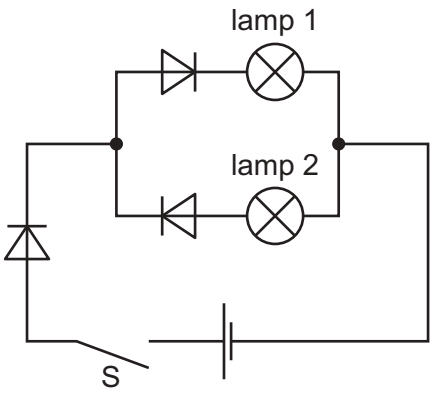
32 There is a current of 5.0 A in a resistor.

The potential difference (p.d.) across the resistor is 24 V.

How much energy is transferred in the resistor in 1.0 minute?

A 5.0 J **B** 120 J **C** 290 J **D** 7200 J

33 The diagram shows a circuit.



Switch S is closed.

Which lamps light?

A lamp 1 only

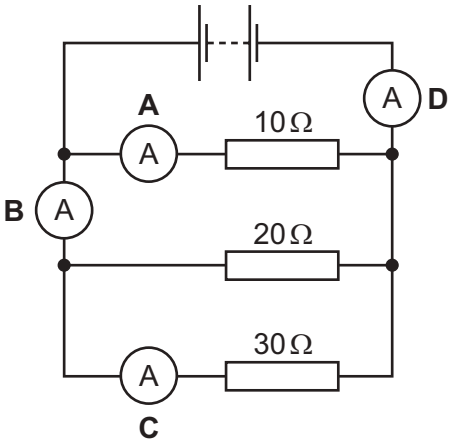
B lamp 2 only

C lamp 1 and lamp 2

D neither lamp 1 nor lamp 2

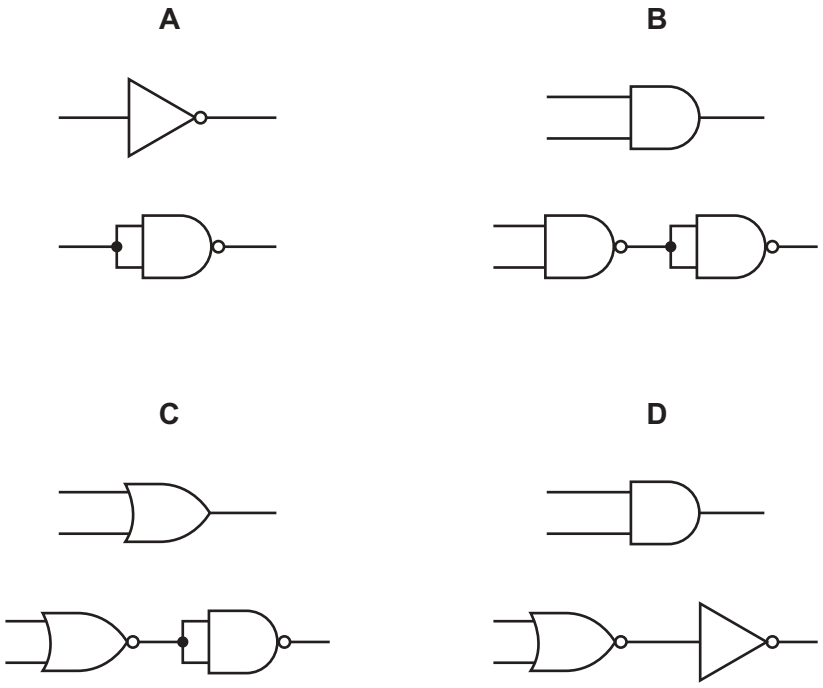
34 A circuit contains four ammeters and three resistors with different values.

Which ammeter shows the largest reading?

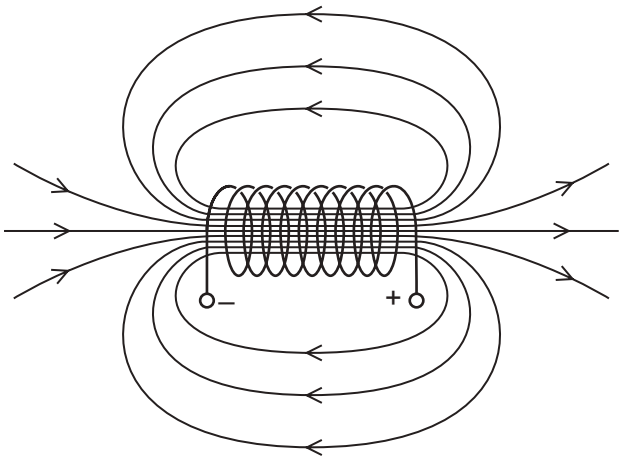


35 The diagrams show pairs of circuits containing logic gates.

In which diagram does the lower circuit of the pair **not** behave in the same way as the upper circuit?



36 The current in a coil produces a magnetic field around it, as shown.



The magnitude of the potential difference across the coil is increased and its direction is reversed.

What happens to the magnetic field?

A The lines become closer together and the right-hand end becomes a south pole.

B The lines become closer together and the right-hand end remains a north pole.

C The lines become further apart and the right-hand end becomes a south pole.

D The lines become further apart and the right-hand end remains a north pole.

37 The notation for an isotope of sodium is $^{23}_{11}Na$.

Which row gives the composition of a neutral atom of this isotope of sodium?

	number of protons	number of neutrons	number of electrons
A	11	12	11
B	11	12	12
C	11	23	11
D	12	11	12

38 The radioactive isotope of hydrogen undergoes beta decay to the isotope $^{3}_{2}He$.

What is the nuclide notation for the hydrogen isotope?

A $^{1}_{1}H$ **B** $^{2}_{1}H$ **C** $^{3}_{1}H$ **D** $^{4}_{2}H$

39 When measuring the emissions from a radioactive rock brought into the laboratory, a teacher mentions that background radiation must be taken into account.

What is this background radiation?

A infra-red radiation from warm objects in the laboratory

B infra-red radiation from the Sun

C ionising radiation from the radioactive rock brought into the laboratory

D ionising radiation in the laboratory when the radioactive rock is not present

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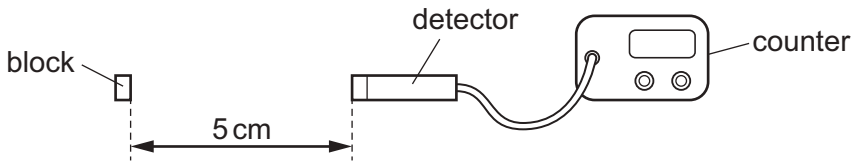
40 Solid caesium-137 decays by the emission of a β-particle to form solid barium-137, which emits a γ-ray.

The barium-137 undergoes no further decay. The half-life of caesium-137 is 33 years.

A block of pure caesium-137 has a mass of 2.0 μg.

The diagram shows a radiation detector a distance of 5 cm from the block. The detector registers a count rate of 2000 counts / second.



Which statement is **not** correct?

A After 33 years, the mass of the block is 1.0 μg.

B After 66 years, the sample contains 1.5 μg of barium.

C With 5 cm of lead between the block and the detector, the count rate is just above background level.

D With 2 mm of aluminium between the block and the detector, the count rate is reduced significantly.

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PHYSICS **0625/32**

Paper 3 Core Theory **March 2018**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	5.0 ÷ 500 or 0.01 (cm)	**B1**
1(b)	30 × 20 × 5 or length × width × height or cross-sectional area × length	**B1**
1(c)	balance	**B1**
1(d)	D = M / V in any acceptable form	**C1**
	2400 ÷ 3000	**C1**
	0.80 (g / cm^3) or 0.8 (g / cm^3)	**A1**

Question	Answer	Marks
2(a)(i)	2nd box ticked section B	**B1**
2(a)(ii)	distance = area under graph or line or 0.5 × base × height	**C1**
	20 × 5 × 0.5	**C1**
	50 (m)	**A1**
2(b)(i)	(average speed =) (total) dist ÷ (total) time	**C1**
	(250 × 4)	**C1**
	1000 ÷ 80	**C1**
	12.5 (m / s)	**A1**
2(b)(ii)	43.88 – 20.16 or 23.72	**B1**

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Question	Answer	Marks
3(a)	12.5 (mm)	**B1**
3(b)	(spring) B	**M1**
	same load gives greater extension (than spring A) owtte	**A1**
3(c)(i)	43.9 – 19.7 or 24.2 (cm)	**B1**
3(c)(ii)	Any **two** from: measure the extension for different (number of 1.0 N) loads repeat each reading (as each (1.0 N) load is removed) AND calculate average (extension for each load) (take reading from ruler with) eye level with pin	**B2**

Question	Answer	Marks
4(a)	any **three** from: water flows down (from reservoir) idea of gravitational / potential energy (transferred to kinetic (energy)) water turns turbine turbine turns generator	**B3**
4(b)	Any **three** from: • does not contribute to atmospheric pollution / acid rain • does not contribute to greenhouse gases / global warming • renewable energy source (so will not run out) • short start-up time / can meet surges in demand owtte • conserve non-renewable reserves / fossil fuels • reduces dependence on fossil fuels (from other countries)	**B3**
4(c)(i)	kinetic	**B1**
4(c)(ii)	efficient	**B1**

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Question	Answer	Marks
5(a)(i)	(pressure) increases	**B1**
5(a)(ii)	any **four** from: (air) molecules / particles have more (kinetic) energy / move faster more frequent collisions harder collisions (with walls) collisions with walls idea of collisions causing force	**B4**
5(b)	P = F / A in any form words or numbers	**C1**
	0.59	**A1**
	N / cm^2	**B1**
5(c)(i)	(Area = $\pi \times r^2$ =) 50.2654 (cm^2)	**B1**
5(c)(ii)	smaller <u>area</u> (in contact with the table)	**B1**

Question	Answer	Marks
6(a)	expansion / voltage / potential difference / emf length / colour / pressure / volume / resistance / density	**B1**
6(b)(i)	8:30 pm	**B1**
6(b)(ii)	9:00 pm	**B1**
	(explanation) Slope / gradient of graph is less or temperature drops / falls (more) slowly / slower	**B1**
6(c)	insulator conduction convection	**B3**

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Question	Answer	Marks
7(a)(i)	(angle) Z	**B1**
7(a)(ii)	any other part of em spectrum or (seismic) S-waves	**B1**
7(b)(i)	3 curved waves after gap	**M1**
	waves evenly spaced and centred on gap (by eye)	**A1**
7(b)(ii)	diffraction	**B1**

Question	Answer	Marks
8(a)(i)	ammeter in series with power supply	**B1**
8(a)(ii)	variable resistor symbol in series with lamp B	**B1**
8(a)(iii)	voltmeter symbol seen	**B1**
	voltmeter symbol in parallel with lamp B	**B1**
8(b)	V = I R in any form	**C1**
	6.0 ÷ 0.2 accept 6 ÷ 0.2	**C1**
	30 (Ω)	**A1**

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Question	Answer	Marks
9(a)(i)	X-rays / X-radiation	**B1**
9(a)(ii)	Radio waves	**B1**
9(b)	ultrasound	**B1**
9(c)	For full marks the method described must work. any **four** from: Means of producing sharp sound use of suitable reflecting surface measure distance travelled by sound Method for measurement of time for sound to travel measured distance. use of speed = distance / time	**B4**

Question	Answer	Marks
10(a)	any **four** from: needle moves (one way) as N pole / magnet moves downward / into coil as coil cuts across magnetic field (of magnet) needle moves in opposite direction as N pole / magnet moves upward / out of coil field is cut in opposite direction needle at zero when spring at max extension magnet is stationary so no cutting of field lines	**B4**
10(b)	(device) X is a step-up transformer	**B1**
	(device) Y is a step-down transformer	**B1**

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Question	Answer	Marks
11(a)	friction (between cloth and rod)	**B1**
	(causes) electrons to move	**B1**
	from cloth / to rod	**B1**
11(b)	rod {moves or rotates} away	**B1**
	like charges repel	**B1**

Question	Answer	Marks
12	For full marks the method described must work. any **four** from: take background reading / reading without source use piece of paper between source and detector beta particles can pass through paper or alpha particles stopped / absorbed by paper?) reading on detector similar / unchanged so no alpha particles emitted use few mm of aluminium between source and detector reading on detector now similar to background reading (because) beta particles stopped by a few mm of aluminium	**B4**

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/32**

Paper 3 Theory (Core) **February/March 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of the page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **20** printed pages.

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CAMBRIDGE International Examinations

1 A student has a pile of A4 paper for his computer printer.

Fig. 1.1 shows the dimensions of the pile of paper.

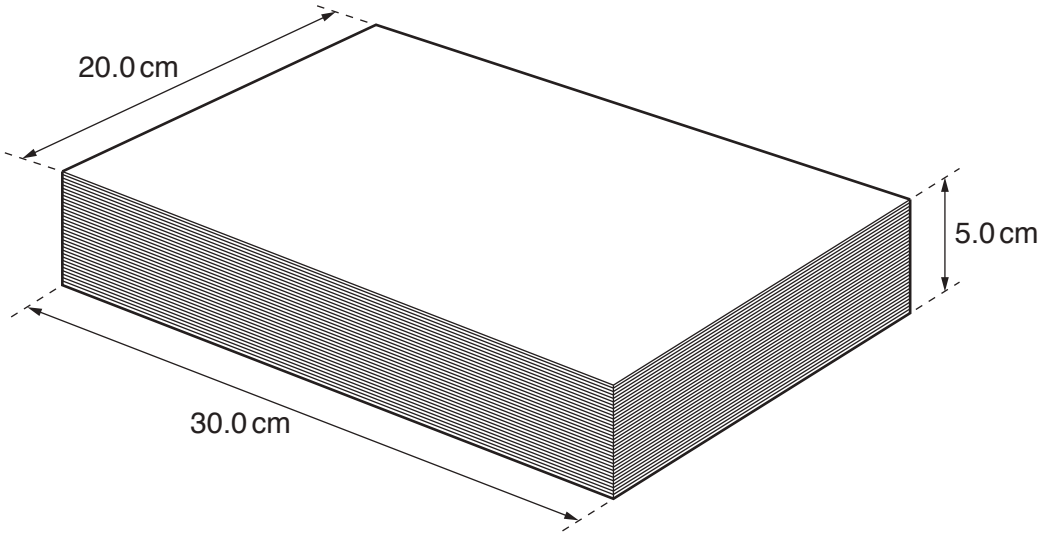

Fig. 1.1 (not to scale)

(a) The pile contains 500 sheets of paper.

Calculate the average thickness of one sheet of paper.

average thickness = ... cm [1]

(b) Show that the pile of paper has a volume of 3000 cm^3. Use the information shown in Fig. 1.1.

[1]

(c) The student measures the total mass of the paper in the pile.

State the name of a device used to measure mass.

..... [1]

(d) The mass of the paper in the pile is 2400 g.

Calculate the density of the paper.

density = ... g/cm^3 [3]

[Total: 6]

2 Some cyclists are racing around a track.

(a) Fig. 2.1 shows the speed-time graph for one cyclist.

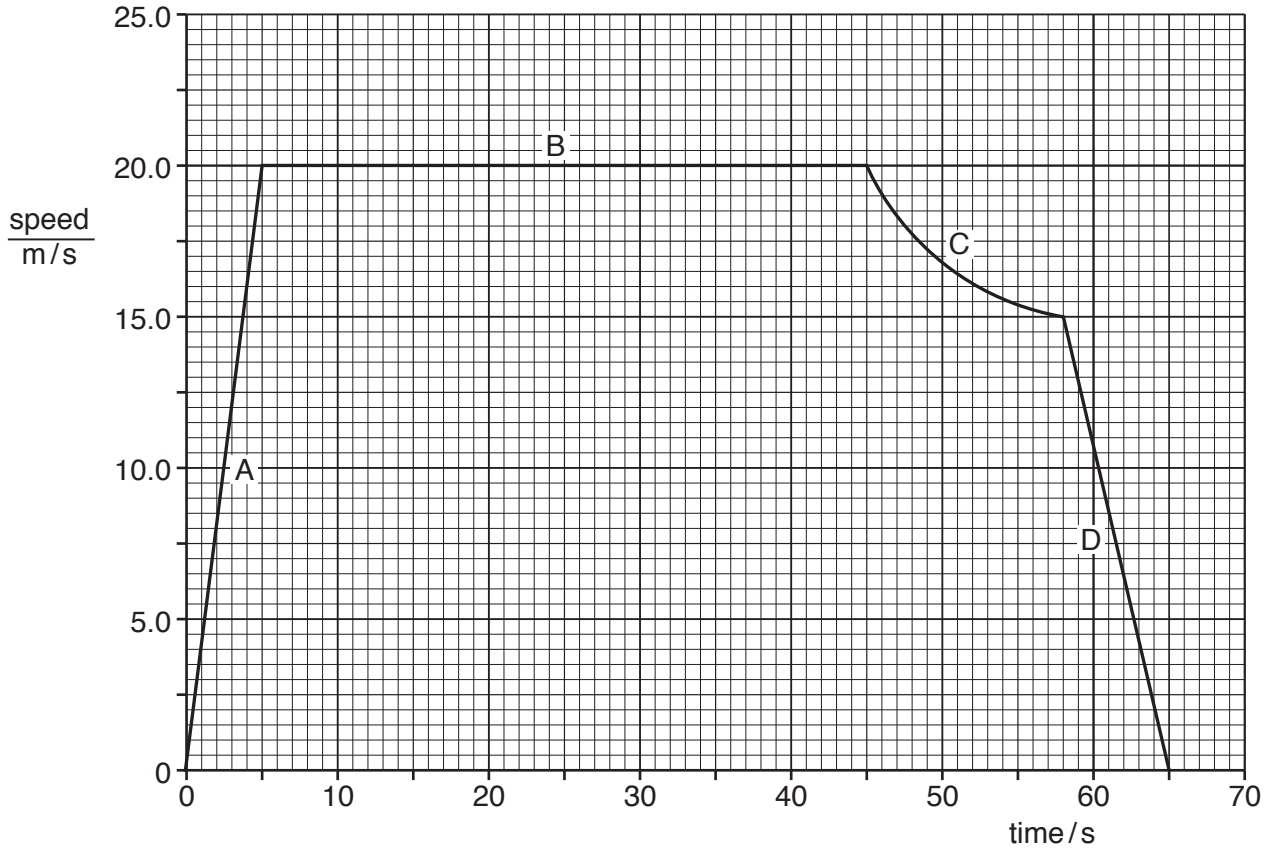

Fig. 2.1

(i) Tick the box that represents the cyclist travelling at constant speed.

☐ A

☐ B

☐ C

☐ D [1]

(ii) Calculate the distance travelled by the cyclist in the first 5 seconds.

distance = ... m [3]

(b) The length of the track is 250 m.

Another cyclist goes around the track four times (four laps). This takes 80.0 seconds.

(i) Calculate the average speed of this cyclist.

average speed = ... m/s [4]

(ii) A friend of the cyclist starts a stopwatch at the beginning of the race.

Fig. 2.2 shows the reading on the stopwatch when the cyclist has gone around the track **once**.

Fig. 2.3 shows the reading on the stopwatch when the cyclist has gone around the track **twice**.

Fig. 2.2

Fig. 2.3

Calculate the time taken for the cyclist to go around the track during the second lap.

time = ... s [1]

[Total: 9]

3 Fig. 3.1 shows the load-extension graphs for two springs, A and B.

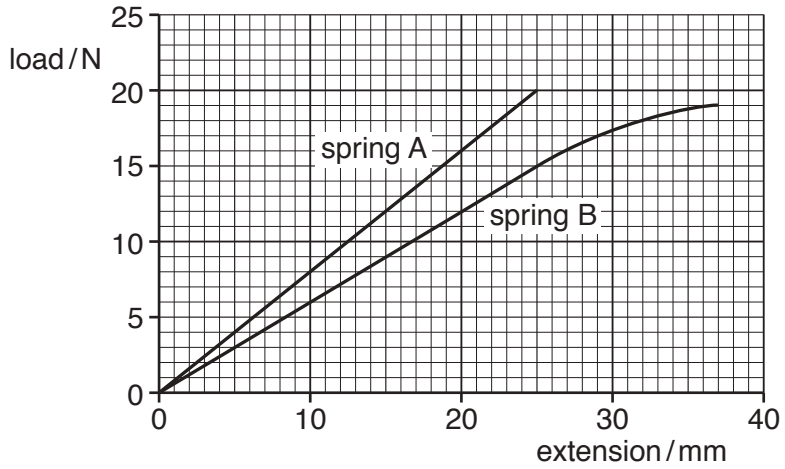

Fig. 3.1

(a) Determine the extension of spring A for a load of 10 N.

extension = ... mm [1]

(b) State which spring is easier to stretch and give a reason for your answer.

spring .....

reason .....

.....
[2]

(c) A different spring is suspended from the edge of a bench, as shown in Fig. 3.2.

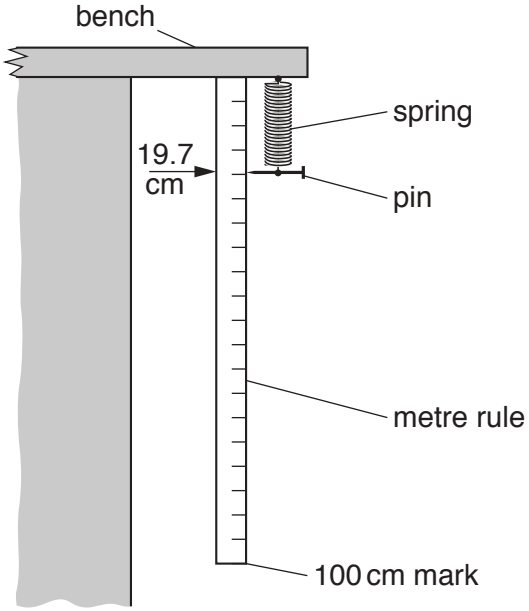

Fig. 3.2

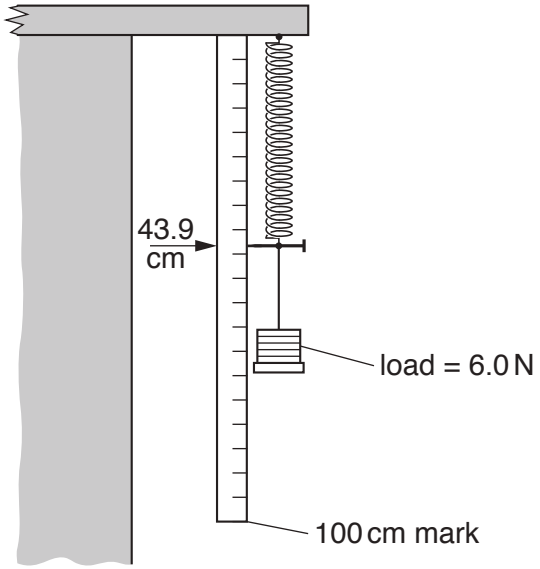

Fig. 3.3

With no load on the spring, the pin points to 19.7 cm on the metre rule, as shown in Fig. 3.2. When a load of 6.0 N is attached to the spring, the pin points to 43.9 cm, as shown in Fig. 3.3.

(i) Calculate the extension of this spring for a load of 6.0 N.

extension = ... cm [1]

(ii) Describe how a student could use the equipment in Fig. 3.2 to obtain accurate readings for a load-extension graph for this spring.

.....

.....

.....

.....

..... [2]

[Total: 6]

4 Fig. 4.1 represents a hydroelectric system for generating electrical energy.

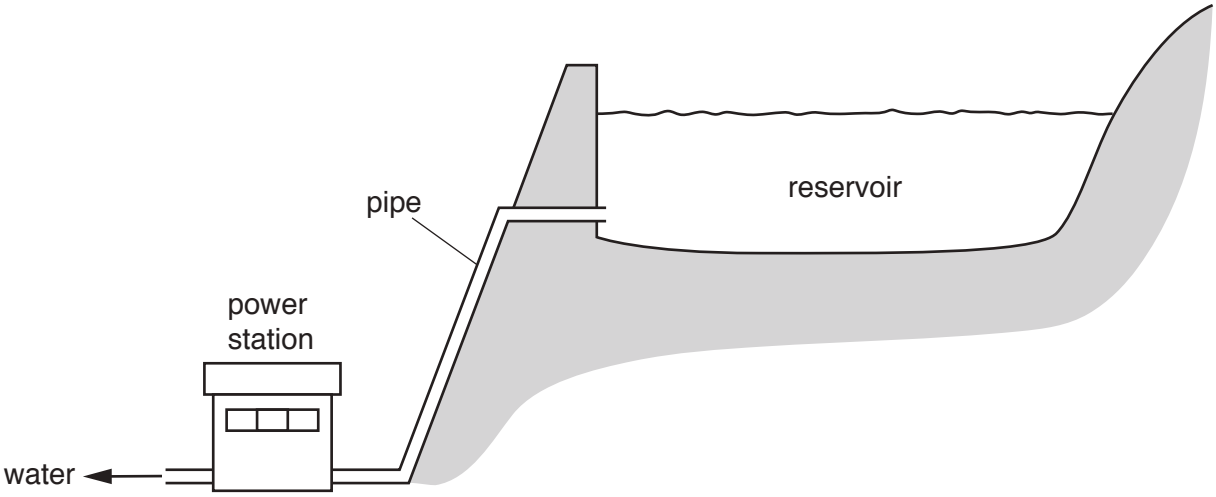

Fig. 4.1

(a) Describe how the power station uses the water in the reservoir to generate electrical energy.

.....

.....

.....

.....

.....

..... [3]

(b) State **three** advantages of generating electrical energy using a hydroelectric system compared with using a coal-fired power station.

1. .....

.....

2. .....

.....

3. .....

.....

[3]

(c) An electric drill is shown in Fig. 4.2. It uses electrical energy.

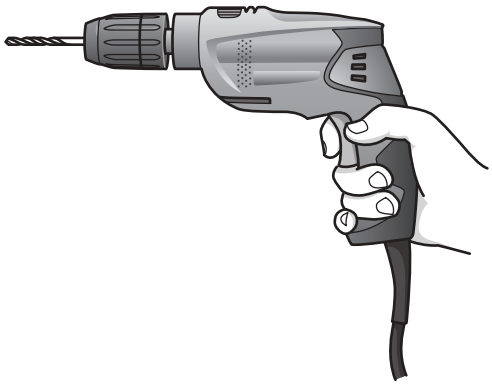

Fig. 4.2

Complete the sentences about the electric drill.

Use words from the box. Each word may be used once, more than once, or not at all.

efficient	kinetic	potential	powerful	reliable	thermal

(i) The electric drill **usefully** transforms electrical energy into ..... energy. [1]

(ii) A second electric drill transforms the same amount of electrical energy per second as the first one. It wastes more of this energy.

The second drill is **less** ..... than the first drill. [1]

[Total: 8]

5 Fig. 5.1 shows a glass bottle containing air. The bottle is sealed with a cap.

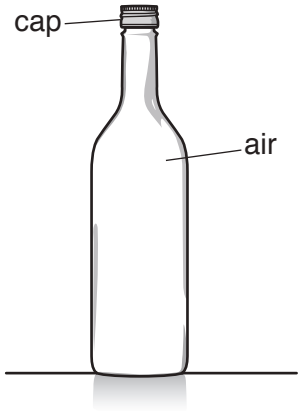

Fig. 5.1

(a) The air in the bottle becomes warmer.

(i) State what happens to the pressure of the air in the bottle.

..... [1]

(ii) Explain why the pressure of the air in the bottle changes. Use your ideas about gas molecules.

.....

.....

.....

.....

.....

..... [4]

(b) The bottle has a weight of 5.4 N and an area of 9.2 cm^2 in contact with the table.

Calculate the pressure produced by the bottle on the table. Give the unit.

pressure = ... [3]

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(c) Fig. 5.2 shows another bottle. The bottle is on a table. Part of the base of this bottle is **not** in contact with the table.

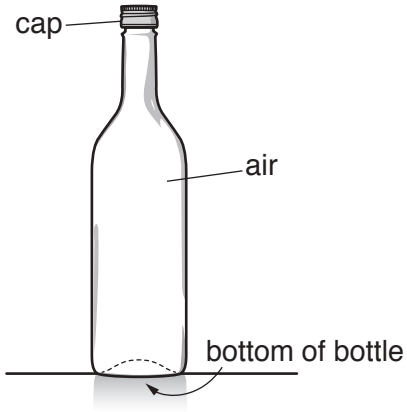

Fig. 5.2

Fig. 5.3 shows the base of the bottle. The shaded area is **not** in contact with the table.

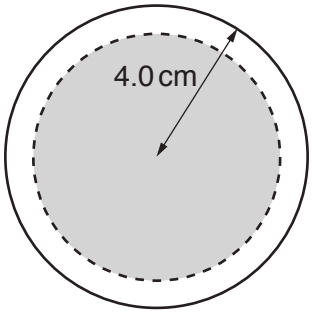

Fig. 5.3 (not to scale)

(i) The base of the bottle is circular. The radius of the outer circle is 4.0 cm as shown in Fig. 5.3. Calculate the area of this circle.

area = ... cm^2 [1]

(ii) The bottle shown in Fig. 5.2 has the same mass as the bottle shown in Fig. 5.1. Explain why the bottle shown in Fig. 5.2 exerts more pressure on the table than the bottle shown in Fig. 5.1.

.....

..... [1]

[Total: 10]

6 A thermometer is used to measure the temperature inside a room in a house.

(a) State a physical property that varies with temperature and can be used in a thermometer.

..... [1]

(b) Fig. 6.1 shows how the temperature of the room changes between 6:00 pm and 11:00 pm.

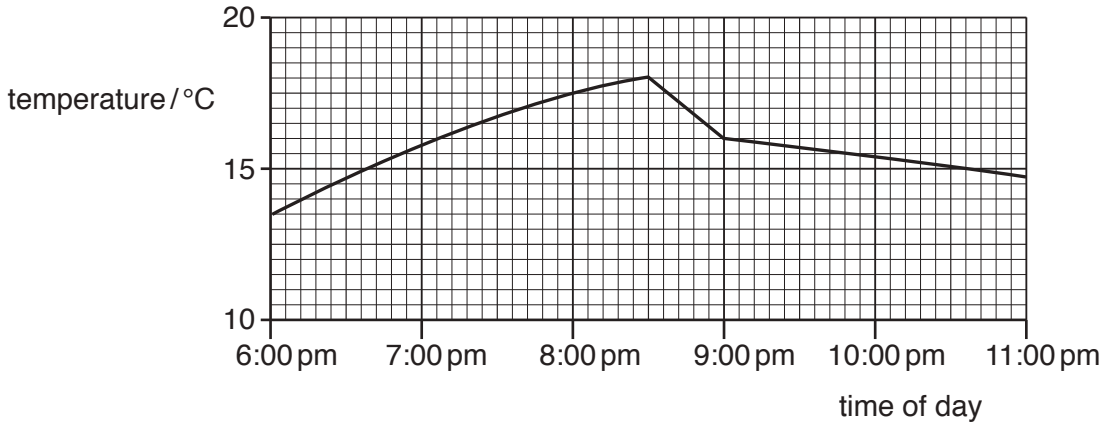

Fig. 6.1

A heater in the room is switched on at 6 pm. The room has a large window. A large amount of thermal energy is transferred through the window. The window in the room has thick curtains. Closing the curtains reduces the loss of thermal energy from the room.

(i) Suggest the time at which the heater is switched off.

..... [1]

(ii) Suggest the time at which the curtains were closed and explain your answer. Use information from the graph.

time .....

explanation .....

.....
[2]

(c) In cool climates, people use mineral wool to reduce heat loss from houses. Mineral wool is made of fibres and trapped air, as shown in Fig. 6.2.

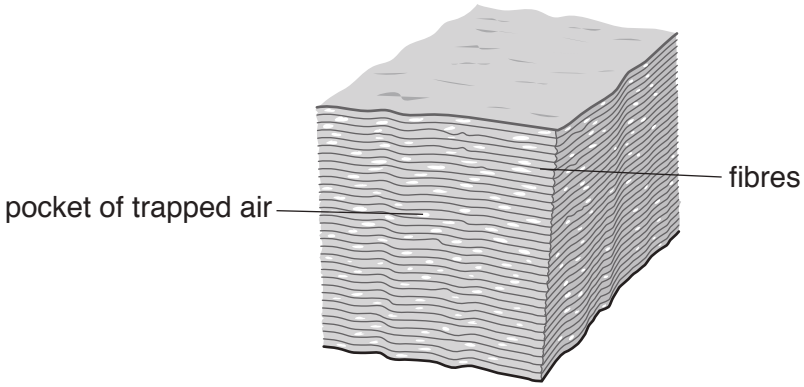

Fig. 6.2

Use words from the box to complete the sentences. Each word may be used once, more than once, or not at all.

conductor	conduction	convection	emitter	insulator	radiation	radiator

Air is a good ..... .

When air is trapped between fibres, it reduces heat loss by ..... and by

..... .

[3]

[Total: 7]

7 **(a)** A ray of light refracts as it travels from air into glass, as shown in Fig. 7.1.

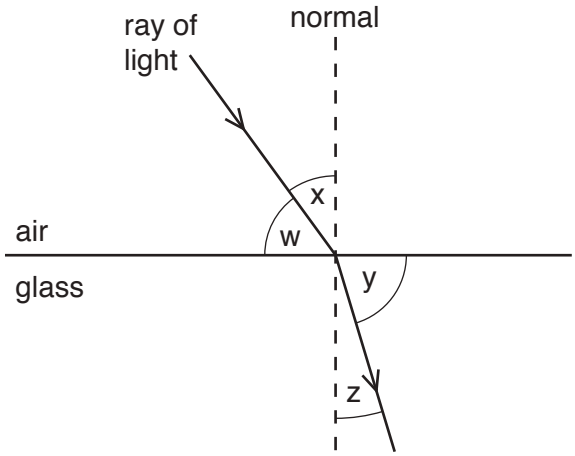

Fig. 7.1

(i) State which angle w, x, y or z, is the angle of refraction.

..... [1]

(ii) Light is a transverse wave.
State another example of a transverse wave.

..... [1]

(b) Fig. 7.2 represents some wavefronts approaching a barrier with a narrow gap.

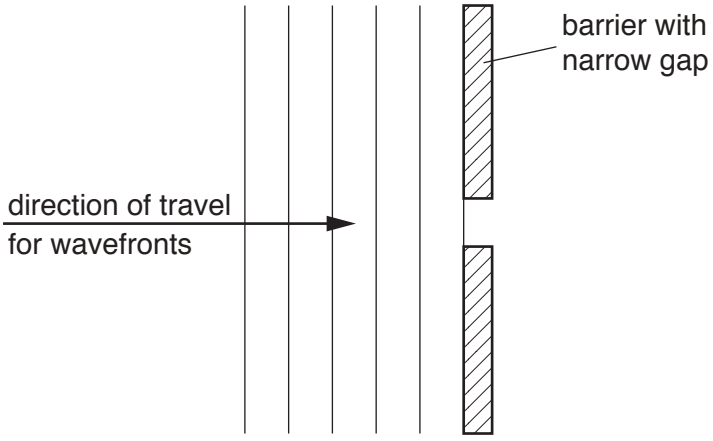

Fig. 7.2

(i) On Fig. 7.2, draw three wavefronts that have passed through the gap. [2]

(ii) State the name of the effect in **(b)(i)**.

..... [1]

[Total: 5]

8 A student sets up an electrical circuit. She draws part of the circuit diagram, as shown in Fig. 8.1.

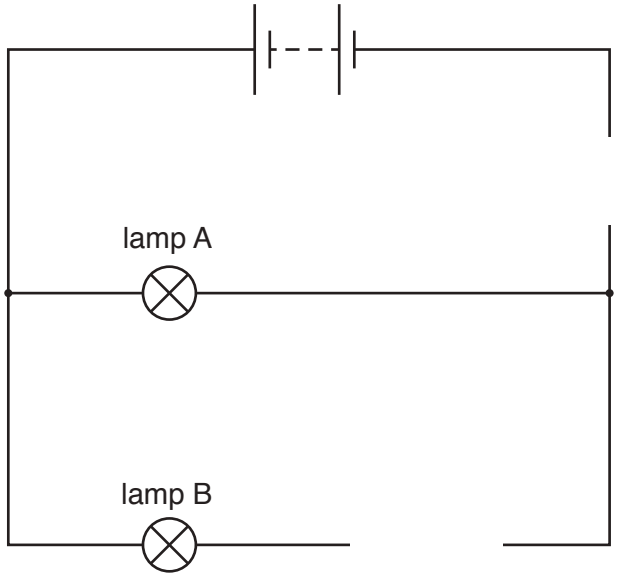

Fig. 8.1

(a) On Fig. 8.1, draw the circuit symbols for three devices so that the student can:

(i) measure the total current in the circuit [1]

(ii) vary the current in the lamp B only [1]

(iii) measure the potential difference (p.d.) across lamp B. [2]

(b) The current in lamp A is 0.20 A. The potential difference (p.d.) across lamp A is 6.0 V.

Calculate the resistance of lamp A.

resistance = ... Ω [3]

[Total: 7]

9 **(a)** Fig. 9.1 represents the seven main regions of the electromagnetic spectrum.

radio waves	microwaves	infra-red radiation	visible light	ultraviolet		gamma rays

Fig. 9.1

(i) In Fig. 9.1, one region is not named.
State the name of the radiation in this region.

..... [1]

(ii) State which region has waves with the longest wavelength.

..... [1]

(b) Tick the box for the wave with the lowest speed in air.

☐ ultraviolet

☐ ultrasound

☐ visible light [1]

(c) A group of students want to determine the speed of sound in air.

Describe a method they can use. State the measurements they need to make.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

10 (a) A teacher demonstrates electromagnetic induction using the apparatus shown in Fig. 10.1.

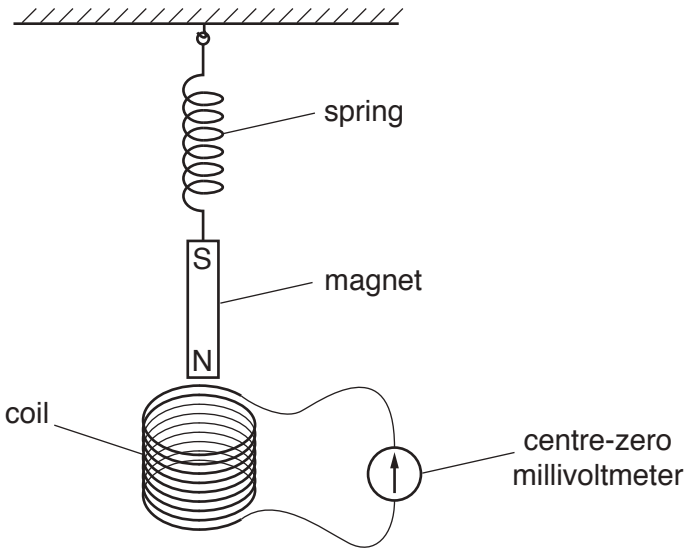

Fig. 10.1

The teacher pulls the magnet down until one end is inside the coil. The teacher then releases the magnet. The magnet moves up and down repeatedly. As it moves, one end of the magnet enters and leaves the coil.

Describe and explain the readings on the centre-zero millivoltmeter as the magnet enters and leaves the coil.

.....

.....

.....

.....

..... [4]

(b) Fig. 10.2 shows a system for transmitting electricity from a power station.

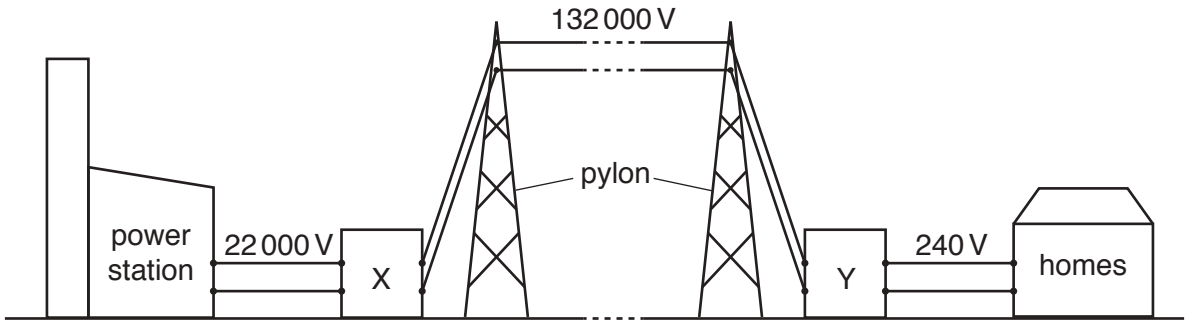

Fig. 10.2

State the name of the device used in X and the name of the device used in Y.

X .....

Y .....
[2]

[Total: 6]

11 **(a)** A student rubs a polythene rod with a dry cloth. The polythene rod becomes negatively charged.

Describe and explain how the rod becomes negatively charged.

.....

.....

..... [3]

(b) The negatively charged polythene rod hangs from a nylon thread so that it is free to turn.

The student charges a second polythene rod and brings it close to the first rod, as shown in Fig. 11.1.

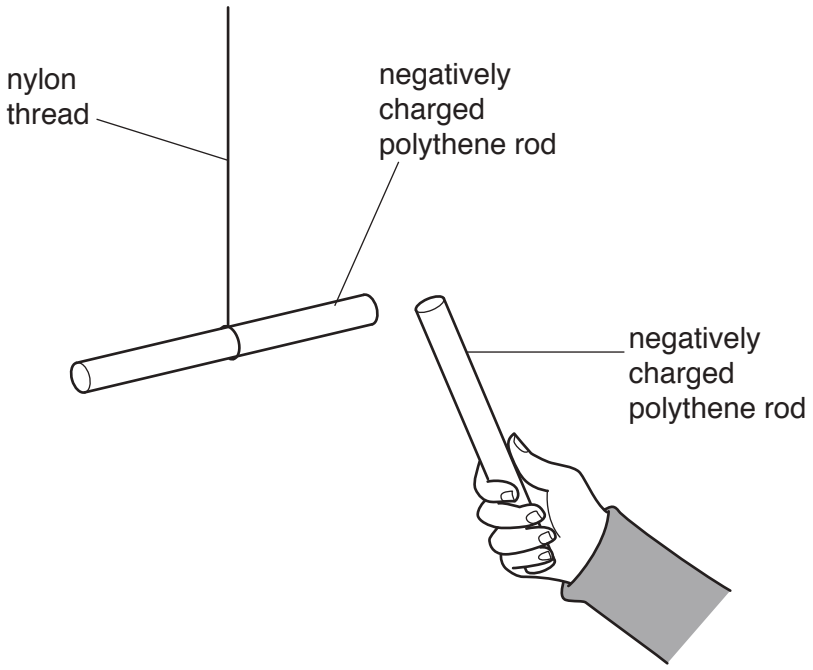

Fig. 11.1

Describe and explain what happens when the negatively charged rods are close to each other.

.....

..... [2]

[Total: 5]

12 Fig. 12.1 shows a radioactive source placed close to a radiation detector and counter. The detector can detect α, β and γ radiation.

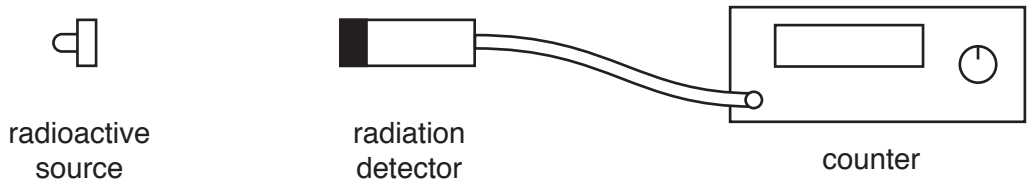

Fig. 12.1

The radioactive source emits β-particles only.

Describe how you could show that the source emits β-particles only.
As part of your answer, you may draw on Fig. 12.1 and add any other apparatus you may need.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 4]

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PHYSICS **0625/42**

Paper 4 Extended Theory **March 2018**

MARK SCHEME

Maximum Mark: 80

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	Rate of change of velocity OR change of velocity / time OR change of velocity over time OR (v – u)/t	**B1**
1(b)(i)	Straight line from origin to (15, 28)	**B1**
	Horizontal line {from (15, 28)} to (32, 28)	**B1**
	a = (v – u) / t OR (t =) (v – u) / a OR (0 – 28) / 2.0	**C1**
	= 14 (s)	**C1**
	Straight line from (32, 28) to (46, 0)	**A1**
1(b)(ii)	**1** Towards the centre of the circle / inwards	**B1**
	2 Velocity is (continually) changing its direction	**B1**

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Question	Answer	Marks
2(a)	(Because g.p.e. is) the work done by the force OR the force × the distance that the object rises OR mgh and height is <u>greater</u>	**B1**
2(b)	mgh OR 80 × 65 × 10 × 1600	**C1**
	8.3×10^7 J	**A1**
2(c)	<u>Method 1</u>	
	W = Pt OR E = Pt in any form	**C1**
	Work input =$1500 \times 10^3 \times 30 \times 60$ OR 2.7×10^9 J	**C1**
	Efficiency = work output / work input (x 100)	**C1**
	0.031 OR 3.1 %	**A1**
	<u>Method 2</u>	
	P = E/t in any form	**(C1)**
	Power output = 8.3×10^7 / 30 × 60	**(C1)**
	Efficiency = power output / power input (× 100)	**(C1)**
	0.031 OR 3.1%	**(A1)**

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Question	Answer	Marks
3(a)	...(the) force × its perpendicular distance from pivot / a point	**B1**
3(b)(i)	centre of mass	**B1**
3(b)(ii)	(mass =) 160 / 10 = 16 kg	**B1**
3(b)(iii)	(Not moving up or down because) no resultant (vertical) force OR upward force = downward force	**C1**
	80 N + 80 N = 160 N	**A1**
	(Not rotating because) no resultant moment (about any point) OR (sum of) clockwise moments = (sum of) anticlockwise moments	**C1**
	clockwise moment (about centre) = 80 × 1.2 anticlockwise moment (about centre) = 80 × 1.2	**A1**

Question	Answer	Marks
4(a)	Molecules of hot liquid collide with (surface of) spoon	**B1**
	transfer energy / heat to (molecules of) spoon	**B1**
	(amplitude of) vibration of spoon's molecules increases / is faster (increasing spoon's temperature)	**B1**
4(b)	Molecules of hot liquid (also) transfer energy to (free) electrons in the spoon	**B1**
	These (free) electrons move through the metal	**B1**
4(c)	(Q =) $mc\Delta\theta$	**C1**
	150 × 4.2 × (80 – 56)	**C1**
	15000 J	**A1**

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Question	Answer	Marks
5(a)(i)	Sketch showing straight lines with sudden changes of direction	**B1**
5(a)(ii)	Any 3 marks from 4 points:	
	Air molecules move in random / different directions	**B1**
	Smoke particles are hit	**B1**
	by air molecules	**B1**
	Change direction at each collision OR undergo Brownian motion	**B1**
5(b)	F = (mv – mu) / t in any form OR Impulse = mv – mu	**C1**
	= 20 × 4.2 / 60	**C1**
	1.4 N	**A1**

Question	Answer	Marks
6(a)	A: infra-red B: ultra-violet C: X-(rays) D: γ-(rays)	**B2**
6(b)(i)	n = sin i / sin r OR sin r = sin i / n OR sin r = sin 35 / 1.50	**C1**
	r = 22°	**A1**
6(b)(ii)	Refraction at XY drawn with r < i	**B1**
	Refraction at XZ drawn with r > i	**B1**
6(b)(iii)	Blue ray drawn below red ray in prism and drawn with r < i	**M1**
	Ray to right of prism diverging downwards from red ray	**A1**

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Question	Answer	Marks
7(a)	n = speed in air / speed in water OR speed in water = 3.0×10^8 / 1.33	**C1**
	2.3×10^8 m / s	**A1**
Answers to **(b)(i)**, **(b)(ii)** and **(b)(iii)** all combined to maximum of 5 marks on same screen		
7(b)(i)	Wavefronts in plastic: meet wavefronts in air	**B1**
	make smaller angle with boundary than wavefronts in air and downwards to the left	**B1**
	parallel to each other	**B1**
7(b)(ii)	Arrow(s) perpendicular to wavefronts in plastic and downwards to right	**B1**
7(b)(iii)	*r* in plastic between refracted wavefront and boundary	**B1**
	OR At a point where refracted wavefront meets boundary, normal to boundary drawn and line perpendicular to wavefront drawn. *r* in plastic between the two lines drawn	**(B1)**

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Question	Answer	Marks
8(a)	P = IV OR (I =) 50 / 12	**C1**
	4.2 A	**A1**
8(b)(i)	(E =) QV	**C1**
	(E =) $270 \times 10^3 \times 12$	**C1**
	3.2×10^6 J / 3200 kJ	**A1**
8(b)(ii)	Volume of fuel used = $3.2 \times 10^6 / 3.6 \times 10^4$	**C1**
	89 cm^3 OR 90 cm^3 if 3.24×10^6 used	**A1**

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Question	Answer	Marks
9(a)(i)	Resistor: tick in 2nd box	**B1**
9(a)(ii)	Lamp: tick in 1st box	**B1**
9(b)	(R =) V / I OR (R =) 6.0 / 4.4	**C1**
	1.4 Ω	**A1**
9(c)	Current in lamp = 4.4 A Current in resistor = 4.0 A	**C1**
	Current from supply (= 4.0 + 4.4) = 8.4 A	**A1**
	OR (With 6 V p.d.) R_L = 6 / 4.4 = 1.36 Ω R_R = 6 / 4 = 1.5 Ω Combined resistance = (1.36 × 1.5) / 2.86) = 0.71 Ω	**(C1)**
	Current = 6 / 0.71 = 8.4 A	**(A1)**
9(d)	p.d. across lamp = 4.9 V p.d. across resistor = 6.0 V	**C1**
	Total p.d. (= 4.9 + 6.0) = 10.9 V	**A1**
	OR (With 4 A current) R_L = 5 / 4 = 1.25 Ω R_R = 6 / 4 =1.5 Ω Total R = 2.75 Ω	**(C1)**
	Total p.d. = 2.75 × 4 = 11.0 V	**(A1)**

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Question	Answer	Marks
10(a)	Strength of magnetic field / magnet	**B1**
	Speed (of movement of wire)	**B1**
	Length of AB / wire (within field)	**B1**
10(b)(i)	$V_p / V_s = N_p / N_s$ OR (N_s =) 8000 × 12 / 240	**C1**
	400 (turns)	**A1**
10(b)(ii)	Circuit connected to A and B with resistor and diode with correct circuit symbols in series	**B1**

Question	Answer	Marks
11(a)(i)	In box / cupboard with lead walls	**B1**
11(a)(ii)	(Handle) with (long) tongs OR remote-controlled device OR wearing lead gloves OR wearing lead suit	**B1**
11(b)	Col 1: gamma / γ (rays) alpha / α (particles) beta / β (particles)	**B1**
	Col 3: – a few cm or up to 10 cm a few m or up to 10 m	**B1**
	Col 4: thick lead or 30 cm lead or very thick concrete or 3 m concrete – thin aluminium or 2 mm aluminium	**B1**
11(c)(i)	alpha / α (particles or rays)	**B1**
11(c)(ii)	beta / β (particles or rays)	**B1**

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/42**

Paper 4 Theory (Extended) **February/March 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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[Turn over

1 **(a)** Define *acceleration*.

..... [1]

(b) Fig. 1.1 shows the speed-time axes for the graph of the motion of a car.

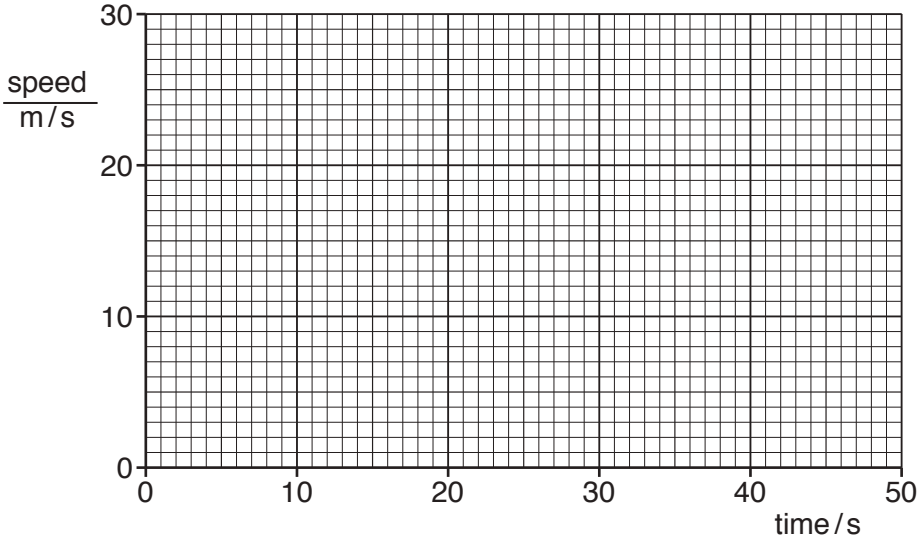

Fig. 1.1

(i) The car starts from rest.

From time = 0 to time = 15 s, the car has a constant acceleration to a speed of 28 m/s.

From time = 15 s to time = 32 s, the car has a constant speed of 28 m/s.

From time = 32 s, the car has a constant deceleration of 2.0 m/s^2 until it comes to rest.

On Fig. 1.1, draw the graph, using the space below for any calculations.

[5]

(ii) From time = 15 s to time = 32 s, the path of the car is part of a circle.

For this motion, state

1. the direction of the resultant force on the car,

.....

2. what happens to the velocity of the car.

.....
[2]

[Total: 8]

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2 **(a)** A force is used to move an object from the Earth's surface to a greater height.

Explain why the gravitational potential energy (g.p.e.) of the object increases.

.....

..... [1]

(b) Fig. 2.1 shows a train moving up towards the top of a mountain.

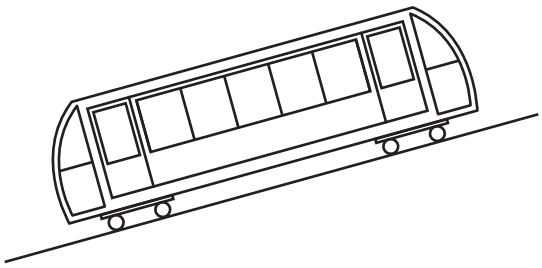

Fig. 2.1

The train transports 80 passengers, each of average mass 65 kg, through a vertical height of 1600 m.

Calculate the increase in the total gravitational potential energy (g.p.e.) of the passengers.

increase in g.p.e. = ... [2]

(c) The engine of the train has a power of 1500 kW. The time taken to reach the top of the mountain is 30 minutes.

Calculate the efficiency of the engine in raising the 80 passengers 1600 m to the top of the mountain.

efficiency = ... [4]

[Total: 7]

3 **(a)** Complete the statement by writing in the blank spaces.

The moment of a force about a pivot is equal to .....

multiplied by..... [1]

(b) Fig. 3.1 shows a horizontal rod of length 2.4 m and weight 160 N. The weight of the rod acts at its centre. The rod is suspended by two vertical ropes X and Y. The tension in each rope is 80 N.

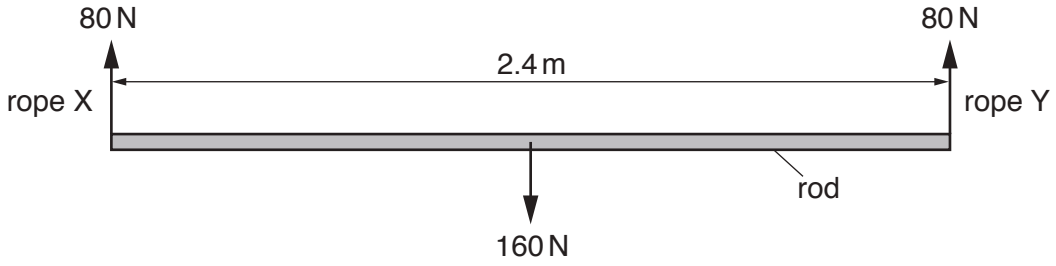

Fig. 3.1

(i) State the name given to the point at which the weight of the rod acts.

..... [1]

(ii) Calculate the mass of the rod.

mass = ... [1]

(iii) The rod is in equilibrium.

Using data from Fig. 3.1, explain why.

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

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4 Fig. 4.1 shows a cold plastic spoon that has just been placed in hot liquid in a cup.

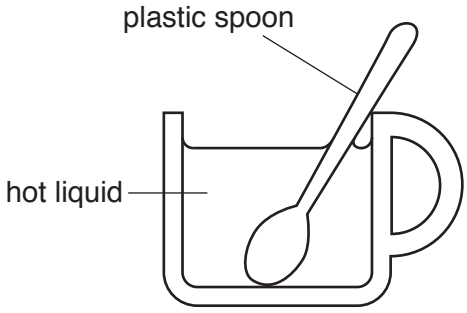


Fig. 4.1

(a) Describe, in terms of molecules, why the temperature of the whole of the spoon increases.

.....

.....

.....

.....

..... [3]

(b) The plastic spoon is replaced by a metal spoon.

Describe an additional process by which the temperature of the whole of this spoon increases.

.....

.....

..... [2]

(c) The cup contains 150 g of liquid of specific heat capacity 4.2 J/(g °C). When the cold spoon is placed into the hot liquid, the temperature of the liquid decreases from 80 °C to 56 °C.

Calculate the loss of thermal energy from the liquid.

energy loss = ... [3]

[Total: 8]

5 **(a)** Fig. 5.1 shows the apparatus used to observe the motion of smoke particles that are in the air in a box.

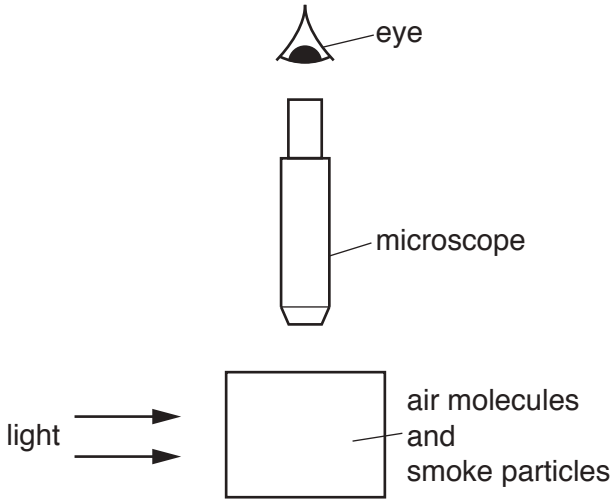
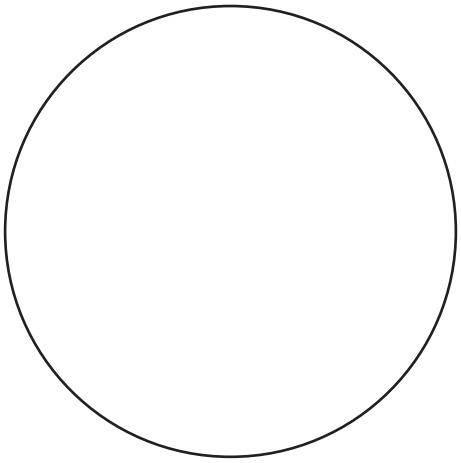


Fig. 5.1

Light from a lamp enters the box through a window in one side of the box. The smoke particles are observed using a microscope fixed above a window in the top of the box.

(i) The motion of a single smoke particle is observed through the microscope.

In the circle shown, sketch the path of this smoke particle.



[1]

(ii) Explain why the smoke particle follows the path that is observed.

.....

.....

.....

..... [3]

(b) A tennis player is practising by hitting a ball many times against a wall.

The ball hits the wall 20 times in 60 s. The average change in momentum for each collision with the wall is 4.2 kg m / s.

Calculate the average force that the ball exerts on the wall.

average force = ... [3]

[Total: 7]

6 **(a)** Fig. 6.1 represents the electromagnetic spectrum.

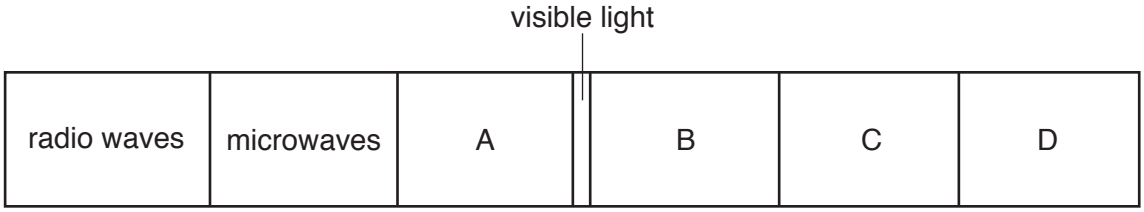


Fig. 6.1

State the radiation in each of the regions represented by A, B, C and D in Fig. 6.1.

A .....

B .....

C .....

D .....

[2]

(b) A source emits visible light.

Fig. 6.2 shows a ray of red light from the source incident on the face XY of a glass prism at point S.

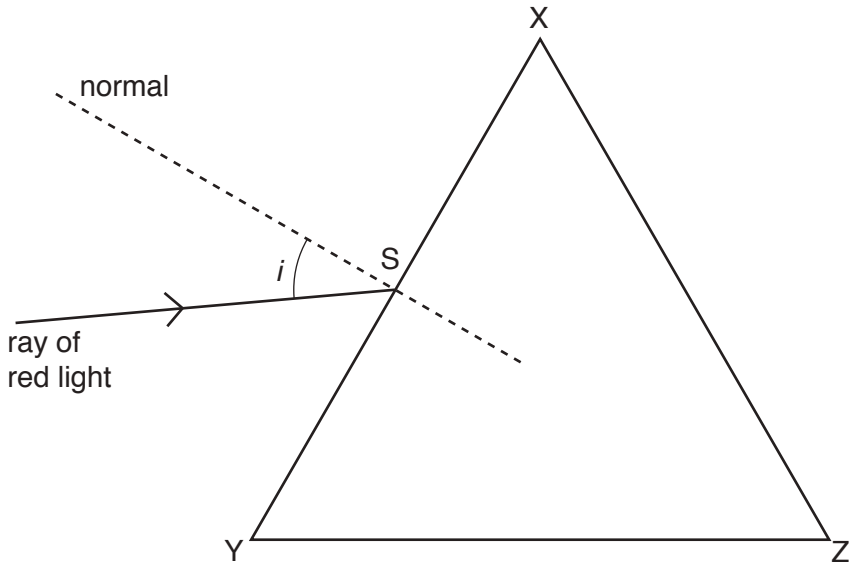


Fig. 6.2

The angle of incidence *i* of the ray is 35°. The refractive index of the glass for red light is 1.5.

(i) Calculate the angle of refraction in the glass at S.

angle of refraction = ... [2]

(ii) On Fig. 6.2, draw the refracted ray at face XY and the ray emerging from face XZ of the prism. Label this ray R. [2]

(iii) A ray of blue light follows the same path as the ray of red light incident on the face XY.

On Fig. 6.2, draw the path of this ray in the prism and emerging from the prism.

Label this ray B. [2]

[Total: 8]

7 **(a)** The speed of a light wave in air is 3.00×10^8 m/s. The refractive index of water is 1.33.

Calculate the speed of the light wave in water.

speed = ... [2]

(b) Fig. 7.1 shows parallel wavefronts of a light wave in air incident on a boundary with a transparent plastic.

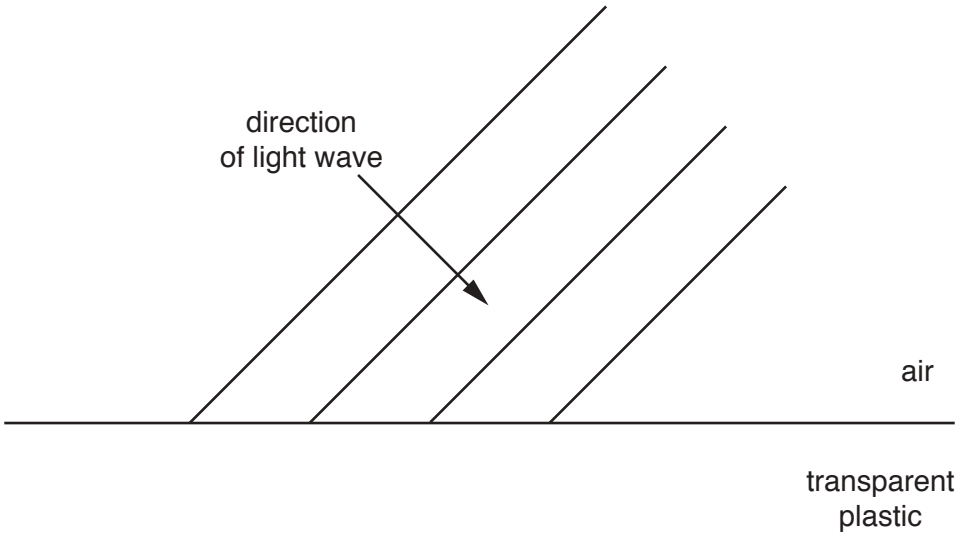


Fig. 7.1

On Fig. 7.1,

(i) draw the positions of the four refracted wavefronts in the plastic, [3]

(ii) draw an arrow to show the direction of travel of the refracted wave, [1]

(iii) label the angle of refraction *r* of the light wave. [1]

[Total: 7]

8 **(a)** The lamp of a car headlight is rated at 12 V, 50 W.

Calculate the current in the lamp when operating normally.

current = ... [2]

(b) A car is driven at night.

In a journey, the total charge that passes through the 12 V battery is 270 kC.

(i) Calculate the electrical energy transferred.

energy = ... [3]

(ii) The fuel used by the car provides 3.6×10^4 J/cm^3.

Calculate the volume of fuel used to provide the energy calculated in **(b)(i)**.

volume = ... [2]

[Total: 7]

9 Fig. 9.1 shows current-potential difference graphs for a resistor and for a lamp.

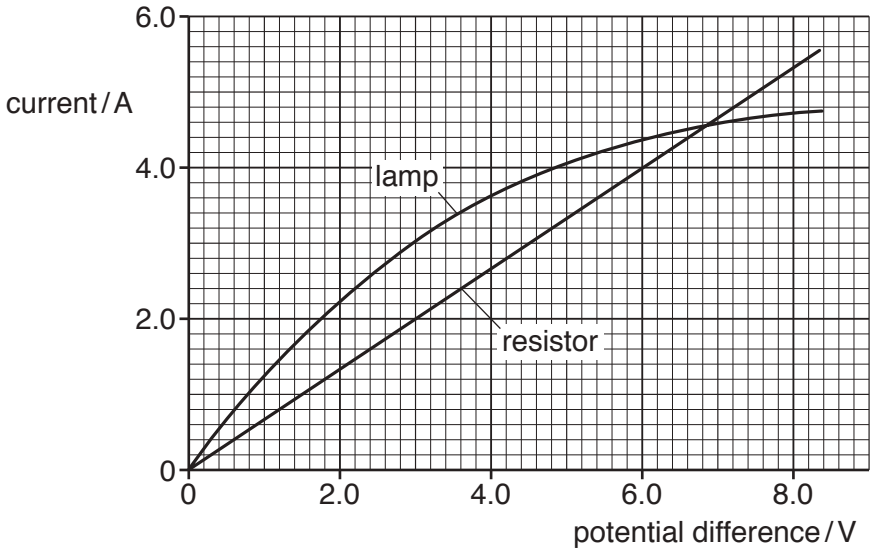


Fig. 9.1

(a) **(i)** The potential difference (p.d.) applied to the resistor is increased. Tick the box that indicates the effect on the resistance of the resistor.

☐ resistance increases

☐ resistance is constant

☐ resistance decreases

[1]

(ii) The potential difference (p.d.) applied to the lamp is increased. Tick the box that indicates the effect on the resistance of the lamp.

☐ resistance increases

☐ resistance is constant

☐ resistance decreases

[1]

(b) The p.d. across the lamp is 6.0 V. Calculate the resistance of the lamp.

resistance = ... [2]

(c) The lamp and the resistor are connected in **parallel** to a 6.0 V supply.

Calculate the current from the supply.

current = ... [2]

(d) The lamp and the resistor are connected in **series** to another power supply. The current in the circuit is 4.0 A.

Calculate the total p.d. across the lamp and the resistor.

p.d. = ... [2]

[Total: 8]

10 **(a)** Fig. 10.1 shows a straight wire AB placed in the magnetic field between the poles of a magnet. The ends of AB are connected to a galvanometer.

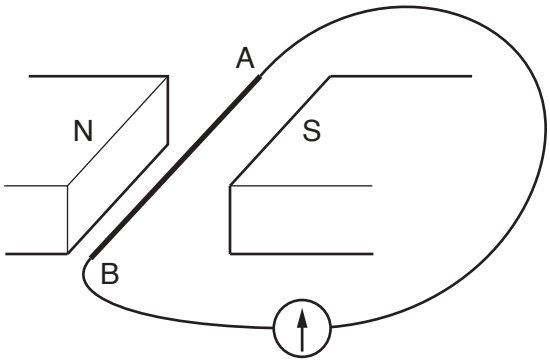


Fig. 10.1

When AB is moved vertically, the needle of the galvanometer shows a deflection.

State **three** factors that affect the size of the deflection.

1 .....

2 .....

3 .....
[3]

(b) Fig. 10.2 shows a transformer.

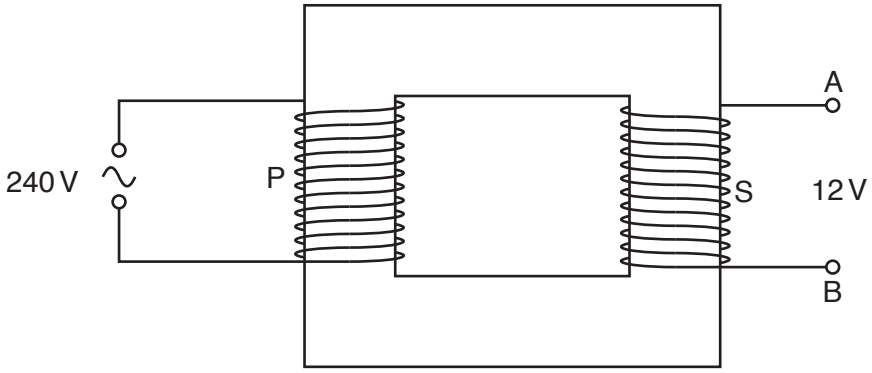


Fig. 10.2

(i) The primary coil P has 8000 turns and an input of 240 V. The secondary coil S has an output of 12 V.

Calculate the number of turns in the secondary coil.

number = ... [2]

(ii) A circuit containing a resistor is connected to the terminals A and B.
A direct current (d.c.) is required in this resistor.

On Fig. 10.2, draw this circuit. [1]

[Total: 6]

11 **(a)** To ensure the safety of workers in laboratories where radioactive sources are used, describe how radioactive materials

(i) should be stored,

.....

..... [1]

(ii) should be handled.

.....

..... [1]

(b) Complete the table below for three types of emission from radioactive sources.

type of emission	nature	range in air	absorbed by
	electromagnetic radiation	several km	
	helium nucleus		0.2 mm paper
	electron		

[3]

(c) State the type of radiation emitted when

(i) an americium nucleus $\left({}^{241}_{95}\text{Am}\right)$ decays into a neptunium nucleus $\left({}^{237}_{93}\text{Np}\right)$,

..... [1]

(ii) a phosphorus nucleus $\left({}^{32}_{15}\text{P}\right)$ decays into a silicon nucleus $\left({}^{32}_{16}\text{Si}\right)$.

..... [1]

[Total: 7]

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PHYSICS **0625/52**

Paper 5 Practical Test **February/March 2018**

CONFIDENTIAL INSTRUCTIONS

Great care should be taken to ensure that any confidential information given does not reach the candidates either directly or indirectly.

If you have any queries regarding these Confidential Instructions, please contact Cambridge stating the Centre number, the nature of the query and the syllabus number quoted above.

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Instructions for preparing apparatus

The Supervisor is **not** allowed to consult the Question Paper before the examination. This teacher should, as part of the preparation of the examination requirements, test the apparatus in order to ensure that it is satisfactory.

The Supervisor is asked to give (and attach to the Supervisor's Report form printed on pages 7 and 8) a *brief* description of the apparatus supplied, mentioning any points that are likely to be of importance to the Examiner in marking the answers. The Supervisor should also report any assistance given to candidates. All reports should be signed by the Supervisor.

In addition to the usual equipment of a physics laboratory, each candidate will require the apparatus specified in these Confidential Instructions. If a candidate breaks any of the apparatus, or loses any of the material supplied, the matter should be rectified and a note made in the Supervisor's Report.

Number of sets of apparatus

As a *minimum*, the number of sets of apparatus provided should be $N/3$, where N is the number of candidates (per session). A few spare sets should, preferably, be available to avoid any candidate being delayed when moving to another question.

The order in which a given candidate attempts the four questions is immaterial. It is suggested that candidates spend **about 20 minutes on each of questions 1 to 3, and about 15 minutes on question 4**.

Assistance to candidates

The purpose of the Physics Practical Test is to find out whether the candidates can carry out simple practical work themselves. The Examiners are aware that candidates may sometimes be unable to show their practical ability through failure to understand some point in the theory of the experiment. If an Examiner were present in the laboratory, he/she would be willing to give a hint to enable such a candidate to get on with an experiment. In order to overcome this difficulty, the Supervisor is asked to co-operate with the Examiners to the extent of being ready to give (or allow the physics teacher to give) a hint to a candidate who is unable to proceed.

The following regulations must be strictly adhered to.

(i) No hint may be announced to the candidates as a whole.

(ii) A candidate who is unable to proceed and requires assistance must come up to the Supervisor and state the difficulty. Candidates should be told that the Examiners will be informed of any assistance given in this way.

(iii) A report must be made of any assistance given to the candidate, with the name and candidate number of the candidate.

It is suggested that the following announcement be made to the candidates.

'The Examiners do not want you to waste time through inability to get on with an experiment. Any candidate, therefore, who is unable to get on with the experiment after spending five minutes at it may come to me and ask for help. I shall report to the Examiners any help given in this way, and some marks may be lost for the help given. You may ask me for additional apparatus which you think would improve the accuracy of your experiments, and you should say, on your script, how you use any such apparatus supplied.'

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Question 1

Items to be supplied by the Centre (per set of apparatus unless otherwise specified).

(i) Metre rule with a scale graduated in mm. See note 1.

(ii) Triangular block to act as a pivot for the metre rule. This block is to stand on the bench.

(iii) Mass of 20 g, labelled **Q**. The mass must be able to stand on the rule.

Note

1. The metre rule should approximately balance on the pivot, with the scale facing upwards, when the 50 cm mark is over the pivot.

Action at changeover

Check that the apparatus is ready for the next candidate.

Question 2

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Two lamps, one 2.5 V, 0.3 A or similar, labelled **X**, and the other 6 V, 0.4 A or similar, labelled **Y**. See note 2.

(ii) Power supply of approximately 2 V to 3 V. See note 3.
Where candidates are provided with a variable power supply, the voltage should be set by the Supervisor and fixed, e.g. taped.

(iii) Switch. The switch may be an integral part of the power supply.

(iv) Sufficient connecting leads to set up the circuit shown in Fig. 2.1, with 4 spare leads.

(v) Ammeter capable of measuring currents up to 1.00 A with a resolution of at least 0.05 A. See note 4.

(vi) Voltmeter capable of measuring up to 3.0 V with a resolution of at least 0.1 V. See note 4.

Notes

1. The circuit is to be set up for candidates as shown in Fig. 2.1. The voltmeter must have leads and terminals that enable it to be connected to different parts of the circuit.

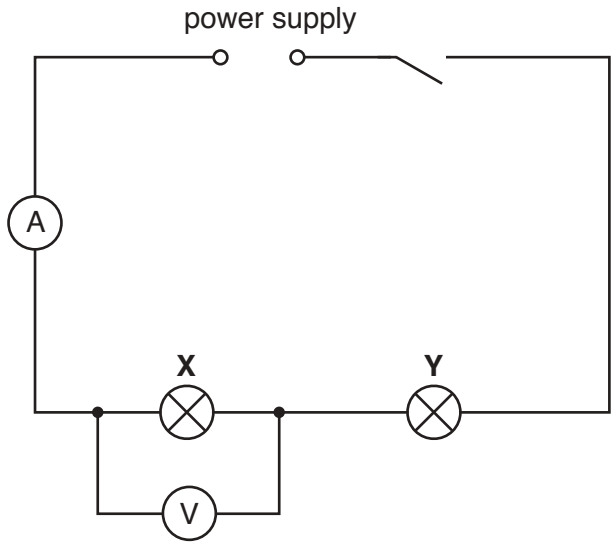

Fig. 2.1

2. The lamps must have suitable terminals so that candidates are able easily and quickly to rearrange the circuit. Spare lamps should be available.

3. If cells are used, they must remain adequately charged throughout the examination. Spare cells must be available.

4. Either analogue or digital meters are suitable. Any variable settings should be set by the Supervisor and fixed, e.g. taped. Spare meters should be available.

Action at changeover

Connect the circuit as shown in Fig. 2.1 and check that the circuit is working.
Switch the circuit off.

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Question 3

Items to be supplied by the Centre (per set of apparatus unless otherwise specified).

(i) Thermometer: –10 °C to 110 °C, graduated in 1 °C intervals. See note 1.

(ii) Clamp, boss and stand. See note 1.

(iii) 250 cm^3 beaker. See notes 1 and 2.

(iv) Supply of hot water. See notes 3 and 4.

(v) Stopclock or stopwatch or wall-mounted clock showing seconds. Candidates will be required to take readings at 30-second intervals. They may use their own wristwatches. The question will refer to a stopclock.

(vi) Paper towels to soak up any water spills.

Notes

1. The thermometer, clamp, boss and stand are to be set up for candidates as shown in Fig. 3.1. The thermometer bulb must be well below the 100 cm^3 level of the beaker. Candidates must be able easily and safely to read temperatures up to 100 °C and to move the thermometer in and out of the beaker.

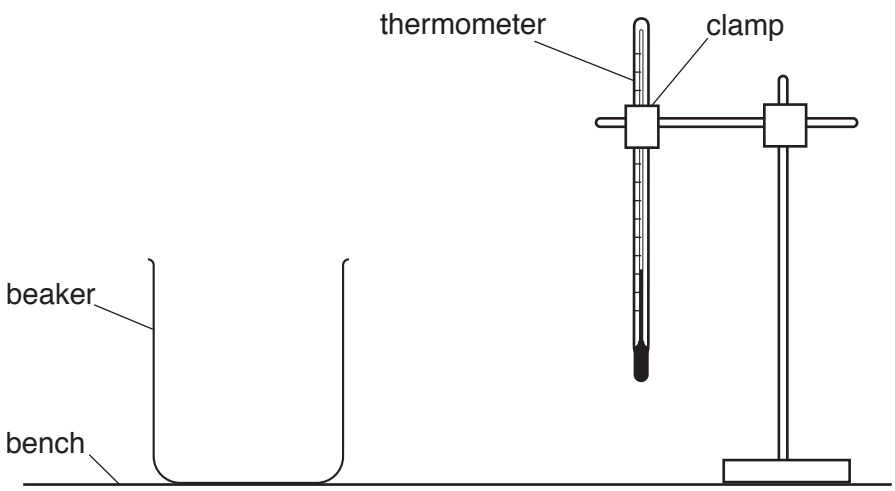

Fig. 3.1

2. If the beaker does not have volume markings, the 200 cm^3 and 100 cm^3 levels must be indicated on the beaker.

3. Hot water is to be available for each candidate throughout the experiment. The hot water should be maintained at an approximately constant temperature between 80 °C and 100 °C. Each candidate will require about 400 cm^3 of hot water in total. They must be able to pour hot water into the beaker safely.

4. Candidates must be warned of the dangers of burns or scalds when using very hot water.

Action at Changeover

Empty the water from the beaker. Check that the apparatus is intact and is arranged as in Fig. 3.1.

Question 4

No apparatus is required for this question.

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This form must be completed and returned with the scripts.

SUPERVISOR'S REPORT

General

The Supervisor is required to give details of any difficulties experienced by particular candidates, giving their names and candidate numbers. These should include reference to:

(a) difficulties due to faulty apparatus;

(b) accidents to apparatus or materials;

(c) any other information that is likely to assist the Examiner, especially if this cannot be discovered in the scripts;

(d) any help given to a candidate.

Information required

A plan of workbenches, giving details by candidate number of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts. The space below can be used for this, or it may be on separate paper.

Information required (cont.)

A list by name and candidate number of candidates requiring help, with details of the help provided.

CENTRE NO. .....

NAME OF CENTRE .....

Declaration (to be signed by the Supervisor)

The preparation of the practical examination has been carried out so as to maintain fully the security of the examination.

SIGNED .....
Supervisor

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Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/52**

Paper 5 Practical **March 2018**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2018 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	5 *b* values decreasing	**1**
	all < 43.0 cm and *b* calculation correct	**1**
1(b)	graph:	
	• axes labelled correct orientation, with quantity and unit	**1**
	• appropriate scales (plots occupying at least ½ grid)	**1**
	• plots all correct to ½ small square and precise plots	**1**
	• well judged line and thin line	**1**
1(c)(i)	*G* present and triangle method seen on graph	**1**
1(c)(ii)	M_R in range 70 (g) to 400 (g)	**1**
	2 / 3 significant figures and unit	**1**
1(d)	(difficult to see correct mark) and: measure width of mass and add ½ width to mark at edge of mass / mean value of marks at both edges of mass / mark centre line of mass and edge of rule / line up mark through gap in slotted mass	**1**
1(e)	more accurate and errors have less effect (with larger values) / less % uncertainty	**1**

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Question	Answer	Marks
2(a)(i)	I_S <1.00 (A)	**1**
2(a)(ii)	V_X and V_Y both <3.00 (V) <u>and</u> $V_X < V_Y$	**1**
2(a)(iii)	V_S within 10% of ($V_X + V_Y$)	**1**
2(a)(iv)	statement matching results	**1**
	justification matching statement with <u>comparative values used</u> e.g. within limits of experimental accuracy	**1**
2(b)	correct calculation of R_1	**1**
	2 / 3 sig figs and unit Ω	**1**
2(c)	lamps in parallel arrangement	**1**
	all circuit elements in correct arrangement and circuit symbols correct	**1**
2(d)(i)	I_P and V_P present <u>and</u> V and A units correct throughout	**1**
2(d)(ii)	$R_2 > R_1$	**1**

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Question	Answer	Marks
3(a)	θ for 200 cm^3 decreasing	**1**
3(b)(i)	θ for 100 cm^3 decreasing more quickly	**1**
3(b)(ii)	s, °C, °C all correct	**1**
	30, 60, 90, 120, 150, 180	**1**
3(c)	conclusion matching results	**1**
	justification matching conclusion with <u>correct</u> mention of comparative temperature change <u>over 0 to 180 s</u>	**1**
3(d)(i)	unit °C / s	**1**
3(d)(ii)	correct calculation of x_1 <u>and</u> $x_2 < x_1$	**1**
3(e)	statement matching results <u>with</u> results used in explanation and reference to different starting temperatures for x_1 and x_2	**1**
3(f)	experiment with lid <u>and</u> no insulation	**1**
	experiment with insulation <u>and</u> no lid	**1**

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Question		Answer	Marks
4	MP1	**factor:** clear statement of appropriate variable to test	**1**
	MP2	**control variable:** named variable which should be kept constant	**1**
	MP3	**apparatus:** metre rule and any apparatus essential to variable under test	**1**
	MP4	**method:** measure factor under test and drop ball and measure diameter / depth of depression	**1**
	MP5	repeat for new value of variable under test	**1**
	MP6	**additional point:** repeat experiment or each value of factor and average / means of measuring depth / diameter of crater accurately / apparatus for measuring diameter of ball accurately / measure diameter of ball / crater in different places (and take mean) / smooth / flatten sand surface / at least 5 sets of data taken / reliable means of releasing ball / sensible values for factor quoted	**1**
	MP7	**graph:** diameter / depth of depression vs appropriate continuous variable	**1**

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/52**

Paper 5 Practical Test **February/March 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of the page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You are advised to spend about 20 minutes on each of questions 1 to 3, and about 15 minutes on question 4.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
Total	

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CAMBRIDGE International Examinations

[Turn over

1 In this experiment, you will determine the mass of a metre rule by a balancing method.

Carry out the following instructions, referring to Fig. 1.1.

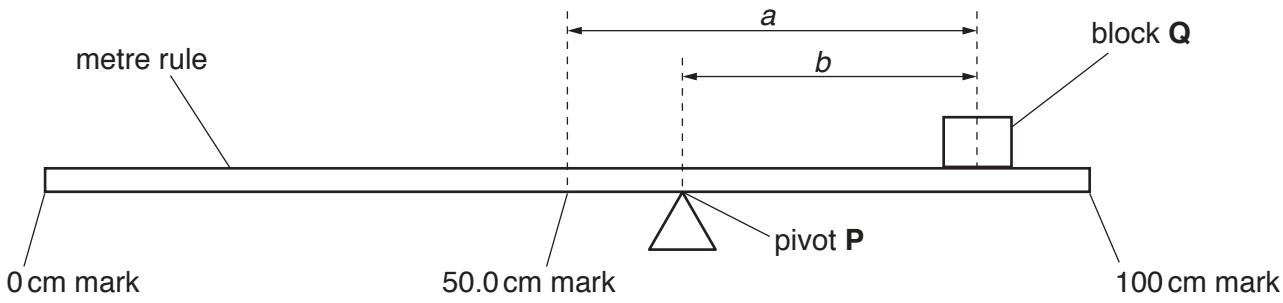


Fig. 1.1

(a) Place the metre rule on the pivot. Place block **Q** on the metre rule with its centre at the 95.0 cm mark. Keep **Q** at the 95.0 cm mark and adjust the position of the metre rule on the pivot until the metre rule is as near to being balanced as possible.

The distance *a* between the centre of **Q** and the 50.0 cm mark has been recorded in Table 1.1.

In the table, record the position of the pivot **P**.

Calculate the distance *b* between the centre of **Q** and the pivot **P**, using the formula

$$b = (\text{position of } \mathbf{Q} - \text{position of } \mathbf{P}).$$

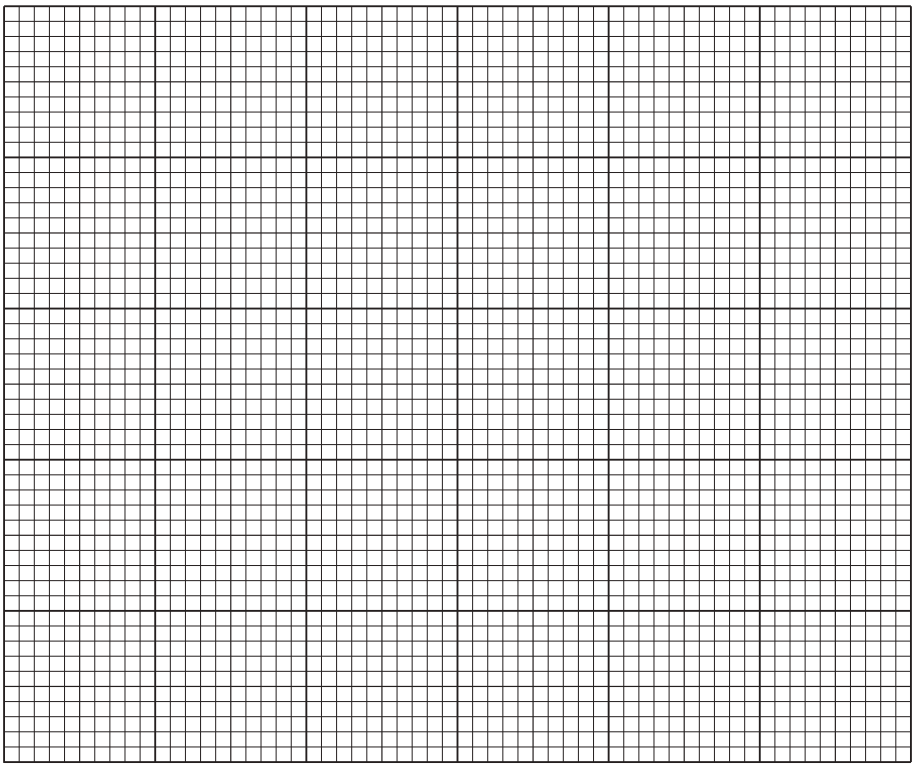
Repeat the procedure for positions of **Q** at the 90.0 cm, 85.0 cm, 80.0 cm and 75.0 cm marks. Record your values for the position of **P** and your values for *b* in the table.

Table 1.1

position of **Q** / cm	*a* / cm	position of **P** / cm	*b* / cm
95.0	45.0		
90.0	40.0		
85.0	35.0		
80.0	30.0		
75.0	25.0		

[2]

(b) Plot a graph of a/cm (y-axis) against b/cm (x-axis). You do not need to start your axes at the origin (0,0).



[4]

(c) **(i)** Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ... [1]

(ii) Calculate the mass M_R of the metre rule using the equation $M_R = \frac{M}{(G-1)}$,

where M = 20 g. Record the value for M_R to a suitable number of significant figures for this experiment.

M_R = ... [2]

(d) Describe why it is difficult to place the block **Q** at the correct mark on the metre rule each time. Explain how you overcame this difficulty. You may draw a diagram to help your explanation.

.....

.....

..... [1]

(e) Two students carry out the experiment correctly but with different values for the mass of block **Q**. One student obtains values of *b* that are larger than those obtained by the other student.

State and explain whether the larger values of *b* are likely to produce a more accurate value for the mass of the metre rule.

.....

.....

..... [1]

[Total: 11]

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2 In this experiment, you will investigate a circuit containing different lamps.

The circuit has been set up for you.

Carry out the following instructions, referring to Fig. 2.1.

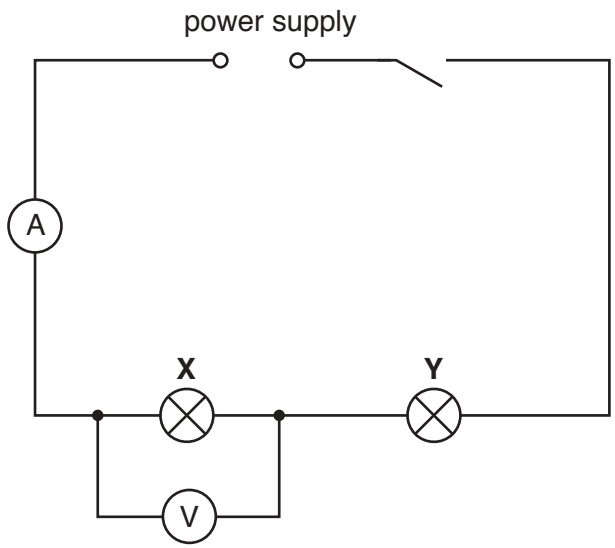

Fig. 2.1

(a) **(i)** Switch on. Record the current I_S in the circuit.

I_S = ... [1]

(ii) Record the potential difference (p.d.) V_X across lamp **X**.

V_X = ...

Disconnect the voltmeter.

Connect the voltmeter to measure the p.d. V_Y across lamp **Y**.
Record V_Y.

V_Y = ...
[1]

(iii) Disconnect the voltmeter.

Connect the voltmeter to measure the p.d. V_S across both lamps **X** and **Y** connected in series.
Record V_S.

V_S = ...[1]

Switch off.

(iv) A student suggests that V_S should be equal to (V_X + V_Y).

State whether your readings support this suggestion. Justify your statement with reference to your results.

statement .....

justification .....

.....

.....
[2]

(b) Calculate the resistance R_1 of lamp **X**. Use your readings from **(a)(i)** and **(a)(ii)** and the equation $R_1 = \frac{V_X}{I_S}$. Record your answer to a suitable number of significant figures for your experiment.

R_1 = ... [2]

(c) The circuit components are to be rearranged so that

- lamps **X** and **Y** are connected in parallel
- the ammeter measures the current in lamp **X** only
- the voltmeter measures the p.d. across the lamps.

Draw a circuit diagram of this arrangement.

[2]

(d) **(i)** Set up the circuit as described in **(c)**.

Switch on. Measure and record the current I_P in lamp **X** and the p.d. V_P across the lamps.

I_P = ...

V_P = ...
[1]

Switch off.

(ii) Calculate the new resistance R_2 of lamp **X**. Use your readings from **(d)(i)** and the equation $R_2 = \frac{V_P}{I_P}$.

R_2 = ... [1]

[Total: 11]

3 In this experiment, you will investigate how the volume of water affects the rate at which water in a beaker cools.

Carry out the following instructions, referring to Fig. 3.1.

The thermometer must remain in the clamp throughout the experiment.

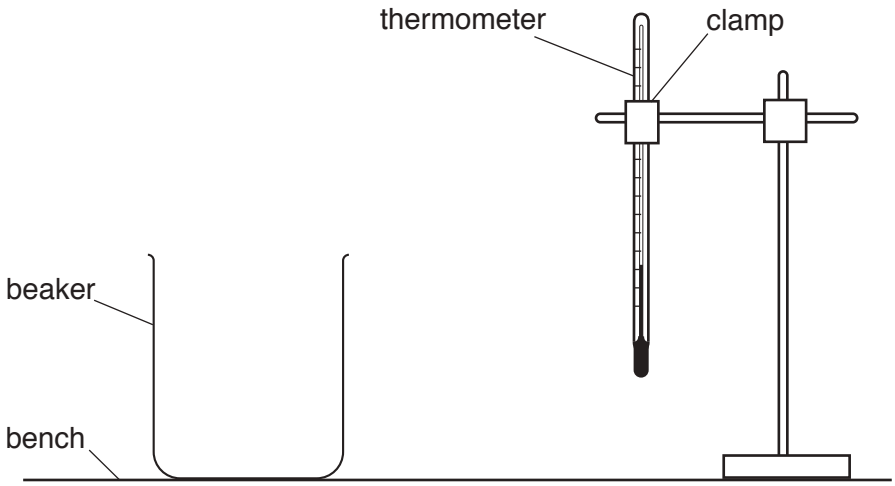

Fig. 3.1

(a) Pour 200 cm^3 of hot water into the beaker.
Place the thermometer in the water.

In the first row of Table 3.1, record the maximum temperature θ of the water and immediately start the stopclock.

Record, in the table, the temperature θ of the water at times t = 30 s, 60 s, 90 s, 120 s, 150 s and 180 s.

Remove the thermometer from the beaker and empty the beaker. [1]

(b) **(i)** Repeat **(a)**, using 100 cm^3 of hot water in the beaker. [1]

(ii) Complete the headings and the time column in the table. [2]

Table 3.1

	beaker with 200 cm^3 of hot water	beaker with 100 cm^3 of hot water
t/	θ/	θ/
0		

(c) Write a conclusion stating how the volume of water in the beaker affects the rate of cooling of the water. Justify your answer by reference to your results.

.....

.....

.....

.....

..... [2]

(d) **(i)** Using your results for 100 cm^3 of water, calculate the average rate of cooling x_1 for the **first** 90 s of the experiment. Use your readings from the table and the equation

$$x_1 = \frac{\theta_0 - \theta_{90}}{t},$$

where $t = 90$ s and θ_0 and θ_{90} are the temperatures at 0 s and 90 s.
Include the unit for the rate of cooling.

x_1 = ... [1]

(ii) Using your results for 100 cm^3 of water, calculate the average rate of cooling x_2 in the **last** 90 s of the experiment. Use your readings from the table and the equation

$$x_2 = \frac{\theta_{90} - \theta_{180}}{t},$$

where $t = 90$ s and θ_{90} and θ_{180} are the temperatures at 90 s and 180 s.
Include the unit for the rate of cooling.

x_2 = ... [1]

(e) A student suggests that it is important that the experiments with the two volumes of water should have the same starting temperatures.

State whether your values for x_1 and x_2 support this suggestion. Justify your statement with reference to your results.

statement .....

justification .....

.....

.....
[1]

(f) Another student wants to investigate whether more thermal energy is lost from the water surface than from the sides of the beakers.

Describe an experiment that could be done to investigate this.

You are **not** required to carry out the experiment.

You may draw a diagram to help your description.

.....

.....

..... [2]

[Total: 11]

4 A student is investigating the factors that affect the size of the crater (hole) a ball makes when it is dropped into sand.

Plan an experiment which would enable you to investigate one factor which might affect the size of the crater. You are **not** required to carry out the experiment.

The apparatus available includes:

metal balls of different sizes
a tray of sand.

Write a plan for the experiment.

In your plan, you should:

- state which factor is being investigated,
- state the key variables that you would control,
- list any additional apparatus needed,
- explain briefly how you would carry out the experiment including what would be measured and how this would be done,
- state the precautions which should be taken to obtain reliable results,
- suggest a suitable graph which could be drawn from the results.

You may draw a diagram if it helps to explain your plan.

.....

.....

..... [7]

[Total: 7]

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **March 2018**

MARK SCHEME

Maximum Mark: 40

Published

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GENERIC MARKING PRINCIPLE 3:

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- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	measure width of mass and add ½ width to mark at edge of mass / mean value of marks at both edges of mass / mark centre line of mass and edge of rule / line up mark through gap in slotted mass	**1**
1(b)	method such as: find point which just tips one way move rule to find point which just tips other way	**1**
	balance point is between these where rule tips either way / owtte	**1**
1(c)(i)	graph:	
	• axes labelled correct orientation, with quantity and unit	**1**
	• appropriate scales (plots occupying at least ½ grid)	**1**
	• plots all correct to ½ small square and precise plots	**1**
	• well judged line and thin line	**1**
1(c)(ii)	*G* present and triangle method seen on graph	**1**
1(c)(iii)	M_R in range 100 g to 400 g	**1**
	2 / 3 significant figures and unit	**1**
1(d)	more accurate and errors have less effect (with larger values) / less % uncertainty	**1**

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Question	Answer	Marks
2(a)(i)	θ for beaker **A** = 87(.0)(°C) <u>and</u> θ for beaker **B** = 89(.0)(°C)	**1**
2(a)(ii)	s, °C, °C all correct	**1**
	30, 60, 90, 120, 150, 180	**1**
2(b)	one precaution e.g.: read at 90° (to scale) / perpendicularly, stir (before reading) / wait until reading stops rising(at start)	**1**
2(c)	conclusion matching results	**1**
	justification matching conclusion with <u>correct</u> mention of comparative temperature change <u>over 0 to 180 s</u>	**1**
2(d)(i)	unit °C / s	**1**
2(d)(ii)	x_1 = 0.094 / ecf <u>and</u> x_2 = 0.067	**1**
2(e)	statement matching results <u>with</u> results used in explanation and reference to different (starting) temperatures for x_1 and x_2	**1**
2(f)	experiment with lid <u>and</u> no insulation	**1**
	experiment with insulation <u>and</u> no lid	**1**

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Question	Answer	Marks
3(a)	correct voltmeter symbol in parallel with lamp **X**	**1**
3(b)	I_S = 0.34 (A)	**1**
3(c)(i)	V_X = 1.2 (V) <u>and</u> V_Y = 1.9 (V)	**1**
3(c)(ii)	V_S present <u>and</u> correct units (A, V) seen in **(b)** and **(c)**	**1**
3(c)(iii)	statement matching results	**1**
	justification matching statement with <u>use of comparative</u> <u>values</u> (e.g. 3.1 and 3.0 are within limits of experimental accuracy)	**1**
3(d)	correct calculation of R_1 (3.5 / ecf)	**1**
3(e)(i)	lamps in parallel arrangement	**1**
	all circuit elements in correct arrangement and all circuit symbols correct	**1**
	resistance increases with temperature	**1**
3(e)(ii)	$R_2 > R_1$ <u>and</u> brighter lamp has higher temperature	**1**

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Question		Answer	Marks
4	MP1	**factor:** clear statement of appropriate variable to test	**1**
	MP2	**control variable:** named variable which should be kept constant	**1**
	MP3	**apparatus:** metre rule and any apparatus essential to variable under test	**1**
	MP4	**method:** measure factor under test and drop ball and measure diameter / depth of depression	**1**
	MP5	repeat for new value of variable under test	**1**
	MP6	**additional point:** repeat experiment or each value of factor and average / means of measuring depth / diameter of crater accurately / apparatus for measuring diameter of ball accurately / measure diameter of ball / crater in different places (and take mean) / smooth / flatten sand surface / at least 5 sets of data taken / reliable means of releasing ball / sensible values for factor quoted	**1**
	MP7	**graph:** diameter / depth of depression vs appropriate continuous variable	**1**

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/62**

Paper 6 Alternative to Practical **February/March 2018**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1 A student is determining the mass of a metre rule by a balancing method.

He is using the apparatus shown in Fig. 1.1.

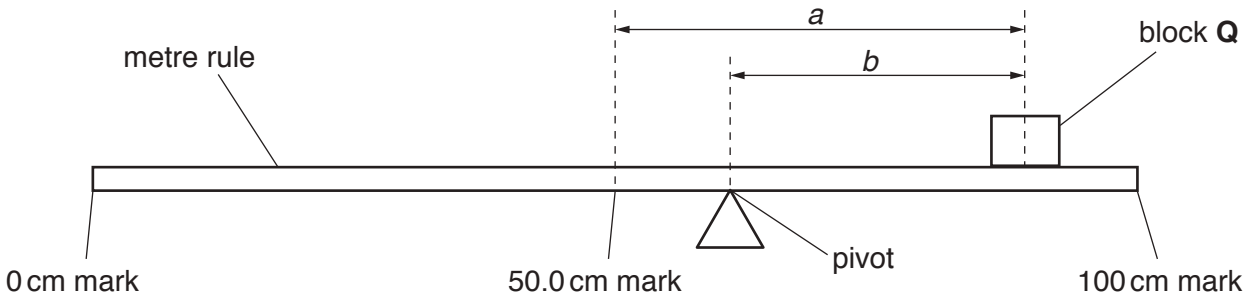

Fig. 1.1

(a) He places the metre rule on the pivot and then places block **Q** with its centre at the 95.0 cm mark.
The student stated that it is difficult to place the mass accurately at the 95.0 cm mark.

Explain how the student could overcome this. You may draw a diagram to help your explanation.

.....

.....

.....[1]

(b) The student keeps block **Q** at the 95.0 cm mark and adjusts the position of the metre rule on the pivot until the metre rule is as near to being balanced as possible.

Describe a method to find the point at which the metre rule is as near to being balanced as possible.

.....

.....

.....

.....[2]

(c) The student determines the distance *a* between the centre of block **Q** and the 50.0 cm mark and also the distance *b* between the centre of block **Q** and the pivot.

He repeats the procedure for positions of block **Q** at the 90.0 cm, 85.0 cm, 80.0 cm and 75.0 cm marks. His results are shown in Table 1.1.

Table 1.1

position of **Q** / cm	*a* / cm	*b* / cm
95.0	45.0	39.0
90.0	40.0	34.3
85.0	35.0	30.0
80.0	30.0	25.2
75.0	25.0	21.4

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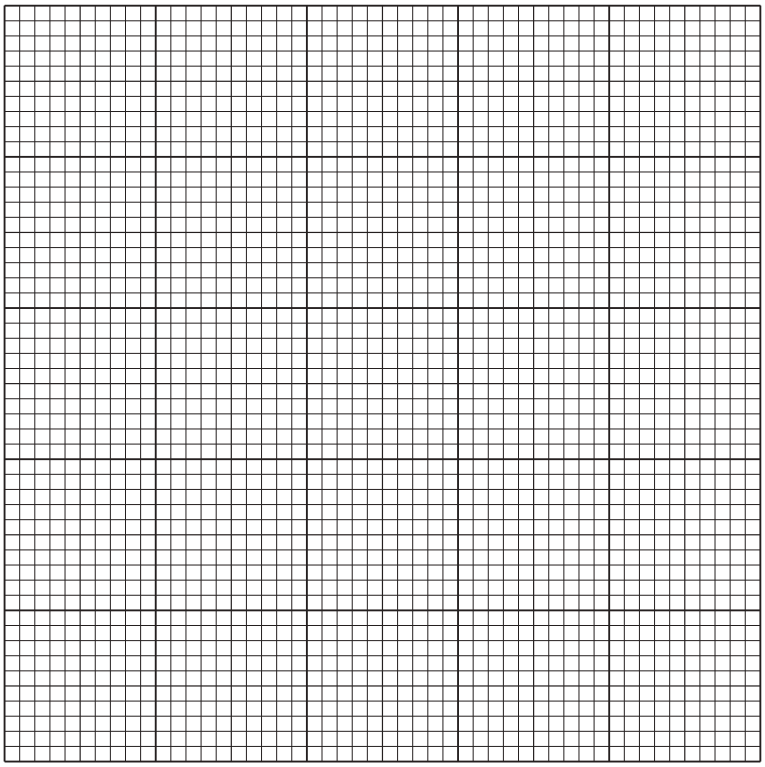
(i) Plot a graph of a/cm (y-axis) against b/cm (x-axis). You do not need to start your axes at the origin (0, 0).



[4]

(ii) Determine the gradient G of your line. Show clearly on the graph how you obtained the necessary information.

G = ...[1]

(iii) Calculate the mass M_R of the metre rule using the equation $M_R = \frac{M}{(G-1)}$,

where M = 20 g. Record the value for M_R to a suitable number of significant figures for this experiment.

M_R = ...[2]

(d) Two students carry out the experiment correctly but with different values for the mass of block **Q**. One student obtains values of *b* that are larger than those obtained by the other student.

State and explain whether the larger values of *b* are likely to produce a more accurate value for the mass of the metre rule.

.....

.....

.....[1]

[Total: 11]

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2 Some students are investigating how the volume of water affects the rate at which water in a beaker cools.

They are using the apparatus shown in Fig. 2.1.

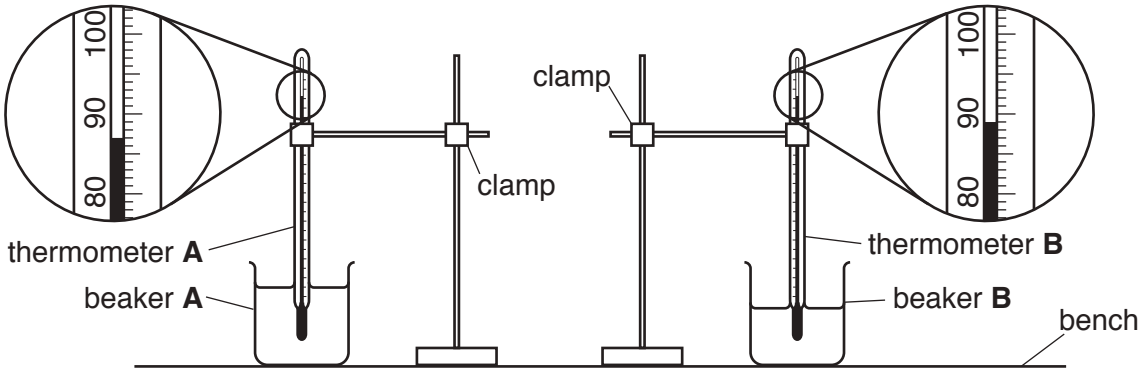

Fig. 2.1

(a) **(i)** 200 cm^3 of hot water is poured into beaker **A** and the initial temperature rises to the value shown on thermometer **A** in Fig. 2.1.

In the first row of Table 2.1, record this temperature θ_A for time $t = 0$.

100 cm^3 of hot water is poured into beaker **B**. The temperature rises to the value shown on thermometer **B** in Fig. 2.1.

In the first row of the table, record this temperature θ_B for time $t = 0$.

[1]

(ii) The temperatures θ_A and θ_B of the water in each experiment at times $t = 30$ s, 60 s, 90 s, 120 s, 150 s and 180 s are shown in the table.

Complete the headings and the time column in the table. [2]

Table 2.1

	beaker **A** with 200 cm^3 of water	beaker **B** with 100 cm^3 of water
t /	θ_A /	θ_B /
0		
	85.0	86.0
	83.0	83.0
	81.5	80.5
	80.0	78.0
	78.5	76.0
	77.5	74.5

(b) Describe one precaution which should be taken to ensure that the temperature readings in the experiment are as accurate as possible.

.....

.....[1]

(c) Write a conclusion stating how the volume of water in the beaker affects the rate of cooling of the water. Justify your answer by reference to the results.

.....

.....

.....

.....

.....[2]

(d) **(i)** Using the results for 100 cm^3 of water, calculate the average rate of cooling x_1 for the **first** 90 s of the experiment. Use the readings from the table and the equation

$$x_1 = \frac{\theta_0 - \theta_{90}}{t},$$

where $t = 90$ s and θ_0 and θ_{90} are the temperatures at time 0 and at time 90 s.
Include the unit for the rate of cooling.

x_1 = ...[1]

(ii) Using the results for 100 cm^3 of water, calculate the average rate of cooling x_2 in the **last** 90 s of the experiment. Use the readings from the table and the equation

$$x_2 = \frac{\theta_{90} - \theta_{180}}{t},$$

where $t = 90$ s and θ_{90} and θ_{180} are the temperatures at time 90 s and at time 180 s.
Include the unit for the rate of cooling.

x_2 = ...[1]

(e) A student suggests that it is important that the experiments with the two volumes of water should have the same starting temperatures.

State whether your values for x_1 and x_2 support this suggestion. Justify your statement with reference to your results.

statement .....

justification .....

.....

.....
[1]

(f) Another student plans to investigate whether more thermal energy is lost from the water surface than from the sides of the beakers.

Describe an experiment that could be done to investigate this.

You may draw a diagram to help your description.

.....

.....

.....[2]

[Total: 11]

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3 A student is investigating a circuit containing different lamps.
She is using the circuit shown in Fig. 3.1.

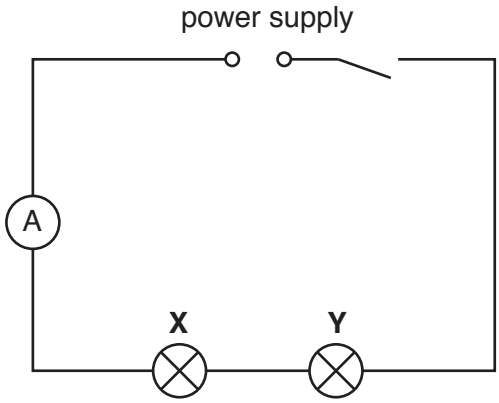

Fig. 3.1

(a) On Fig. 3.1, draw a voltmeter connected so that it measures the potential difference (p.d.) across lamp **X**.

[1]

(b) The student uses the ammeter to measure the current in the circuit.

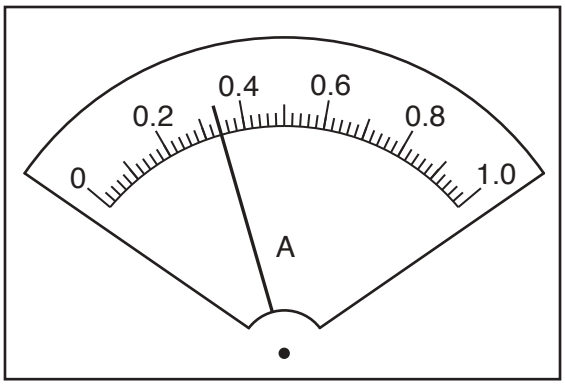

Fig. 3.2

Record the current I_S in the circuit, as shown in Fig. 3.2.

I_S = ...[1]

(c) **(i)** The student uses the voltmeter to measure the p.d. V_X across lamp **X** and then reconnects the voltmeter to measure the p.d. V_Y across lamp **Y**.

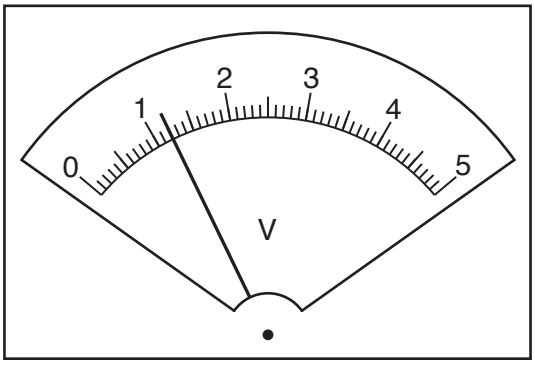

Fig. 3.3

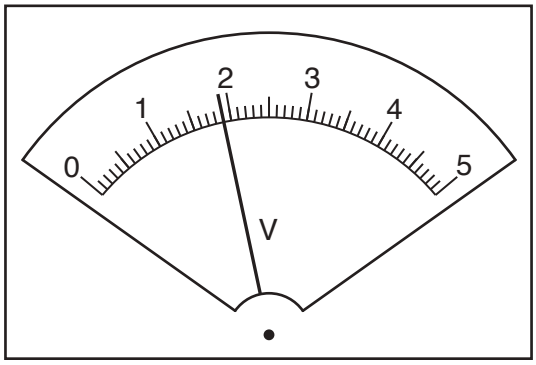

Fig. 3.4

Record the value of the p.d. V_X across lamp **X**, shown in Fig. 3.3.

V_X = ...

Record the value of the p.d. V_Y across lamp **Y**, shown in Fig. 3.4.

V_Y = ...
[1]

(ii) She then measures the p.d. V_S across both lamps in series.

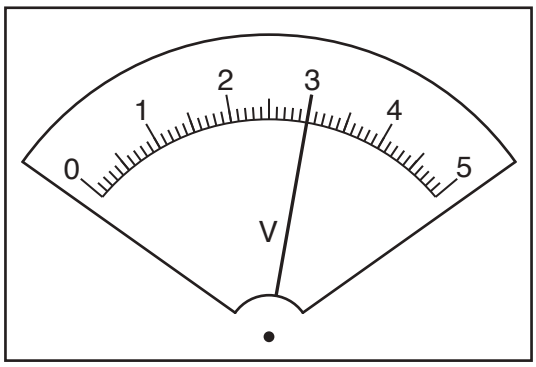

Fig. 3.5

Record the value of the p.d. V_S across both lamps in series, shown in Fig. 3.5.

V_S = ...[1]

(iii) A student suggests that V_S should be equal to (V_X + V_Y).
State whether the readings support this suggestion. Justify your statement with reference to the results.

statement .....

justification .....

.....

.....
[2]

(d) Calculate the resistance R_1 of lamp **X**. Use the readings from **(b)** and **(c)(i)** and the equation $R_1 = \frac{V_X}{I_S}$.

R_1 = ... Ω [1]

(e) **(i)** The circuit components are to be rearranged so that

- lamps **X** and **Y** are connected in parallel
- the ammeter measures the current in lamp **X** only
- the voltmeter measures the p.d. across the lamps.

Draw a circuit diagram of this arrangement.

[2]

(ii) The student sets up the circuit as described in **(e)(i)**.

She measures and records the current in lamp **X** and the p.d. across the lamps.

She then calculates a new resistance R_2 for lamp **X** in this parallel circuit.

R_2 = ...8.3 Ω.....

The student notices that lamp **X** is very bright in this parallel circuit, but it was dim in the series circuit in **(a)**.

Suggest how temperature affects the resistance of a lamp.
Justify your suggestion by reference to the value of R_1 from **(d)** and the value of R_2.

.....

.....

.....

.....
[2]

[Total: 11]

4 A student is investigating the factors that affect the size of the crater (hole) a ball makes when it is dropped into sand.

Plan an experiment which would enable you to investigate one factor which might affect the size of the crater.

The apparatus available includes

metal balls of different sizes
a tray of sand

Write a plan for the experiment.

In your plan you should:

- state which factor is being investigated,
- state the key variables that you would control,
- list any additional apparatus needed,
- explain briefly how you would carry out the experiment including what would be measured and how this would be done,
- state the precautions which should be taken to obtain reliable results,
- suggest a suitable graph which could be drawn from the results.

You may draw a diagram if it helps to explain your plan.

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.....[7]

[Total: 7]

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PHYSICS **0625/51**

Paper 5 Practical Test **May/June 2018**

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Instructions for preparing apparatus

The Supervisor is **not** allowed to consult the Question Paper before the examination. The teacher should, as part of the preparation of the examination requirements, test the apparatus in order to ensure that it is satisfactory.

The Supervisor is asked to give (and attach to the Supervisor's Report printed on pages 7 and 8) a *brief* description of the apparatus supplied, mentioning any points that are likely to be of importance to the Examiner in marking the answers. The Supervisor should also report any assistance given to candidates. All reports should be signed by the Supervisor.

In addition to the usual equipment of a physics laboratory, each candidate will require the apparatus specified in these Confidential Instructions. If a candidate breaks any of the apparatus, or loses any of the material supplied, the matter should be rectified and a note made in the Supervisor's Report.

Number of sets of apparatus

As a *minimum*, the number of sets of apparatus provided should be $N/3$, where N is the number of candidates (per session). A few spare sets should, preferably, be available to avoid any candidate being delayed when moving to another question.

The order in which a given candidate attempts the four questions is immaterial. It is suggested that candidates spend **about 20 minutes on each of questions 1 to 3, and about 15 minutes on question 4**.

Assistance to candidates

The purpose of the Practical Physics Test is to find out whether the candidates can carry out simple practical work themselves. The Examiners are aware that candidates may sometimes be unable to show their practical ability through failure to understand some point in the theory of the experiment. If an Examiner were present in the laboratory, he/she would be willing to give a hint to enable such a candidate to get on with an experiment. In order to overcome this difficulty, the Supervisor is asked to co-operate with the Examiners to the extent of being ready to give (or allow the physics teacher to give) a hint to a candidate who is unable to proceed.

The following regulations must be strictly adhered to.

(i) No hint may be announced to the candidates as a whole.

(ii) A candidate who is unable to proceed and requires assistance must come up to the Supervisor and state the difficulty. Candidates should be told that the Examiners will be informed of any assistance given in this way.

(iii) A report must be made of any assistance given to a candidate, with the name and candidate number of the candidate.

It is suggested that the following announcement be made to the candidates.

'The Examiners do not want you to waste time through inability to get on with an experiment. Any candidate, therefore, who is unable to get on with the experiment after spending five minutes at it may come to me and ask for help. I shall report to the Examiners any help given in this way, and some marks may be lost for the help given. You may ask me for additional apparatus which you think would improve the accuracy of your experiments, and you should say, on your script, how you use any such apparatus supplied.'

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Question 1

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Clamp, boss and stand.

(ii) Pendulum bob attached to approximately 110 cm of thin inextensible string.

(iii) Metre rule.

(iv) Stopclock or stopwatch with a minimum precision of 0.1 s. Candidates may use their own wristwatch if suitable.

(v) Split cork or similar device to hold the string of the pendulum between the jaws of the clamp.

Notes

1. The pendulum should be set up for the candidates with length approximately 60 cm from the bottom of the split cork to the bottom of the pendulum bob.

2. Candidates must be able easily to adjust the length of the pendulum up to a length of 100 cm. The pendulum must be able to swing freely at this length.

3. It may be necessary to increase the stability of the clamp stand (for example, using a G-clamp or by placing a weight on the base).

Action at changeover

Arrange the pendulum as described in Note 1.

Question 2

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Power supply of approximately 1.5 V – 3 V. Where candidates are provided with a power supply with a variable output voltage, the voltage must be set by the Supervisor and fixed (e.g. taped). See note 2.

(ii) Three resistors of nominal value 4.7 Ω with a power rating of at least 2 W. See note 3.

(iii) Switch. The switch may be an integral part of the power supply.

(iv) Ammeter capable of reading up to 1.00 A with a resolution of at least 0.05 A. See note 4.

(v) Voltmeter capable of measuring the supply p.d. with a resolution of at least 0.1 V. See note 4.

(vi) Sufficient connecting leads to construct the circuit shown in Fig. 2.1.

Notes

1. The circuit is to be connected by the Supervisor as shown in Fig. 2.1.

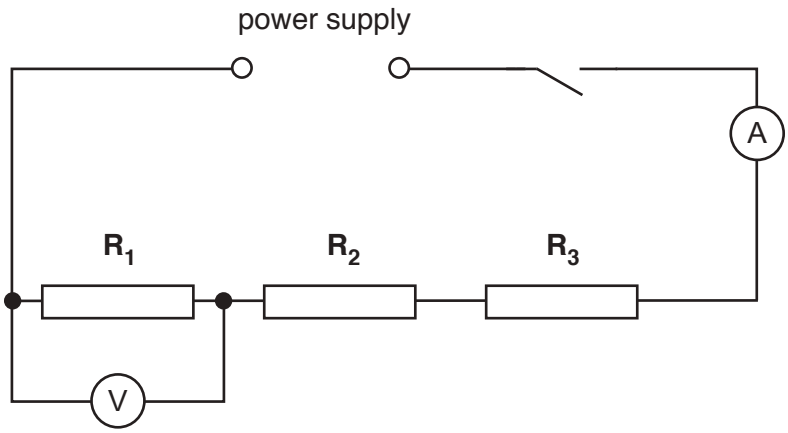

Fig. 2.1

2. If cells are to be used, they must remain adequately charged throughout the examination. Spare cells must be available.

3. The resistors must be labelled $\mathbf{R_1}$, $\mathbf{R_2}$ and $\mathbf{R_3}$. The values of resistance must **not** be visible to the candidates. The resistors must have suitable terminals so that candidates are able easily and quickly to rearrange the circuit.

4. Either analogue or digital meters are suitable. Any variable settings must be set by the Supervisor and fixed (e.g. taped). Spare meters should be available.

Action at changeover

Set up the circuit so that it is arranged as shown in Fig. 2.1.
Check that the circuit works. Switch off.

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Question 3

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Converging lens, focal length between 14 cm and 16 cm, with a suitable holder.

(ii) Illuminated object with a triangular hole of height 1.5 cm (see Figs. 3.1 and 3.2). The hole is to be covered with thin translucent paper (e.g. tracing paper). See notes 1 and 2.

(iii) Metre rule, calibrated in mm.

(iv) Screen. A white sheet of stiff card approximately 15 cm × 15 cm, fixed to a wooden support is suitable. See Fig. 3.3.

(v) Spare lamps should be available.

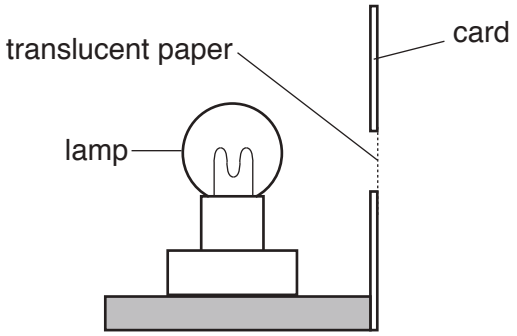

Fig. 3.1

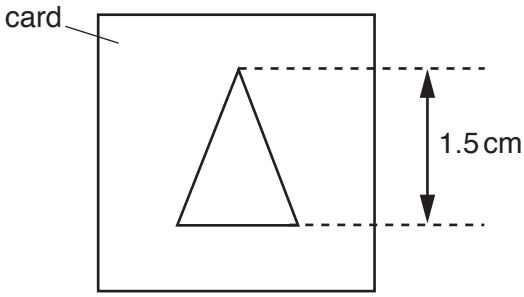

Fig. 3.2

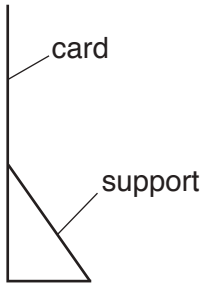

Fig. 3.3

Notes

1. The lamp for the illuminated object should be a low voltage lamp, approximately 24 W or higher power, with a suitable power supply.

2. The centre of the triangular hole, the lamp filament and the centre of the lens in its holder are all to be at the same height above the bench.

3. The apparatus is to be situated away from direct sunlight.

Action at changeover

Check that the apparatus is ready for the next candidate. The apparatus should **not** be left as arranged by a previous candidate.

Question 4

No apparatus is required for this question.

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This form must be completed and returned with the scripts.

SUPERVISOR'S REPORT

General

The Supervisor is required to give details of any difficulties experienced by particular candidates, giving their names and candidate numbers. These should include reference to:

(a) difficulties due to faulty apparatus;

(b) accidents to apparatus or materials;

(c) any other information that is likely to assist the Examiner, especially if this cannot be discovered in the scripts;

(d) any help given to a candidate.

Information required

A plan of workbenches, giving details by candidate number of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts.

The space below can be used for this, or it may be on separate paper.

Information required (cont.)

A list by name and candidate number of candidates requiring help, with details of the help provided.

CENTRE NO. .....

NAME OF CENTRE .....

Declaration (to be signed by the Supervisor).

The preparation of the practical examination has been carried out so as to maintain fully the security of the examination.

SIGNED .....
Supervisor

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PHYSICS **0625/52**

Paper 5 Practical Test **May/June 2018**

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Question 1

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Plastic or polystyrene drinks cup with a volume of approximately 180 cm^3 – 250 cm^3.

(ii) 30 cm ruler graduated in mm. Candidates may use their own.

(iii) 250 cm^3 or 100 cm^3 measuring cylinder.

(iv) A beaker containing approximately 200 cm^3 of water at room temperature. See note 1.

(v) Top-pan balance capable of measuring masses up to 200 g to the nearest gram. A balance may be shared between several candidates but the balance must be situated so that it is easily accessible to them.

(vi) Supply of paper towels to mop up any spills of water.

Notes

1. The beaker must be labelled '**W**'.

Action at changeover

Refill the beaker **W**.

Empty the measuring cylinder and plastic cup.

Replace the plastic cup, if necessary.

Question 2

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Thermometer, –10 °C to 110 °C, graduated in 1°C intervals.

(ii) 250 cm^3 beaker.

(iii) 100 cm^3 or 250 cm^3 measuring cylinder.

(iv) Stopclock, stopwatch or wall-mounted clock showing seconds. Candidates may use their own wristwatch if suitable. The question will refer to a stopclock.

(v) Supply of hot water. See notes 1 and 2.

(vi) Clamp, boss and stand. See note 3.

(vii) Supply of paper towels to mop up any spills of water.

Notes

1. The hot water is to be supplied for each candidate by the Supervisor. The water should be maintained at a temperature as hot as is reasonably and safely possible. Each candidate will require about 300 cm^3 of hot water.

2. Candidates should be warned of the dangers of burns or scalds when using very hot water.

3. The clamp, boss and stand must be set up for the candidates with the thermometer held in the clamp. The candidates must be able to read temperatures up to 100 °C.

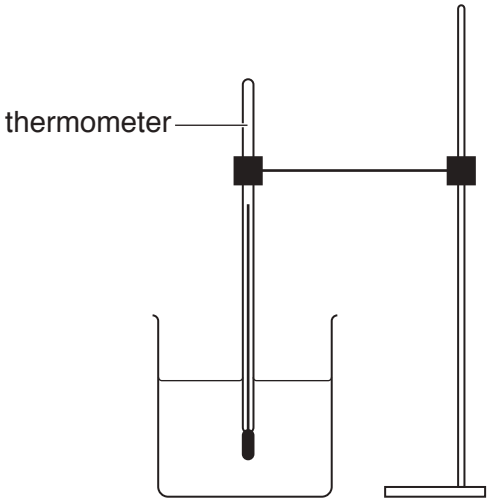

Fig. 2.1

Action at changeover

Empty the beaker and measuring cylinder.

Check the supply of hot water.

Question 3

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Converging lens, focal length between 14 cm and 16 cm, with a suitable holder.

(ii) Illuminated object with a triangular hole of height 1.5 cm to 2.0 cm (see Figs. 3.1 and 3.2). The hole is to be covered with thin translucent paper (e.g. tracing paper). See notes 1 and 2.

(iii) Metre rule calibrated in mm.

(iv) Screen. A white sheet of stiff card approximately 15 cm × 15 cm, fixed to a wooden support is suitable. See Fig. 3.3.

(v) Spare lamps should be available.

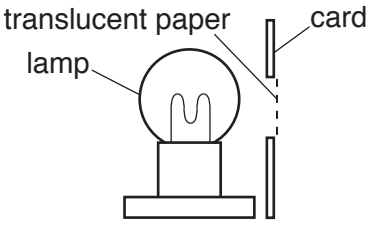

Fig. 3.1

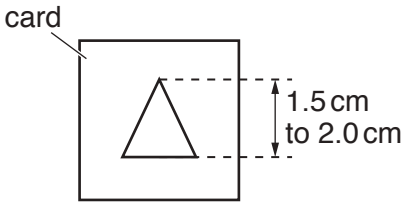

Fig. 3.2

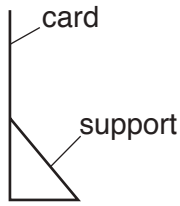

Fig. 3.3

Notes

1. The lamp for the illuminated object should be a low voltage lamp, approximately 24 W or higher power, with a suitable power supply.

2. The centre of the hole which forms the object, the lamp filament and the centre of the lens in its holder are all to be at the same height above the bench.

3. The apparatus is to be situated away from direct sunlight.

Action at changeover

Check that the apparatus is ready for the next candidate.

Question 4

No apparatus is required for this question.

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SUPERVISOR'S REPORT

General

The Supervisor is required to give details of any difficulties experienced by particular candidates giving their names and candidate numbers. These should include reference to:

(a) difficulties due to faulty apparatus;

(b) accidents to apparatus or materials;

(c) any other information that is likely to assist the Examiner, especially if this cannot be discovered in the scripts;

(d) any help given to a candidate.

Information required

A plan of workbenches, giving details by candidate number of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts.

The space below can be used for this, or it may be on separate paper.

Information required (cont.)

A list by name and candidate number of candidates requiring help, with details of the help provided.

CENTRE NO. .....

NAME OF CENTRE .....

Declaration (to be signed by the Supervisor)

The preparation of the practical examination has been carried out so as to maintain fully the security of the examination.

SIGNED .....
Supervisor

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/53**

Paper 5 Practical Test **May/June 2018**

CONFIDENTIAL INSTRUCTIONS

Great care should be taken to ensure that any confidential information given does not reach the candidates either directly or indirectly.

If you have any queries regarding these Confidential Instructions, please contact Cambridge stating the Centre number, the nature of the query and the syllabus number quoted above.

e-mail info@cie.org.uk
phone +44 1223 553554
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Instructions for preparing apparatus

The Supervisor is **not** allowed to consult the Question Paper before the examination. The teacher should, as part of the preparation of the examination requirements, test the apparatus in order to ensure that it is satisfactory.

The Supervisor is asked to give (and attach to the Supervisor's Report printed on pages 7 and 8) a *brief* description of the apparatus supplied, mentioning any points that are likely to be of importance to the Examiner in marking the answers. The Supervisor should also report any assistance given to candidates. All reports should be signed by the Supervisor.

In addition to the usual equipment of a physics laboratory, each candidate will require the apparatus specified in these Confidential Instructions. If a candidate breaks any of the apparatus, or loses any of the material supplied, the matter should be rectified and a note made in the Supervisor's Report.

Number of sets of apparatus

As a *minimum*, the number of sets of apparatus provided should be $N/3$, where N is the number of candidates (per session). A few spare sets should, preferably, be available to avoid any candidate being delayed when moving to another question.

The order in which a given candidate attempts the four questions is immaterial. It is suggested that candidates spend **about 20 minutes on each of questions 1 to 3, and about 15 minutes on question 4**.

Assistance to candidates

The purpose of the Physics Practical Test is to find out whether the candidates can carry out simple practical work themselves. The Examiners are aware that candidates may sometimes be unable to show their practical ability through failure to understand some point in the theory of the experiment. If an Examiner were present in the laboratory, he/she would be willing to give a hint to enable such a candidate to get on with an experiment. In order to overcome this difficulty, the Supervisor is asked to co-operate with the Examiners to the extent of being ready to give (or allow the physics teacher to give) a hint to a candidate who is unable to proceed.

The following regulations must be strictly adhered to.

(i) No hint may be announced to the candidates as a whole.

(ii) A candidate who is unable to proceed and requires assistance must come up to the Supervisor and state the difficulty. Candidates should be told that the Examiners will be informed of any assistance given in this way.

(iii) A report must be made of any assistance given to a candidate, with the name and candidate number of the candidate.

It is suggested that the following announcement be made to the candidates.

'The Examiners do not want you to waste time through inability to get on with an experiment. Any candidate, therefore, who is unable to get on with the experiment after spending five minutes at it may come to me and ask for help. I shall report to the Examiners any help given in this way, and some marks may be lost for the help given. You may ask me for additional apparatus which you think would improve the accuracy of your experiments, and you should say, on your script, how you use any such apparatus supplied.'

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Question 1

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) 250 cm^3 beaker. See notes 1 and 3.

(ii) Two lids to fit the beaker, labelled **A** and **B**. See note 2.

(iii) Thermometer: –10 °C to 110 °C, graduated in 1 °C intervals. See note 1.

(iv) Clamp, boss and stand. See note 1.

(v) Stopclock or stopwatch or wall-mounted clock showing seconds. Candidates will be required to take readings at 30-second intervals. They may use their own wristwatches. The question will refer to a stopclock.

(vi) Supply of hot water. See notes 4 and 5.

(vii) Paper towels to soak up any water spillages.

Notes

1. The thermometer, clamp, boss and stand are to be set up for candidates as shown in Fig. 1.1. The thermometer bulb must be well below the 100 cm^3 level of the beaker.
Candidates must be able easily and safely to read temperatures up to 100 °C and to move the thermometer in and out of the beaker.

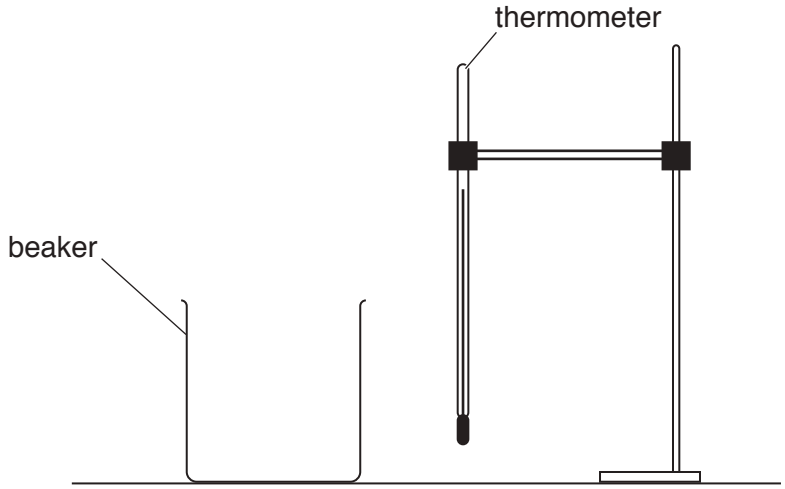

Fig. 1.1

2. Thin cardboard is a suitable material for the lids.
Lid **A** and lid **B** must be cut to shape as shown in Fig. 1.2 and Fig. 1.3. They must each be stable when partly covering the beaker as shown.

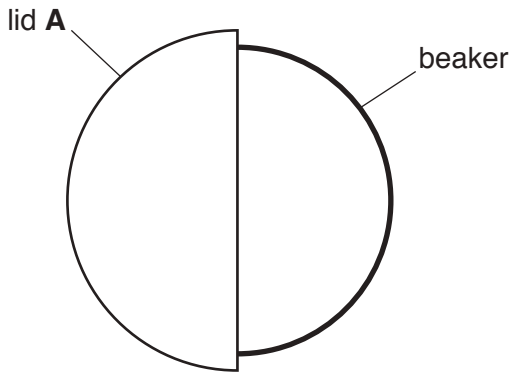

Fig. 1.2

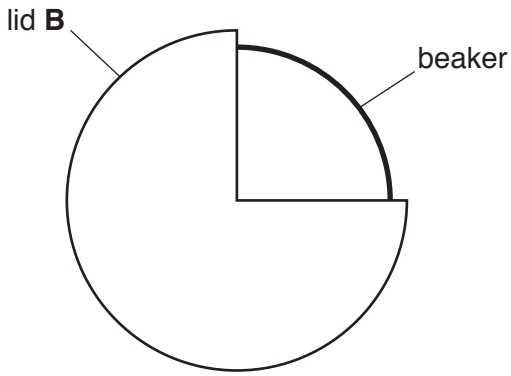

Fig. 1.3

3. If the beaker does not have volume markings, the 100 cm^3 level must be indicated.

4. Hot water is to be available for each candidate throughout the experiment. The hot water should be maintained at an approximately constant temperature between 80 °C and 90 °C. Each candidate will require about 250 cm^3 of hot water in total.
They must be able to pour hot water into the beakers safely. Candidates will need to dispose of hot water during the experiment.

5. Candidates should be warned of the dangers of burns and scalds when using very hot water.

Action at changeover

Empty the water from the beaker. Check that the apparatus is intact and is arranged as in Fig. 1.1.
Spare lids, labelled **A** and **B**, must be available.

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Question 2

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) One 2 W resistor approximately 2 Ω, labelled 'fixed resistor'. See note 2.

(ii) Three 2 W resistors, approximately 1 Ω, 3 Ω and 10 Ω, labelled **X**, **Y** and **Z** respectively. See notes 1 and 2.

(iii) Power supply of approximately 2 V – 3 V. See note 3.
Where candidates are provided with a variable power supply, the voltage should be set by the Supervisor and fixed, e.g. taped.

(iv) Switch. The switch may be an integral part of the power supply.

(v) Sufficient connecting leads to set up the circuit shown in Fig. 2.1.

(vi) Ammeter capable of measuring currents up to 1.00 A with a resolution of at least 0.05 A . See note 4.

(vii) Voltmeter capable of measuring up to 3.0 V with a resolution of at least 0.1 V . See note 4.

Notes

1. These resistors must have suitable terminals so that candidates are able easily and quickly to connect **X**, **Y** and **Z** into the circuit.

2. The circuit is to be set up for candidates as shown in Fig. 2.1. The fixed resistor is to remain in the circuit during the experiment.

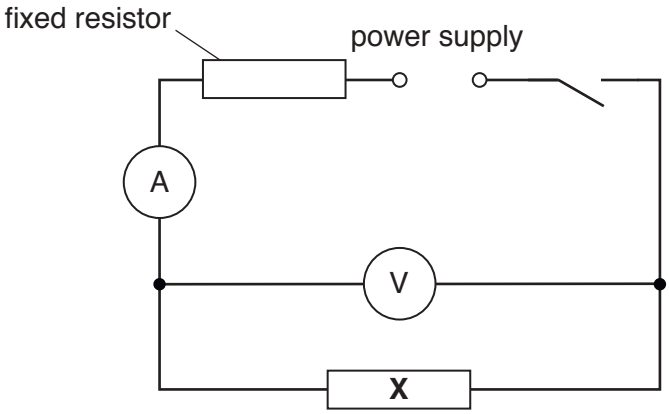

Fig. 2.1

3. If cells are used, they must remain adequately charged throughout the examination. Spare cells must be available.

4. Either analogue or digital meters are suitable. Any variable settings should be set by the Supervisor and fixed, e.g. taped. Spare meters should be available.

Action at changeover

Connect the circuit as shown in Fig. 2.1. Ensure that resistor **X** is connected in the circuit. Check that the circuit is working.
Switch the circuit off.

Question 3

Items to be supplied by the Centre (per set of apparatus unless otherwise specified)

(i) Converging lens of focal length between 14 cm and 16 cm with a suitable holder.

(ii) Metre rule calibrated in mm.

(iii) Illuminated object consisting of rigid card with a triangular hole of height 1.5 cm to 2.0 cm (see Fig. 3.1). The hole is to be covered with thin translucent paper (e.g. tracing paper) secured with adhesive tape. See note 1.

(iv) Plain white screen. A white sheet of stiff card approximately 150 mm × 150 mm, fixed to a wooden support, is suitable (see Fig. 3.2).

(v) 50 cm or 30 cm ruler, graduated in mm. Candidates may use their own.

Notes

1. The lamp used for the illuminated object should be low voltage, 24 W or greater, with a suitable power supply.

2. The lamp filament, the centre of the hole which forms the object and the centre of the lens in its holder must all be the same height above the bench.

3. The apparatus should be situated away from direct sunlight.

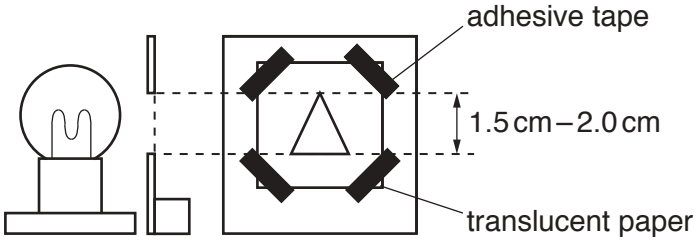

Fig. 3.1

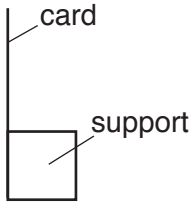

Fig. 3.2

Action at changeover

Check that the apparatus is intact and that the lamp is working.
Replace or re-cover the screen if it has been marked.
Switch off.

Question 4

No apparatus is required for this question.

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CENTRE NO. .....

NAME OF CENTRE .....

Declaration (to be signed by the Supervisor)

The preparation of the practical examination has been carried out so as to maintain fully the security of the examination.

SIGNED .....
Supervisor

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Grade thresholds – June 2018

Cambridge IGCSE™ Physics (0625)

Grade thresholds taken for Syllabus 0625 (Physics) in the June 2018 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 11	40	–	–	23	20	17	15	13
Component 12	40	–	–	25	21	17	15	13
Component 13	40	–	–	24	21	18	15	12
Component 21	40	27	23	20	18	16	14	12
Component 22	40	28	24	20	18	16	13	10
Component 23	40	28	25	22	19	16	13	10
Component 31	80	–	–	47	40	33	26	19
Component 32	80	–	–	41	35	28	20	12
Component 33	80	–	–	43	35	26	19	12
Component 41	80	46	34	22	19	16	13	10
Component 42	80	50	39	29	23	18	14	10
Component 43	80	44	33	23	19	14	10	6
Component 51	40	25	22	19	16	14	11	8
Component 52	40	28	25	23	20	17	14	11
Component 53	40	26	23	20	17	15	12	9
Component 61	40	28	24	21	18	16	12	8
Component 62	40	28	25	22	19	16	13	10
Component 63	40	25	21	18	15	13	10	7

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **200**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
BX	21, 41, 51	143	121	99	77	67	58	48	38
BY	22, 42, 52	152	131	110	89	76	64	51	38
BZ	23, 43, 53	141	121	101	82	69	57	44	31
CX	21, 41, 61	147	124	101	79	69	60	49	38

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Grade thresholds continued

Cambridge IGCSE Physics (0625)

Option	Combination of Components	A*	A	B	C	D	E	F	G
CY	22, 42, 62	153	131	109	88	75	63	50	37
CZ	23, 43, 63	140	120	100	80	67	55	42	29
FX	11, 31, 51	–	–	–	112	96	81	66	51
FY	12, 32, 52	–	–	–	112	95	78	62	46
FZ	13, 33, 53	–	–	–	110	92	75	58	41
GX	11, 31, 61	–	–	–	114	98	83	67	51
GY	12, 32, 62	–	–	–	111	94	77	61	45
GZ	13, 33, 63	–	–	–	108	90	73	56	39

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PHYSICS **0625/11**

Paper 1 Multiple Choice (Core) **May/June 2018**

MARK SCHEME

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1	A	**1**
2	D	**1**
3	C	**1**
4	B	**1**
5	D	**1**
6	C	**1**
7	A	**1**
8	B	**1**
9	D	**1**
10	D	**1**
11	A	**1**
12	C	**1**
13	D	**1**
14	C	**1**
15	A	**1**
16	C	**1**
17	B	**1**
18	B	**1**
19	B	**1**
20	B	**1**
21	A	**1**
22	B	**1**
23	A	**1**
24	A	**1**
25	B	**1**
26	D	**1**
27	C	**1**
28	B	**1**

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Question	Answer	Marks
29	A	**1**
30	C	**1**
31	C	**1**
32	D	**1**
33	D	**1**
34	B	**1**
35	C	**1**
36	C	**1**
37	D	**1**
38	D	**1**
39	C	**1**
40	C	**1**

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PHYSICS **0625/12**

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2	B	**1**
3	C	**1**
4	C	**1**
5	D	**1**
6	A	**1**
7	B	**1**
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21	C	**1**
22	A	**1**
23	C	**1**
24	B	**1**
25	D	**1**
26	C	**1**
27	B	**1**
28	C	**1**

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Question	Answer	Marks
29	C	**1**
30	D	**1**
31	D	**1**
32	D	**1**
33	B	**1**
34	A	**1**
35	A	**1**
36	C	**1**
37	D	**1**
38	B	**1**
39	A	**1**
40	B	**1**

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PHYSICS **0625/13**

Paper 1 Multiple Choice (Core) **May/June 2018**

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2	D	**1**
3	C	**1**
4	B	**1**
5	B	**1**
6	B	**1**
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23	B	**1**
24	C	**1**
25	D	**1**
26	C	**1**
27	B	**1**
28	C	**1**

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Question	Answer	Marks
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30	B	**1**
31	B	**1**
32	D	**1**
33	B	**1**
34	C	**1**
35	B	**1**
36	C	**1**
37	D	**1**
38	C	**1**
39	A	**1**
40	B	**1**

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PHYSICS **0625/21**

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2	C	**1**
3	D	**1**
4	B	**1**
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24	D	**1**
25	C	**1**
26	B	**1**
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28	C	**1**

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Question	Answer	Marks
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30	B	**1**
31	D	**1**
32	B	**1**
33	B	**1**
34	C	**1**
35	A	**1**
36	A	**1**
37	D	**1**
38	D	**1**
39	C	**1**
40	A	**1**

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **May/June 2018**

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2	C	**1**
3	B	**1**
4	C	**1**
5	D	**1**
6	C	**1**
7	D	**1**
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22	A	**1**
23	A	**1**
24	D	**1**
25	C	**1**
26	B	**1**
27	B	**1**
28	C	**1**

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Question	Answer	Marks
29	D	**1**
30	B	**1**
31	D	**1**
32	B	**1**
33	D	**1**
34	A	**1**
35	A	**1**
36	A	**1**
37	D	**1**
38	D	**1**
39	A	**1**
40	A	**1**

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PHYSICS **0625/23**

Paper 2 Multiple Choice (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1	A	**1**
2	C	**1**
3	A	**1**
4	B	**1**
5	A	**1**
6	A	**1**
7	B	**1**
8	D	**1**
9	B	**1**
10	B	**1**
11	B	**1**
12	D	**1**
13	B	**1**
14	D	**1**
15	B	**1**
16	C	**1**
17	B	**1**
18	B	**1**
19	B	**1**
20	D	**1**
21	A	**1**
22	A	**1**
23	D	**1**
24	B	**1**
25	C	**1**
26	D	**1**
27	D	**1**
28	C	**1**

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Question	Answer	Marks
29	C	**1**
30	C	**1**
31	D	**1**
32	B	**1**
33	A	**1**
34	C	**1**
35	C	**1**
36	C	**1**
37	D	**1**
38	C	**1**
39	D	**1**
40	A	**1**

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PHYSICS **0625/31**

Paper 3 Core Theory **May/June 2018**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	72 (s)	1
1(b)	(average speed =) distance ÷ time	1
	120 ÷ 54	1
	2.2(2) (m / s)	1
1(c)	area under line **OR** three areas indicated **OR** (dist =) (av.) speed × time **OR** 1/2 (b + h) × L	1
	$\frac{1}{2} \times 3.5 \times 4.0$ **OR** 7 (m) seen **OR** 6 × 3.5 OR 21 (m)	1
	6 × 3.5 **OR** 21 (m) **AND** $\{\frac{1}{2} \times 3.5 \times 4.0$ **OR** 7 (m)} **OR** 14 (m)	1
	(21 + 14 =) 35 (m)	1

Question	Answer	Marks
2(a)(i)	measure mass of empty measuring cylinder/beaker add measured/fixed volume of liquid measure mass of measuring cylinder/beaker and liquid determine mass of liquid (by subtracting mass empty from mass when full) use of D = M/V	5
2(a)(ii)	g / cm^3 **OR** kg / m^3	1
2(b)(i)	(polythene is) less dense (than water)	1
2(b)(ii)	W = m × g in any form **OR** (m =) W ÷ g **OR** 100 g weighs 1 N	1
	0.84 ÷ 10 **OR** 100 (g) × 0.84	1
	0.084 (kg) **OR** 84 g	1

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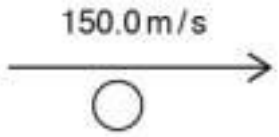
Question	Answer	Marks
3(a)	43.0 + 2.4 = 45.4 (N)	**1**
	(74.2 – 45.4 =) 28.8 (N)	**1**
	upwards	**1**
3(b)		**1**

Question	Answer	Marks
4(a)	Any **four** from: specs/dots (of light) (smoke/air particles) moving (smoke/air particles) randomly (because fast moving) air molecules collide with smoke particles (producing)Brownian motion	**4**
4(b)	evaporate/evaporation	**1**
	high(er) energy/enough energy/fast(er) moving molecules OR molecules with great(er) KE	**1**
	escape (from the water surface)	**1**

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Question	Answer	Marks
5(a)	Q S P R	**3**
5(b)	any **one** advantage from: continuous supply/steady supply or reverse argument any **one** disadvantage from: only available in certain areas/thin crust/near geysers or can damage water table OR limited lifespan/rocks can cool	**2**

Question	Answer	Marks
6(a)	(26 – 23 =) 3(°C)	**1**
6(b)	any **three** from: use metal pipe paint black or use black pipe use matt or dull (paint) (place) reflector behind pipe use long(er) pipe use pipe with great(er) surface area slow(er) flow rate (place) glass/(clear) plastic cover over pipe	**3**
6(c)	infra-red (radiation through space/air)	**1**
	conduction <u>through pipe</u>	**1**

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Question	Answer	Marks
7(a)(i)	blue between indigo and green	1
	yellow between green and orange	1
7(a)(ii)	arrow pointing right ⟶	1
7(b)(i)	ray(s) refracted down at first boundary (air/glass)	1
	correct refraction for candidate's ray (in glass prism)	1
7(b)(ii)	refraction	1

Question	Answer	Marks
8(a)(i)	tape measure	1
8(a)(ii)	reflection (of sound)	1
8(b)	time for sound to travel to wall and back = 1.0 s	1
	340 m in 1.0 s	1
	(speed =) 340	1
	m / s	1

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Question	Answer	Marks
9(a)(i)	X-rays between gamma rays and ultraviolet	**1**
	microwaves between infra-red and radio	**1**
9(a)(ii)	ring drawn around radio on Fig.9.1	**1**
9(b)	any **two** from: lead/metal apron (use long) tongs limit (time of) exposure point source away (from you) owtte	**2**

Question	Answer	Marks
10(a)	resistor identified	**1**
10(b)	quantity: current NOT amps ignore ammeter unit: A/amps/amperes	**2**
	quantity: potential difference or p.d. or emf unit: V/volts ignore voltmeter	**2**
10(c)	increasing (length) increases resistance owtte	**1**
	increasing (diameter) decreases resistance owtte	**1**

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Question	Answer	Marks
11(a)(i)	cell and switch connected in series with any part of conductor (on Fig.11.1)	1
	correct symbols used – (on Fig.11.1)	1
11(a)(ii)	circular	1
	around conductor/wire	1
11(a)(iii)	no change/nothing	1
11(b)	conductor/wire between the poles of a magnet	1
	opposite poles facing each other	1
	current in wire	1
	wire moves/Flemings left hand rule indicated	1

Question	Answer	Marks
12(a)(i)	α or alpha	1
12(a)(ii)	α or alpha	1
12(b)(i)	beta or β	1
	beta emission would be affected by the thickness of the metal owtte	1
12(b)(ii)	(counter) reading higher	1
12(b)(iii)	rollers move apart/provide less force/pressure owtte	1
12(b)(iv)	38	1

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PHYSICS **0625/32**

Paper 3 Core Theory **May/June 2018**

MARK SCHEME

Maximum Mark: 80

Published

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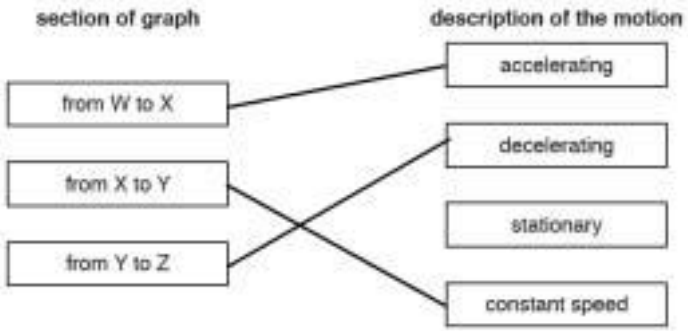
Question	Answer	Marks
1(a)	 1 mark for each correct line. 2 or more lines from any section loses the mark.	**3**
1(b)	(distance travelled) = area under graph OR ½ × base × height	**1**
	½ × 40 × 20	**1**
	400 (m)	**1**
1(c)	1st section/WX/from 0 s to 30 s has greater gradient than last (section)/YZ/from 60 s to 100 s	**1**

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Question	Answer	Marks
2(a)	(W =) m × g	1
	650 × 8	1
	5200 (N)	1
2(b)(i)	(volume of log =) 3 × 0.04 = 0.12 (m^3)	1
	D = M / V OR (D =) M / V	1
	550 (kg / m^3)	1
2(b)(ii)	The density of logs is less than density of water owtte.	1

Question	Answer	Marks
3(a)(i)	(moment =) force × distance	1
	150 × 0.5	1
	75	1
	N m	1
3(a)(ii)	accept any example involving turning forces	1
3(b)	increase distance (of force from pivot point)	1

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Question	Answer	Marks
4(a)(i)	38 (°C)	**1**
4(a)(ii)	2nd box ticked i.e. expansion of liquid	**1**
4(b)	conduction	**1**
4(c)	any **three** from: water is a fluid water molecules gain (kinetic) energy/move faster/further apart water expands/volume increases warm/hot water or molecules rises convection (current created) cooler/cold/water falls/sinks (to be heated again)	**3**
	correct reference to density change of water	**1**

Question	Answer	Marks
5(a)	(focal length =) 5 (cm)	**1**
5(b)(i)	straight line through F and then parallel to PA from centre of lens	**1**
5(b)(ii)	straight line from top of object through centre of lens	**1**
5(b)(iii)	image indicated at point where rays cross	**1**
	arrow drawn inverted on RHS of lens	**1**

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Question	Answer	Marks
6(a)	(thermal energy is used) to produce steam	1
	steam turns a turbine	1
	(turbine) turns a generator	1
6(b)	any **two** from: radioactive material/waste produced problems storing waste long half-life of waste/fission products (accidental) leak of nuclear/radioactive material	2

Question	Answer	Marks
7(a)(i)	microwaves	1
7(a)(ii)	3.0×10^8 (m / s)	1
7(a)(iii)	ultraviolet or X-rays or gamma/γ-rays	1
7(b)(i)	X-rays any one from: detecting broken bones/damaged teeth or detecting/treating cancer	1
	gamma: any one from: detecting/treating cancer or sterilising (hospital) equipment/food	1
7(b)(ii)	any **two** from: ionising radiations/high frequency/high energy (e-m radiation) (may) damage or mutate cells/DNA (may) cause radiation burns	2

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Question	Answer	Marks
8(a)(i)	vibrates	1
8(a)(ii)	longitudinal	1
8(a)(iii)	vacuum	1
8(b)(i)	1000 (Hz)	1
8(b)(ii)	frequency in range 10 001 to 30 000 (Hz)	1
8(b)(iii)	lowest frequency heard by humans is 20 Hz	1
	(but) elephants can hear frequencies below 20 Hz	1
8(b)(iv)	ultrasound	1

Question	Answer	Marks
9(a)(i)	top box (electrons) ticked	1
9(a)(ii)	12 + 6 seen or 18 (Ω)	1
9(a)(iii)	(V =) I × R	1
	(V =) 0.50 × 18(.0)	1
	(V =) 9.0 (V) ecf from **(a)(ii)**	1
9(b)	(reading/current) increases	1
	(because effective circuit) resistance decreases/resistors in parallel have less resistance	1

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Question	Answer	Marks
10(a)(i)	second box (The balloon loses electrons) ticked	**1**
10(a)(ii)	positive (charge)	**1**
	like charge(s) repel	**1**
10(b)	circle around copper **AND** silver	**1**

Question	Answer	Marks
11(a)(i)	(Q is the) secondary/output (coil)	**1**
11(a)(ii)	1. (soft–) iron	**1**
	2. core	**1**
11(a)(iii)	magnetic field **OR** e.m.f. **OR** magnet	**1**
	changing **OR** alternating	**1**
11(a)(iv)	EITHER more …**AND** step-down **OR** fewer …**AND** step-up	**1**
11(b)	any **two** from: smaller current (in wires) smaller drop in p.d./voltage (across cables) smaller heating effect less energy wasted/more efficient thinner cables can be used fewer pylons neededl (electricity) can be transmitted over long(er) distances	**2**

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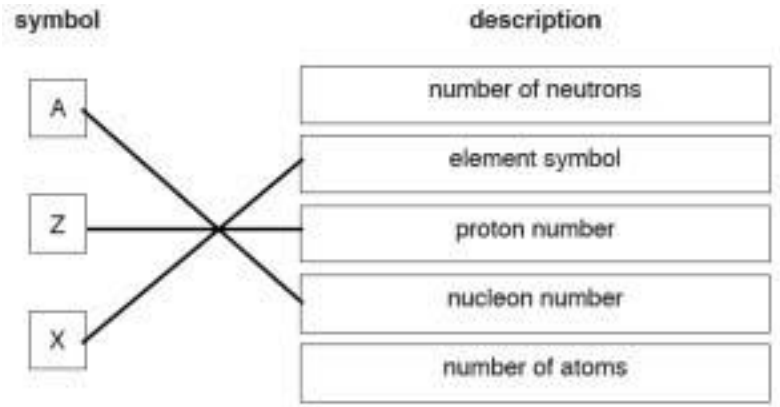
Question	Answer	Marks
12(a)	 1 mark for each correct line. 2 or more lines from any section loses the mark.	**3**
12(b)(i)	18 / 6 or 3 half lives seen or implied	**1**
	1 / 8 or division by 8	**1**
	1.5 (mg)	**1**
12(b)(ii)	any **two** from: high energy/fast-moving electron/negatively charged particle about 2000 times smaller than a proton/neutron	**2**
12(b)(iii)	any **one** from: new element formed neutron becomes/turns into a proton Z/proton number increases by one neutron number decreases by one	**1**

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PHYSICS **0625/33**

Paper 3 Core Theory **May/June 2018**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	2 : 33 : 65 – 1 : 22 : 15 **OR** 153.65 – 82.15	**1**
	71.50 (s)	**1**
1(b)	4 × 20 **OR** 4000 × 20	**1**
	(average speed =) distance ÷ time	**1**
	80 000 ÷ 1600	**1**
	50 (m / s)	**1**
1(c)(i)	(section) P or from 0 s to 2.5 s	**1**
	(line has) greatest gradient	**1**
1(c)(ii)	dist travelled = area under graph **OR** ½ × b × h	**1**
	½ × 2.5 × 40	**1**
	50 (m)	**1**

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Question	Answer	Marks
2(a)	W = m × g	**1**
	50 ÷ 1000 **OR** 0.05 seen	**1**
	0.5 (N)	**1**
2(b)	**any 4** from: fix ruler vertically add weight/hanger to spring fix pin (horizontally) to (top/bottom) of weight hanger pin arranged so near ruler scale ensure load stationary eye level with pin to take reading (of length) determine extension for given load repeat for different loads	**4**

Question	Answer	Marks
3(a)(i)	(D =) m ÷ v in any form	**1**
	120 ÷ 16.0	**1**
	7.50 (g / cm^3)	**1**
3(a)(ii)	10 (m / s^2)	**1**
3(b)(i)	(downward force) weight **AND** (upward force) air resistance/friction/drag	**1**
3(b)(ii)	(1.2 – 0.3 =) 0.9 (N)	**1**

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Question	Answer	Marks
4	moment = force × (perp.) distance (from pivot/bracket)	**1**
	25 × 90 or 25 × 0.9	**1**
	2250 or 22.5	**1**
	N cm or N m	**1**

Question	Answer	Marks
5(a)	P = F ÷ A **OR** (F =) P × A in any form	**1**
	20 000 × 0.009	**1**
	1800 (N)	**1**
5(b)	pressure increases	**1**
	any **two** from: molecules move faster/have more ke collide harder/more often (with walls of can) (change in momentum due to) collisions impart(s) force on can walls	**2**

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Question	Answer	Marks
6(a)(i)	80 – 56 OR 24(°C)	**1**
6(a)(ii)	20 – 18 or 2(°C)	**1**
6(b)	water hotter (at start)	**1**
	(so) greater temperature difference (between can and surroundings)	**1**
6(c)	(dull) black	**1**
	greater (rate of) loss of thermal energy (from dark colours) **OR** black or it is better radiator/emitter (of thermal energy)	**1**

Question	Answer	Marks
7(a)	(part **A**) radio	**1**
	(part **B**) visible/light	**1**
7(b)	transverse	**1**
7(c)(i)	IR/infra-red	**1**
7(c)(ii)	gamma **OR** γ **OR** X-rays **OR** ultraviolet	**1**

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Question	Answer	Marks
8(a)(i)	Longitudinal	**1**
8(a)(ii)	Amplitude	**1**
8(a)(iii)	pitch	**1**
8(b)	frequencies (of sound)	**1**
	above 20 000 Hz	**1**

Question	Answer	Marks
9(a)	Any **two** from: pole of magnet placed on/near steel rod magnet stroked along rod owtte repeat strokes same direction	**2**
9(b)	place pole of rod next to a known magnet	**1**
	like poles repel	**1**
9(c)	accept iron loses magnetism easily owtte or reverse argument	**1**

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Question	Answer	Marks
10(a)(i)	variable resistor	**1**
	change the current	**1**
10(a)(ii)	Any **three** from: use low value of current measure (and record) current measure (and record) voltage repeat other values (of I and V) plot graph of pd against current (and find gradient) OR use V = I × R	**3**
10(b)(i)	V = I × R in any form **OR** (I =) V ÷ R	**1**
	240 ÷ 21.8	**1**
	11.0 (A)	**1**
10(b)(ii)	Answer in range 12 to 15 (A)	**1**

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Question	Answer	Marks
11(a)	Correctly-drawn magnetic field around coil	1
	lines to start and end near coil/tube	1
	field line arrows point towards left hand of coil	1
11(b)	electromagnet	1
11(c)	(when switch S_1 is closed there is a) current in the coil (of wire)	1
	(soft) iron (core) becomes magnetised/magnetic field created	1
	soft iron armature attracted (to core)	1
	contacts/A and B close/(motor) circuit completed/current in motor circuit	1

Question	Answer	Marks
12(a)	neutron	1
	electron	1
12(b)	upper row: 2 in both	1
	lower row: 1 in left box **AND** 3 in right box	1
12(c)(i)	weak(ly) penetrating	1
12(c)(ii)	Any **two** from: absorbed over a short distance large mass high charge highly ionising cause cell mutation/damage DNA (high risk) of developing cancer	2

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/41**

Paper 4 Extended Theory **May/June 2018**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	Mention of gradient of graph at t = 30 s **OR** tangent drawn at t = 30 s and triangle drawn	1
	Acceleration in range 0.30 to 0.45 m / s^2	1
1(b)	Acceleration less/at a slower rate	1
	Less driving force **OR** greater resistive force/friction/air resistance/drag	1
	Resultant force less	1
1(c)	Area under graph	1
	Distance = (20 × 40) + (½ × 40 × 10) **OR** ½ × (30 + 20) × 40	1
	1000 m	1

Question	Answer	Marks
2(a)	Chemical (potential energy)	1
2(b)(i)	(E =) m × g × h **OR** 32 × 10 × 2.5	1
	800 J	1
2(b)(ii)	Output power = E ÷ t **OR** 800 ÷ 5.4 **OR** 148.148 (W)	1
	Eff. = output (power) ÷ input (power) **OR** $P_{out} \div P_{in}$ **OR** $E_{out} \div E_{in}$ **OR** output power ÷ 0.65 **OR** 148.148 ÷ 0.65 **OR** 800 ÷ 0.65	1
	= 230 W	1
2(c)	Advantage: not dependent on weather/wind blowing **OR** always available	1
	Disadvantage: polluting **OR** CO_2/SO_2/greenhouse gases emitted **OR** leads to global warming **OR** oil must be transported **OR** not renewable **OR** oil will run out/be used up	1

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Question	Answer	Marks
3(a)(i)	W = (4.8 × 10 =) 48 N	1
3(a)(ii)	(P =) F ÷ A OR 48 ÷ (0.12 × 0.16)	1
	2500 Pa	1
3(b)	Atmospheric pressure (in addition to liquid pressure)	1
3(c)	P = hdg or in words OR (d =) P ÷ hg OR 2500 ÷ (0.32 × 10)	1
	780 kg / m^3	1
	OR d = M ÷ V = 4.8 ÷ (0.12 × 0.16 × 0.32)	**(1)**
	780 kg / m^3	**(1)**

Question	Answer	Marks
4(a)(i)	(Molecules) vibrate	1
4(a)(ii)	random/haphazard/in all directions	1
	Any **one** of: with high speed freely zig-zag in straight lines	1
4(b)	(Molecules) collide with walls (of box) **OR** (Molecules) rebound from walls (of box)	1
	Change of momentum (occurs)	1
	force (on walls) = (total) change of momentum per second	1
	Pressure = (total) force ÷ (total) area (of walls)	1

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Question	Answer	Marks
5(a)(i)	Refraction **OR** reflection	**1**
5(a)(ii)	If refraction in **(i)** Change or increase or decrease in speed of wave **OR** change of refractive index **OR**	**1**
	If reflection in **(i)** Mention of surface or boundary	**(1)**
5(b)(i)	2 points both labelled F at 3.5 cm either side of optical centre of lens	**1**
5(b)(ii)	Any **two** of: Paraxial ray from tip of O refracted through farther F/3.5 cm Undeviated ray from tip of O through optical centre of lens Ray from tip of O through nearer F refracted paraxially	**2**
	Image/I drawn from intersection of rays to principal axis with indication that image is inverted	**1**
5(b)(iii)	In range 3.6 to 4.1 cm	**1**
5(b)(iv)	(Image is) real **and** light passes through it **OR** can be projected/seen on a screen **OR** refracted rays cross/meet	**1**

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Question	Answer	Marks
6(a)(i)	At least 3 circular wavefronts centred on gap extending to at least half of semicircle	**1**
	Same spacing as incident wavefronts	**1**
6(a)(ii)	At least 3 straight, parallel, wavefronts, approximately same length as width of gap	**1**
	Ends of straight lines curving towards but not reaching barrier	**1**
6(b)	Any **four** of: Diagram to show: labelled barrier, incident straight or curved waves Diagram shows appropriately reflected waves Water surface e.g. tank of water/ripple tank/pond/acceptable alternative How waves are produced: e.g., moving end or length of solid rod dipping into surface **OR** small solid object thrown in. Detail of barrier: made of metal, glass or wood fixed in position How observed: by eye, video, film, stroboscope	**4**

Question	Answer	Marks
7(a)	(Metals) contain free/mobile electrons/delocalised electrons	**1**
7(b)(i)	$R \alpha L$ **and** $R \alpha 1 \div A$ **OR** $R \alpha L \div A$ **OR** $R = 16 \times ½ \div 2$ **OR** $R = 16 \div 4$	**1**
	4.0 Ω	**1**
7(b)(ii)	$1 \div R = (1 \div R_1) + (1 \div R_2)$ **OR** $R = (R_1 \times R_2) \div (R_1 + R_2)$ **OR** $(1 \div R) = (1 \div 4) + (1 \div 16)$ **OR** $(4 \times 16) \div (4 + 16)$	**1**
	3.2 Ω	**1**
7(c)(i)	3E or 3 × E	**1**
7(c)(ii)	$I_B > I_2 > I_1$ (6th box ticked)	**1**

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Question	Answer	Marks
8(a)	(Q =) mc$\Delta\theta$ **OR** 200 × 4.2 × 22	**1**
	18000 J	**1**
8(b)	Q = m × L **OR** (L =) Q ÷ m **OR** 18 480 ÷ 60	**1**
	310 J / g	**1**
8(c)	(Thermal) energy/heat transfers from surroundings **OR** into water	**1**

Question	Answer	Marks
9(a)	Would not be effective **OR** No	**1**
	With current on **OR** the (alternating) current should not be switched off	**1**
	Magnet should be withdrawn from the coil	**1**
	OR Magnet would be alternately magnetised in different directions	**(1)**
	Would remain magnetised in the direction occurring at the moment of switching off	**(1)**
9(b)(i)	Coil turns	**1**
	Clockwise/continuously	**1**
	Current (in coil) reverses every half turn/when coil is in vertical position **OR** force on current in a magnetic field	**1**
9(b)(ii)	**1** × (4 × T)	**1**
	2 × (2 × T)	**1**
	3 × (T ÷ 2)	**1**

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Question	Answer	Marks
10(a)	To produce an alternating/changing magnetic field	1
	so that current/voltage is <u>induced</u> (continuously) in the <u>secondary</u> coil **OR** <u>secondary</u> circuit	1
10(b)(i)	$N_s \div N_p = V_s \div V_p$ in any form **OR** (N_s =) $N_p \times V_s \div V_p$ **OR** $8000 \times 6 \div 240$	1
	200	1
10(b)(ii)	$I_pV_p = I_sV_s$ in any form **OR** (I_p =) $I_s \times V_s \div V_p$ **OR** $2.0 \times 6 \div 240$	1
	0.050 A	1
10(b)(iii)	(Number of lamps =) $2 \div 0.05 = 40$	1

Question	Answer	Marks
11(a)	Number of protons = 86 and number of electrons = 86	1
	Number of neutrons = 136	1
11(b)	$^{218}_{84}Po$	1
	$+ ^{4}_{2}\alpha$	1
11(c)	7.6 days = 2 half-lives or evidence of two halvings	1
	(number of Rn atoms left = $6.4 \times 10^6 \div 4$ =) 1.6×10^6	1
	number of α-particles emitted = ($6.4 \times 10^6 - 1.6 \times 10^6$ =) 4.8×10^6	1

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Question	Answer	Marks
1(a)(i)	**1** straight line from (0,0) to (10,50)	**1**
	2 gradient/slope	**1**
1(a)(ii)	$a = \Delta v \div \Delta t$ in any form **OR** (a=) $\Delta v \div \Delta t$ **OR** (a =) (9–5) ÷ 10 **OR** 4 ÷ 10	**1**
	(a =) 0.40 m / s^2	**1**
1(b)(i)	straight line down from any point on y-axis to any speed at 100 s	**1**
	from (0,50) to (100,15)	**1**
1(b)(ii)	uses area <u>under</u> graph **OR** av speed × time **OR** $s=ut + ½ at^2$ **OR** $v^2=u^2 + 2as$	**1**
	100 × (50 + 15) ÷ 2 **OR** 100 × 15 + ½ (100 × 35) **OR** 5000 – ½ × 0.35 × 100^2	**1**
	3300 m	**1**

Question	Answer	Marks
2(a)	average/overall/combined density (of the metal and air contained) less (than density of sea water)	**1**
2(b)	(P =) $h \times \rho \times g$ **OR** (V=) $A \times l$ in any form	**1**
	(P= 1.2 × 1020 × 10 =) 12 000 (Pa) **OR** (V= 0.8 × 1.2 =) 0.96 (m^3)	**1**
	$P = F \div A$ **OR** (F =) $P \times A$ **OR** (W =) $V \times \rho \times g$	**1**
	(F = 12240 × 0.80 =) 9800 N **OR** (F = W =) 9800 N	**1**
2(c)	same numerical answer as **(b)**	**1**
	resultant/net (vertical) force = 0 **OR** downward force = upward force **OR** forces are balanced	**1**

Question	Answer	Marks
3(a)	(KE =) ½ × $m \times v^2$	**1**
	(KE =) ½ × 9500 × 75^2	**1**
	(KE =) 2.7 × 10^7 J	**1**
3(b)	$KE = F \times l$ **OR** (F =)$KE \div l$ **OR** (F =) 2.671875 × 10^7 × 150 **OR** $v^2 - u^2 = 2ax$ **OR** (a =) $v^2 - u^2 \div (2 \times x)$ **OR** (a =) $75^2 \div (2 \times 150) = 18.75$	**1**
	(F =) 1.8 × 10^5 N **OR** ((F =) $m \times a$ = 9500 × 18.75) = 1.8 × 10^5 N	**1**

Question	Answer	Marks
4(a)(i)	atoms drawn close to each other and in rows	**1**
4(a)(ii)	atoms drawn far apart and randomly positioned	**1**
4(b)(i)	(atoms) vibrate/oscillate	**1**
4(b)(ii)	attractive forces between atoms/molecules (in the rock) **OR** energy/work to separate atoms/molecules	**1**
	force (applied must be large enough) to overcome forces between atoms/molecules **OR** work/energy (large) enough to separate atoms/molecules	**1**
4(c)	helium spreads/diffuses/moves freely/collides with air (molecules)	**1**
	the helium atoms travel in all directions/randomly/at high speed	**1**
	OR helium rises	**(1)**
	helium has low density **OR** He atoms high speed	**(1)**

Question	Answer	Marks
5	diagram shows cans placed near heater	**1**
	put thermometers in water **AND** observe readings	**1**
	good detail e.g. cans equal distances from heater same water volumes/levels thermometers same positions in cans	**1**
	higher thermometer reading in black (painted) can **OR** black (surface) good/best/better absorber	**1**

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Question	Answer	Marks
6(a)	frequency 35 000 Hz ringed	**1**
	longitudinal ringed	**1**
6(b)	$v = f\lambda$ **OR** (λ =) $v \div f$	**1**
	(λ=) $3 \times 10^8 \div 1.3 \times 10^{17}$	**1**
	(λ =) 2.3×10^{-9} m	**1**
6(c)	X-rays ionising/harmful/dangerous (to humans)	**1**
	Any **one** from: patient rarely exposed low total dose on patient meaningful comment about benefit outweighs danger dentist frequently exposed total dose on dentist would be high if stayed in room	**1**
6(d)	microwaves harmful/dangerous (to humans)	**1**
	microwaves would pass through open door	**1**

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Question	Answer	Marks
7(a)	(speed/it) decreases	1
	refractive index > 1.0 **OR** sin (*i*) > sin (*r*) **OR** *i* > *r* **OR** refraction/bends towards normal **OR** $n_p > n_w$ **OR** sin (*i*) ÷ sin (*r*) = $c_w \div c_p$	1
7(b)(i)	paraxial ray refracts through F_2	1
	other ray continues undeviated	1
7(b)(ii)	candidate's rays from **(b)(i)** traced <u>back</u> to intersection	1
	image marked from intersection of candidate's rays to axis	1
7(b)(iii)	in range 2.7 cm to 3.3 cm **AND** rays converge to the left of the object	1
7(b)(iv)	virtual **AND** light does not pass through image/cannot be projected on to a screen **OR** object distance < f **OR** on left of object	1

Question	Answer	Marks
8(a)(i)	variable resistor **OR** rheostat	1
8(a)(ii)	voltmeter symbol correctly connected across 20 Ω resistor	1
8(b)	(*I* =)*V* ÷ *R* **OR** 6.0 ÷ 20 **OR** (any value < 6.0) ÷ 20	1
	correct calculation of I for V>0 accept point on graph with correct co-ordinates, apart from the origin	1
	straight line from (0,0) to (6.0,0.30) tolerance within ½ small square	1
8(c)(i)	(combined resistance) less (than the resistance of either/smaller resistor)	1
8(c)(ii)	steeper **OR** gradient greater **OR** description of how the line differs (e.g. reaches 0.40 A before V reaches 6.0 V) ignore 2nd line above 1st line	1

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Question	Answer	Marks
9(a)(i)	forces on AB and CD in opposite (vertical) directions	1
9(a)(ii)	Column 2 increased by factor 3 Box 6	1
	Column 3 increased by factor 3 Box 6	1
	Column 4 decreased by factor 2 Box 3	1
9(b)(i)	deflects **OR** shows I/V/p.d.	1
	returns to zero	1
9(b)(ii)	produces/changes magnetic field	1
	S pole at bottom **OR** magnetic field opposes motion/(magnetic) field of magnet	1

Question	Answer	Marks
10(a)(i)	electrons/–ve charges (in metal) move o.w.t.t.e. to top half/move up	1
10(a)(ii)	more –ve charges in top half than bottom **OR** more +ve charges in bottom half than top NOT if contradiction e.g. more +ve in top and more –ve in top	1
10(a)(iii)	helps (keep plastic sheet in place)/yes	1
	unlike charges attract **OR** attractive force between metal plate and plastic sheet	1
10(b)	**1** both threads angled away from other ball	1
	2 like/same/positive charges repel	1

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Question	Answer	Marks
11(a)	^{231}Th	1
	$_{90}Th$	1
11(b)(i)	splitting of a nucleus into (2) parts/light(er)nucleus	1
11(b)(ii)	(fission involves production of) ionising radiation **OR** radiation dangerous/harmful (to humans)	1
	(thick concrete walls) absorb/stop the radiation (and so protect workers)	1
11(b)(iii)	no CO_2/SO_2/greenhouse gases/acid rain	1
	nuclear waste (disposal) **OR** leaks of radioactive material **OR** risk of radiation in case of accident	1
11(c)	(52 hours =) 2 half-lives **OR** evidence of 2 halvings	1
	(after 52 hours number of thorium atoms left = $4.8 \times 10^9 \div 4$ =) 1.2×10^9 **OR** (number of thorium atoms decayed =) $\frac{3}{4} \times 4.8 \times 10^9$	1
	(number of atoms decayed = $4.8 \times 10^9 - 1.2 \times 10^9$) = 3.6×10^9	1

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1(a)	tangent on graph **OR** gradient **OR** (a =) $\Delta v \div \Delta t$ or $(v - u) \div t$	**C1**
	accept gradient increases; **not** gradient decreases	**C1**
	values from tangent or line 13 to 14 m / s^2	**A1**
1(b)(i)	gradient changes **OR** graph is curved	**B1**
1(b)(ii)	mass of space rocket <u>decreases</u> **OR** gravitational field strength decreases	**B1**
1(c)	area under graph **OR** (distance =) <u>average</u> speed × time	**C1**
	4550 × 100 **OR** (4100 + 5000) ÷ 2 × 100	**C1**
	4.5/4.55/4.6 × 10^5 m	**A1**

Question	Answer	Marks
2(a)(i)	(*KE* =) ½ × *m* × v^2	**C1**
	½ × 0.020 × 350^2	**C1**
	1200 J	**A1**
2(a)(ii)	(Δh =) *KE* ÷ *mg* **OR** 1200 ÷ (0.020 × 10) **OR** 1225 ÷ (0.020 × 10)	**C1**
	6000/6100 m	**A1**
2(b)(i)	(force of) air resistance acts downwards	**M1**
	adds to gravitational force/resultant force increases/deceleration increases/deceleration > *g*	**A1**
2(b)(ii)	(kinetic energy) to gravitational potential energy	**B1**
	(kinetic energy) to thermal/internal energy	**B1**

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Question	Answer	Marks
3(a)(i)	(p =) $h \times \rho \times g$ or $5.0 \times 1000 \times 10$	C1
	50 000 (Pa)	C1
	(total pressure = 50 000 + 1.0×10^5 =) 1.5×10^5 Pa	A1
3(a)(ii)	1.5×10^5 Pa	B1
3(b)	(rises because) density of gas is less than density of **OR** resultant upward force on bubble	B1
	(as bubble rises) pressure (of gas in bubble) decreases	B1
	(volume of bubble increases because) $p \times V$ = constant **OR** $V \propto 1 \div p$	B1

Question	Answer	Marks
4(a)	more energetic molecules escape/evaporate	B1
	less energetic molecules remain	B1
	average <u>kinetic</u> energy of molecules decreases **OR** temperature depends on <u>kinetic</u> energy	B1
4(b)	convection	B1
	surface/colder water more dense **OR** contracts	B1
	(cold water) sinks **OR** warmer water rises	B1
4(c)(i)1	difference between the maximum temperature and minimum temperature it can measure	B1
4(c)(i)2	distance moved by the thread per °C **OR** per unit temperature change	B1
4(c)(ii)	(range) increases **and** less expansion/increase in volume (of mercury per unit temperature rise)	B1

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Question	Answer	Marks
5(a)(i)	path shows three or more straight line sections	**B1**
	with sudden changes of direction **and** at least two different lengths	**B1**
5(a)(ii)	air molecules travelling in random (directions)	**B1**
	collide with the smoke particle	**B1**
5(b)	(average) speed of the molecules decreases	**B1**
	molecules collide less often (on the piston and the walls of the cylinder)	**B1**
	smaller momentum change molecules (on collision)	**B1**
	piston now has a greater force on its right-hand side **OR** pressure less than atmospheric	**B1**

Question	Answer	Marks
6(a)	attempt at compressions and rarefactions	**B1**
	at least one compression labelled **and** at least one rarefaction labelled	**B1**
	wavelength **and** labelled λ	**B1**
6(b)(i)	(it/frequency remains) constant	**B1**
6(b)(ii)	(it/wavelength) decreases	**B1**
6(c)	320 to 350 m / s	**B1**

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Question	Answer	Marks
7(a)	one side of wave(front) slows down before the other side	**B1**
	wave(front) slews around **OR** bends at boundary	**B1**
	bends towards the normal **OR** bends towards the side that slows first	**B1**
7(b)	(n =) $c \div v$ **OR** $(3.0 \times 0^8) \div (1.9 \times 10^8)$	**C1**
	1.6	**A1**

Question	Answer	Marks
8(a)(i)	straight line from tip of O to tip of I	**B1**
	dotted line/lens marked at 3.0 cm from O	**B1**
8(a)(ii)	Any **one** of: paraxial ray from tip of O refracting at lens to tip of I paraxial ray to I from lens **and** ray from O to meet it at lens	**B1**
8(a)(iii)	(focal length) in range 2.2 cm to 2.6 cm	**B1**
8(a)(iv)	real **and** light pass through it/projected on to screen/rays converge	**B1**
8(b)	(focused rays) set fire to curtain	**B1**

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Question	Answer	Marks
9(a)	(R =) $V \div I$ **OR** 12 ÷ 0.15	**C1**
	80 Ω	**A1**
9(b)(i)	increases	**B1**
9(b)(ii)	(voltmeter reading) decreases **OR** less p.d. across variable resistor	**B1**
	more p.d. across 20Ω/fixed resistor	**B1**
9(c)(i)	1.5 J of (electrical) energy supplied in driving charge around the circuit	**B1**
	energy per unit charge **OR** per coulomb	**B1**
9(c)(ii)	8	**B1**

Question	Answer	Marks
10(a)(i)	there is a reading **OR** shows I/V/p.d.	**M1**
	then returns to zero/centre	**A1**
10(a)(ii)	S/south-pole at the right-hand end which attracts the magnet	**B1**
	opposes the change (causing the deflection)	**B1**
10(b)(i)	(turns ratio or $N_P \div N_S$ =) $V_P \div V_S$ **OR** 240 ÷ 12	**C1**
	20 **OR** 20 ÷ 1 **OR** 20:1	**A1**
10(b)(ii)	**diode** underlined	**B1**

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Question	Answer	Marks
11(a)(i)	β(-particles)	**B1**
11(a)(ii)	α(-particles)	**B1**
11(a)(iii)	γ(-rays)	**B1**
11(b)(i)	downward curve	**B1**
11(b)(ii)	3 (half-lives identified) **OR** 168 ÷ 56	**C1**
	1 ÷ 8 **OR** 9.0×10^5 (Rn) atoms remain	**C1**
	(7.2 × 06 – 9.0 × 105 =) 6.3×10^6 (α-particles emitted)	**A1**

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PHYSICS **0625/51**

Paper 5 Practical Test **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(i)	t = 13 to 15 (s)	**1**
1(a)(ii)	$T = t / 10$ (s)	**1**
1(a)(iii)	T^2 correct	**1**
	Unit s^2	**1**
1(a)(iv)	g correct calculation from T^2	**1**
1(b)(i)	New set of values present with t value greater than **(a)(i)**	**1**
1(b)(ii)	g in range 8 to 12(m / s^2)	**1**
	both g *(1(a)(iv) and 1(b)(ii))* values 9 to 11(m / s^2)	**1**
1(c)	Use of additional d values **OR** use a larger d value	**1**
	Count more swings	**1**
1(d)	Any **one** from: Perpendicular viewing of rule Counting beginning with zero (owtte) Use of fiducial mark (owtte) Use of set-square or horizontal rule to aid measurement of d Use rule close to/touching the rule Time taken from centre of swing, (not extremities)	**1**

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Question	Answer	Marks
2(a)(i)	V_1 to at least 1 dp and < 4 V	1
	I to at least 2 dp and < 1 A	1
2(a)(ii)	Correct calculation of R_1	1
2(b)(i),(ii)	R_2 present within 10% of R_1	1
2(c)(i),(ii)	R_3 present **and** V, A, Ω at least once and not contradicted	1
2(c)(iii)	R correct **and** to 2 or 3 significant figures	1
2(d)	Statement matches readings (Expect YES)	1
	Justification to include the idea of within the limits of experimental accuracy (but accept beyond limits, if ecf allowed for statement matching readings)	1
2(e)	3 resistors in parallel	1
	Correct variable resistor symbol	1
	Other symbols **and** circuit correct	1

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Question	Answer	Marks
3(a)	Table:	
	First *u* 45 to 51 (cm) and first *v* 19 to 25	**1**
	u values > *v* values	**1**
	uv values correct	**1**
3(b)	Graph:	
	Axes correctly labelled and right way round	**1**
	Suitable scales	**1**
	All plots correct to ½ small square	**1**
	Good line judgement, single, thin, continuous line	**1**
3(c)	Triangle method clearly shown on graph	**1**
	Triangle using at least half of candidate's line	**1**
3(d)	Any **two** from: Finding exact position that gives clearest image Measuring to centre of lens Room too bright/lamp too dim	**2**

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Question	Answer	Marks
4	Method to include: Hot water in copper can, time taken for temperature to drop	**1**
	Correct use of at least 3 larger outer containers, separately	**1**
	Some indication that size of air gap is measured	**1**
	Any **two** from: Use of something to cover air gap Use of lid on copper can Same starting temperature Same room temperature Same volume of hot water Use of 'control' with no outer container Inner container standing on an insulator Uniform air gap all round	**2**
	Table with clear columns for temperature and / or time (to match method) and air-gap, with appropriate units	**1**
	Conclusion: Least temperature drop **OR** longest time for temperature to drop shows lowest cooling rate **OR** best insulation **OR** plot temperature against time and least gradient shows lowest cooling rate (ora)	**1**

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Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.

NOTE:
- If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line! The only marks available in this case are the first (axes right way round and labelled) So maximum 1.
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PHYSICS **0625/52**

Paper 5 Practical Test **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)(i)	2 or more measurements	**1**
	D_B correct within ± 2 mm	**1**
1(a)(ii)	D_T correct within ± 2 mm	**1**
1(a)(iii)	*D* correct average	**1**
1(b)(i)	*h* sensible in cm	**1**
1(b)(i),(ii)	*V* correct and *V* / 2 correct	**1**
1(c)(i)	*m* recorded	**1**
1(c)(ii)	*ρ* to 2/3 significant figures	**1**
	Answer in range 0.9 to 1.3	**1**
	g / cm^3 (or equivalent)	**1**
1(d)	Any **one** from: part (a) drawn circle not exact / thickness of rim or cup part (b) height is not length of side of cup / D^2 increases the inaccuracy in *D* part (c) volume measurements only to nearest 1 or 2 cm^3/mass of cup has been ignored	**1**

Question	Answer	Marks
2(a)	sensible value for θ_R <u>with unit</u>	**1**
2(b)	table: correct *t* values	**1**
	temperatures decreasing	**1**
2(c)	graph:	
	axes correctly labelled and right way round	**1**
	suitable scales	**1**
	all plots correct to ½ small square	**1**
	good line judgement, thin, continuous line	**1**
2(d)	horizontal line at θ_R correctly positioned	**1**
2(e)	any **two** from: higher starting temperature use of metal can instead of beaker lower room temperature/cold water bath use of a fan container with a greater surface area/larger beaker	**2**
2(f)	any **one** from: perpendicular viewing of thermometer wait for thermometer to reach θ_{MAX} before reading not allow thermometer to touch sides of beaker	**1**

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Question	Answer	Marks
3(a)(i)	v_1 = 45 to 80 (cm)	**1**
3(a)(ii)	value for *f* in range 14 to 16 (cm)	**1**
3(b)(i)	v_2 = 25 to 35 (cm)	**1**
3(b)(ii)	f_2 correct calculation	**1**
	within 10% of f_1	**1**
3(c)	*f* to 2 or 3 significant figures	**1**
	unit seen in **(a)**, **(b)** or **(c)** and not contradicted	**1**
3(d)	at least 3 values suggested	**1**
	new values between 20 cm and 70 cm	**1**
3(e)	any **two** from: use of darkened room/brighter lamp mark position of centre of lens on holder place metre rule on bench/clamp in position) ensure object and (centre of) lens are same height from the bench object <u>and</u> lens <u>and</u> screen perpendicular to bench move screen slowly/back and forth to obtain best image	**2**

Question	Answer	Marks
4	method to include:	
	place truck on ramp and (release)	1
	measure distance (travelled) from bottom of ramp	1
	repeat with different mass(es) (loaded on the same truck)	1
	additional apparatus:	
	(metre) rule(r) / measuring tape	1
	variables:	
	height/angle of ramp/number of supporting bricks	1
	release position/height above bench	1
	table with clear columns for mass, and distance travelled, with appropriate units in the headings of the table	1

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Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.

NOTE: – If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line! The only marks available in this case are the first (axes right way round and labelled) so maximum 1.

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PHYSICS **0625/53**

Paper 5 Practical Test **May/June 2018**

MARK SCHEME

Maximum Mark: 40

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Question	Answer	Marks
1(a)	θ for beaker **A** decreasing	**1**
1(b)(i)	θ for beaker **B** decreasing more slowly	**1**
1(b)(ii)	s, ºC, ºC all correct	**1**
	30, 60, 90, 120, 150, 180	**1**
1(c)(i)	beaker with lid **A** (has a greater rate of cooling)	**1**
	correct mention of comparative temperature change over 0 to 180s	**1**
1(c)(ii)	any suitable change to apparatus relating to comparison e.g. insulate sides / stand on mat use plastic beaker thicker lid use of fan use wider beaker	**1**
	matching explanation e.g. thermal energy only escapes from surface less transfer of thermal energy by sides / bottom less conduction through lid larger surface area (for evaporation to occur)	**1**
1(d)	straight line	**1**
	through the origin	**1**
1(e)	any **one** appropriate factor e.g. volume of water initial temperature of water (same) lids type / material / size of beaker room temperature / appropriate environmental factor	**1**

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Question	Answer	Marks
2(a)	*I* values, all decreasing and all < 1.00 A	**1**
	V values, all increasing and all < 3.0 V	**1**
	I to 2dp at least and *V* to 1dp at least	**1**
2(b)	A, V	**1**
2(c)	correct calculations of *P*	**1**
	P for 3Ω > other *P* values	**1**
	consistent 2 or consistent 3 significant figures	**1**
2(d)	increases (at first)	**1**
	to a maximum / *then* decreases	**1**
2(e)	any **two** additions from: draw a graph; different / more resistors / values of resistance/greater range of values for resistance; use (at least) 5 sets of values for resistance	**2**

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Question	Answer	Marks
3(a)	h_O = 1.0 to 2.5 (cm)	**1**
	h_I decreasing	**1**
3(b)	*N* calculations correct	**1**
3(c)	graph:	
	axes labelled correct orientation, with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to ½ small square and precise plots	**1**
	well judged line and thin line	**1**
3(d)	*G* in range 13.0 to 17.0	**1**
	triangle method seen on graph occupying at least half line	**1**
3(e)	any inherent difficulty e.g. hand/ruler in way of image **OR** screen can move (when measuring)	**1**
	matching improvement to <u>apparatus</u> e.g. use translucent screen and view from behind **OR** fix ruler/grid to screen **OR** clamp screen in place	**1**

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Question	Answer	Marks
4	Apparatus: forcemeter, (10 g and 100 g) masses/masses only (if clear they are used to change the mass of the block and as weights to the block via the pulley)	**1**
	Diagram: block, workable means of pulling and measuring force	**1**
	Method (2): measure force required to make block slide/find mass (on pulley) required to make block slide	**1**
	repeat for new value of mass	**1**
	Precautions: any **one** from: same surface to slide on/repeat each measurement and take average / same angle of pulling force	**1**
	Graph: mass on block vs force (needed to slide)	**1**
	Any additional point: at least 5 sets of data taken / keep force horizontal / add mass of block to load / extra precaution	**1**

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PHYSICS **0625/61**

Paper 6 Alternative to Practical **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)	d = 5(.0) (cm)	**1**
1(b)(i)	D = 50 (cm)	**1**
1(b)(ii)	t = 14.06	**1**
1(b)(iii)	T = 1.406 (allow ecf from 1(b)(ii): t/10 (s))	**1**
1(b)(iv)	T^2 = 1.98 or 1.99 (allow ecf from 1(b)(iii))	**1**
1(b)(v)	g = 10.1 (allow ecf from 1(b)(iv))	**1**
1(c)(i)	Unit s^2	**1**
1(c)(ii)	g given to 2 or 3 significant figures	**1**
1(d)	Use of additional d values **OR** use a larger d value	**1**
	Count more swings	**1**
1(e)	Any **one** from: Perpendicular viewing of rule Counting beginning with zero (owtte) Use of fiducial mark (owtte) Use of set-square or horizontal rule to aid measurement of d Use rule close to/touching the bob Time taken from centre of swing, (not extremities) Measure length to top and bottom of bob and average Measure string length and add radius of bob measured with callipers or micrometer	**1**

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Question	Answer	Marks
2(a)(i)	EITHER V_1 = 2.2 **OR** I = 0.46 correct	**1**
	Both values correct **and** correct units V and A	**1**
2(a)(ii)	R_1 = 4.78 (Ω) (allow ecf from 2(a)(i))	**1**
2(b)	Statement matches readings (Expect YES)	**1**
	Expect justification to include the idea of within the limits of experimental accuracy (but accept beyond limits, if ecf allowed for statement matching readings)	**1**
2(c)	R = 14.3 **OR** 14.4; 2 or 3 significant figures required	**1**
	Unit Ω	**1**
2(d)	$3V_1$	**1**
2(e)	3 resistors in parallel	**1**
	Correct variable resistor symbol	**1**
	Voltmeter symbol correct **and** circuit correct	**1**

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Question	Answer	Marks
3(a)	*uv* values 1065, 1128, 1200, 1283, 1353	**1**
3(b)	Graph: (all marks are still available if *uv* values are wrong) Axes correctly labelled and right way round	**1**
	Suitable scales	**1**
	All plots correct to ½ small square	**1**
	Good line judgement, thin, continuous line	**1**
3(c)	Triangle method clearly shown on graph	**1**
	Triangle using at least half of candidate's line	**1**
3(d)	*G* in range 14.0 to 16.0	**1**
	f = *G* to 2 or 3 significant figures	**1**
3(e)	Any **two** from: Finding exact position that gives clearest image Measuring to centre of lens Room too bright/lamp too dim/image too faint	**2**

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Question	Answer	Marks
4	Method to include: (Hot) water in copper can, time taken for temperature to drop	**1**
	Correct use of at least 3 larger outer containers, separately	**1**
	Some indication that size of air gap is measured	**1**
	Any **two** from: Use of something to cover air gap Use of lid on copper can Same starting temperature Same room temperature Same volume of hot water Use of 'control' with no outer container Inner container standing on an insulator Uniform air gap all round	**2**
	Table with clear columns for temperature and/or time (to match method) and air-gap, with appropriate units	**1**
	Conclusion: Least temperature drop **OR** longest time for temperature to drop shows lowest cooling rate **OR** best insulation **OR** plot temperature against time and least gradient shows lowest cooling rate (ora)	**1**

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

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GENERIC MARKING PRINCIPLE 4:

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)(i)	2 or more measurements seen	**1**
	D_B = 4.8 ± 0.1 (cm)	**1**
1(a)(ii)	D = 6.0 (cm)	**1**
1(b)	1 h = 7.8 (cm) **AND** 2 V = 220(.428) (cm^3)	**1**
1(c)	ρ = 1 / 1.1 / 1.05(…….)	**1**
	2 or 3 significant figures	**1**
	g / cm^3	**1**
1(d)	any **one** from: part **(a)** drawn circle not exact / thickness of rim or cup / thickness of the pencil line part **(b)** difficult to measure the height (in practice) / D^2 increases inaccuracy in D part **(c)** mass of cup has been ignored	**1**
1(e)	diagram showing clearly:	
	line of sight perpendicular to measuring cylinder	**1**
	to the bottom of the meniscus	**1**

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Question	Answer	Marks
2(a)	θ_R = 23(.0) (°C)	**1**
2(b)(i)	ensure thermometer / bulb / alcohol / mercury has reached the temperature of the water	**1**
2(b)(ii)	s / seconds, °C	**1**
2(b)(iii)	*t* values 30, 60, 90, 120, 150	**1**
2(b)(iv)	graph:	
	axes correctly labelled and right way round	**1**
	suitable scales (scales must start below θ_R)	**1**
	all plots correct to ½ small square	**1**
	good line judgement, thin, continuous line	**1**
2(c)	horizontal line at θ_R correctly positioned	**1**
2(d)	any **two** from: perpendicular viewing of thermometer stir (before taking temperature reading) don't let the thermometer (bulb) touch the sides / bottom of beaker wait for thermometer to reach θ_{MAX} before reading	**2**
2(e)	any **two** from: higher starting temperature / use hotter water use of metal can instead of beaker / metal bench lower room temperature / cold water bath use of a fan container with a greater surface area / larger beaker	**2**

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Question	Answer	Marks
3(a)(i)	v = 5.8(0) (cm) / 58 (mm)	**1**
3(a)(ii)	V = 29(.0) (cm)	**1**
3(a)(iii)	f_1 = 11.8(3673) / 12 (cm)	**1**
3(b)	f_A = 12.0 (cm)	**1**
	2 or 3 significant figures	**1**
3(c)	at least 3 new values suggested	**1**
	all new values between 15 cm and 70 cm with at least 5 cm between each value	**1**
3(d)	any **two** from: use of darkened room / brighter lamp mark position of centre of lens on holder place metre rule on bench / clamp in position ensure object and (centre of) lens are same height (from the bench) object <u>and</u> lens <u>and</u> screen perpendicular to bench move screen slowly / back and forth to obtain best image	**2**

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Question	Answer	Marks
4	method to include:	
	place truck on ramp (and release)	1
	measure distance (travelled) from bottom of ramp	1
	repeat with different mass(es) (loaded on the same truck)	1
	additional apparatus:	
	(metre) rule(r) / measuring tape	1
	control variables:	
	height / angle of ramp / number of supporting bricks	1
	release position / height above bench	1
	table with clear columns for mass, and distance travelled, with appropriate units in the headings of the table	1

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Additional graph notes:

NOTE: The principle to apply here is 'could I draw a significantly better line, using these points, under examination conditions?' If the answer is definitely 'yes', do not award the mark.

NOTE: – If candidate's scale consists of actual readings at equal intervals this will produce a perfect straight line! The only marks available in this case are the first (axes right way round and labelled) So maximum 1.

– If axes are wrong way round, the other 3 marks are still available.

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Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/63**

Paper 6 Alternative to Practical **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Marks
1(a)	21(.0) (ºC)	**1**
1(b)	s, ºC, ºC all correct	**1**
	30, 60, 90, 120, 150, 180	**1**
1(c)	appropriate precaution e.g. avoidance of parallax (only if explained) / wait until reading stops rising (at start)	**1**
1(d)(i)	beaker with lid **A** (has a greater rate of cooling)	**1**
	correct mention of comparative temperature change <u>over 0 to 180 s</u>	**1**
1(d)(ii)	any suitable change to <u>apparatus</u> relating to comparison e.g. insulate sides / stand on mat use plastic beaker thicker lid use of fan use wider beaker	**1**
	matching explanation e.g. thermal energy only escapes from surface less transfer of thermal energy by sides / bottom less conduction through lid larger surface area (for evaporation to occur)	**1**
1(e)	straight line	**1**
	through the origin	**1**
1(f)	any appropriate factor e.g. volume of water initial temperature of water (same) lids type / material / size of beaker room temperature / appropriate environmental factor	

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Question	Answer	Marks
2(a)	correct voltmeter symbol in parallel with **X**	**1**
2(b)(i)	I = 0.86 (A)	**1**
	V = 0.9 (V)	**1**
2(b)(ii)	Ω	**1**
	A, V	**1**
2(c)	correct calculations of P (0.77 / ecf, 0.94, 0.58(W))	**1**
	consistent 2 or consistent 3 significant figures	**1**
2(d)	increases (at first)	**1**
	to a maximum AND *then* decreases	**1**
2(e)	any 2 additions from: draw a graph; different / more resistors / values of resistance / greater range of values for resistance; use (at least) 5 sets of values for resistance	**2**

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Question	Answer	Marks
3(a)	h_O = 1.4 (cm)	**1**
3(b)(i)	h_I = 4.5 (cm)	**1**
3(b)(ii)	N = 0.31 / ecf	**1**
3(c)	graph:	
	axes labelled correct orientation, with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to ½ small square and precise plots	**1**
	well judged line and thin line	**1**
3(d)	G in range 14.0 to 17.0	**1**
	triangle method seen on graph occupying at least half line	**1**
3(e)	any inherent difficulty e.g. hand / ruler in way of image **OR** screen can move (when measuring)	**1**
	matching improvement to <u>apparatus</u> e.g. use translucent screen and view from behind **OR** fix ruler / grid to screen **OR** clamp screen in place	**1**

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Question	Answer	Marks
4	Apparatus: forcemeter, (10 g and 100 g) masses / masses only (if clear they are used to change the mass of the block and as weights to the block via the pulley)	**1**
	Diagram: block, workable means of pulling and measuring force	**1**
	Method (2): measure force required to make block slide / find mass (on pulley) required to make block slide	**1**
	repeat for new value of mass	**1**
	Precautions: any **one** from: same surface to slide on / repeat each measurement and take average / same angle of pulling force	**1**
	Graph: mass on block vs force (needed to slide)	**1**
	Any additional point: at least 5 sets of data taken / keep force horizontal / add mass of block to load / extra precaution	**1**

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/11**

Paper 1 Multiple Choice (Core) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = $10\,m/s^2$).

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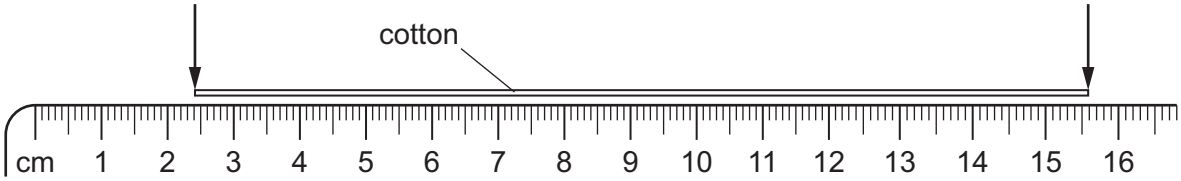
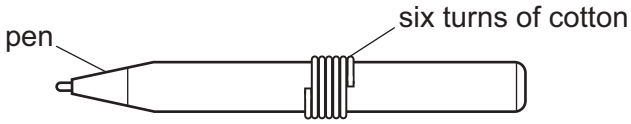
1 A length of cotton is measured between two points on a ruler.



When the length of cotton is wound closely around a pen, it goes round six times.

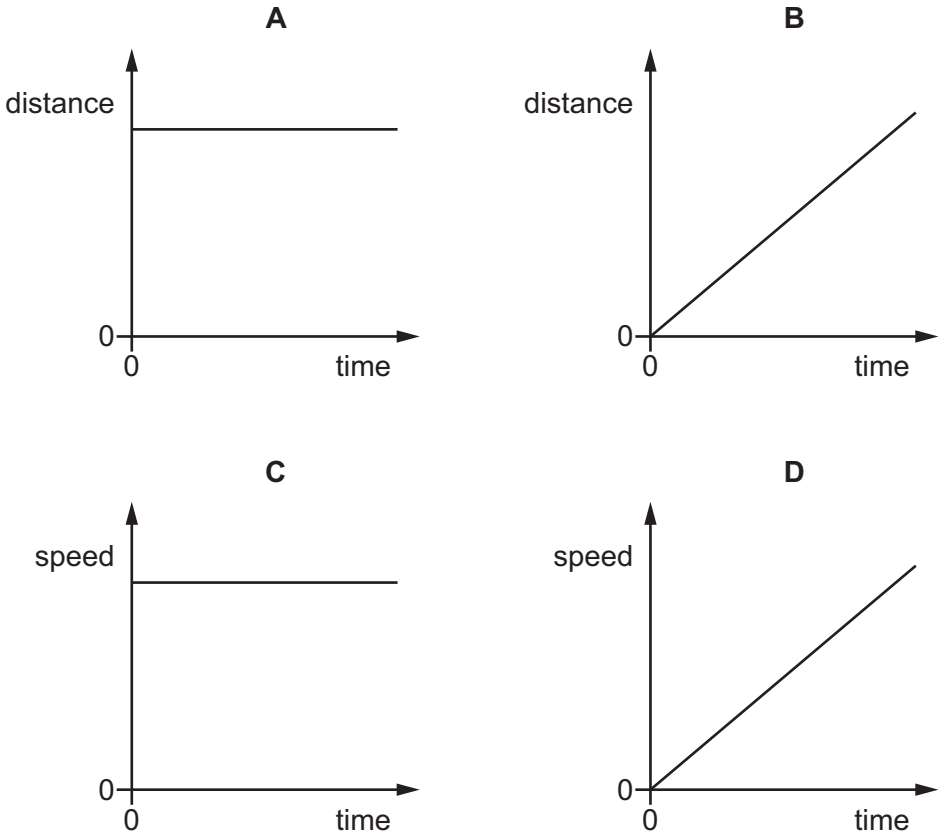


What is the distance once round the pen?

A 2.2 cm **B** 2.6 cm **C** 13.2 cm **D** 15.6 cm

2 A car is moving along a straight, level road, with a constant acceleration.

Which graph shows the motion of the car?



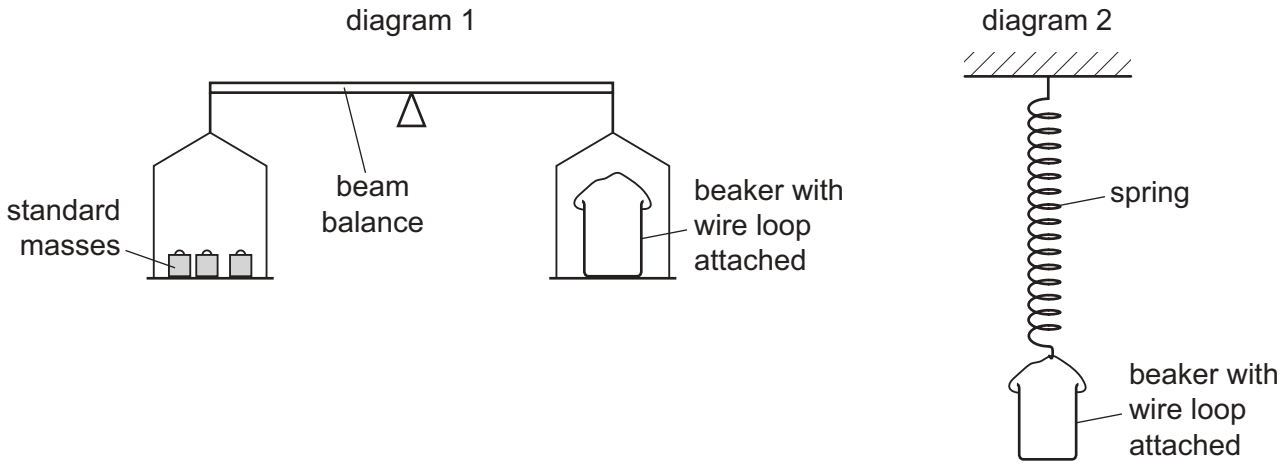
3 A car takes 15 minutes to travel along a road that is 20 km long.

What is the average speed of the car?

A 0.75 km / h **B** 5.0 km / h **C** 80 km / h **D** 300 km / h

4 Diagram 1 shows a beam balance. A beaker with a wire loop balances the standard masses.

The beaker is then removed and hung from a spring. The spring extends by 5.0 cm, as in diagram 2.



The experiment is repeated with the same apparatus on the Moon, where the acceleration of free fall is less than on Earth.

Which statement describes what happens on the Moon?

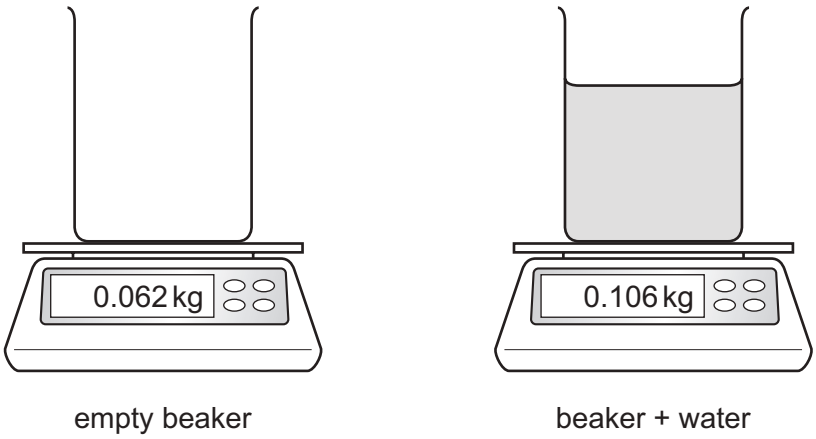
A The beam balance is balanced and the spring extends by 5.0 cm.

B The beam balance is balanced and the spring extends by less than 5.0 cm.

C The right-hand balance pan is higher and the spring extends by 5.0 cm.

D The right-hand balance pan is higher and the spring extends by less than 5.0 cm.

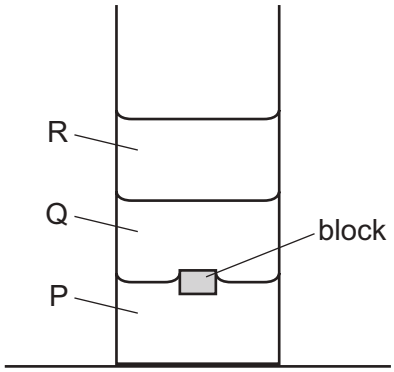
5 An empty beaker is placed on a top-pan balance. Some water is now poured into the beaker.



What is the weight of the water?

A 0.044 kg **B** 0.168 kg **C** 0.0044 N **D** 0.44 N

6 Three liquids P, Q and R have different densities and do not mix. The liquids are placed in a measuring cylinder and allowed to settle. A small block is then dropped into the measuring cylinder and comes to rest, as shown.



Which statement about the density of the block is correct?

A It is equal to the density of Q.

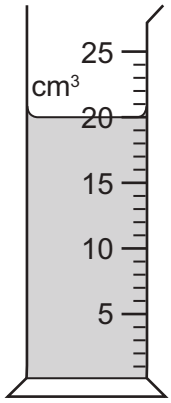
B It is greater than the density of P.

C It is greater than the density of R.

D It is less than the density of Q.

7 The diagram shows some liquid in a measuring cylinder.

The mass of the liquid is 16 g.



What is the density of the liquid?

A $0.80\,g/cm^3$ **B** $1.25\,g/cm^3$ **C** $36\,g/cm^3$ **D** $320\,g/cm^3$

8 A car is moving in a straight line on a level road. Its engine provides a forward force on the car. A second force of equal size acts on the car due to resistive forces.

Which statement describes what happens?

A The car changes direction.

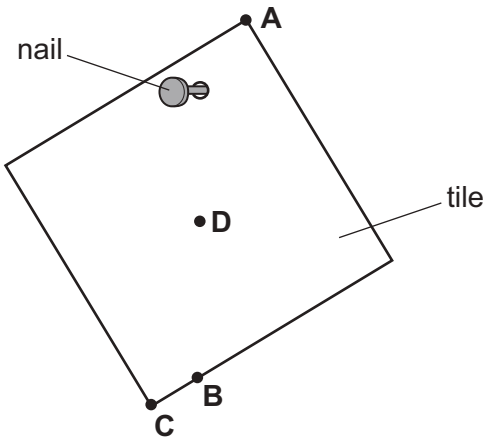
B The car moves at a constant speed.

C The car slows down.

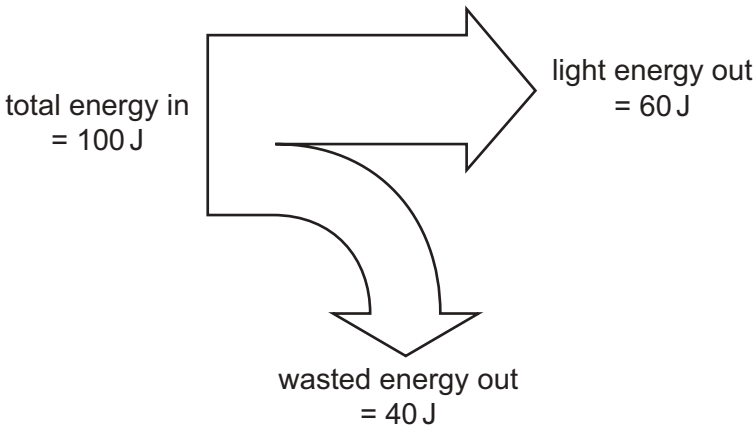
D The car speeds up.

9 A hole is drilled in a square tile. The diagram shows the tile hanging freely on a nail.

Where is the centre of mass of the tile?



10 The diagram shows the energy transferred in a lamp in one second.



Which type of wasted energy is produced by the lamp?

A chemical potential energy

B electrical energy

C gravitational potential energy

D thermal energy

11 Which energy resource is **not** renewable?

A fossil fuel

B sunlight

C tides

D wind

12 A student does work by pulling a box across a horizontal floor.

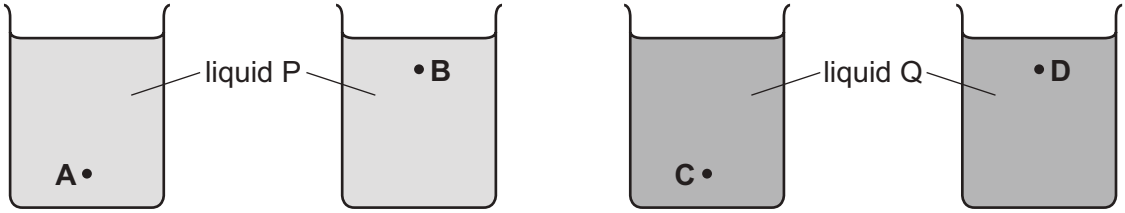
She now pulls a second box along the same floor.

Which row indicates that the student is now doing twice as much work?

	force used to pull box	distance the box is pulled
A	is doubled	is doubled
B	is doubled	is halved
C	stays the same	is doubled
D	stays the same	is halved

13 Four identical beakers are filled with equal volumes of liquids P or Q, as shown. Liquid P is more dense than liquid Q.

At which point is the pressure the least?



14 A woman has a weight of 600 N. She stands on a horizontal floor. The area of her feet in contact with the floor is $0.050\,m^2$.

What is the pressure she exerts on the floor?

A $1.2 \times 10^3\,N/m^2$

B $2.4 \times 10^3\,N/m^2$

C $1.2 \times 10^4\,N/m^2$

D $2.4 \times 10^4\,N/m^2$

15 On a warm day, a carton of fresh milk is covered with a wet cloth.

Why does this help to reduce the temperature of the milk?

A Some water evaporates from the cloth so the remaining water becomes cooler.

B The water has a very high thermal capacity.

C The water insulates the milk from the warm air around it.

D Water is always colder than the air around it.

16 Air is trapped in a cylinder by a piston.

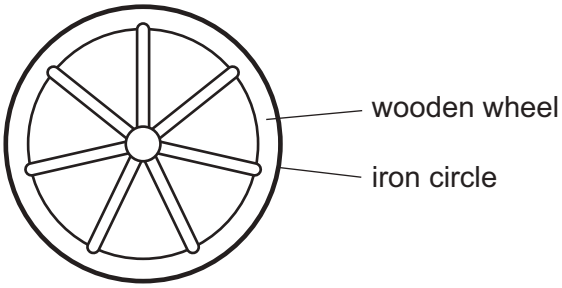
The piston is pushed inwards and the volume of the air is reduced.

The temperature of the trapped air remains constant.

Which row describes how the average speed of the air molecules and the average distance between them changes?

	average speed of molecules	average distance between molecules
A	increases	decreases
B	increases	unchanged
C	unchanged	decreases
D	unchanged	increases

17 A wooden wheel can be strengthened by putting a tight circle of iron around it.



Which action would make it easier to fit the circle over the wood?

A cooling the iron circle

B heating the iron circle

C heating the wooden wheel and cooling the iron circle

D heating the wooden wheel but not heating or cooling the iron circle

18 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	melting point of ice	boiling point of mercury
B	melting point of ice	boiling point of water
C	melting point of mercury	boiling point of mercury
D	melting point of mercury	boiling point of water

19 Which row gives the correct name for each change of state shown?

	change of state		
	gas to liquid	liquid to solid	solid to liquid
A	condensation	melting	solidification
B	condensation	solidification	melting
C	evaporation	melting	solidification
D	evaporation	solidification	melting

20 On a cold day, a metal front-door knob X and a similar plastic knob Y are at the same temperature.

Why does X feel cooler to the touch than Y?

A X convects thermal energy better than Y.

B X is a better thermal conductor than Y.

C X is a better insulator than Y.

D X is a better radiator of thermal energy than Y.

21 A liquid is heated and it expands.

How does this lead to the formation of a convection current?

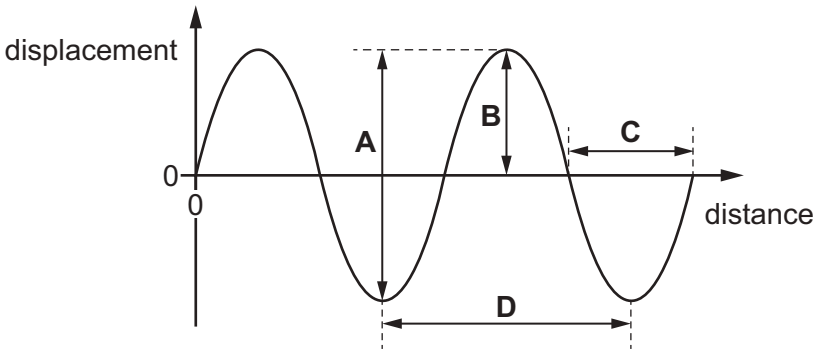
A The density of the heated liquid decreases.

B The density of the heated liquid increases.

C The mass of the heated liquid molecules decreases.

D The mass of the heated liquid molecules increases.

22 Which arrow on the graph shows the amplitude of the wave?



23 In which situation is the wavelength of the wave changed?

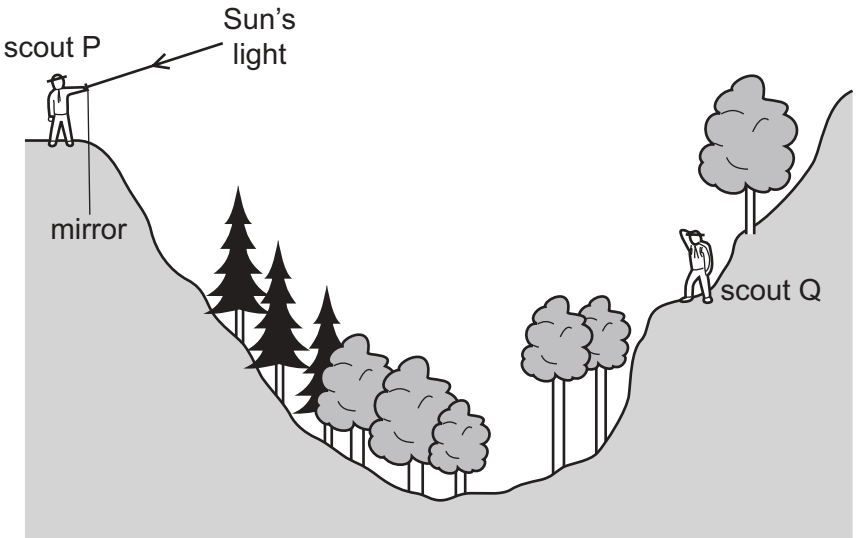
A light from the Sun passing from air into water

B radio waves travelling from an Earth satellite to the Moon

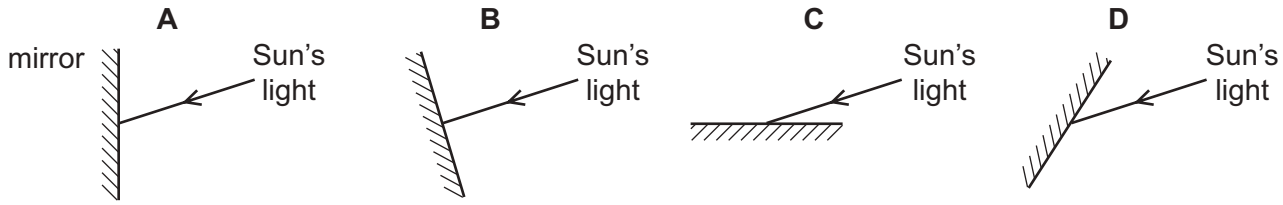
C sound reflecting from a wall

D water waves passing through a narrow gap

24 Scout P signals to scout Q on the other side of a valley by using a mirror to reflect the Sun's light.



Which mirror position allows the Sun's light to be reflected to scout Q?



25 The diagram shows the electromagnetic spectrum. The numbers indicate the approximate wavelength at the boundaries between the various regions of the spectrum.

For a device to be able to make use of electromagnetic radiation, it needs an aerial of approximately the same size as the radiation it is designed to work with.

P	Q	R	S	T	U	V

1 m 10^{-3} m 7×10^{-7} m 4×10^{-7} m 10^{-8} m 10^{-11} m

Which statement is correct?

A A mobile phone uses radiation from region P.

B A television satellite dish uses radiation from region Q.

C The receptor cells in an eye use radiation from region R.

D The remote controller for a television uses radiation from region U.

26 A dolphin has a range of audible frequencies of 150 Hz–150 kHz.

Which range of frequencies can be heard both by humans with good hearing and by dolphins?

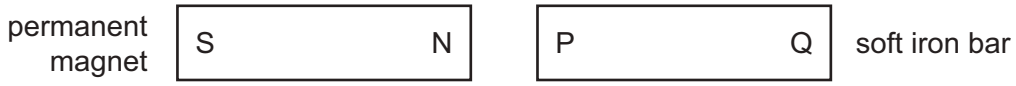
A 20 Hz–150 Hz

B 20 Hz–150 kHz

C 20 kHz–150 kHz

D 150 Hz–20 kHz

27 A permanent magnet is placed close to a bar of soft iron.



What are the polarities of end P and of end Q?

	end P	end Q
A	N	N
B	N	S
C	S	N
D	S	S

28 Which metal is used for the core of an electromagnet?

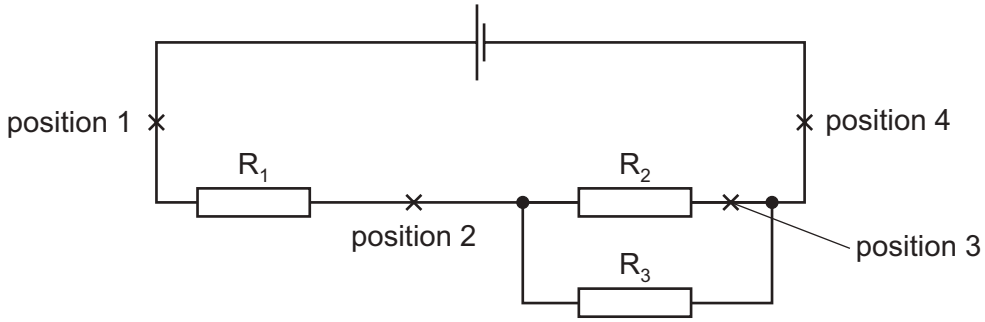
A copper

B iron

C magnesium

D steel

29 The diagram shows a cell connected to three resistors R_1, R_2 and R_3.



A student connects an ammeter first in position 1, then in position 2, 3 and 4 in turn.

In which positions does the ammeter show the current in R_1?

A 1, 2 and 4 **B** 1 and 2 only **C** 3 only **D** 4 only

30 A plastic rod is rubbed with a cloth. The rod becomes positively charged.

What happens to the plastic rod and what is the charge on the cloth?

	plastic rod	charge on cloth
A	gains electrons	negative
B	gains electrons	positive
C	loses electrons	negative
D	loses electrons	positive

31 A student measures the potential difference across a device and the current in the device.

Which calculation gives the resistance of the device?

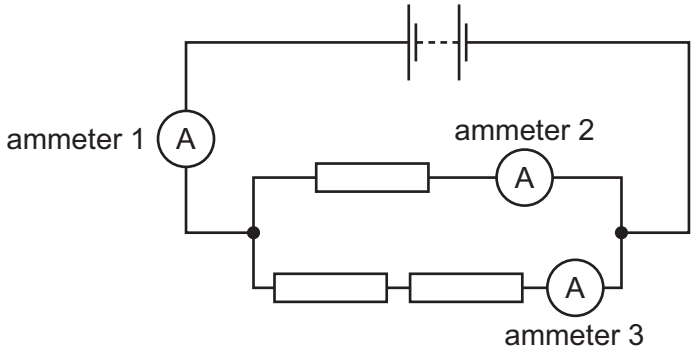
A current + potential difference

B current ÷ potential difference

C potential difference ÷ current

D potential difference × current

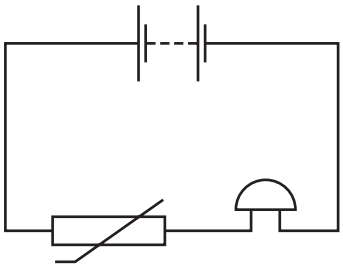
32 The diagram shows three identical resistors, three ammeters and a battery, connected in a circuit.



What is the order of the magnitudes of the readings on the ammeters from smallest to largest?

	smallest	intermediate	largest
A	ammeter 1	ammeter 2	ammeter 3
B	ammeter 1	ammeter 3	ammeter 2
C	ammeter 2	ammeter 3	ammeter 1
D	ammeter 3	ammeter 2	ammeter 1

33 A student sets up this circuit.



What is the purpose of the circuit?

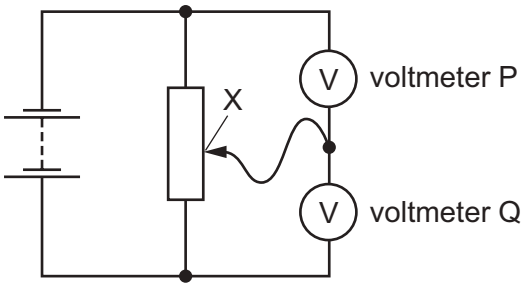
A to allow a lamp to be made dimmer or brighter as required

B to amplify the sound of a voice

C to light a lamp in the dark

D to sound a bell when the temperature rises

34 The diagram shows two voltmeters P and Q connected to a potential divider.



The sliding connection at point X is moved towards the top of the diagram.

What happens to the reading on P and to the reading on Q?

	reading on P	reading on Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

35 Which statement about electromagnetic induction is correct?

A A strong magnet that is held stationary near a stationary conductor causes a greater effect than a weak magnet.

B The effect occurs when a magnet and a conductor are both moved with the same speed and in the same direction.

C The effect occurs when a magnet is moved away from a nearby conductor.

D The effect only occurs when a magnet is moved towards a conductor.

36 An electrical device changes the voltage of an electrical supply from 240 V a.c. to 20 V a.c.

What is this device?

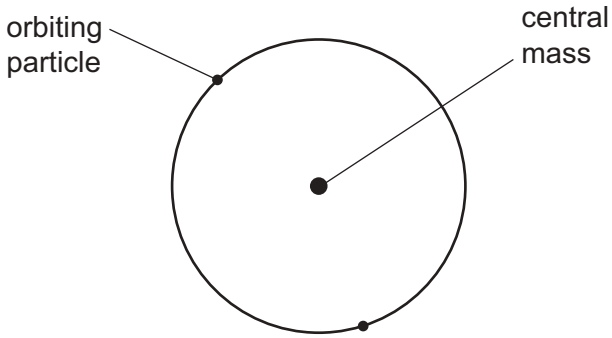
A a generator

B a relay

C a transformer

D a voltmeter

37 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.



What is the name of the central mass and of the orbiting particles?

	central mass	orbiting particles
A	neutron	α-particles
B	neutron	electrons
C	nucleus	α-particles
D	nucleus	electrons

38 A neutral atom of argon-40 ($^{40}_{18}A$) and a neutral atom of potassium-39 ($^{39}_{19}K$) are compared.

Which atom has more electrons, and which atom has more protons?

	more electrons	more protons
A	argon	argon
B	argon	potassium
C	potassium	argon
D	potassium	potassium

39 Which statement about α-particles and β-particles is correct?

A α-particles are less ionising than β-particles.

B α-particles are more penetrating than β-particles.

C α-particles have greater mass than β-particles.

D α-particles have the same charge as β-particles.

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40 An explosion in a nuclear reactor spread the isotope caesium-137 across a large area.

Ninety years after the explosion, the quantity of caesium-137 present will be 12.5% of its original level.

What is the half-life of caesium-137?

A 11.25 years **B** 22.5 years **C** 30.0 years **D** 45.0 years

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/12**

Paper 1 Multiple Choice (Core) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **16** printed pages.

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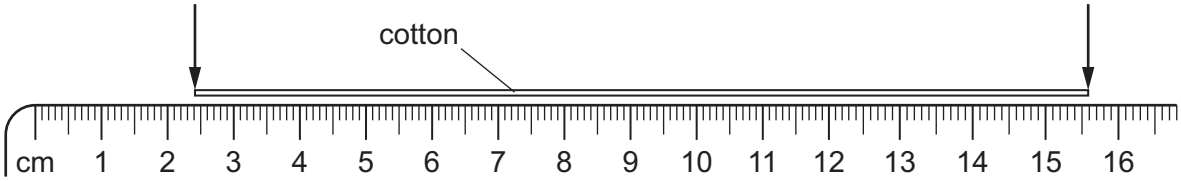
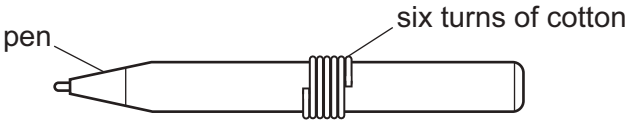
1 A length of cotton is measured between two points on a ruler.



When the length of cotton is wound closely around a pen, it goes round six times.

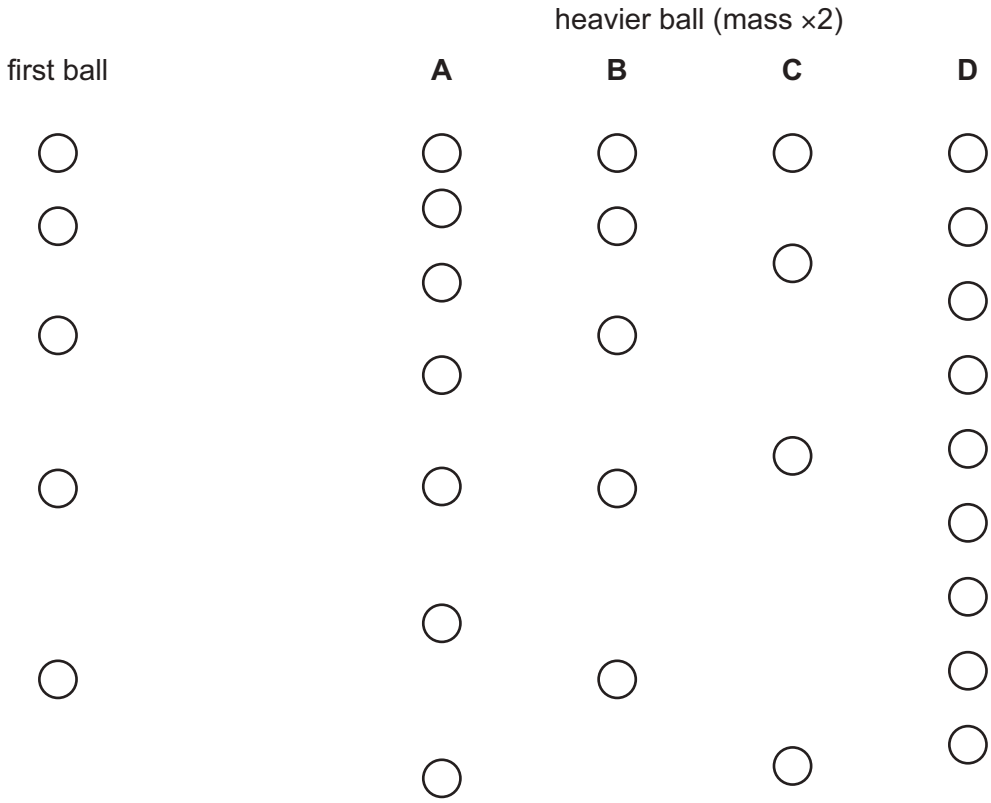


What is the distance once round the pen?

A 2.2 cm **B** 2.6 cm **C** 13.2 cm **D** 15.6 cm

2 A ball is dropped in an evacuated tube. A series of photographs is taken at equal time intervals from the time of release. Another ball of the same size but twice the mass is also dropped in the same evacuated tube and photographed.

Which diagram shows the motion of the heavier ball?



3 A car takes 15 minutes to travel along a road that is 20 km long.

What is the average speed of the car?

A 0.75 km / h **B** 5.0 km / h **C** 80 km / h **D** 300 km / h

4 Which statement about the mass and the weight of an object is correct?

A They are both affected by changes in the acceleration of free fall.

B They are both forces.

C They have different units.

D Weight is calculated by dividing mass by the acceleration of free fall.

5 Two objects P and Q are placed in a beaker containing a liquid.

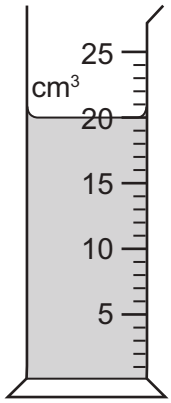
Object P floats in the liquid and object Q sinks.

Which row for the densities of object P, object Q and the liquid is possible?

	density of object P / g/cm^3	density of object Q / g/cm^3	density of liquid / g/cm^3
A	1.2	0.6	0.8
B	1.2	1.4	1.0
C	11.3	8.9	13.6
D	11.3	19.3	13.6

6 The diagram shows some liquid in a measuring cylinder.

The mass of the liquid is 16 g.



What is the density of the liquid?

A 0.80 g/cm^3 **B** 1.25 g/cm^3 **C** 36 g/cm^3 **D** 320 g/cm^3

7 A spacecraft is travelling in space with no resultant force and no resultant moment acting on it.

Which statement about the spacecraft is correct?

A Its direction is changing.

B It is in equilibrium.

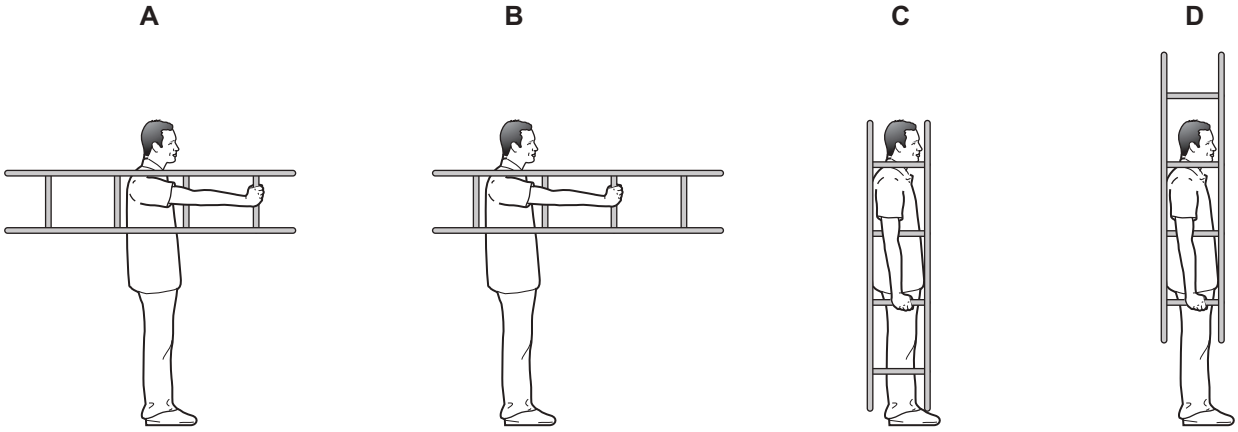
C Its speed is decreasing.

D Its speed is increasing.

8 A man holds a short ladder in four different positions.

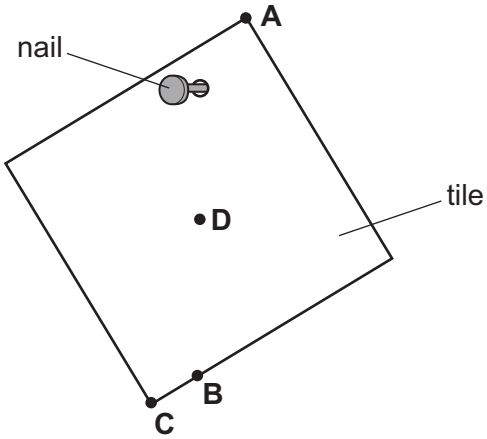
The weight of the ladder causes a moment about the man's shoulder.

In which position is the moment greatest?



9 A hole is drilled in a square tile. The diagram shows the tile hanging freely on a nail.

Where is the centre of mass of the tile?



10 Which source of energy is renewable?

A coal

B natural gas

C oil

D wind

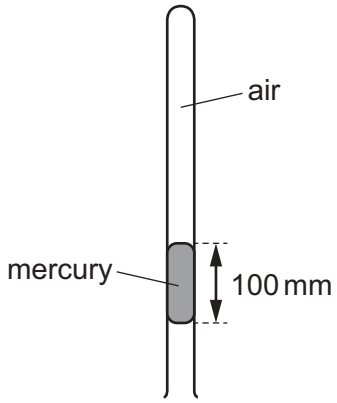
11 A student does work by pulling a box across a horizontal floor.

She now pulls a second box along the same floor.

Which row indicates that the student is now doing twice as much work?

	force used to pull box	distance the box is pulled
A	is doubled	is doubled
B	is doubled	is halved
C	stays the same	is doubled
D	stays the same	is halved

12 Air is trapped in a closed tube by a thread of mercury. The mercury thread is 100 mm long. The tube is held as shown.



Atmospheric pressure is 770 mm Hg.

What is the pressure of the trapped air?

A 100 mm Hg **B** 670 mm Hg **C** 770 mm Hg **D** 870 mm Hg

13 Brownian motion is the random motion of particles due to molecular bombardment.

In which states of matter is Brownian motion observed?

A gases, liquids and solids

B gases and liquids only

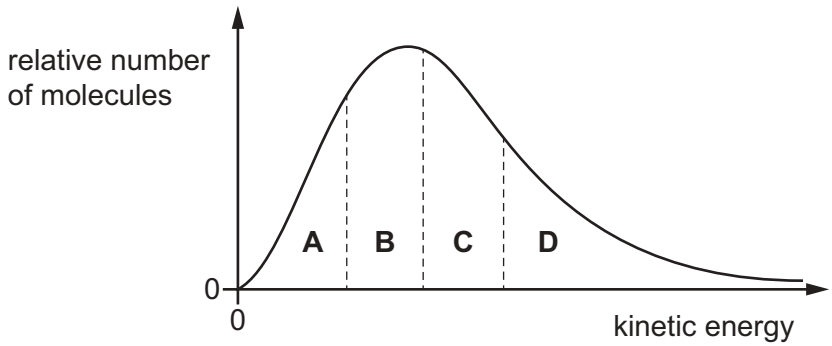
C gases and solids only

D liquids and solids only

14 The diagram shows the relative number of molecules in a liquid that have a given kinetic energy.

The graph is divided into sections so that each section contains the same number of molecules.

From which section does the greatest number of molecules escape from the liquid per unit time?



15 An electric kettle heats some water. The same kettle then heats a different liquid. The temperature of the liquid rises more rapidly than the temperature of the water.

What is a possible explanation of this difference?

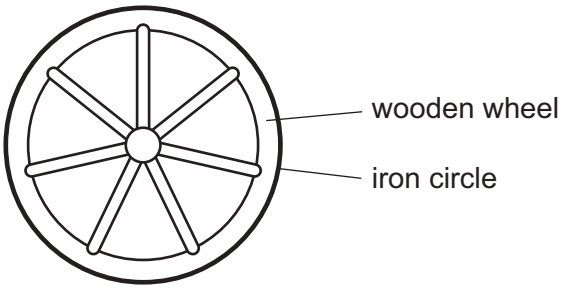
A The liquid condenses on the cooler parts of the kettle less than the water does.

B The liquid expands more than the water as it heats up.

C The liquid has a lower boiling point than the water.

D The liquid has a smaller thermal capacity than the water.

16 A wooden wheel can be strengthened by putting a tight circle of iron around it.



Which action would make it easier to fit the circle over the wood?

A cooling the iron circle

B heating the iron circle

C heating the wooden wheel and cooling the iron circle

D heating the wooden wheel but not heating or cooling the iron circle

17 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	melting point of ice	boiling point of mercury
B	melting point of ice	boiling point of water
C	melting point of mercury	boiling point of mercury
D	melting point of mercury	boiling point of water

18 Four thermometers, with their bulbs painted different colours, are placed at equal distances from a radiant heater.

Which thermometer shows the slowest temperature rise when the heater is first switched on?

A matt black

B matt white

C shiny black

D shiny white

19 A tank contains water. Ripples are produced on the surface of the water.

What causes the ripples to refract?

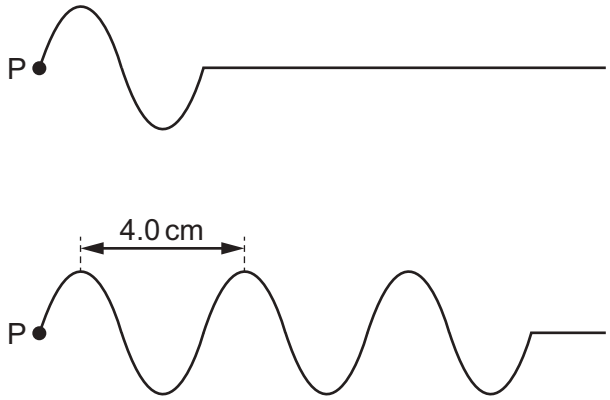
A The cold water in the tank is replaced by warm water.

B The ripples change speed as they move from deep to shallow water.

C The ripples hit the wall of the tank.

D The ripples pass through a narrow gap.

20 The diagrams show a wave on the surface of the water in a tank at times 1.0 s apart. The wave is produced at P and travels to the right.

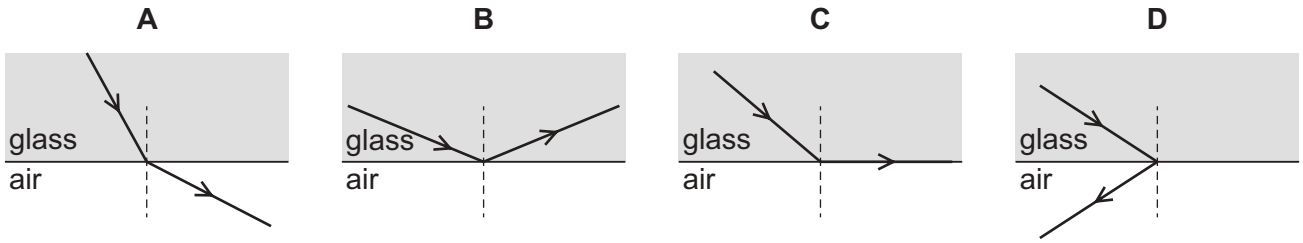


Which row gives the frequency and the speed of this water wave?

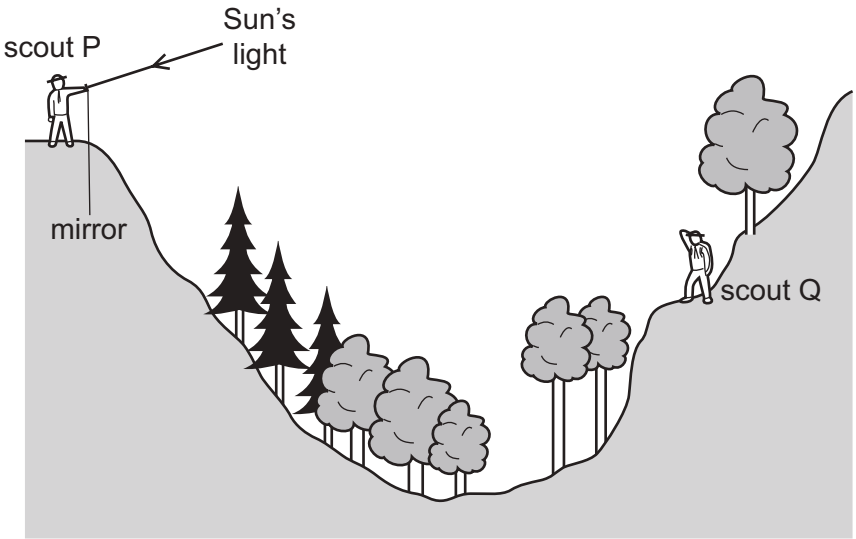
	frequency / Hz	speed / cm / s
A	2.0	4.0
B	2.0	8.0
C	4.0	4.0
D	4.0	8.0

21 Light passes from glass into air.

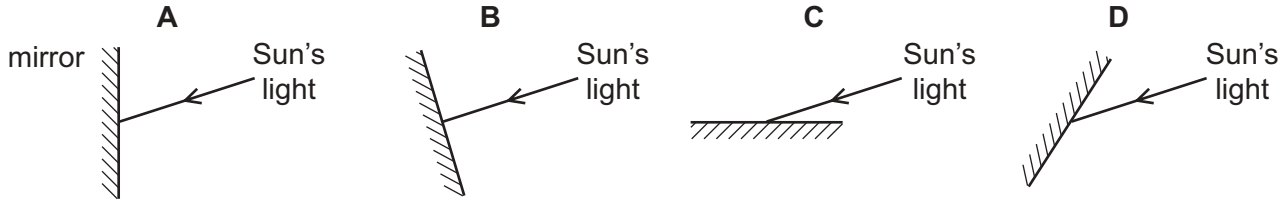
Which diagram shows a ray of light incident at the critical angle on the air-glass boundary?



22 Scout P signals to scout Q on the other side of a valley by using a mirror to reflect the Sun's light.



Which mirror position allows the Sun's light to be reflected to scout Q?



23 The table describes white light that passes through a prism and forms a spectrum.

Which row is correct?

	colour refracted the most	colour next to the red
A	red	orange
B	red	yellow
C	violet	orange
D	violet	yellow

24 Where do all types of electromagnetic waves travel at the same speed?

A air

B a vacuum

C glass

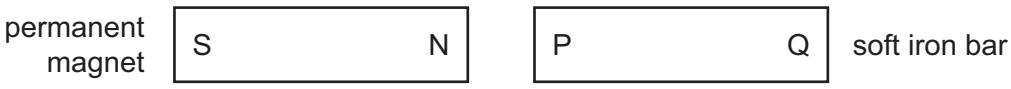
D water

25 A siren is emitting a sound. As time passes, the sound becomes louder and higher pitched.

What is happening to the amplitude and to the frequency of the emitted sound wave?

	amplitude	frequency
A	decreasing	decreasing
B	decreasing	increasing
C	increasing	decreasing
D	increasing	increasing

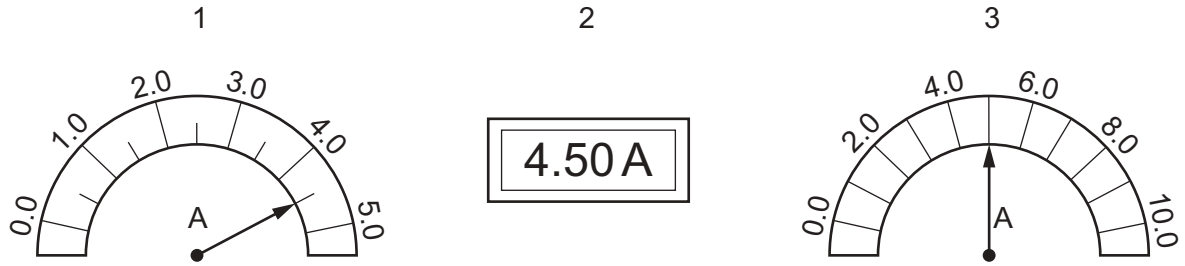
26 A permanent magnet is placed close to a bar of soft iron.



What are the polarities of end P and of end Q?

	end P	end Q
A	N	N
B	N	S
C	S	N
D	S	S

27 The diagrams show three ammeters.



Which ammeters show the same value of current?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

28 A student measures the potential difference across a device and the current in the device.

Which calculation gives the resistance of the device?

A current + potential difference

B current ÷ potential difference

C potential difference ÷ current

D potential difference × current

29 A lamp is connected across one cell, then across two cells. The potential difference (p.d.) across the lamp and the current in it are measured in each case.

The results are shown.

number of cells	p.d. / V	current / A
1	2.8	0.25
2	5.4	0.40

What is the change in the resistance of the lamp when the number of cells is increased from one to two?

A It decreases by 0.015 Ω.

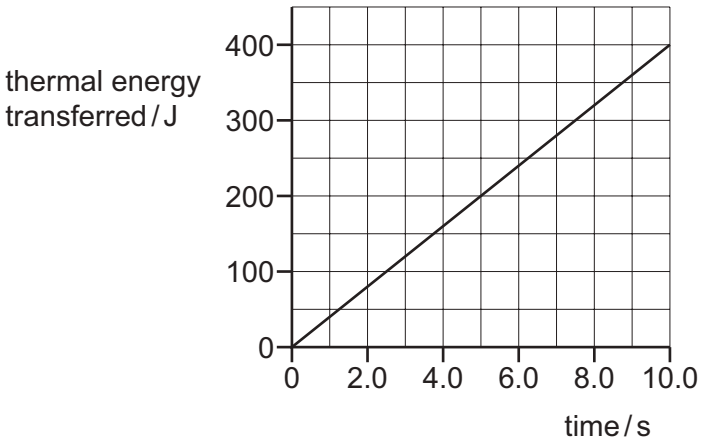
B It increases by 1.5 Ω.

C It increases by 2.3 Ω.

D It increases by 17 Ω.

30 An electrical heater transfers thermal energy to the surroundings.

The graph shows how the amount of thermal energy transferred varies with time.

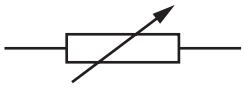


The heater continues to transfer energy at the same rate.

How much thermal energy is transferred by the heater in 5.0 minutes?

A 200 J **B** 400 J **C** 2000 J **D** 12 000 J

31 Which electrical component does the symbol represent?



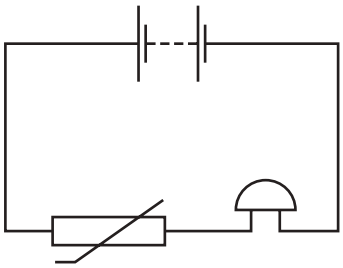
A a fuse

B a relay coil

C a thermistor

D a variable resistor

32 A student sets up this circuit.



What is the purpose of the circuit?

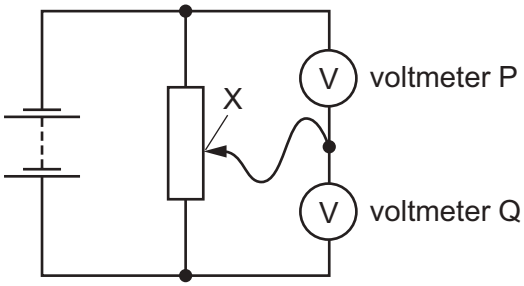
A to allow a lamp to be made dimmer or brighter as required

B to amplify the sound of a voice

C to light a lamp in the dark

D to sound a bell when the temperature rises

33 The diagram shows two voltmeters P and Q connected to a potential divider.



The sliding connection at point X is moved towards the top of the diagram.

What happens to the reading on P and to the reading on Q?

	reading on P	reading on Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

34 A simple electric generator induces an electromotive force (e.m.f.).

Which modification would increase the induced e.m.f.?

A Increase the number of turns in the coil of the generator.

B Increase the distance between the magnetic poles.

C Reduce the strength of the magnetic field around the coil.

D Reverse the direction of the magnetic field.

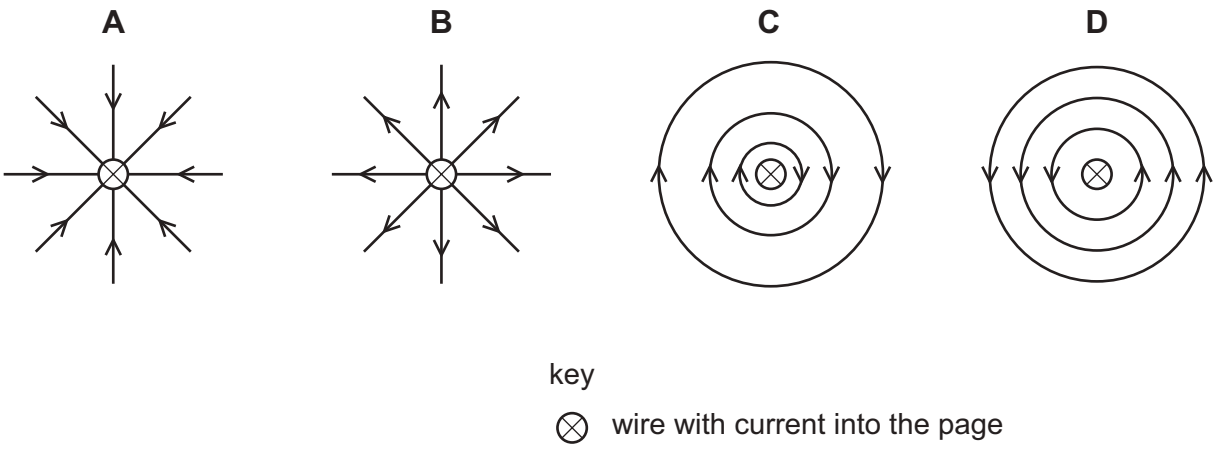
35 A transformer has N_p turns in the primary coil and N_s turns in the secondary coil.

Which row gives the values of N_p and N_s for a transformer that steps up a voltage of 1200 V to 36 000 V?

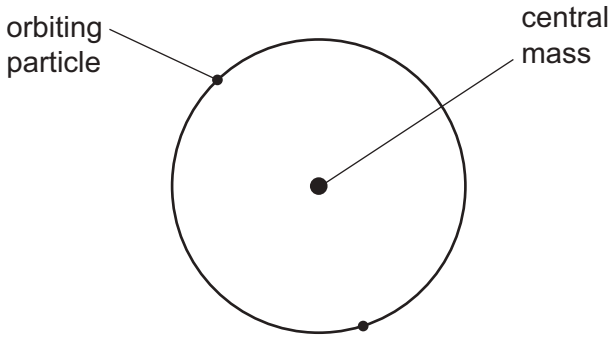
	N_p	N_s
A	2 000	60 000
B	2 000	600 000
C	60 000	2 000
D	600 000	2 000

36 A straight wire is perpendicular to the paper. It carries a current into the paper.

What is the magnetic field pattern and its direction near the wire?



37 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.



What is the name of the central mass and of the orbiting particles?

	central mass	orbiting particles
A	neutron	α-particles
B	neutron	electrons
C	nucleus	α-particles
D	nucleus	electrons

38 The table shows the composition of three different nuclei.

nucleus	number of protons	number of neutrons
X	3	3
Y	3	4
Z	4	3

Which nuclei are isotopes of the same element?

A X, Y and Z **B** X and Y only **C** X and Z only **D** Y and Z only

39 The table compares the penetrating abilities and ionising effects of α-radiation and of γ-radiation.

Which row is correct?

	least penetrating	most ionising
A	α	α
B	α	γ
C	γ	α
D	γ	γ

40 Radioactive materials must be handled in a safe way.

What is **not** a safety procedure?

A Monitor exposure time to radioactive materials.

B Store radioactive materials in cardboard boxes.

C Use tongs to pick up the radioactive source.

D Wear protective clothing.

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/13**

Paper 1 Multiple Choice (Core) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **16** printed pages.

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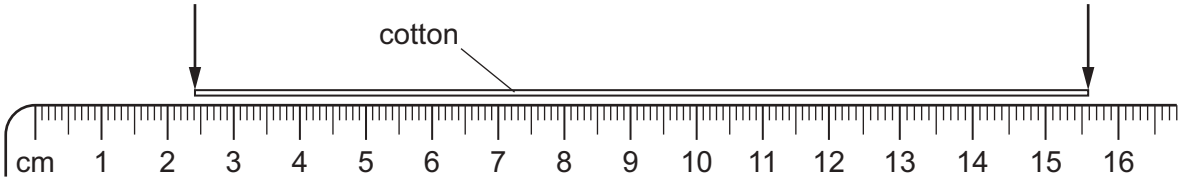
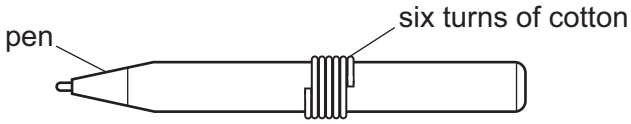
1 A length of cotton is measured between two points on a ruler.



When the length of cotton is wound closely around a pen, it goes round six times.



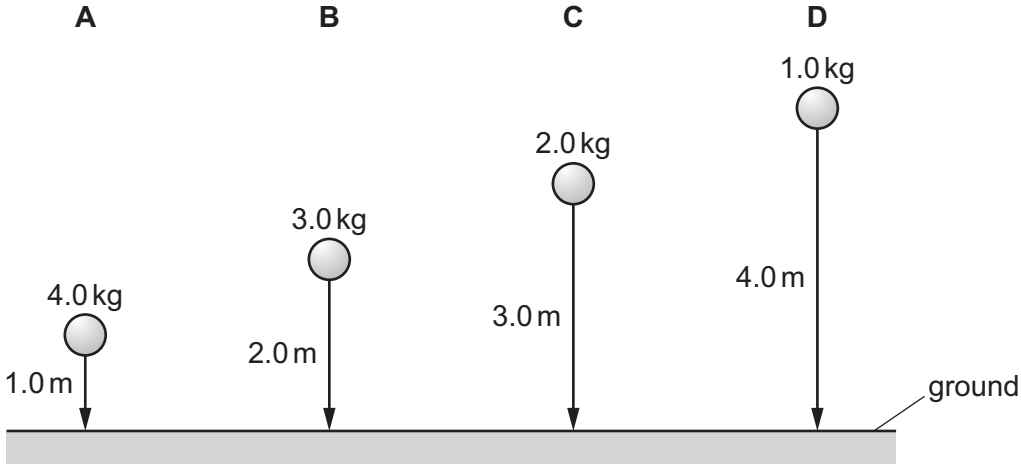
What is the distance once round the pen?

A 2.2 cm **B** 2.6 cm **C** 13.2 cm **D** 15.6 cm

2 Four balls with different masses are dropped from the heights shown.

Air resistance may be ignored.

Which ball has the greatest average speed?



3 A car takes 15 minutes to travel along a road that is 20 km long.

What is the average speed of the car?

A 0.75 km / h **B** 5.0 km / h **C** 80 km / h **D** 300 km / h

4 A person steps onto a bathroom scales.

The bathroom scales records both mass and weight.

Which row shows the readings on the scales?

	mass	weight
A	60 N	600 kg
B	60 kg	600 N
C	600 kg	60 N
D	600 N	60 kg

5 Which properties of an object can be changed by a force?

A direction of motion, mass and speed

B direction of motion, shape and speed

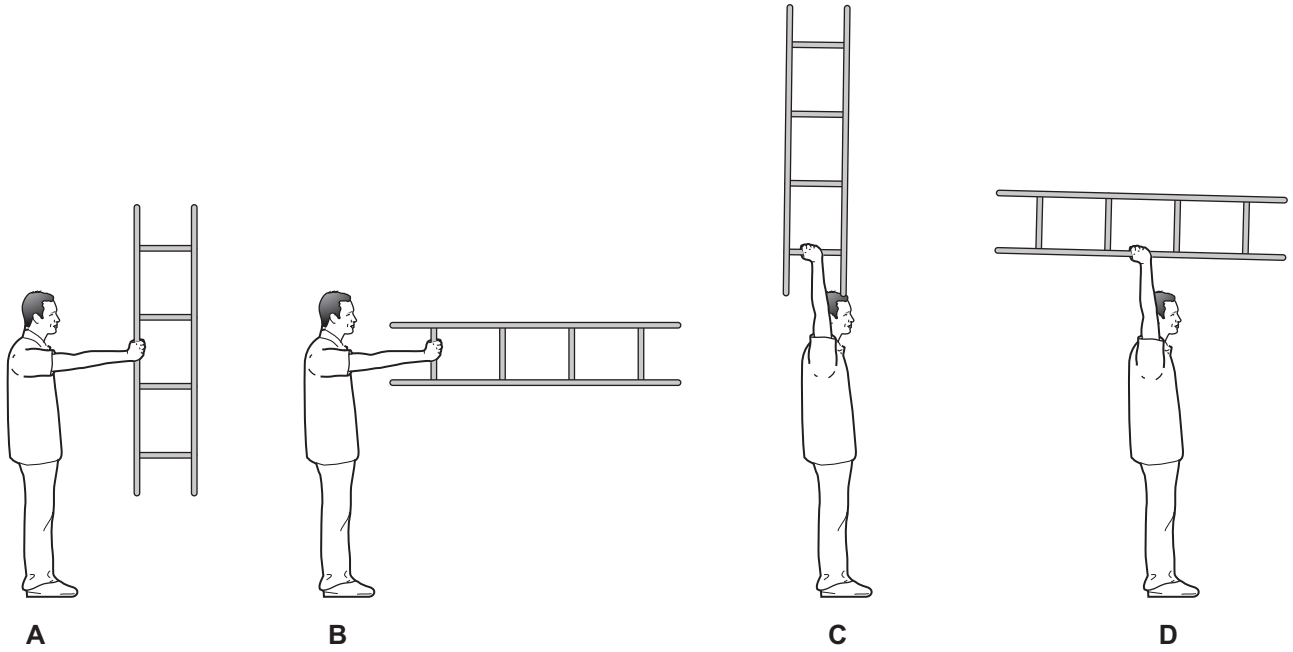
C direction of motion and speed only

D mass, shape and speed

6 A man holds a ladder in four different positions, pivoting around his shoulder.

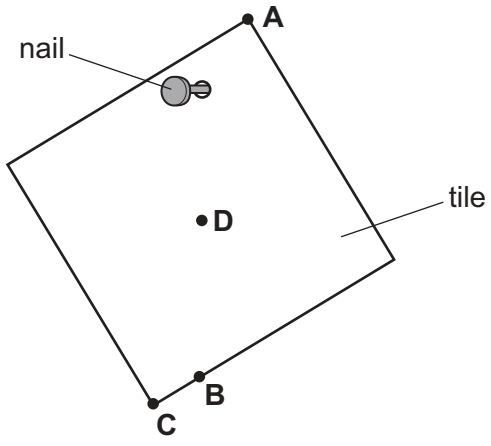
The weight of the ladder causes a moment about the man's shoulder.

In which position is the moment greatest?



7 A hole is drilled in a square tile. The diagram shows the tile hanging freely on a nail.

Where is the centre of mass of the tile?



8 Which method of drying clothes has the least impact on the environment?

A Evaporate the water in them in an electrically heated tumble dryer.

B Hang them on a washing line in direct sunlight.

C Remove the water from them in an electric spin dryer.

D Suspend them close to a coal fire.

9 A student does work by pulling a box across a horizontal floor.

She now pulls a second box along the same floor.

Which row indicates that the student is now doing twice as much work?

	force used to pull box	distance the box is pulled
A	is doubled	is doubled
B	is doubled	is halved
C	stays the same	is doubled
D	stays the same	is halved

10 A simple barometer includes a column of mercury.

Which property of this column of mercury is used to give a measurement of atmospheric pressure?

A its cross-sectional area

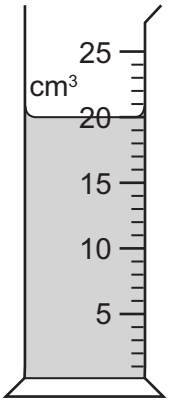
B its height

C its temperature

D its thermal capacity

11 The diagram shows some liquid in a measuring cylinder.

The mass of the liquid is 16 g.



What is the density of the liquid?

A $0.80\,g/cm^3$ **B** $1.25\,g/cm^3$ **C** $36\,g/cm^3$ **D** $320\,g/cm^3$

12 Brownian motion of particles is observed.

Which statements describe the movement of the particles?

1 The particles all travel along a curved path.

2 The particles move randomly.

3 The particles all travel in the same direction.

A 1 and 3 **B** 1 only **C** 2 and 3 **D** 2 only

13 A pure liquid is left in an open beaker and some of the liquid molecules escape by evaporation.

Which statement about this process is correct?

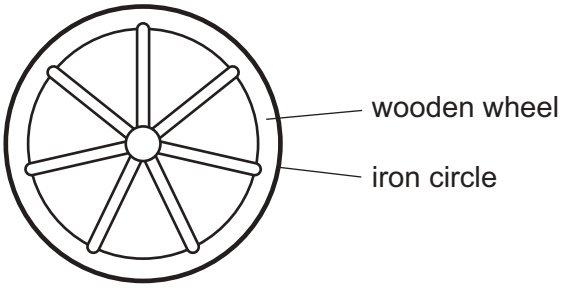
A None of the escaping molecules return to the liquid.

B The escaping molecules are generally the more energetic ones.

C The rate of escape of the molecules can be increased by increasing the depth of the liquid in the beaker.

D The temperature of the remaining liquid is unaffected by the escape of the molecules.

14 A wooden wheel can be strengthened by putting a tight circle of iron around it.



Which action would make it easier to fit the circle over the wood?

A cooling the iron circle

B heating the iron circle

C heating the wooden wheel and cooling the iron circle

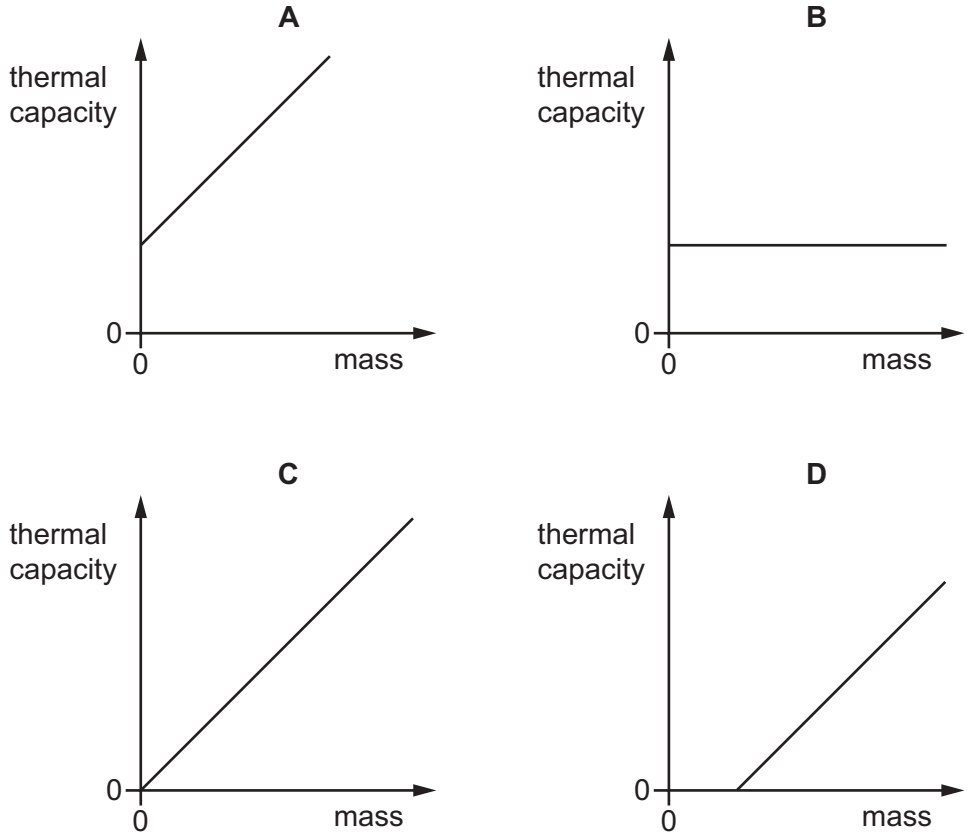
D heating the wooden wheel but not heating or cooling the iron circle

15 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

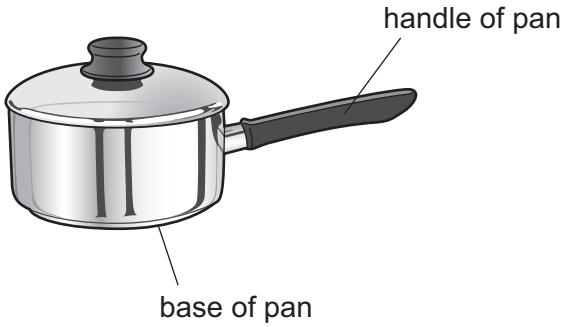
Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	melting point of ice	boiling point of mercury
B	melting point of ice	boiling point of water
C	melting point of mercury	boiling point of mercury
D	melting point of mercury	boiling point of water

16 Which diagram shows how the thermal capacity of a silver object depends on its mass?



17 The diagram shows a pan used for cooking food.



Which row is correct for the materials used to make the base and the handle of the pan?

	base of pan	handle of pan
A	good thermal conductor	good thermal conductor
B	good thermal conductor	poor thermal conductor
C	poor thermal conductor	good thermal conductor
D	poor thermal conductor	poor thermal conductor

18 A saucepan of water is heated from its base on an electric hob.

After five minutes the water near the top of the saucepan is becoming hot.

What is the main process of heat transfer within the water?

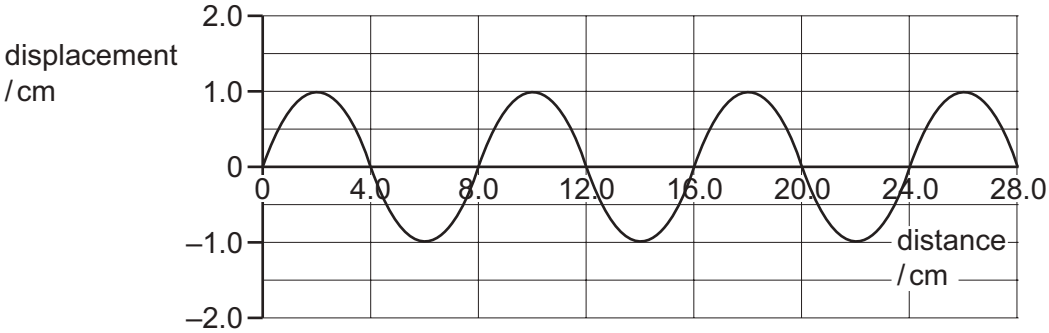
A condensation

B conduction

C convection

D radiation

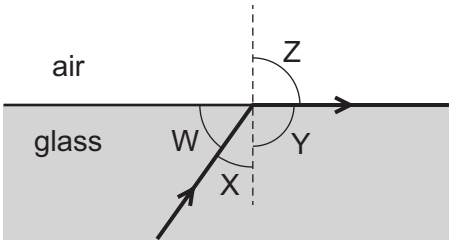
19 The diagram shows a wave.



Which row is correct?

	amplitude of the wave / cm	wavelength of the wave / cm
A	1.0	4.0
B	1.0	8.0
C	2.0	4.0
D	2.0	8.0

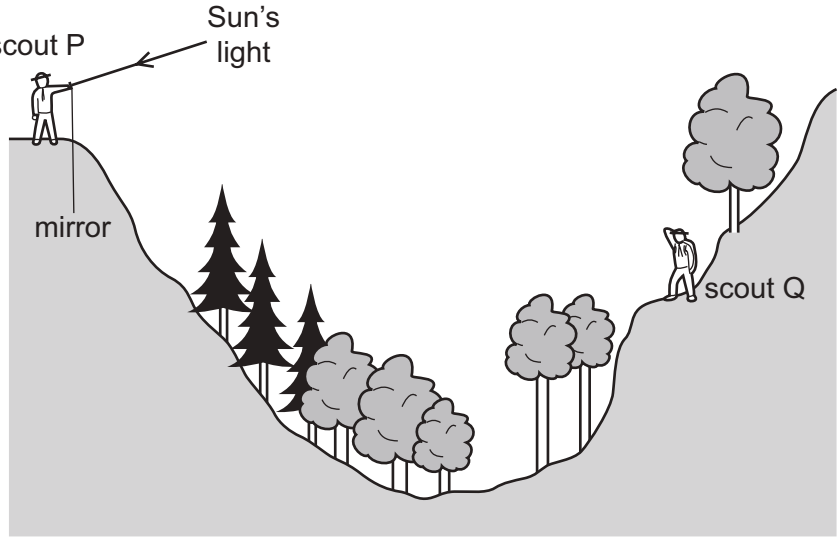
20 The diagram shows a ray of light passing from glass to air, at the critical angle.



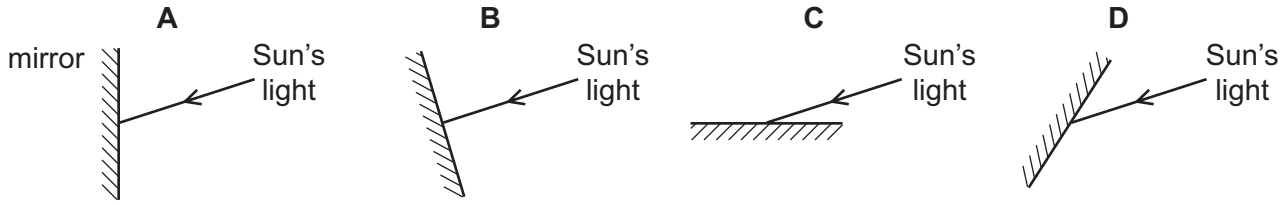
Which angles are the angle of incidence and the angle of refraction?

	angle of incidence	angle of refraction
A	W	Y
B	W	Z
C	X	Y
D	X	Z

21 Scout P signals to scout Q on the other side of a valley by using a mirror to reflect the Sun's light.



Which mirror position allows the Sun's light to be reflected to scout Q?



22 It takes 0.24 seconds for a microwave signal to travel from a transmitting station on Earth to a satellite and then back to the station on Earth. Microwaves travel at 3.0×10^8 m / s.

How far is the transmitting station from the satellite?

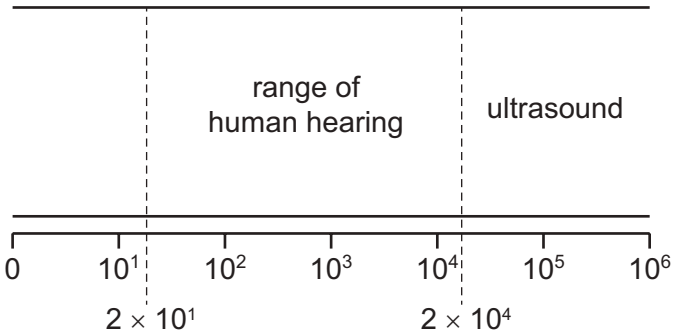
A 36 000 km

B 72 000 km

C 36 000 000 km

D 72 000 000 km

23 The diagram shows the ranges of human hearing and of ultrasound waves.



To which characteristic of sound waves do the numbers on the diagram refer?

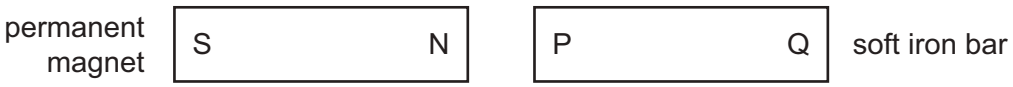
A amplitude in cm

B frequency in Hz

C speed in metres / second

D wavelength in metres

24 A permanent magnet is placed close to a bar of soft iron.

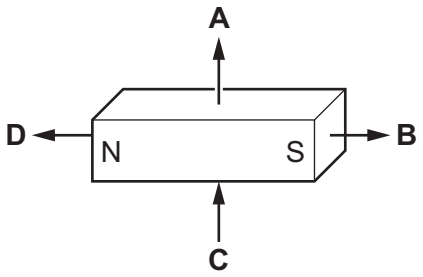


What are the polarities of end P and of end Q?

	end P	end Q
A	N	N
B	N	S
C	S	N
D	S	S

25 The diagram shows a permanent bar magnet placed on a wooden table. A student draws arrows to show the direction of the magnetic field at four points.

Which arrow shows the direction of the magnetic field at that position?



26 Which statement about electric charges is correct?

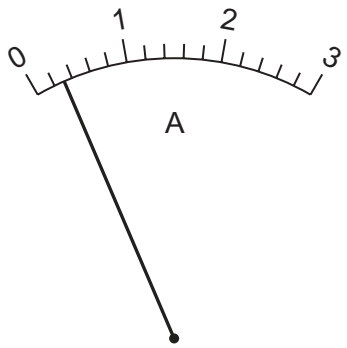
A Like charges attract and unlike charges attract.

B Like charges attract and unlike charges repel.

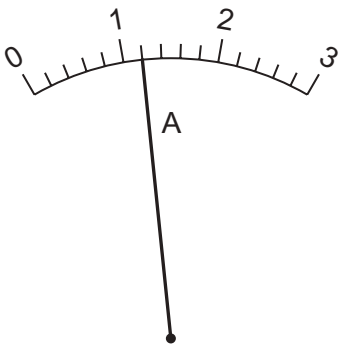
C Like charges repel and unlike charges attract.

D Like charges repel and unlike charges repel.

27 The diagrams show two readings on the same ammeter. Reading 1 is taken before the ammeter is connected in a circuit. Reading 2 shows the reading when the ammeter is connected in a circuit.



reading 1
not connected in a circuit



reading 2
connected in a circuit

What is the current in the circuit?

A 0.80 A **B** 0.90 A **C** 0.95 A **D** 1.20 A

28 A student measures the potential difference across a device and the current in the device.

Which calculation gives the resistance of the device?

A current + potential difference

B current ÷ potential difference

C potential difference ÷ current

D potential difference × current

29 A battery in an electric circuit is connected to a lamp.

Chemical energy in the battery is transferred to which other types of energy?

A internal energy only

B kinetic energy and sound energy

C light energy and thermal energy

D light energy only

30 Which component is represented by the symbol shown?

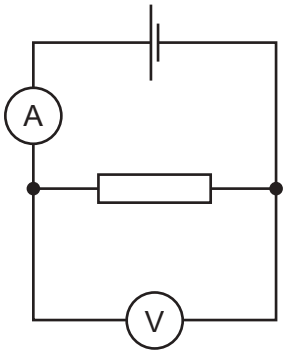
A fixed resistor

B fuse

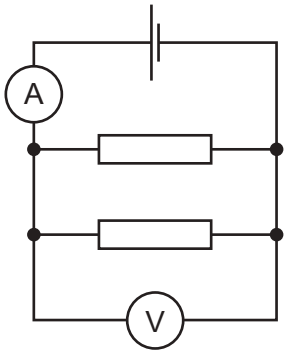
C thermistor

D variable resistor

31 A student sets up a circuit which she calls circuit 1. She records the value of the current I_1, and calculates the resistance R_1 of the circuit.



circuit 1



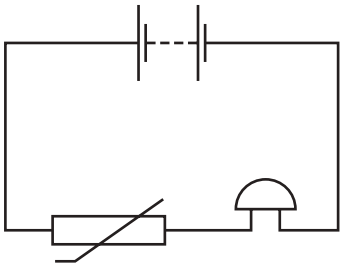
circuit 2

She then connects an identical resistor in parallel with the original resistor. She calls this circuit 2. She records current I_2 and calculates the total resistance R_2 of this circuit.

Which row correctly compares the two currents and the two resistances in the circuits?

	I_2	R_2
A	greater than I_1	greater than R_1
B	greater than I_1	less than R_1
C	less than I_1	greater than R_1
D	less than I_1	less than R_1

32 A student sets up this circuit.



What is the purpose of the circuit?

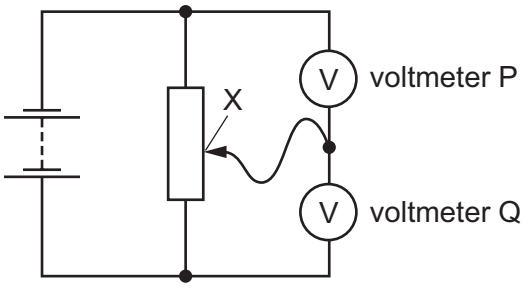
A to allow a lamp to be made dimmer or brighter as required

B to amplify the sound of a voice

C to light a lamp in the dark

D to sound a bell when the temperature rises

33 The diagram shows two voltmeters P and Q connected to a potential divider.

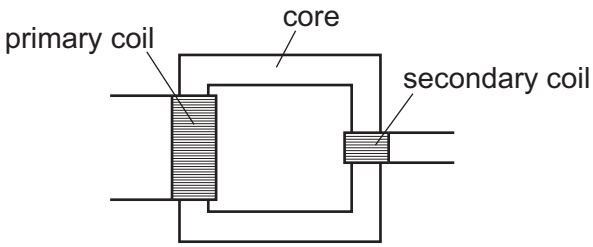


The sliding connection at point X is moved towards the top of the diagram.

What happens to the reading on P and to the reading on Q?

	reading on P	reading on Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

34 The diagram shows a transformer.



Which materials are the most suitable for the core and for the coils?

	core material	coil material
A	copper	copper
B	copper	iron
C	iron	copper
D	iron	iron

35 A current-carrying conductor placed in a magnetic field experiences a force.

Which changes result in reversing the direction of the force?

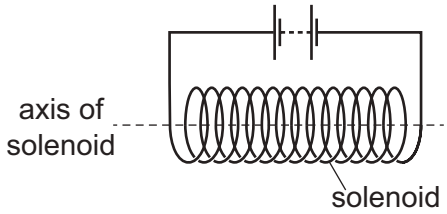
A Decrease the current, keeping the field direction constant.

B Increase the current and reverse the field direction.

C Increase the current, keeping the field direction constant.

D Reverse the current and reverse the field direction.

36 A solenoid is connected to a battery.



Which statement about the magnetic field at the centre of the solenoid is correct?

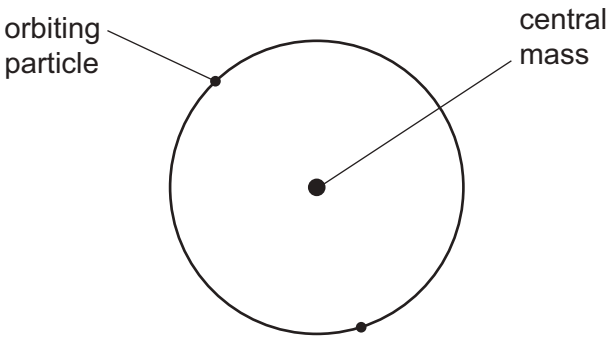
A The magnetic field along the axis is zero.

B The direction of the magnetic field is at an angle of 45° to the axis.

C The direction of the magnetic field is parallel to the axis.

D The direction of the magnetic field is perpendicular to the axis.

37 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.



What is the name of the central mass and of the orbiting particles?

	central mass	orbiting particles
A	neutron	α-particles
B	neutron	electrons
C	nucleus	α-particles
D	nucleus	electrons

38 One isotope of lead is represented by the nuclide symbol $^{214}_{82}Pb$.

How many neutrons and how many protons does one nucleus of this isotope contain?

	number of neutrons	number of protons
A	82	132
B	82	214
C	132	82
D	214	82

39 Three sources of background radiation are listed.

1 cosmic rays

2 medical X-rays

3 radioactive emissions from radon gas from the ground

Which of these sources are naturally occurring?

A 1 and 3 only **B** 1 only **C** 2 and 3 only **D** 2 only

40 The rates of emission from four radioactive sources are measured at 20 minute intervals.

Each row in the table shows the results for one of the radioactive sources.

Which source has the longest half-life?

	rate of emission / emissions per minute		
	time 0	time 20 min	time 40 min
A	120	60	30
B	120	110	101
C	240	60	15
D	240	170	122

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PHYSICS **0625/21**

Paper 2 Multiple Choice (Extended) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

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This document consists of **15** printed pages and **1** blank page.

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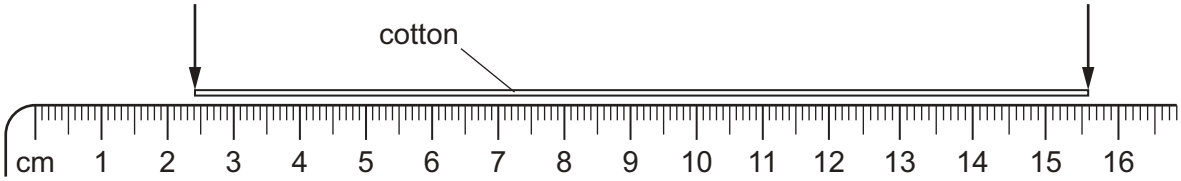
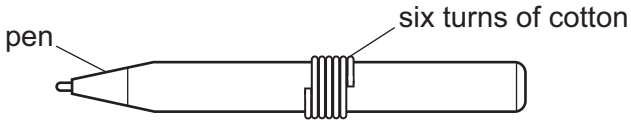
1 A length of cotton is measured between two points on a ruler.



When the length of cotton is wound closely around a pen, it goes round six times.



What is the distance once round the pen?

A 2.2 cm **B** 2.6 cm **C** 13.2 cm **D** 15.6 cm

2 When does an object falling vertically through the air reach terminal velocity?

A when the acceleration of the object becomes negative

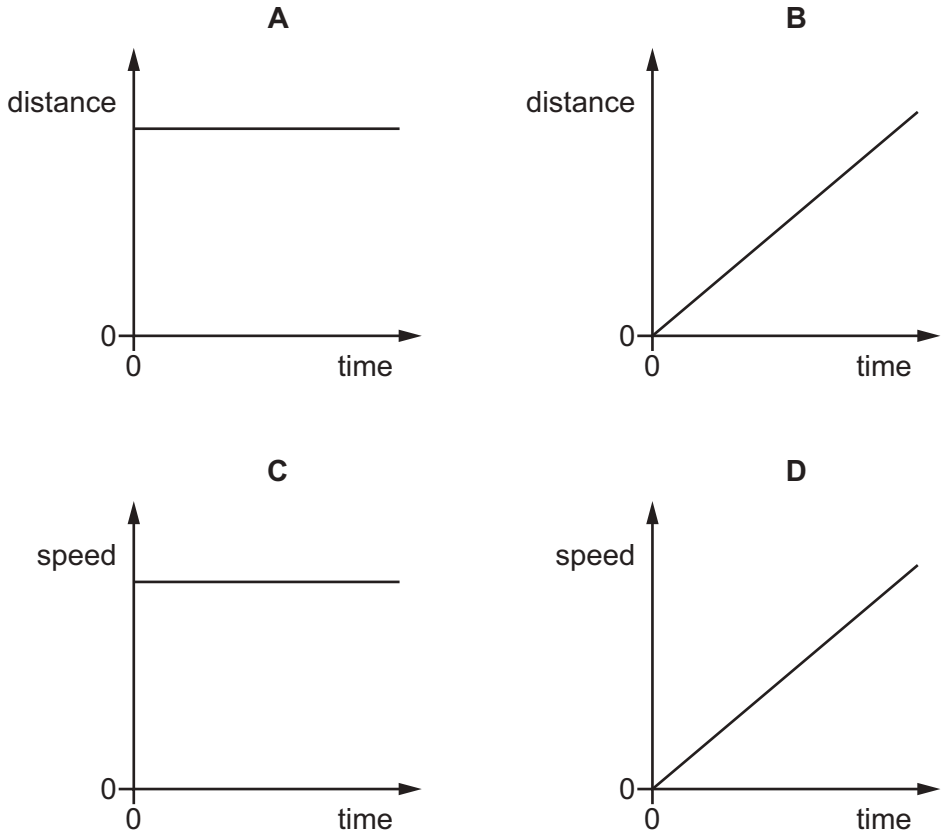
B when the acceleration of the object is equal to *g*

C when the air resistance equals the weight of the object

D when the air resistance is greater than the weight of the object

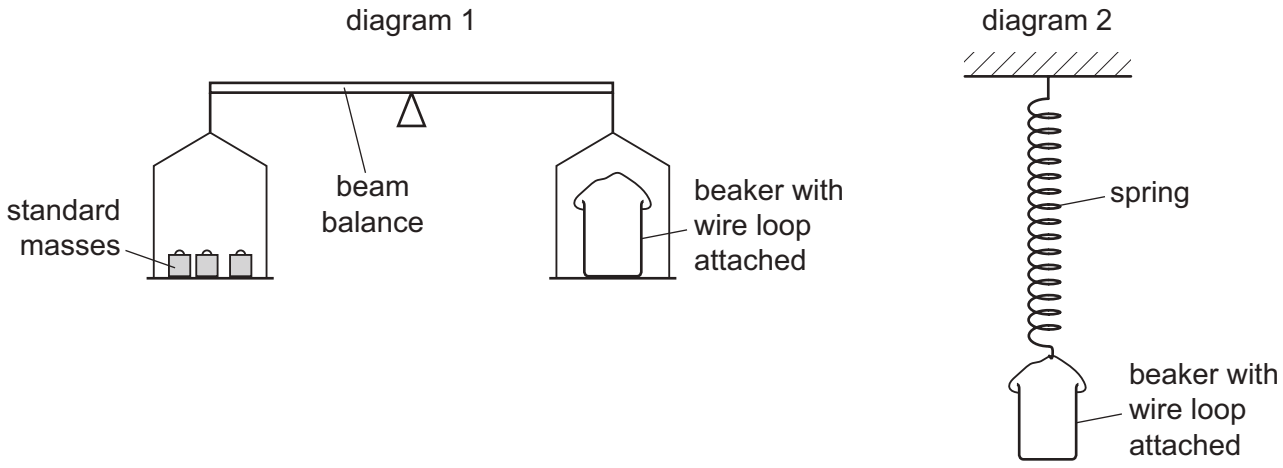
3 A car is moving along a straight, level road, with a constant acceleration.

Which graph shows the motion of the car?



4 Diagram 1 shows a beam balance. A beaker with a wire loop balances the standard masses.

The beaker is then removed and hung from a spring. The spring extends by 5.0 cm, as in diagram 2.



The experiment is repeated with the same apparatus on the Moon, where the acceleration of free fall is less than on Earth.

Which statement describes what happens on the Moon?

A The beam balance is balanced and the spring extends by 5.0 cm.

B The beam balance is balanced and the spring extends by less than 5.0 cm.

C The right-hand balance pan is higher and the spring extends by 5.0 cm.

D The right-hand balance pan is higher and the spring extends by less than 5.0 cm.

5 An object always has mass but does not always have weight.

What must be present and acting on the mass for it to have weight?

A a gravitational field

B a set of scales

C displaced water

D friction due to air resistance

6 A force acting on a moving ball causes its motion to change. This force stays constant.

What makes the force produce a greater change in the motion of the ball?

A decreasing the total mass of the ball

B increasing the temperature of the ball

C using a ball with a hollow centre but the same mass

D using a different material for the ball so that it has a lower density but the same mass

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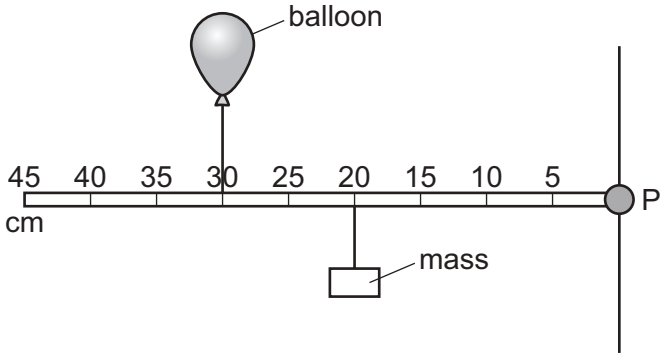
7 A balloon and a mass are attached to a rod that is pivoted at P.



The balloon is filled with helium, a gas less dense than air, so that it applies an upward force on the rod.

The rod is horizontal and stationary.

Which action causes the rod to rotate clockwise?

A Move both the balloon and mass 10 cm to the left.

B Move both the balloon and mass 10 cm to the right.

C Move both the balloon and mass to the 25 cm mark.

D Move the balloon to the 20 cm mark and the mass to the 30 cm mark.

8 A car is moving in a straight line on a level road. Its engine provides a forward force on the car. A second force of equal size acts on the car due to resistive forces.

Which statement describes what happens?

A The car changes direction.

B The car moves at a constant speed.

C The car slows down.

D The car speeds up.

9 Which expression gives the momentum of an object?

A mass × acceleration

B mass × gravitational field strength

C mass × velocity

D $\frac{1}{2}$ × mass × (velocity)^2

10 As energy is transferred into different forms, it eventually becomes dissipated.

What does this mean?

A All the energy disappears.

B The energy finally changes into every possible form of energy.

C The energy spreads out among the objects and their surroundings.

D The total amount of energy becomes less.

11 A ball of mass 1.2 kg is dropped from a height of 30 m. As it falls, 25% of its initial gravitational potential energy is transferred to thermal energy.

What is the kinetic energy of the ball just before it hits the ground?

A 27 J **B** 90 J **C** 270 J **D** 360 J

12 A girl hangs by her hands from a bar in the gymnasium. She pulls herself up until her chin is level with the bar.

The mass of the girl is 48 kg.

She pulls herself up through a distance of 0.25 m.

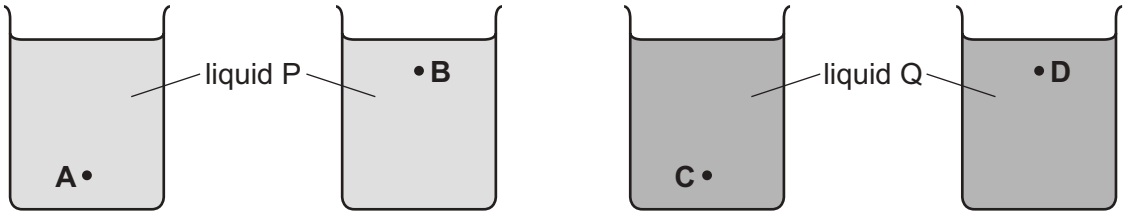
She does this in 2.0 s.

What is the useful power she uses to pull herself up?

A 6.0 W **B** 24 W **C** 60 W **D** 240 W

13 Four identical beakers are filled with equal volumes of liquids P or Q, as shown. Liquid P is more dense than liquid Q.

At which point is the pressure the least?



14 An oil tank has a base of area 2.5 m^2 and is filled with oil to a depth of 1.2 m.

The density of the oil is 800 kg / m^3.

What is the force exerted on the base of the tank due to the oil?

A 960 N **B** 2400 N **C** 9600 N **D** 24 000 N

15 When molecules of a gas rebound from a wall of a container, the wall experiences a pressure.

What is the cause of this pressure?

A the change in energy of the molecules

B the change in momentum of the molecules

C the change in power of the molecules

D the change in speed of the molecules

16 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	melting point of ice	boiling point of mercury
B	melting point of ice	boiling point of water
C	melting point of mercury	boiling point of mercury
D	melting point of mercury	boiling point of water

17 Which statements about boiling and about evaporation are both correct?

	boiling	evaporation
A	takes place only at the surface	takes place only at the surface
B	takes place only at the surface	takes place throughout the liquid
C	takes place throughout the liquid	takes place only at the surface
D	takes place throughout the liquid	takes place throughout the liquid

18 On a cold day, a metal front-door knob X and a similar plastic knob Y are at the same temperature.

Why does X feel cooler to the touch than Y?

A X convects thermal energy better than Y.

B X is a better thermal conductor than Y.

C X is a better insulator than Y.

D X is a better radiator of thermal energy than Y.

19 Light travels at a speed of 2.0×10^{8} m/s in a glass block.

In the glass, the wavelength of the light is 4.0×10^{-7} m.

What is the frequency of the light?

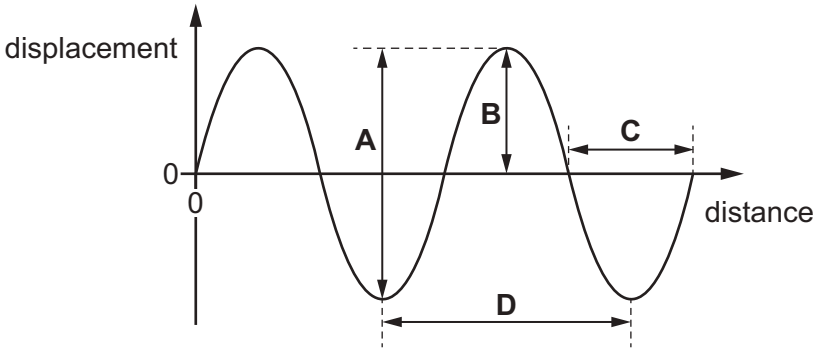
A 2.0×10^{-15} Hz

B 1.3×10^{-2} Hz

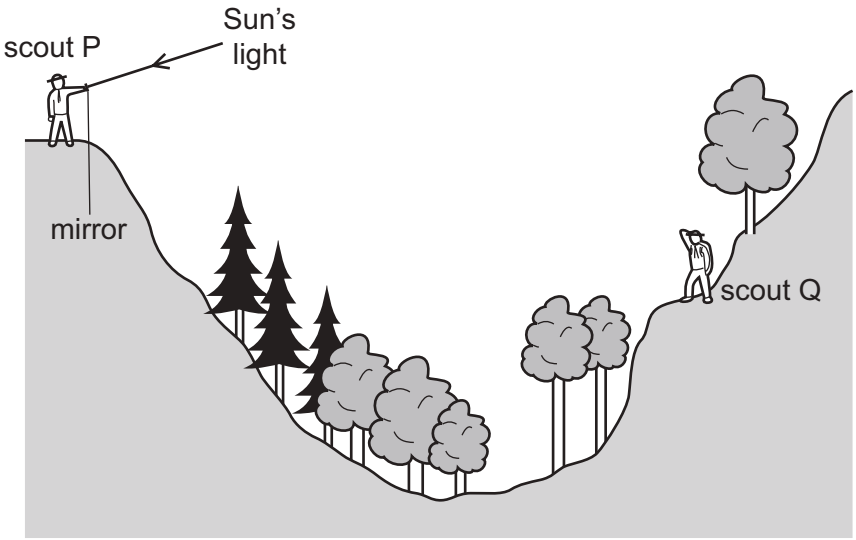
C 80 Hz

D 5.0×10^{14} Hz

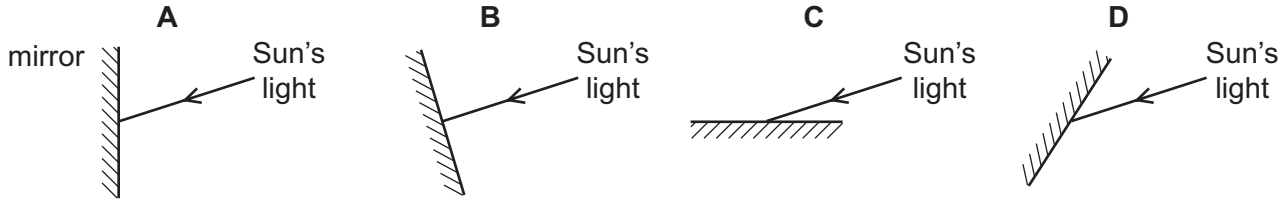
20 Which arrow on the graph shows the amplitude of the wave?



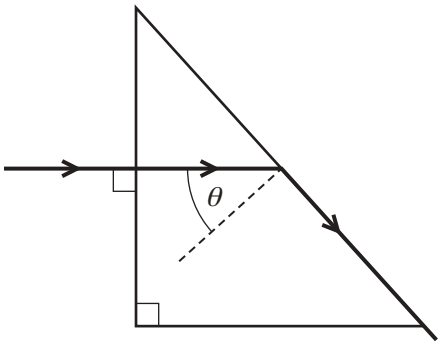
21 Scout P signals to scout Q on the other side of a valley by using a mirror to reflect the Sun's light.



Which mirror position allows the Sun's light to be reflected to scout Q?



22 A prism is made from transparent plastic. In this plastic, light travels at 0.80 *c*, where *c* is its speed in air. Light enters one face of the prism at right-angles as shown.



NOT TO SCALE

The light just escapes from the sloping face of the prism.

What is angle θ?

A 37° **B** 39° **C** 51° **D** 53°

23 The Sun emits infra-red radiation and light.

Light from the Sun reaches the Earth in 8 minutes.

Which row gives correct information about the infra-red radiation?

	wavelength of infra-red radiation	time taken for infra-red radiation to reach Earth
A	longer than wavelength of light	8 minutes
B	longer than wavelength of light	much less than 8 minutes
C	shorter than wavelength of light	8 minutes
D	shorter than wavelength of light	much more than 8 minutes

24 A dolphin has a range of audible frequencies of 150 Hz–150 kHz.

Which range of frequencies can be heard both by humans with good hearing and by dolphins?

A 20 Hz–150 Hz

B 20 Hz–150 kHz

C 20 kHz–150 kHz

D 150 Hz–20 kHz

25 A permanent magnet is placed close to a bar of soft iron.

What are the polarities of end P and of end Q?

	end P	end Q
A	N	N
B	N	S
C	S	N
D	S	S

26 A steel magnet is placed inside a coil of wire.

Which method is used to demagnetise the magnet?

A connect the coil to an a.c. power supply

B connect the coil to an a.c. power supply and slowly remove the magnet from the coil

C connect the coil to a d.c. power supply

D connect the coil to a d.c. power supply and slowly remove the magnet from the coil

27 The electromotive force (e.m.f.) of a rechargeable battery is 6.0 V.

What does this mean?

A 6.0 J is the maximum energy the battery can provide in 1.0 s.

B 6.0 J is the total energy the battery can provide before it has to be recharged.

C 6.0 J of energy is provided by the battery to drive a charge of 1.0 C around a complete circuit.

D 6.0 J of energy is provided by the battery to drive a current of 1.0 A around a complete circuit.

28 A student measures the potential difference across a device and the current in the device.

Which calculation gives the resistance of the device?

A current + potential difference

B current ÷ potential difference

C potential difference ÷ current

D potential difference × current

29 A water heater is connected to a 230 V supply and there is a current of 26 A in the heater. It takes 20 minutes to heat the water to the required temperature.

How much energy is supplied by the heater?

A 6.0×10^3 J **B** 1.0×10^4 J **C** 1.2×10^5 J **D** 7.2×10^6 J

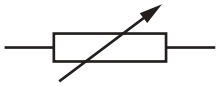
30 Which electrical symbol represents a diode?

A

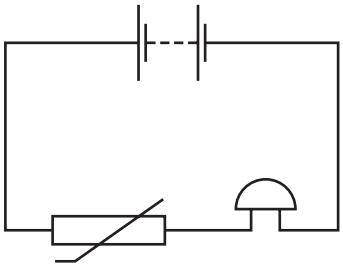
B

C

D



31 A student sets up this circuit.



What is the purpose of the circuit?

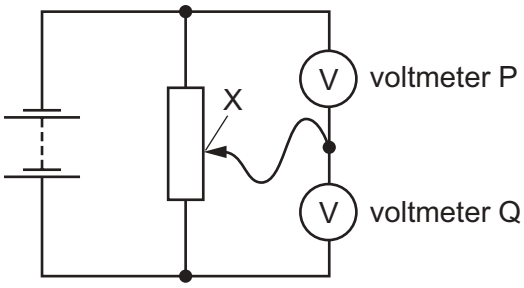
A to allow a lamp to be made dimmer or brighter as required

B to amplify the sound of a voice

C to light a lamp in the dark

D to sound a bell when the temperature rises

32 The diagram shows two voltmeters P and Q connected to a potential divider.

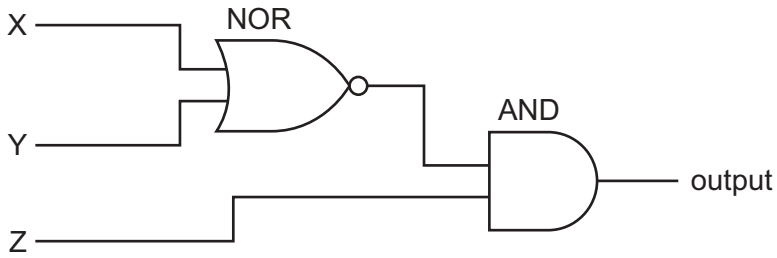


The sliding connection at point X is moved towards the top of the diagram.

What happens to the reading on P and to the reading on Q?

	reading on P	reading on Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

33 The diagram represents a digital circuit using a NOR gate and an AND gate.



What is the truth table for this circuit?

A

X	Y	Z	output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

B

X	Y	Z	output
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

C

X	Y	Z	output
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

D

X	Y	Z	output
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

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34 Which statement about electromagnetic induction is correct?

A A strong magnet that is held stationary near a stationary conductor causes a greater effect than a weak magnet.

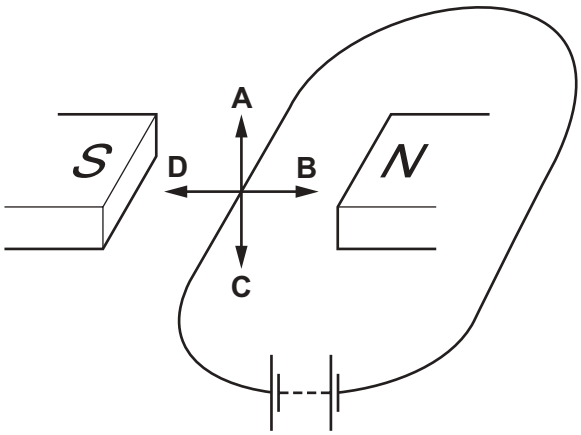
B The effect occurs when a magnet and a conductor are both moved with the same speed and in the same direction.

C The effect occurs when a magnet is moved away from a nearby conductor.

D The effect only occurs when a magnet is moved towards a conductor.

35 The diagram shows a current-carrying conductor in a magnetic field.

Which arrow shows the direction of the force acting on the conductor?



36 Power losses in transmission cables are reduced by increasing the transmission voltage.

What is the explanation for this reduction?

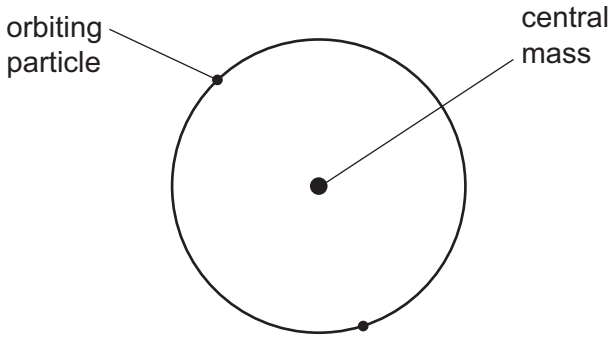
A The current decreases, reducing thermal energy losses.

B The current increases, increasing the flow of charge.

C The resistance of the cable increases, reducing the current.

D The resistance of the cable decreases.

37 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.



What is the name of the central mass and of the orbiting particles?

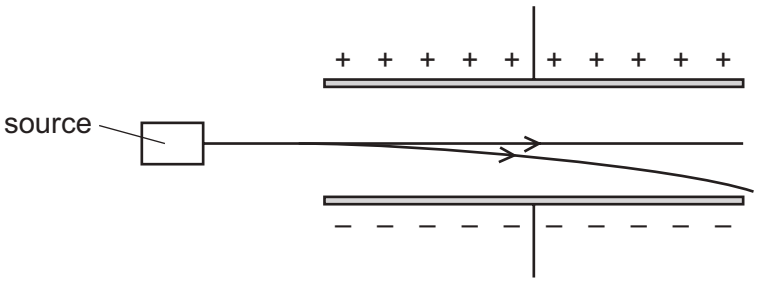
	central mass	orbiting particles
A	neutron	α-particles
B	neutron	electrons
C	nucleus	α-particles
D	nucleus	electrons

38 Nuclear fusion is a reaction that takes place in stars.

Which row describes this reaction?

	action of atomic nuclei	energy
A	an atomic nucleus splits into two or more smaller nuclei	absorbed
B	an atomic nucleus splits into two or more smaller nuclei	released
C	atomic nuclei join together to form a larger nucleus	absorbed
D	atomic nuclei join together to form a larger nucleus	released

39 The diagram shows emissions from a source passing into the electric field between two charged plates.



What is emitted by this source?

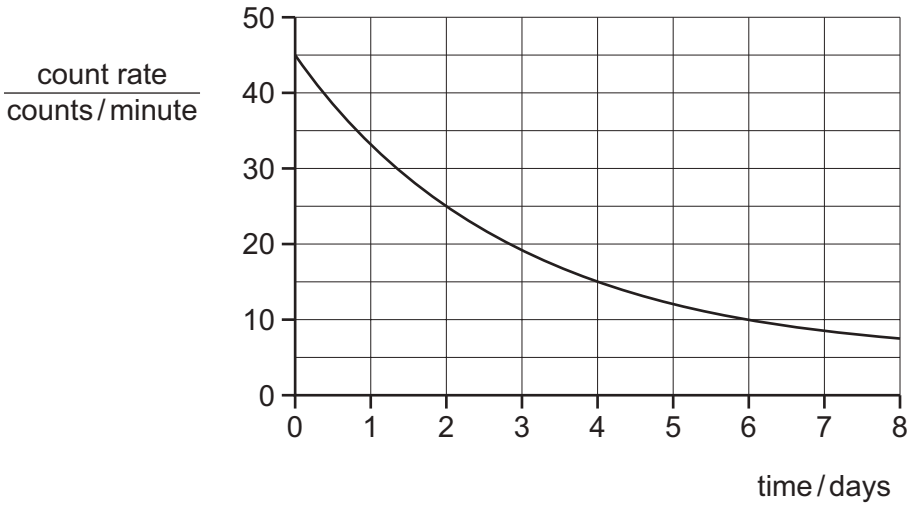
A neutrons and γ-rays only

B α-particles and β-particles only

C α-particles and γ-rays only

D β-particles and γ-rays only

40 The graph shows how the count rate registered by a counter near to a sample of a radioactive isotope changes over a period of a few days. The background count rate is 5 counts per minute.



What is the half-life of the isotope?

A 2.0 days **B** 2.5 days **C** 3.0 days **D** 4.0 days

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.

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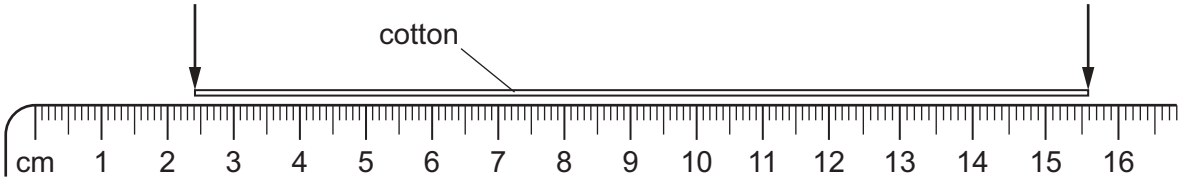
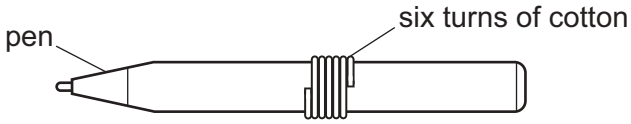
1 A length of cotton is measured between two points on a ruler.



When the length of cotton is wound closely around a pen, it goes round six times.



What is the distance once round the pen?

A 2.2 cm **B** 2.6 cm **C** 13.2 cm **D** 15.6 cm

2 When does an object falling vertically through the air reach terminal velocity?

A when the acceleration of the object becomes negative

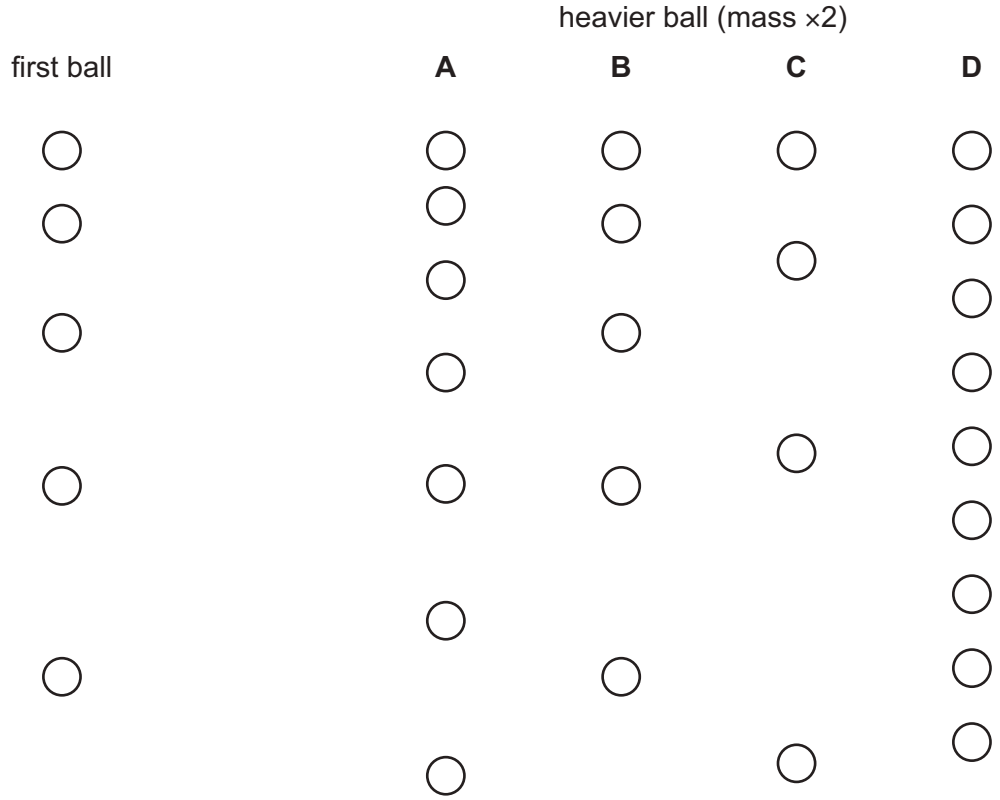
B when the acceleration of the object is equal to *g*

C when the air resistance equals the weight of the object

D when the air resistance is greater than the weight of the object

3 A ball is dropped in an evacuated tube. A series of photographs is taken at equal time intervals from the time of release. Another ball of the same size but twice the mass is also dropped in the same evacuated tube and photographed.

Which diagram shows the motion of the heavier ball?



4 Which statement about the mass and the weight of an object is correct?

A They are both affected by changes in the acceleration of free fall.

B They are both forces.

C They have different units.

D Weight is calculated by dividing mass by the acceleration of free fall.

5 Which statement about the mass of an object is correct?

A It is equal to the density divided by the volume.

B It is equal to weight multiplied by the gravitational field strength.

C It is the effect of a gravitational field on the object.

D It is the property that resists a change in velocity.

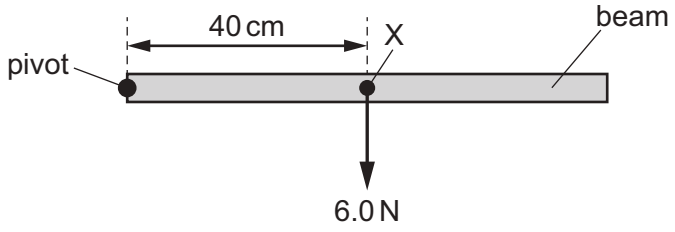
6 An object decelerates from 25.0 m / s to 5.0 m / s in a time of 4.0 s.

It has a mass of 50 kg.

What is the resultant force on the object?

A 0.63 N **B** 10 N **C** 250 N **D** 4000 N

7 A beam is pivoted at one end, as shown.



The beam weighs 6.0 N and its weight acts at a point X, 40 cm from the pivot.

A force of 4.0 N is applied to the beam causing it to balance horizontally.

In which direction and where is the 4.0 N force applied?

A downwards at 20 cm to the left of X

B downwards at 20 cm to the right of X

C upwards at 20 cm to the left of X

D upwards at 20 cm to the right of X

8 A spacecraft is travelling in space with no resultant force and no resultant moment acting on it.

Which statement about the spacecraft is correct?

A Its direction is changing.

B It is in equilibrium.

C Its speed is decreasing.

D Its speed is increasing.

9 A car of mass 1000 kg travelling at 8.0 m / s collides with a lorry of mass 3000 kg that is travelling at 2.0 m / s in the same direction. After colliding, the two vehicles stick together.

What is their speed after the collision?

A 2.0 m / s **B** 2.5 m / s **C** 3.5 m / s **D** 5.0 m / s

10 What is the main process by which energy is released in the Sun?

A α-decay

B β-decay

C nuclear fission

D nuclear fusion

11 The work done W by a force is related to the magnitude F of the force and the distance d moved in the direction of the force.

Which equation for W is correct?

A $W = d \div F$

B $W = d + F$

C $W = F \div d$

D $W = F \times d$

12 A crane on a construction site lifts concrete beams.

The useful work done by the crane is 4000 kJ in a time of 160 s.

What is the useful output power of the crane?

A 0.04 kW **B** 25 W **C** 25 kW **D** 640 kW

13 A submarine is in water of density 1.0×10^3 kg / m^3. The submarine changes its depth. This causes the pressure on it to change by 0.10 MPa.

What is the change in depth of the submarine?

A 0.10 m **B** 10 m **C** 100 m **D** 1000 m

14 An oil tank has a base of area 2.5 m^2 and is filled with oil to a depth of 1.2 m.

The density of the oil is 800 kg / m^3.

What is the force exerted on the base of the tank due to the oil?

A 960 N **B** 2400 N **C** 9600 N **D** 24 000 N

15 When molecules of a gas rebound from a wall of a container, the wall experiences a pressure.

What is the cause of this pressure?

A the change in energy of the molecules

B the change in momentum of the molecules

C the change in power of the molecules

D the change in speed of the molecules

16 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	melting point of ice	boiling point of mercury
B	melting point of ice	boiling point of water
C	melting point of mercury	boiling point of mercury
D	melting point of mercury	boiling point of water

17 In an experiment, an object is heated.

The data from the experiment is shown.

- The energy transferred to the object is 3.0 kJ.
- The mass of the object is 2.0 kg.
- The rise in temperature of the object is 10 °C.
- The specific heat capacity of the object is 150 J / (kg °C).

What is the thermal capacity of the object?

A 30 J / °C **B** 300 J / °C **C** 3000 J / °C **D** 9000 J / °C

18 Four thermometers, with their bulbs painted different colours, are placed at equal distances from a radiant heater.

Which thermometer shows the slowest temperature rise when the heater is first switched on?

A matt black

B matt white

C shiny black

D shiny white

19 A tank contains water. Ripples are produced on the surface of the water.

What causes the ripples to refract?

A The cold water in the tank is replaced by warm water.

B The ripples change speed as they move from deep to shallow water.

C The ripples hit the wall of the tank.

D The ripples pass through a narrow gap.

20 Light travels at a speed of 2.0×10^{8} m/s in a glass block.

In the glass, the wavelength of the light is 4.0×10^{-7} m.

What is the frequency of the light?

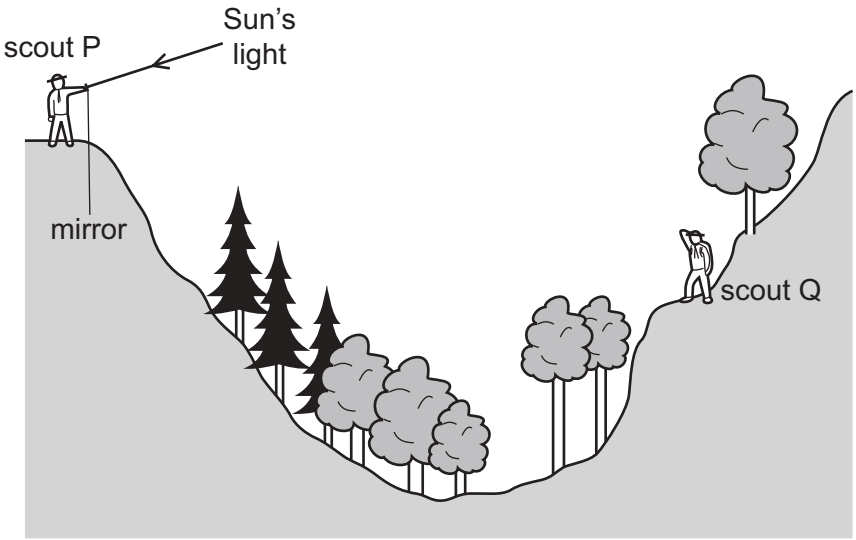
A 2.0×10^{-15} Hz

B 1.3×10^{-2} Hz

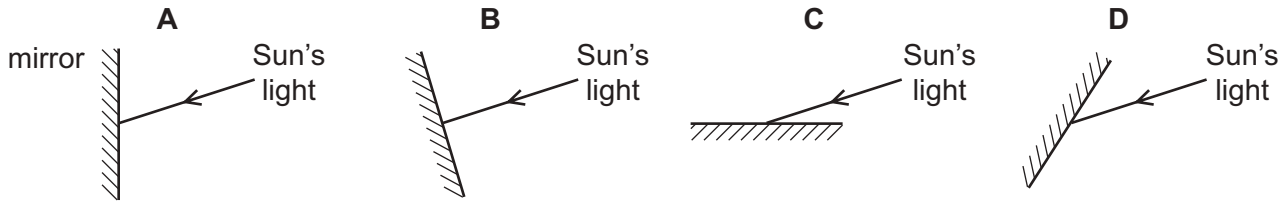
C 80 Hz

D 5.0×10^{14} Hz

21 Scout P signals to scout Q on the other side of a valley by using a mirror to reflect the Sun's light.



Which mirror position allows the Sun's light to be reflected to scout Q?



22 A scientist describes light as being monochromatic.

What does this tell you about the light?

A It has a single frequency.

B It has more than one wavelength.

C It travels at a single speed in a single direction.

D It travels at different speeds in different directions.

23 Which statement is **not** correct?

A The speed of long-wavelength infra-red radiation in a vacuum is greater than that of short-wavelength ultraviolet light.

B The speed of microwaves in air is approximately 3.0×10^8 m/s.

C The speed of γ-rays emitted from a sample of cobalt-60 is 3.0×10^5 km/s.

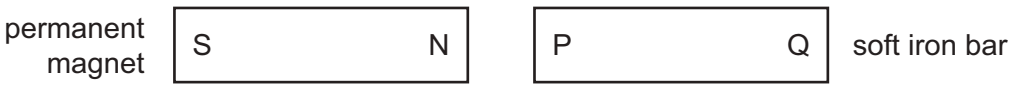
D The X-rays emitted in a supernova explosion reach the Earth at the same time as the visible light emitted.

24 A siren is emitting a sound. As time passes, the sound becomes louder and higher pitched.

What is happening to the amplitude and to the frequency of the emitted sound wave?

	amplitude	frequency
A	decreasing	decreasing
B	decreasing	increasing
C	increasing	decreasing
D	increasing	increasing

25 A permanent magnet is placed close to a bar of soft iron.



What are the polarities of end P and of end Q?

	end P	end Q
A	N	N
B	N	S
C	S	N
D	S	S

26 Which method is used to demagnetise a bar magnet?

A lower it into water

B heat it with a Bunsen burner

C place it in a metal box

D suspend it in a sling

27 What is the electromotive force (e.m.f.) of a cell?

A the amount of charge that passes through the cell per unit time

B the energy gained per unit charge as charge passes through the cell

C the total amount of charge flowing through the cell

D the total energy stored in the cell

28 A student measures the potential difference across a device and the current in the device.

Which calculation gives the resistance of the device?

A current + potential difference

B current ÷ potential difference

C potential difference ÷ current

D potential difference × current

29 A piece of wire is 40 cm long and has a diameter of 2.0 mm.

Its resistance is 0.30 Ω.

Which wire of the same material has a resistance of 0.15 Ω?

	length / cm	diameter / mm
A	20	1.0
B	20	4.0
C	80	1.0
D	80	4.0

30 A diode is used as a rectifier.

What is the purpose of a rectifier?

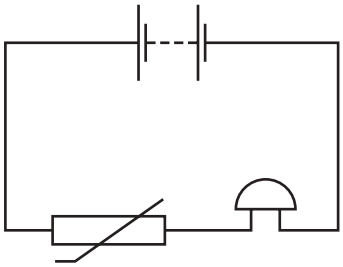
A to allow current to pass in either direction

B to change alternating current into direct current

C to switch off the circuit in case of a large current

D to provide an efficient source of light

31 A student sets up this circuit.



What is the purpose of the circuit?

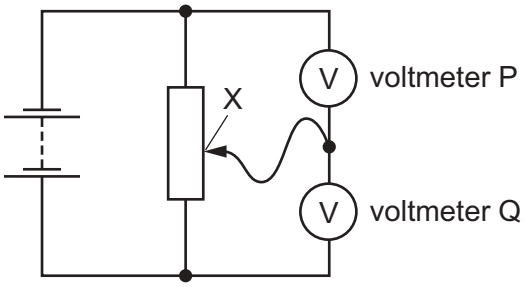
A to allow a lamp to be made dimmer or brighter as required

B to amplify the sound of a voice

C to light a lamp in the dark

D to sound a bell when the temperature rises

32 The diagram shows two voltmeters P and Q connected to a potential divider.

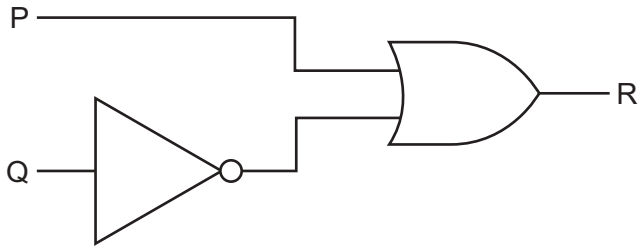


The sliding connection at point X is moved towards the top of the diagram.

What happens to the reading on P and to the reading on Q?

	reading on P	reading on Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

33 The circuit shown contains two gates.



Which truth table describes the operation of the circuit?

A

P	Q	R
0	0	0
0	1	1
1	0	1
1	1	1

B

P	Q	R
0	0	0
0	1	0
1	0	1
1	1	1

C

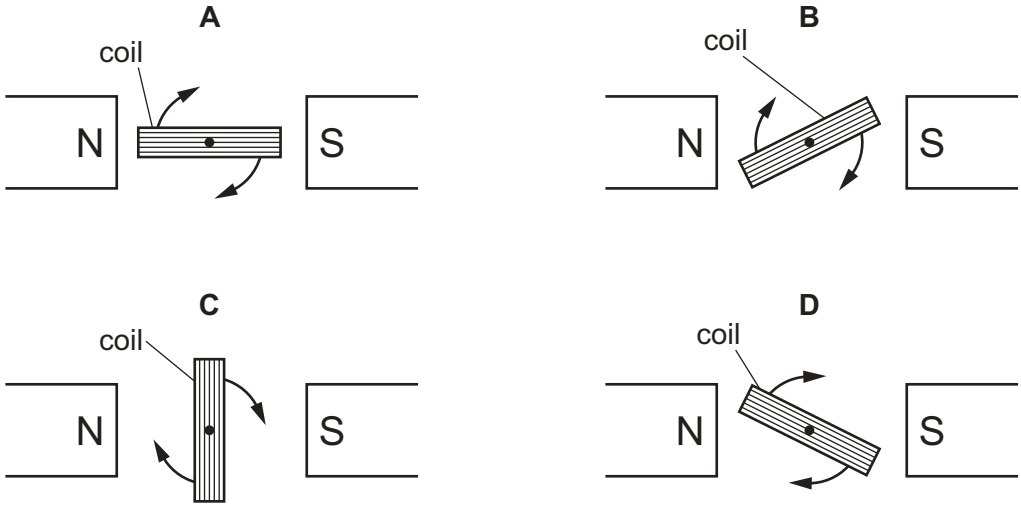
P	Q	R
0	0	1
0	1	0
1	0	0
1	1	0

D

P	Q	R
0	0	1
0	1	0
1	0	1
1	1	1

34 In an a.c. generator, a coil is rotated in a magnetic field and an electromotive force (e.m.f.) is induced in the coil.

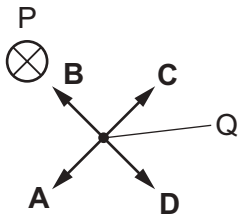
In which position of the coil does the e.m.f. have the largest value?



35 Wire P carries a current directed perpendicularly into the page. A compass is placed at point Q which is close to wire P.

The magnetic field at Q due to the current is very much larger than the magnetic field of the Earth.

In which direction does the North pole of the compass point?

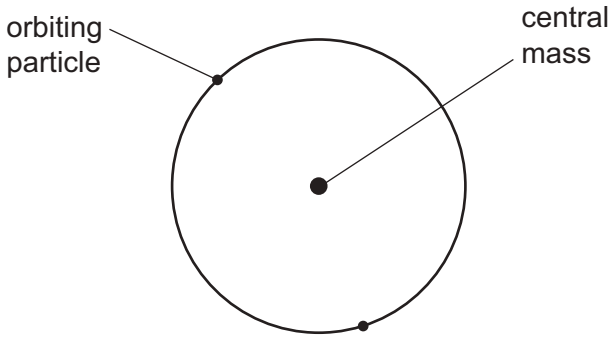


36 A transformer has N_p turns in the primary coil and N_s turns in the secondary coil.

Which row gives the values of N_p and N_s for a transformer that steps up a voltage of 1200 V to 36 000 V?

	N_p	N_s
A	2 000	60 000
B	2 000	600 000
C	60 000	2 000
D	600 000	2 000

37 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.



What is the name of the central mass and of the orbiting particles?

	central mass	orbiting particles
A	neutron	α-particles
B	neutron	electrons
C	nucleus	α-particles
D	nucleus	electrons

38 An isotope of polonium has the nuclide notation $^{218}_{84}Po$.

A nucleus of this isotope decays by emitting an α-particle. A β-particle is then emitted to form nuclide X.

What is the notation for nuclide X?

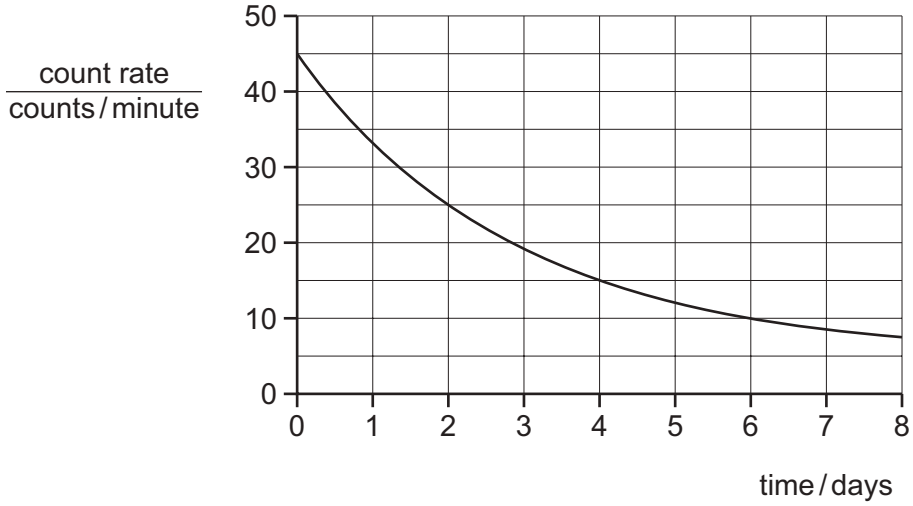
A $^{214}_{81}X$ **B** $^{213}_{82}X$ **C** $^{213}_{83}X$ **D** $^{214}_{83}X$

39 The table compares the penetrating abilities and ionising effects of α-radiation and of γ-radiation.

Which row is correct?

	least penetrating	most ionising
A	α	α
B	α	γ
C	γ	α
D	γ	γ

40 The graph shows how the count rate registered by a counter near to a sample of a radioactive isotope changes over a period of a few days. The background count rate is 5 counts per minute.



What is the half-life of the isotope?

A 2.0 days **B** 2.5 days **C** 3.0 days **D** 4.0 days

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Cambridge International General Certificate of Secondary Education

PHYSICS **0625/23**

Paper 2 Multiple Choice (Extended) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = $10\,m/s^2$).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **16** printed pages.

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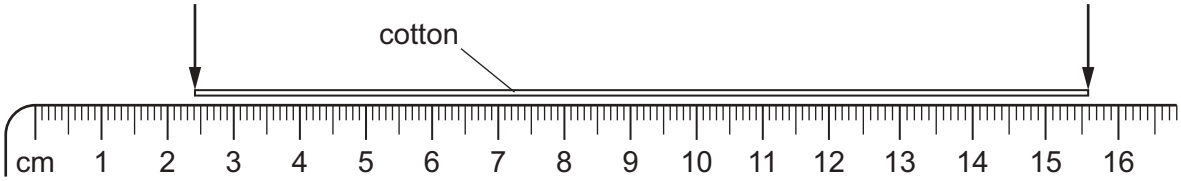
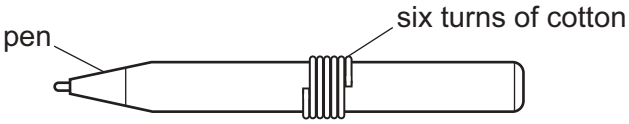
1 A length of cotton is measured between two points on a ruler.



When the length of cotton is wound closely around a pen, it goes round six times.



What is the distance once round the pen?

A 2.2 cm **B** 2.6 cm **C** 13.2 cm **D** 15.6 cm

2 When does an object falling vertically through the air reach terminal velocity?

A when the acceleration of the object becomes negative

B when the acceleration of the object is equal to *g*

C when the air resistance equals the weight of the object

D when the air resistance is greater than the weight of the object

3 A sprinter runs a 100 m race in a straight line. The table shows how his speed changes with time for the first 5.0 s of the race.

speed / m/s	0	1.7	4.1	5.7	6.5	6.8
time / s	0	1.0	2.0	3.0	4.0	5.0

What is the average acceleration of the sprinter between time 2.0 s and time 3.0 s?

A 1.6 m/s^2 **B** 1.9 m/s^2 **C** 4.1 m/s^2 **D** 5.7 m/s^2

4 A person steps onto a bathroom scales.

The bathroom scales records both mass and weight.

Which row shows the readings on the scales?

	mass	weight
A	60 N	600 kg
B	60 kg	600 N
C	600 kg	60 N
D	600 N	60 kg

5 An object has a weight of 7600 N in a gravitational field of strength 100 N / kg.

What is the mass of the object?

A 76 kg **B** 760 N **C** 7600 g **D** 76 000 N

6 A load is hung from a steel wire. The load is increased.

The length of the wire increases until the limit of proportionality is reached.

The load is now increased slightly.

What happens?

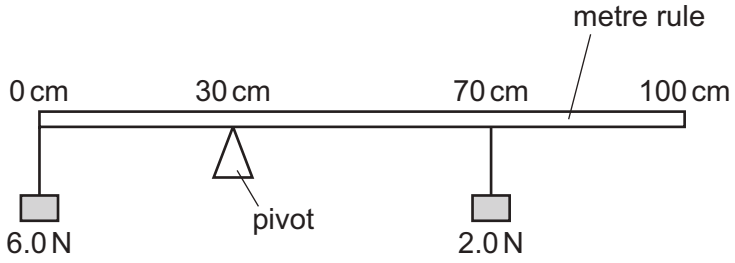
A The extension of the wire increases and the wire no longer obeys Hooke's law.

B The extension of the wire decreases and the wire no longer obeys Hooke's law.

C The extension of the wire increases and it obeys Hooke's law.

D The extension of the wire decreases and it obeys Hooke's law.

7 The diagram shows a uniform metre rule pivoted at the 30 cm mark.



The rule balances when a weight of 6.0 N is hanging from the zero mark and a weight of 2.0 N is hanging from the 70 cm mark.

What is the weight of the rule?

A 2.0 N **B** 5.0 N **C** 6.0 N **D** 13.0 N

8 An astronaut orbits the Earth in a space station.

Which is a vector quantity?

A the mass of the astronaut

B the speed of the satellite

C the temperature inside the satellite

D the weight of the astronaut

9 A visitor to a fairground throws a soft object of mass 0.12 kg at a coconut of mass 0.48 kg. The soft object stops moving when it hits the coconut. In order to dislodge the coconut, it must be made to move at 0.10 m/s.

What is the minimum speed with which the visitor should throw the soft object in order to dislodge the coconut?

A 0.20 m/s

B 0.40 m/s

C 2.0 m/s

D 4.0 m/s

10 An aircraft with a mass of 300 000 kg is flying at an altitude of 2000 m with a speed of 100 m / s.

What is the kinetic energy of the aircraft?

A 1.5×10^4 kJ **B** 1.5×10^6 kJ **C** 3.0×10^6 kJ **D** 6.0×10^6 kJ

11 Which method of drying clothes has the least impact on the environment?

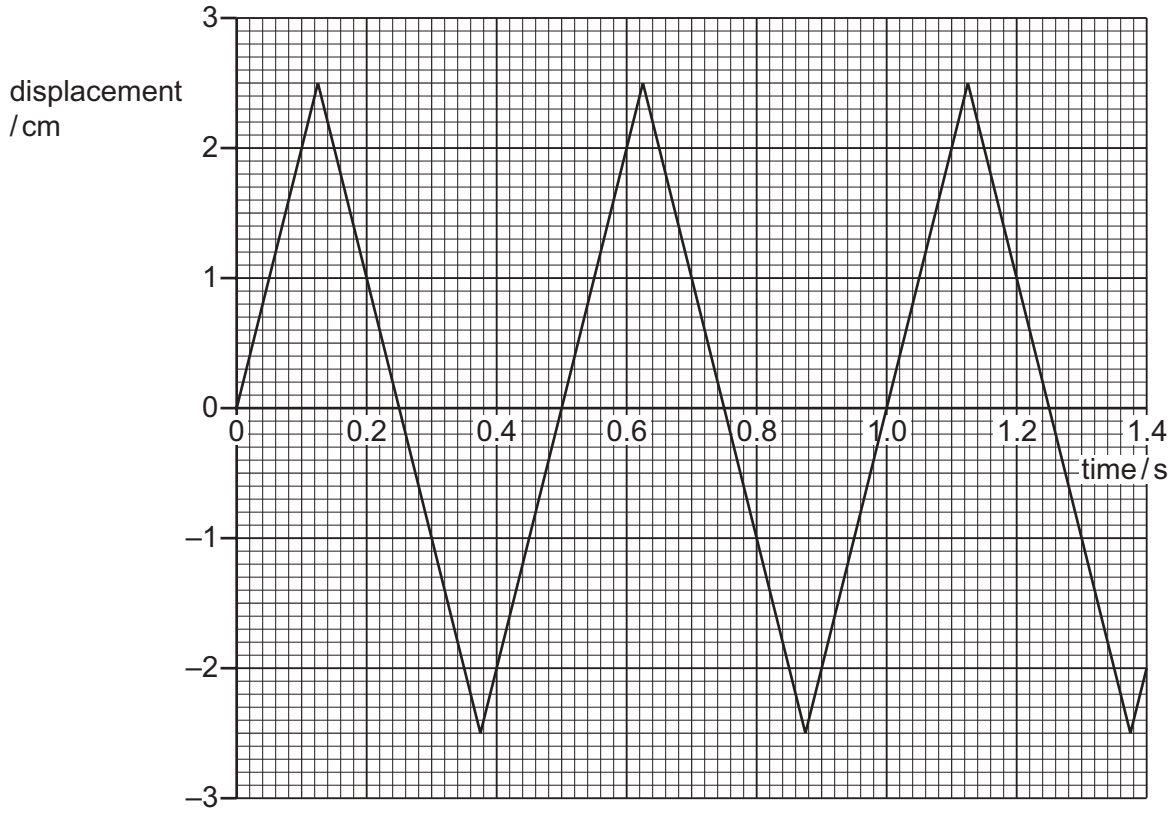
A Evaporate the water in them in an electrically heated tumble dryer.

B Hang them on a washing line in direct sunlight.

C Remove the water from them in an electric spin dryer.

D Suspend them close to a coal fire.

12 The vertical displacement of a mass of 0.20 kg changes with time. The graph shows how this displacement changes.



At which rate does it gain gravitational potential energy as it moves upwards?

A 0.025 W **B** 0.050 W **C** 0.20 W **D** 0.40 W

13 A simple barometer includes a column of mercury.

Which property of this column of mercury is used to give a measurement of atmospheric pressure?

A its cross-sectional area

B its height

C its temperature

D its thermal capacity

14 An oil tank has a base of area 2.5 m^2 and is filled with oil to a depth of 1.2 m.

The density of the oil is 800 kg / m^3.

What is the force exerted on the base of the tank due to the oil?

A 960 N **B** 2400 N **C** 9600 N **D** 24 000 N

15 When molecules of a gas rebound from a wall of a container, the wall experiences a pressure.

What is the cause of this pressure?

A the change in energy of the molecules

B the change in momentum of the molecules

C the change in power of the molecules

D the change in speed of the molecules

16 Two liquid-in-glass thermometers P and Q contain the same volume of mercury and have capillary tubes of the same length.

Thermometer P has a capillary tube with a smaller diameter than thermometer Q.

Which thermometer has the greater range and which has the greater sensitivity?

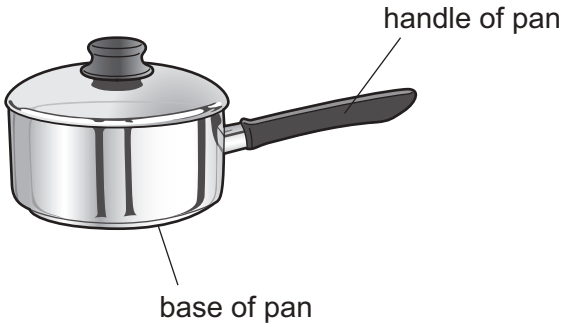
	greater range	greater sensitivity
A	P	P
B	P	Q
C	Q	P
D	Q	Q

17 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	melting point of ice	boiling point of mercury
B	melting point of ice	boiling point of water
C	melting point of mercury	boiling point of mercury
D	melting point of mercury	boiling point of water

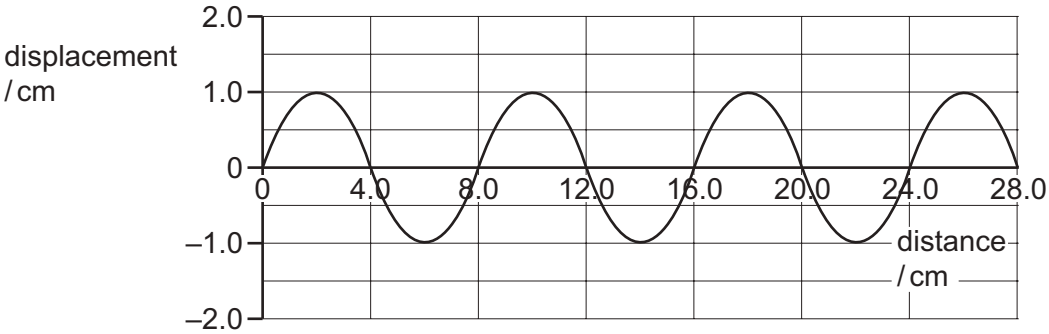
18 The diagram shows a pan used for cooking food.



Which row is correct for the materials used to make the base and the handle of the pan?

	base of pan	handle of pan
A	good thermal conductor	good thermal conductor
B	good thermal conductor	poor thermal conductor
C	poor thermal conductor	good thermal conductor
D	poor thermal conductor	poor thermal conductor

19 The diagram shows a wave.



Which row is correct?

	amplitude of the wave / cm	wavelength of the wave / cm
A	1.0	4.0
B	1.0	8.0
C	2.0	4.0
D	2.0	8.0

20 Light travels at a speed of 2.0×10^{8} m/s in a glass block.

In the glass, the wavelength of the light is 4.0×10^{-7} m.

What is the frequency of the light?

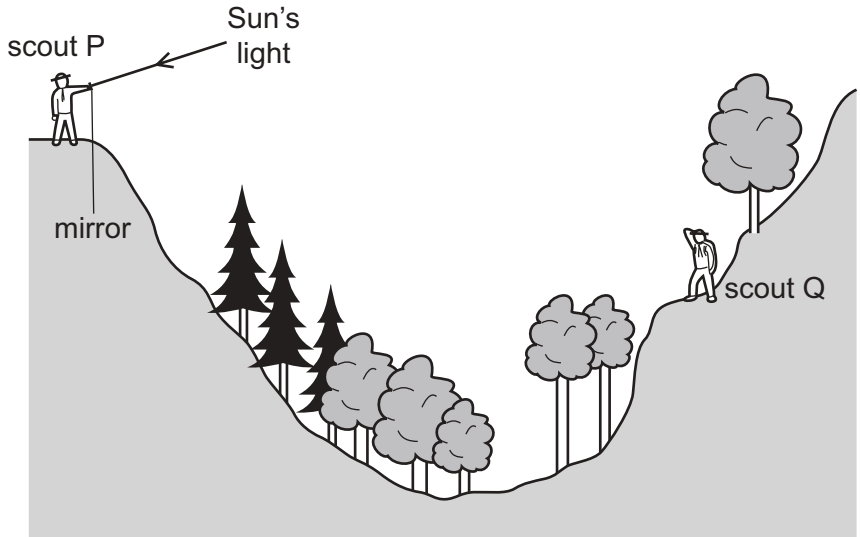
A 2.0×10^{-15} Hz

B 1.3×10^{-2} Hz

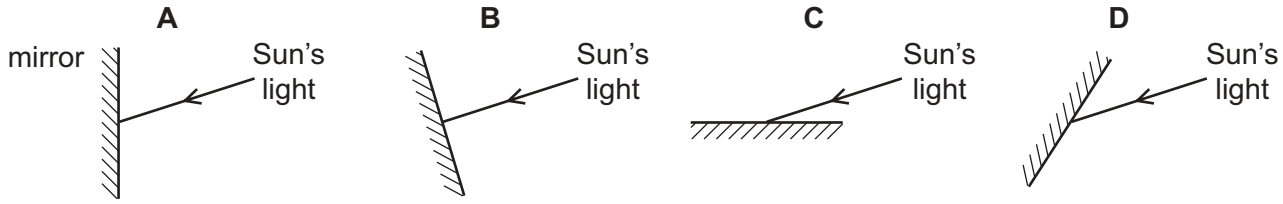
C 80 Hz

D 5.0×10^{14} Hz

21 Scout P signals to scout Q on the other side of a valley by using a mirror to reflect the Sun's light.



Which mirror position allows the Sun's light to be reflected to scout Q?

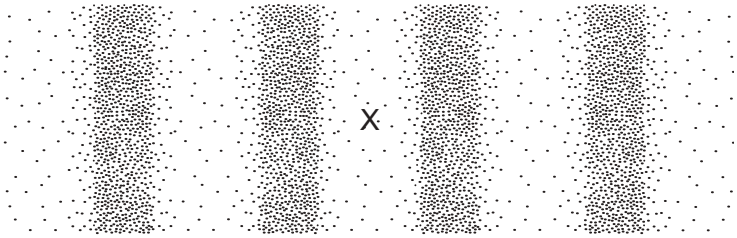


22 Images formed by lenses and mirrors can either be described as real or as virtual.

Which row describes real and virtual images of a point object?

	real images	virtual images
A	formed where light rays meet	an image in a plane mirror is an example of a virtual image
B	formed where light rays meet	can be projected onto a screen
C	formed from where light rays appear to diverge	an image in a plane mirror is an example of a virtual image
D	formed from where light rays appear to diverge	can be projected onto a screen

23 The diagram shows the air molecules in part of a sound wave at a particular moment in time.



Which statement is **not** correct?

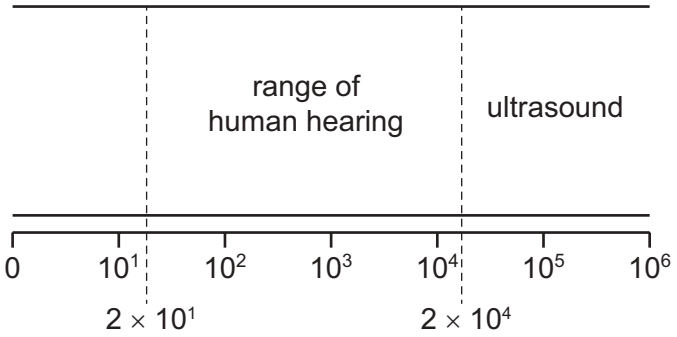
A Earlier, there was compression at X.

B Later, there will be a rarefaction at X.

C This part of the wave is travelling horizontally across the page.

D This part of the wave is travelling towards the top of the page.

24 The diagram shows the ranges of human hearing and of ultrasound waves.



To which characteristic of sound waves do the numbers on the diagram refer?

A amplitude in cm

B frequency in Hz

C speed in metres / second

D wavelength in metres

25 A permanent magnet is placed close to a bar of soft iron.

What are the polarities of end P and of end Q?

	end P	end Q
A	N	N
B	N	S
C	S	N
D	S	S

26 Which method is used to demagnetise a magnet?

A cool it in a freezer

B drop it into a beaker of water

C place it inside a coil carrying a direct current

D strike it with a hammer

27 Two power supplies are connected in separate circuits. Both power supplies provide the same magnitude current.

Power supply P has an electromotive force (e.m.f.) of 1.5 V and power supply Q has an e.m.f. of 3.0 V.

Which statements are correct?

1 Source Q supplies twice the charge per unit time.

2 Source Q supplies twice the energy per unit charge.

3 Source Q supplies twice the energy per unit time.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

28 A student measures the potential difference across a device and the current in the device.

Which calculation gives the resistance of the device?

A current + potential difference

B current ÷ potential difference

C potential difference ÷ current

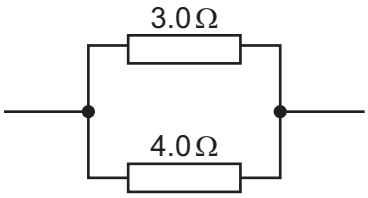
D potential difference × current

29 An electricity meter records that 200 MJ of electrical energy are drawn from the 240 V mains supply in a 24 hour period.

What is the average rate of electrical charge passing through the meter?

A 9.6 C / h **B** 580 C / h **C** 35 kC / h **D** 0.83 MC / h

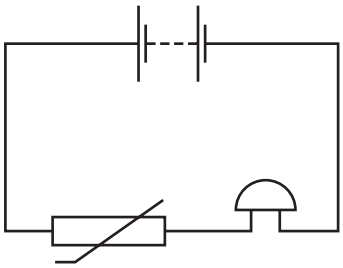
30 A 3.0 Ω resistor is connected in parallel with a 4.0 Ω resistor.



What is the resistance of this combination?

A 0.14 Ω **B** 0.58 Ω **C** 1.7 Ω **D** 7.0 Ω

31 A student sets up this circuit.



What is the purpose of the circuit?

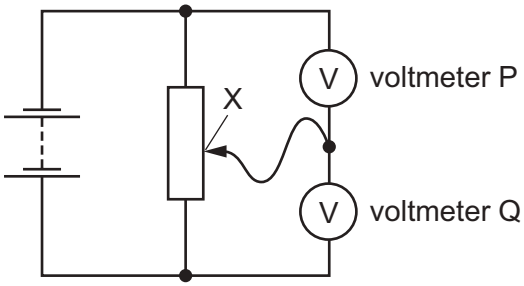
A to allow a lamp to be made dimmer or brighter as required

B to amplify the sound of a voice

C to light a lamp in the dark

D to sound a bell when the temperature rises

32 The diagram shows two voltmeters P and Q connected to a potential divider.

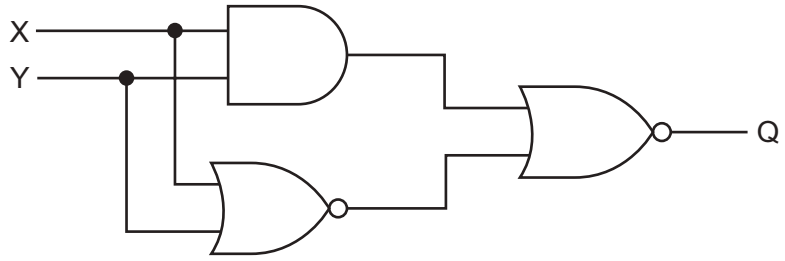


The sliding connection at point X is moved towards the top of the diagram.

What happens to the reading on P and to the reading on Q?

	reading on P	reading on Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

33 The diagram shows a logic circuit with inputs X and Y.



The output is Q.

Which truth table is correct?

A

X	Y	Q
0	0	0
0	1	1
1	0	1
1	1	0

B

X	Y	Q
0	0	1
0	1	0
1	0	0
1	1	1

C

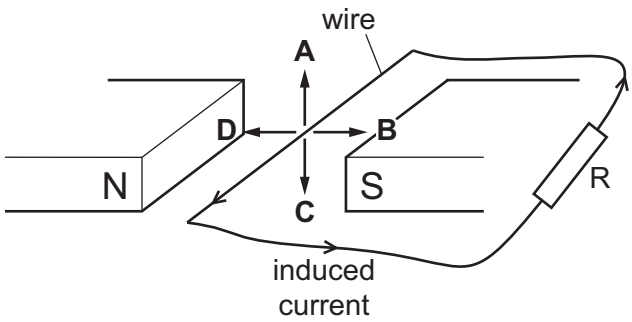
X	Y	Q
0	0	1
0	1	1
1	0	1
1	1	1

D

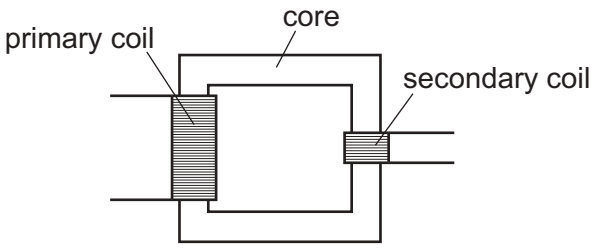
X	Y	Q
0	0	0
0	1	0
1	0	0
1	1	0

34 A wire connected to a resistor is moved in a magnetic field. A current is induced in the direction shown.

In which direction is the wire moved?



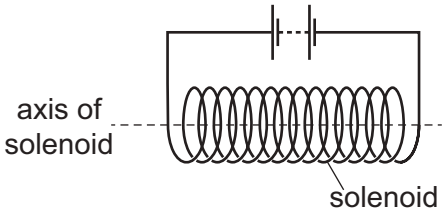
35 The diagram shows a transformer.



Which materials are the most suitable for the core and for the coils?

	core material	coil material
A	copper	copper
B	copper	iron
C	iron	copper
D	iron	iron

36 A solenoid is connected to a battery.



Which statement about the magnetic field at the centre of the solenoid is correct?

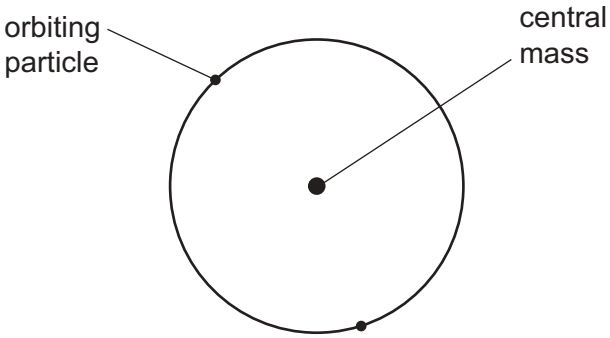
A The magnetic field along the axis is zero.

B The direction of the magnetic field is at an angle of 45° to the axis.

C The direction of the magnetic field is parallel to the axis.

D The direction of the magnetic field is perpendicular to the axis.

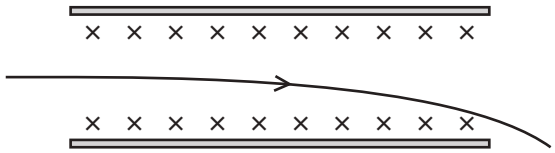
37 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.



What is the name of the central mass and of the orbiting particles?

	central mass	orbiting particles
A	neutron	α-particles
B	neutron	electrons
C	nucleus	α-particles
D	nucleus	electrons

38 The radiation from a radioactive source passes between two metal plates, and is deflected as shown in the diagram. Between the plates there is a magnetic field directed into the plane of the paper, as indicated by the crosses.



Only one type of radiation is present.

Which situation is possible?

A The source emits alpha particles and there is an upwards electric field between the plates.

B The source emits alpha particles and there is no electric field between the plates.

C The source emits beta particles and there is an upwards electric field between the plates.

D The source emits gamma radiation and there is a downwards electric field between the plates.

39 The nucleus of an isotope of nitrogen (N) absorbs a neutron. It then decays into an isotope of carbon (C) and emits x.

$$^{1}_{0}n + ^{14}_{7}N \rightarrow ^{14}_{6}C + x$$

What is x?

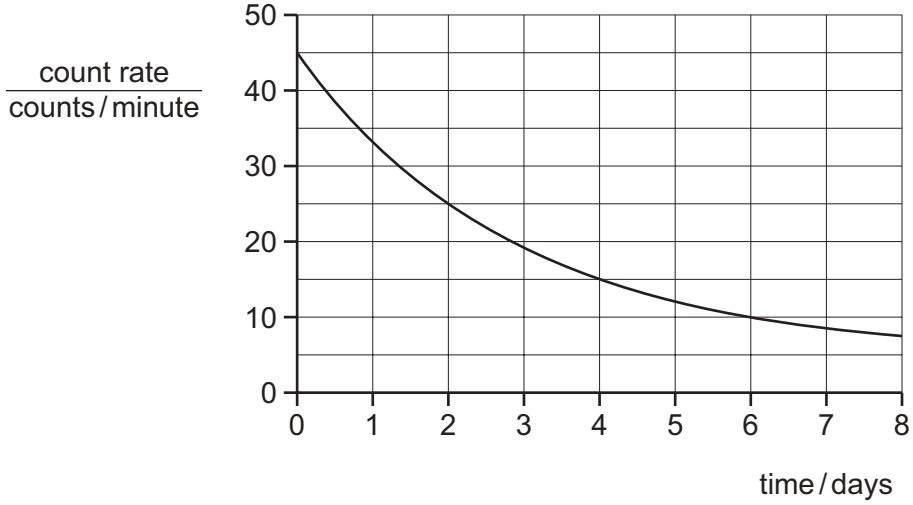
A α-particle

B β-particle

C γ-radiation

D proton

40 The graph shows how the count rate registered by a counter near to a sample of a radioactive isotope changes over a period of a few days. The background count rate is 5 counts per minute.



What is the half-life of the isotope?

A 2.0 days **B** 2.5 days **C** 3.0 days **D** 4.0 days

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/31**

Paper 3 Theory (Core) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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This document consists of **19** printed pages and **1** blank page.

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1 Model trains move along a track passing through two model stations. Students analyse the motion of a train. They start a digital timer as the train starts to move. They record the time that it enters Station A and the time it enters Station B.

Fig. 1.1 shows the time on entering Station A and the time on entering Station B.

time entering Station A

time entering Station B

Fig. 1.1

(a) Calculate the time taken from the train entering Station A to the train entering Station B. State your answer in seconds.

time taken = ... s [1]

(b) A faster train takes 54 s to travel from Station A to Station B. The distance between the stations is 120 m.

Calculate the average speed of this train.

average speed = ... m/s [3]

(c) Fig. 1.2 shows the speed-time graph for a train travelling on a different part of the track.

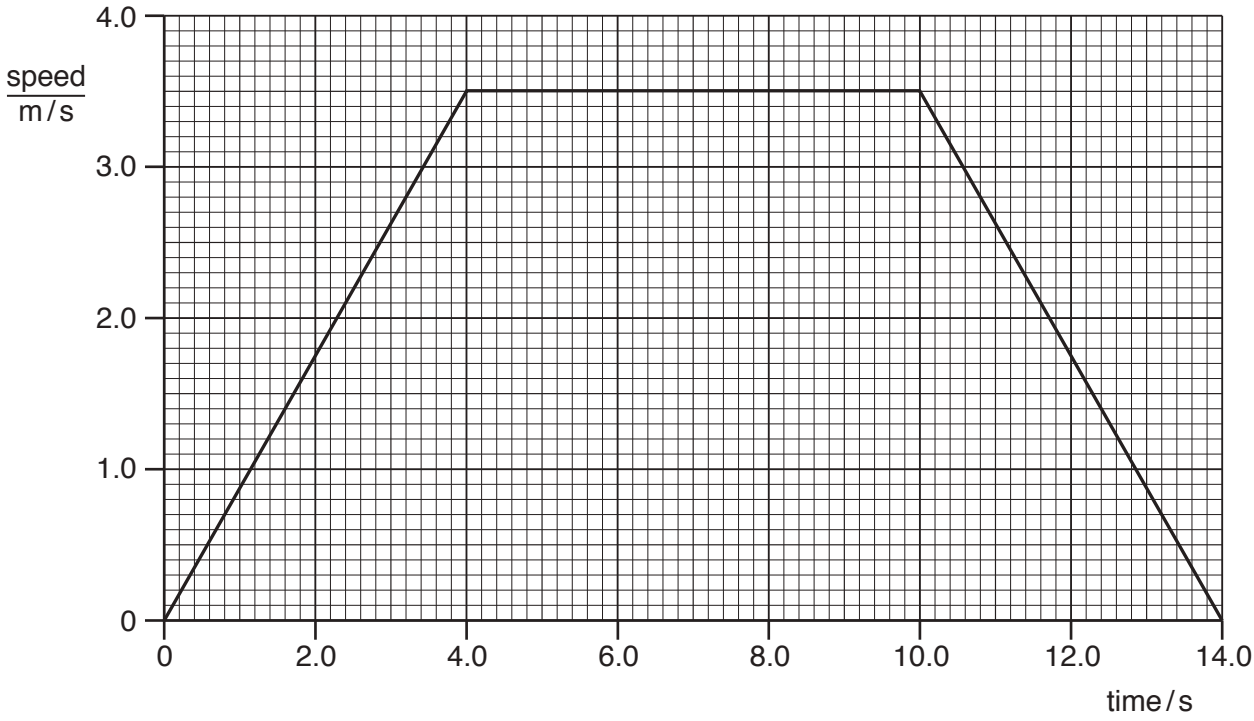

Fig. 1.2

Determine the total distance travelled by the train on this part of the track.

distance = ... m [4]

[Total: 8]

2 A 250 cm^3 beaker containing some liquid is shown in Fig. 2.1.

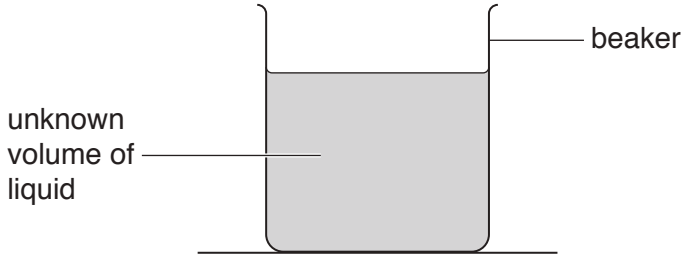

Fig. 2.1

(a) **(i)** A student has a measuring cylinder and a balance.

Describe an experiment to determine the density of the liquid.

.....

.....

.....

.....

.....

.....

.....

.....[5]

(ii) Suggest the unit of density used by the student.

.....[1]

(b) Fig. 2.2 shows a block of polythene.

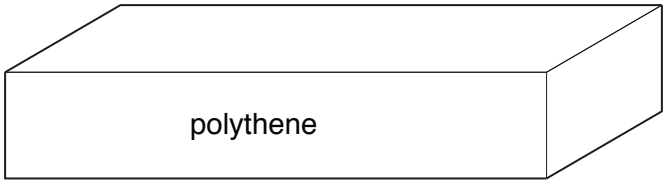

Fig. 2.2

(i) Polythene floats in water. Explain why polythene floats.

.....[1]

(ii) The weight of the polythene block is 0.84 N.

Calculate the mass of the block.

mass = ... kg [3]

[Total: 10]

3 **(a)** Fig. 3.1 shows the vertical forces on a rocket.

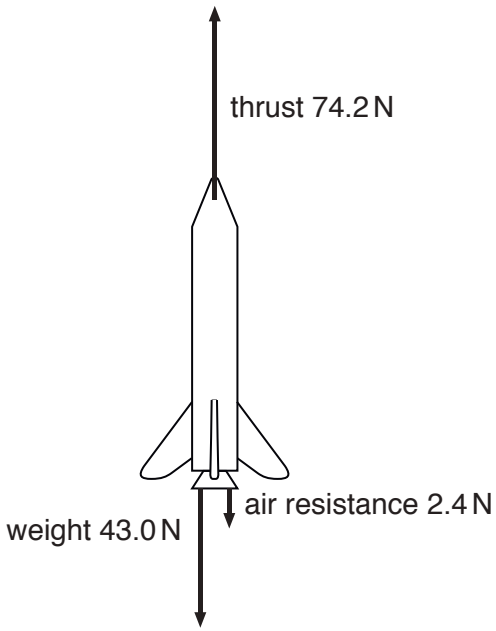

Fig. 3.1

Calculate the resultant force on the rocket.

resultant force = ... N

direction = ...[3]

(b) Fig. 3.2 shows the speed and direction of motion of an object at a point in time.

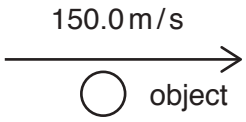

Fig. 3.2

The resultant force on the object is zero for 10 seconds.

Deduce the speed and direction of motion after 5 seconds. Indicate the speed and direction of the object by drawing a **labelled** arrow next to the object in Fig. 3.3.

Fig. 3.3

[1]

[Total: 4]

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4 **(a)** Fig. 4.1 shows a smoke cell. The cell contains smoke particles and air molecules. It is lit from the side. A student views the motion of smoke particles in the cell by using a microscope.

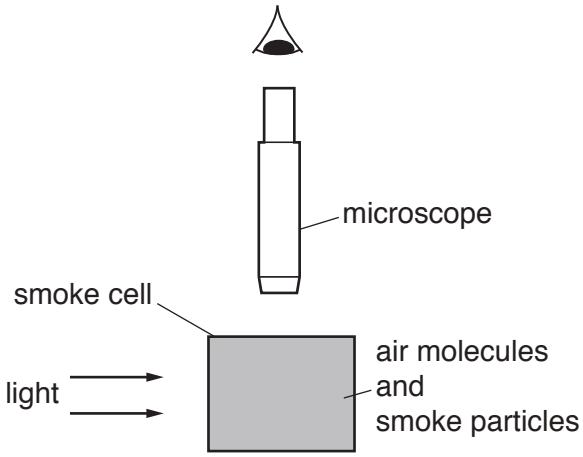


Fig. 4.1

Describe and explain what the student sees when viewing the smoke particles through the microscope.

.....

.....

.....

.....

.....

.....[4]

(b) Drops of water on a warm surface disappear after a short time. State the term used to describe this process. Explain the process, using your ideas about molecules.

name of process .....

explanation .....

.....

.....
[3]

[Total: 7]

5 Fig. 5.1 shows a geothermal power station. It generates electricity.

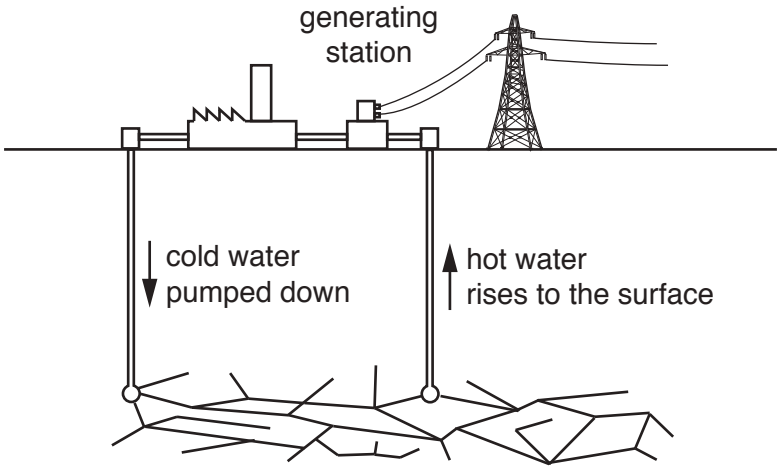


Fig. 5.1

(a) In a geothermal power station, the process of generating electricity includes seven stages. Four of the stages are shown below.

P steam turns a turbine

Q hot underground rocks heat the cold water

R the turbine spins a generator

S hot water rises to the surface

The flow chart in Fig. 5.2 shows the seven stages, but it is incomplete. Complete the flow chart by adding the letters P, Q, R and S in the correct sequence.

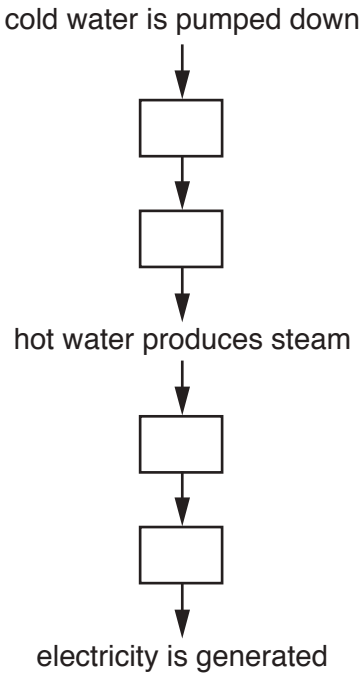


Fig. 5.2

[3]

(b) The cost of electrical energy obtained from a geothermal power station is similar to the cost of electrical energy obtained from wind turbines.

Describe one advantage and one disadvantage of using a geothermal power station to generate electricity compared with using wind turbines.

advantage .....

.....

disadvantage .....

.....
[2]

[Total: 5]

6 A student constructs a device for absorbing thermal energy from the Sun. Fig. 6.1 shows the device.

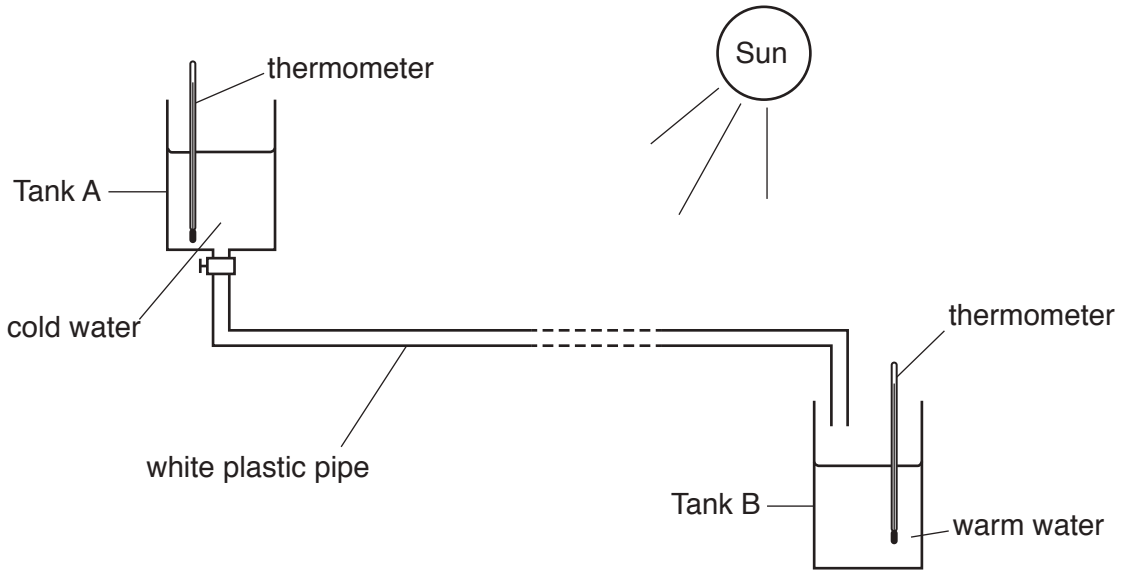
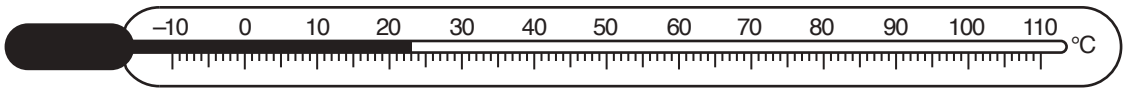


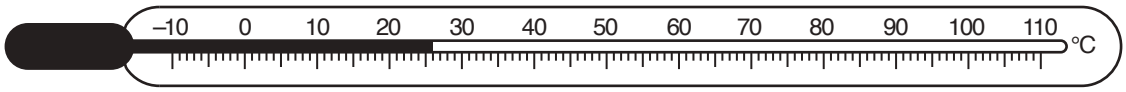
Fig. 6.1

The student places the white plastic pipe in sunlight. The cold water flows slowly from Tank A to Tank B. Energy from the Sun heats the water in the pipe.

Fig. 6.2 shows the temperatures in Tank A and Tank B.



Thermometer showing temperature in Tank A.



Thermometer showing temperature in Tank B.

Fig. 6.2

(a) Determine the rise in temperature of the water.

temperature rise = ... °C [1]

(b) The student wants to increase the thermal energy absorbed by the water in the pipe. Suggest three improvements he can make to increase the thermal energy absorbed.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

(c) Describe how the thermal energy is transferred from the Sun to the water inside the pipe.

.....

.....[2]

[Total: 6]

7 The spectrum of white light is made up of seven colours.

(a) Fig. 7.1 shows a partially-completed spectrum. Two labels are missing.

violet	indigo		green		orange	red

Fig. 7.1

(i) On Fig. 7.1, write the name of the missing colour in each blank space. [2]

(ii) On Fig. 7.1, indicate the direction of **increasing** wavelength for the spectrum. Draw an arrow in the box below the spectrum of colours. [1]

(b) A ray of red light strikes one face of a triangular glass prism as shown in Fig. 7.2.

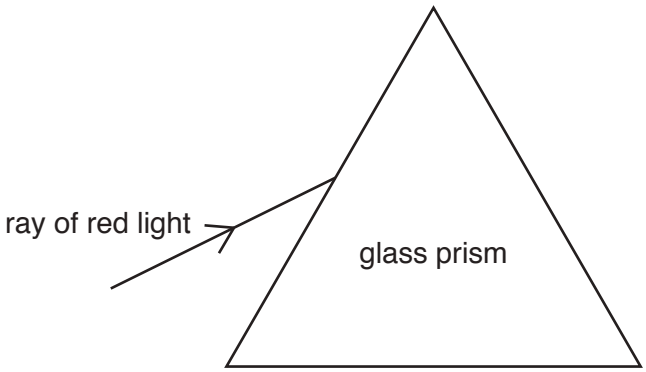


Fig. 7.2

(i) On Fig. 7.2, draw the path of the ray as it travels through the glass prism and enters the air. [2]

(ii) State the term used to describe what happens to the ray of red light as it enters and leaves the prism.

.....[1]

[Total: 6]

8 This question is about measuring the speed of sound in air.

A student stands in front of a large wall. She hits a drum and hears an echo. Fig. 8.1 shows the position of the student and the wall.

Fig. 8.1

(a) **(i)** State the name of a piece of equipment for measuring the distance from the student to the wall.

.....[1]

(ii) Explain how sound forms an echo.

.....

.....[1]

(b) The student hits her drum repeatedly once per second. She walks away from the wall and listens for the echo. When the student is 170 m from the wall she hears the echo from one beat of the drum at the same time as the next beat of the drum.

Use this information to determine the speed of sound. State the unit.

speed = ... [4]

[Total: 6]

9 Fig. 9.1 shows a partially-labelled diagram of the electromagnetic spectrum.

Fig. 9.1

(a) **(i)** On Fig. 9.1, add the names of the missing radiations at **A** and at **B**. [2]

(ii) Indicate the radiation that has the lowest frequency. On Fig. 9.1, draw a ring around the radiation. [1]

(b) State two safety precautions when handling sources that emit gamma radiation.

1 .....

2 .....
[2]

[Total: 5]

10 Fig. 10.1 shows a circuit for determining the resistance of a component.

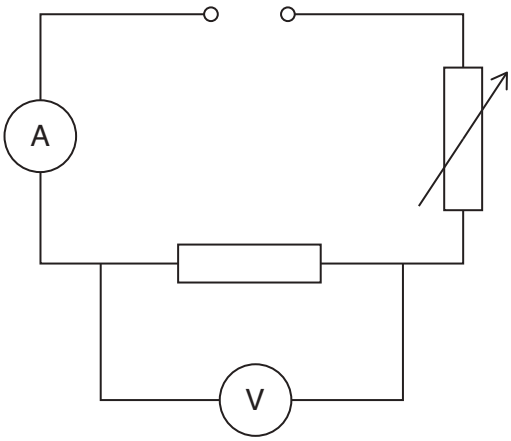


Fig. 10.1

(a) On Fig. 10.1, label the fixed resistor, by writing the letter R. [1]

(b) Two components in Fig. 10.1 measure electrical quantities.

Identify the quantity that each component measures.

Write each quantity and the unit of each quantity in the correct place in Table 10.1.

component	quantity	unit
A		
V		

Table 10.1

[4]

(c) A student uses the circuit in Fig. 10.1 to determine the resistance of wires made from the same material.

State how the resistance of a wire is related to its length and its diameter.

length .....

.....

diameter .....

.....

[2]

[Total: 7]

11 Fig. 11.1 shows a vertical conductor passing through a horizontal piece of card.

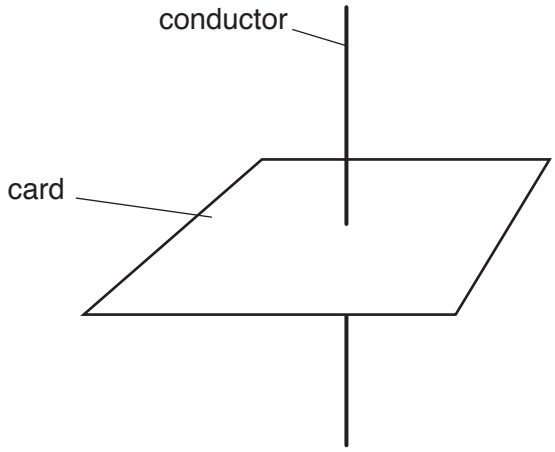


Fig. 11.1

(a) **(i)** On Fig. 11.1, draw a cell and a switch in series with the conductor to form a complete circuit.

Use the correct circuit symbols. [2]

(ii) A student sprinkles iron filings onto the card and closes the switch. There is a current in the conductor. Describe the pattern of the magnetic field seen.

.....

.....[2]

(iii) The student reverses the direction of the current in the conductor. State the effect, if any, on the pattern he sees.

.....[1]

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(b) Describe an experiment to show that a force acts on a current-carrying conductor in a magnetic field. Show how to arrange the equipment. Include a diagram in your answer.

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 9]

12 Radioactive decay may include the emission of:

α-radiation
β-radiation
γ-radiation

(a) **(i)** From the list, state the type of radiation which has the **greatest** ionising effect.

.....[1]

(ii) From the list, state the type of radiation which has the **lowest** penetrating ability.

.....[1]

(b) In a factory, rollers press aluminium metal to make thin foil sheets. An automatic system for controlling the thickness of the foil uses a radioactive source. The automatic system changes the gap between the top and bottom roller. Fig. 12.1 shows the equipment.

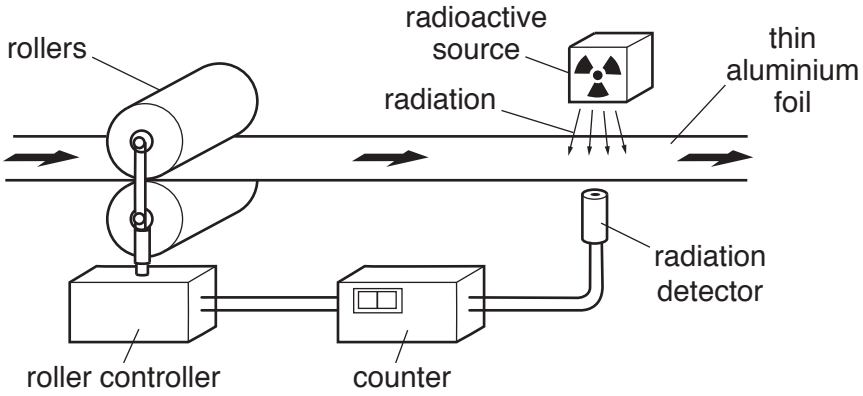

Fig. 12.1

(i) Use your ideas about the properties of radiation to suggest and explain the type of radiation used.

type of radiation .....

explanation .....

.....

.....

.....
[2]

(ii) The aluminium foil passing the radiation detector is too thin. Describe how this fault affects the reading on the counter.

.....[1]

(iii) Suggest how the fault in **(b)(ii)** is corrected. State what happens to the rollers.

.....[1]

(iv) The source used is strontium-90. A nucleus of strontium-90 can be described as $^{90}_{38}Sr$. State the number of protons in a nucleus of strontium-90.

.....[1]

[Total: 7]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/32**

Paper 3 Theory (Core) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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1 Fig. 1.1 shows the speed-time graph for a car.

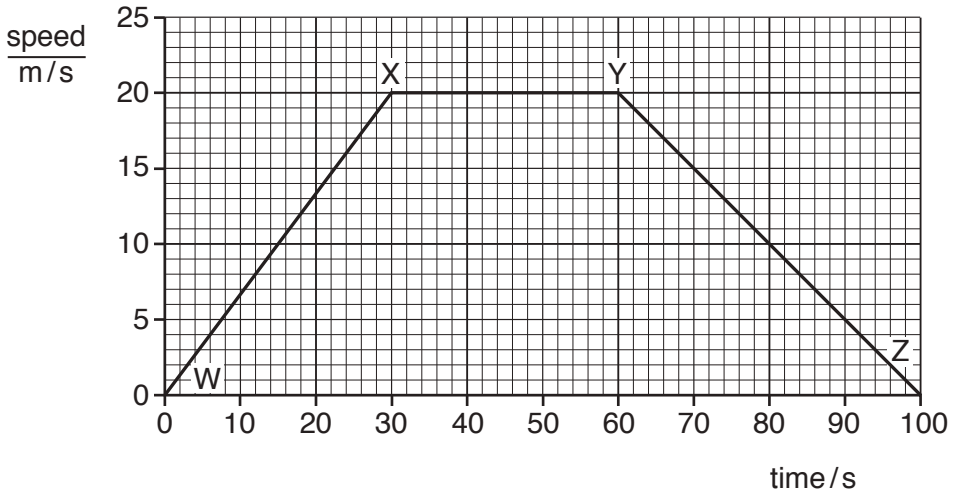

Fig. 1.1

(a) On Fig. 1.1, the labels W, X, Y and Z show the points when the car's motion changed.

On Fig. 1.2, draw a line from each section of the graph to the correct description of the motion.

section of graph	**description of the motion**
from W to X	accelerating
from X to Y	decelerating
from Y to Z	stationary
	constant speed

Fig. 1.2 [3]

(b) Calculate the distance that the car travels between 60 s and 100 s.

distance travelled = ... m [3]

(c) Fig. 1.1 shows that the car's acceleration is greater than its deceleration.

Explain how the graph shows this.

.....

.....[1]

[Total: 7]

2 Fig. 2.1 shows a wooden raft. The raft is made from 8 logs.
The logs are all of the same type of wood.

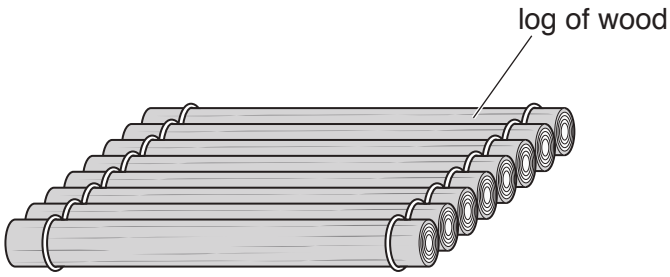

Fig. 2.1

(a) The average mass of each log is 65.0 kg.

Calculate the total weight of the raft.

total weight of the raft = ... N [3]

(b) **(i)** The mass of one of the logs is 66.0 kg. It is 3.0 m long and has a cross sectional area of $0.040\,m^2$.

Calculate the density of the wood in the log.

density = ... kg/m^3 [3]

(ii) Explain why the log in **(b)(i)** floats on water.

.....

.....[1]

[Total: 7]

3 A man uses a metal bar to remove an iron nail from a piece of wood, as shown in Fig. 3.1.

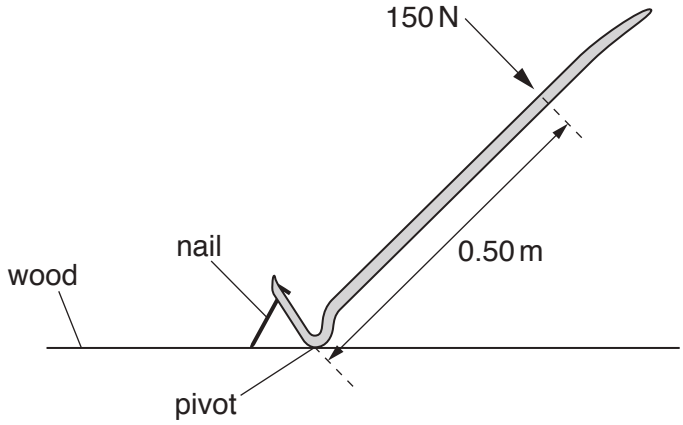

Fig. 3.1

(a) **(i)** The man applies a force of 150 N at a distance of 0.50 m from the pivot.

Calculate the moment of this force about the pivot. Include a unit.

moment = ...[4]

(ii) The force applied by the man produces a turning effect (moment) about the pivot.

Describe another example of using the turning effect of a force.

.....

.....[1]

(b) The man tries to use the metal bar to remove another nail from the piece of wood. He applies the same force of 150 N at a distance of 0.50 m from the pivot.

The turning effect produced is not enough to remove this nail from the piece of wood.

Describe how the man can increase the turning effect without increasing the force.

.....

.....[1]

[Total: 6]

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4 A Bunsen burner heats a beaker of water, as shown in Fig. 4.1.

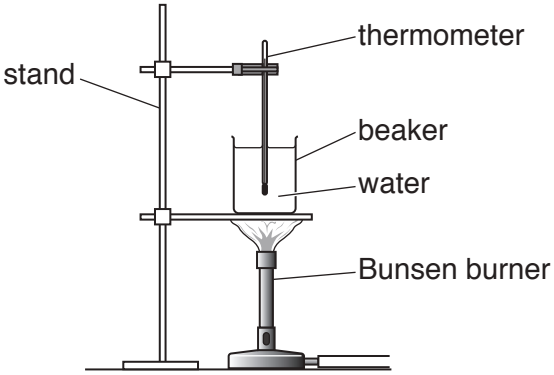

Fig. 4.1

(a) **(i)** Fig. 4.2 shows the thermometer used in Fig. 4.1.

State the temperature shown on the thermometer.

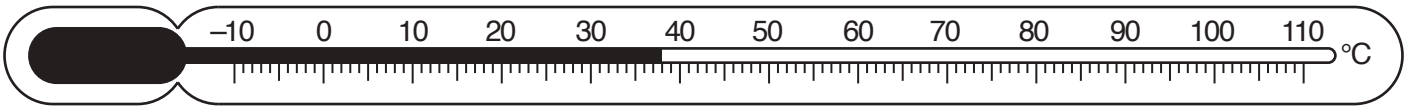

Fig. 4.2

temperature = ... °C [1]

(ii) The thermometer shown in Fig. 4.2 uses a physical property that changes with temperature.

Indicate the measurable property that changes with temperature. Tick **one** box.

- [ ] expansion of glass
- [ ] expansion of liquid
- [ ] colour of liquid
- [ ] colour of glass [1]

(b) Thermal energy (heat) transfers through the bottom of the beaker to the water.

State the name given to this process.

.....[1]

(c) Thermal energy transfers throughout the water in the beaker.

Describe and explain how this happens.

.....

.....

.....

.....

.....[4]

[Total: 7]

5 Fig. 5.1 represents an object positioned on the principal axis of a thin lens.

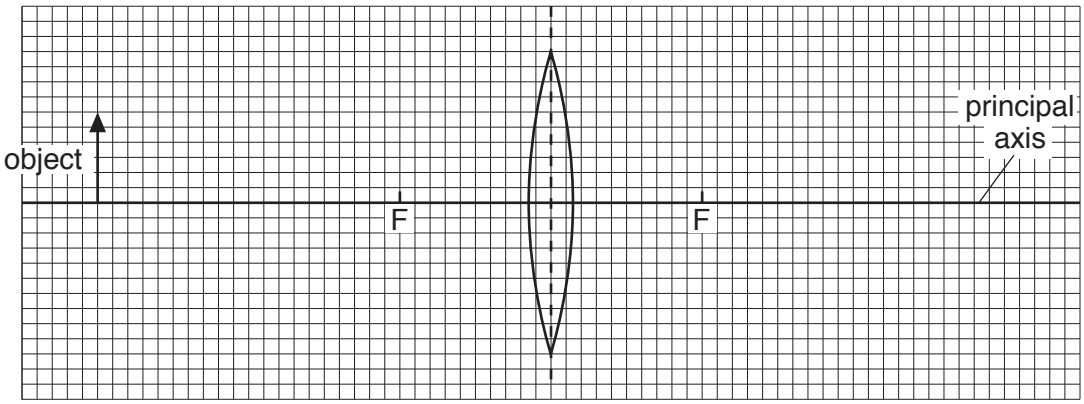

Fig. 5.1

Each small square of the grid represents 0.5 cm. Each principal focus of the lens is labelled F.

(a) Use the grid to determine the focal length of the lens.

focal length = ... cm [1]

(b) **(i)** On Fig. 5.1, draw a ray from the top of the object that passes through a principal focus, then through the lens and beyond it.

[1]

(ii) On Fig. 5.1, draw a second ray from the top of the object that passes through the centre of the lens. Continue the path of this ray to the edge of the grid. [1]

(iii) On Fig. 5.1, draw an arrow to show the position and nature of the image produced by the lens. [2]

[Total: 5]

6 Nuclear fission is used in nuclear power stations to release thermal energy.

(a) Describe how the thermal energy is used to generate electricity.

.....

.....

.....

.....

.....

.....[3]

(b) Describe two environmental problems that are due to using nuclear power stations.

1. .....

.....

2. .....

.....
[2]

[Total: 5]

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7 Fig. 7.1 shows some parts of the electromagnetic spectrum.

radio waves		infra-red waves	visible light	ultraviolet waves	X-rays	γ-rays

Fig. 7.1

(a) **(i)** In Fig. 7.1, one part of the electromagnetic spectrum is not labelled.

State the name of this part.

.....[1]

(ii) The speed of visible light waves in a vacuum is 3.0×10^8 m/s.

Suggest a value for the speed of infra-red waves in a vacuum.

speed = ... m/s [1]

(iii) Some parts of the electromagnetic spectrum have a wavelength shorter than that of visible light.

State one example.

.....[1]

(b) **(i)** X-rays and γ-rays are used in hospitals.

Describe one medical use for X-rays and one use for γ-rays.

X-rays .....

.....

γ-rays .....

.....
[2]

(ii) Explain why γ-rays are dangerous to living things.

.....

.....

.....[2]

[Total: 7]

8 **(a)** Complete the sentences about sound. Use words from the box above each sentence.

(i)

glows	reflects	refracts	vibrates

Sound is produced when a source ..... . [1]

(ii)

electromagnetic	longitudinal	transverse

Sound waves are ..... waves. [1]

(iii)

metal	vacuum	liquid

Sound waves cannot travel through a ..... . [1]

(b) Humans, elephants, mice and dolphins have different hearing ranges. Fig. 8.1 shows the hearing range for each type of animal.

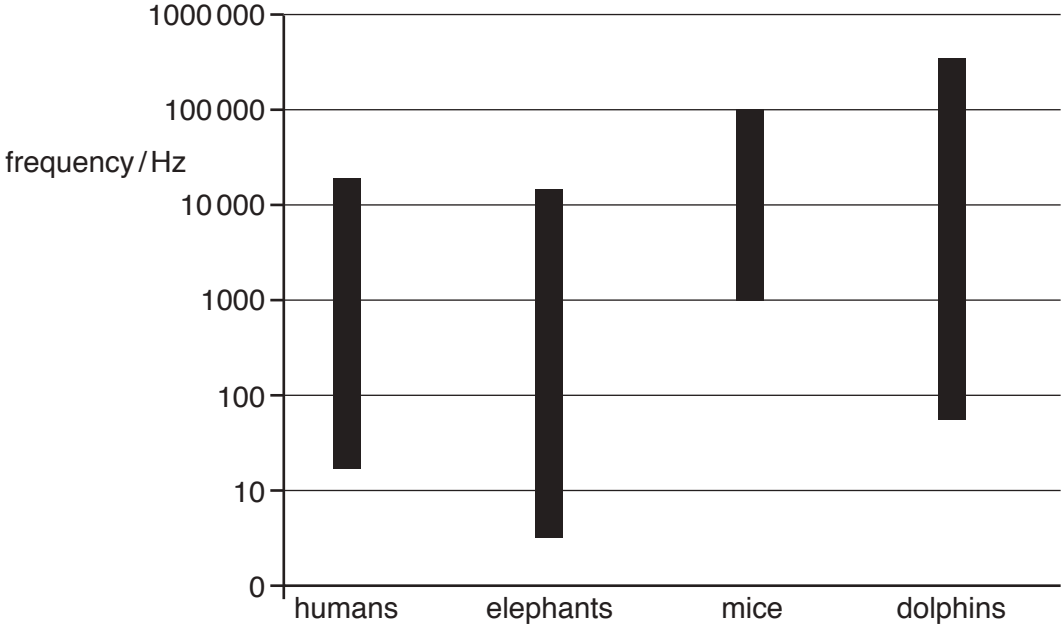

Fig. 8.1

(i) State the lowest frequency of sound that can be heard by mice.

..... Hz [1]

(ii) State the highest frequency of sound that can be heard by elephants.

..... Hz [1]

(iii) Explain how the chart shows that elephants can hear some sounds that humans **cannot** hear.

.....

.....

.....[2]

(iv) State the term given to the high frequencies that dolphins can hear but humans **cannot** hear.

.....[1]

[Total: 8]

9 **(a)** Fig. 9.1 shows a simple circuit.

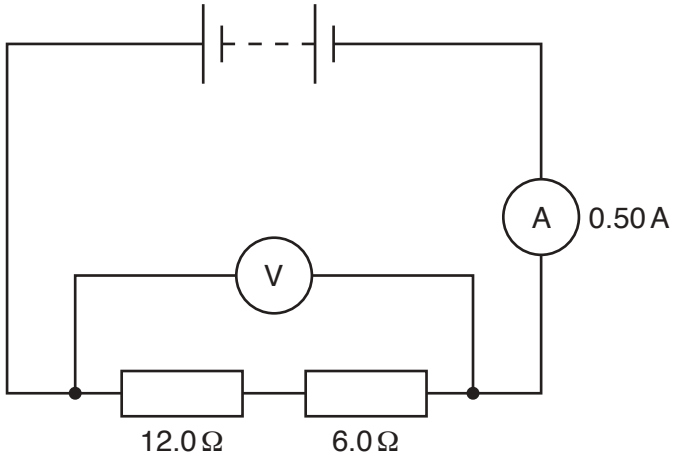

Fig. 9.1

(i) The current in the wires of the circuit is a flow of particles.
Indicate the name of these particles. Tick **one** box.

☐ electrons

☐ atoms

☐ protons [1]

(ii) Calculate the combined resistance of the two resistors.

resistance = ... Ω [1]

(iii) Calculate the potential difference (p.d.) reading that would be shown on the voltmeter.

potential difference (p.d.) = ... V [3]

(b) The circuit is changed.
The two resistors are connected in parallel.

Explain what happens, if anything, to the current reading on the ammeter.

.....

.....

.....[2]

[Total: 7]

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10 **(a)** Fig. 10.1 shows a balloon hanging from an insulating thread.

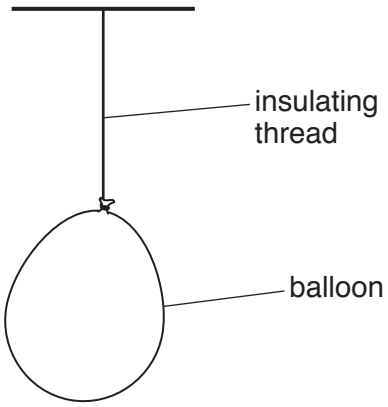

Fig. 10.1

(i) A student gives the balloon a positive charge.

Which statement explains why the balloon becomes positively charged? Tick **one** box.

- [ ] The balloon gains electrons
- [ ] The balloon loses electrons
- [ ] The balloon gains protons
- [ ] The balloon loses protons [1]

(ii) The student brings a charged rod close to the balloon as shown in Fig. 10.2.

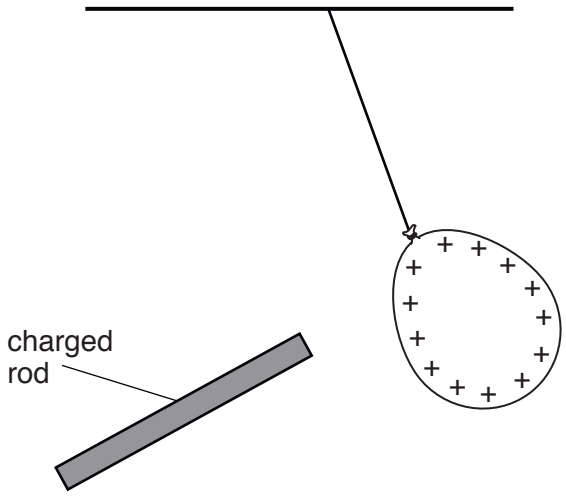

Fig. 10.2

State the type of charge on the rod.

.....

Explain your answer.

.....

.....
[2]

(b) Electrical charges can move easily through some materials.

Draw a circle around each material that charges can move through easily.

copper plastic rubber silver wood [1]

[Total: 4]

11 Fig. 11.1 represents a transformer.

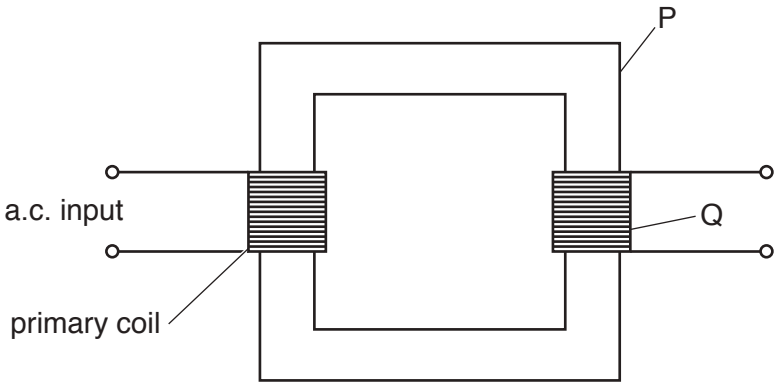

Fig. 11.1

(a) **(i)** State the name of the part of the transformer labelled Q in Fig. 11.1.

.....[1]

(ii) In Fig. 11.1, part P is made from a metal.

1. State the metal used to make part P. .....

2. State the term given to part P. .....

[2]

(iii) There is an alternating current (a.c.) in the primary coil.

Describe what this current produces in part P.

.....

.....[2]

(iv) Complete the sentence using terms from the box.

more	fewer	step-up	step-down

When there are ..... turns in the primary coil than in Q, the device is called a

..... transformer. [1]

(b) The high-voltage transmission of electricity uses transformers.

Describe **two** advantages of transmitting electricity at high voltages rather than at low voltages.

1. .....

.....

2. .....

.....

[2]

[Total: 8]

12 **(a)** The nuclide notation $^{A}_{Z}X$ describes the nucleus of one type of atom.

Draw a line from each symbol to the correct description for that symbol.

symbol	**description**
A	number of neutrons
	element symbol
Z	proton number
	nucleon number
X	number of atoms

[3]

(b) **(i)** One radioactive isotope has a half-life of 6.0 years.
A sample of this isotope has a mass of 12 mg.

Calculate the mass of this isotope that remains in the sample after 18 years.

mass remaining = ... mg [3]

(ii) The sample decays by emitting a β-particle.

Describe the nature of a β-particle.

.....

.....[2]

(iii) Describe how the nucleus of the isotope changes due to the emission of a β-particle.

.....

.....[1]

[Total: 9]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

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5561498289

PHYSICS **0625/33**

Paper 3 Theory (Core) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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CAMBRIDGE International Examinations

1 A student watches a car race around a track. He uses a stopwatch to measure the time for the car to make one lap of the track.

(a) The student forgets to reset the stopwatch at the start of the race. Fig. 1.1 shows the time on the stopwatch at the start and the time after going around the track once.

time at start

time after going around the track once

Fig. 1.1

Calculate the time the car takes to go around the track once, in seconds.

time = ... s [2]

(b) The length of the track is 4.0 km. The car goes around the track 20 times. The car takes 26 minutes and 40 seconds to complete the 20 laps.

Calculate the average speed of the car in m/s.

average speed = ... m/s [4]

(c) Fig. 1.2 shows a speed-time graph for the car during part of the race.

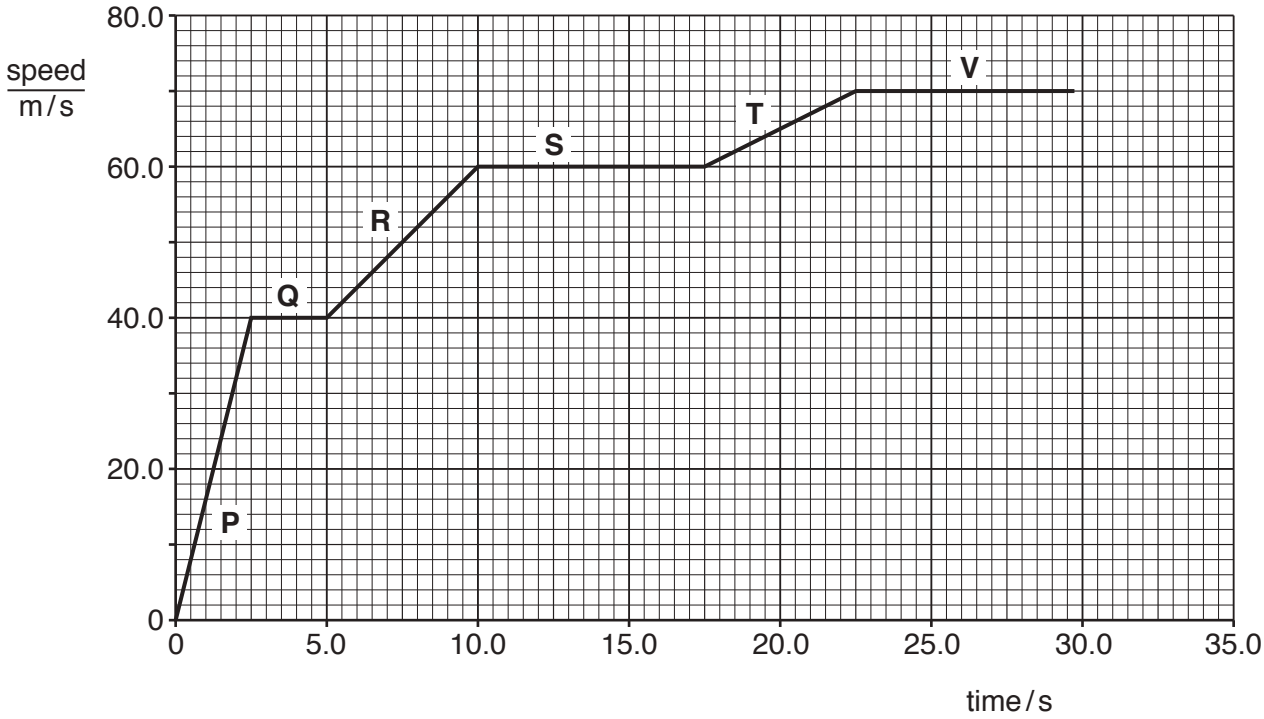

Fig. 1.2

(i) State the section of the graph that shows the greatest acceleration.

.....

Explain your answer.

.....
[2]

(ii) Calculate the distance travelled by the car during the first 2.5 seconds.

distance = ... m [3]

[Total: 11]

2 A student is using some 50 g masses.

(a) Calculate the weight of one 50 g mass.

weight of 50 g mass = ... N [3]

(b) The student uses the 50 g masses as loads to stretch a spring.

Fig. 2.1 shows the apparatus the student uses to obtain readings for a load-extension graph.

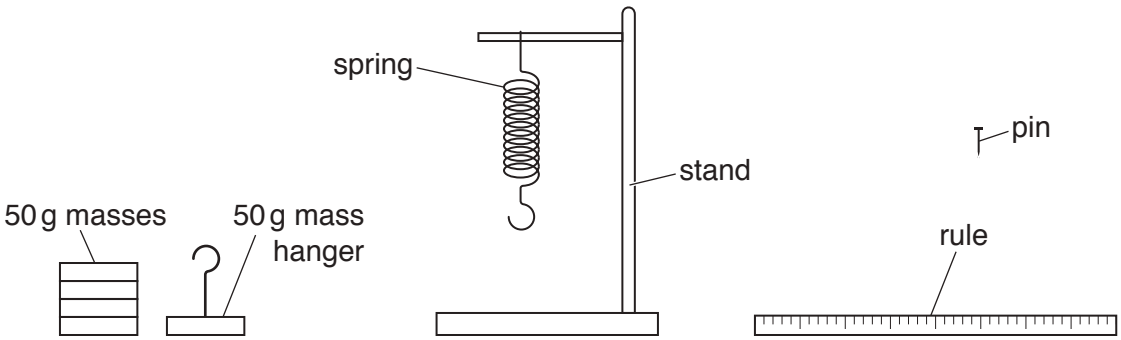

Fig. 2.1 (NOT to scale)

Describe how the student could use the apparatus and ensure that the readings are accurate.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 7]

3 **(a)** The mass of a small steel ball is 120 g. The volume of the ball is 16.0 cm^3.

(i) Calculate the density of the steel ball.

density = ... g/cm^3 [3]

(ii) The ball falls to the ground from rest. At a time of 0.2 s after it started to fall, its acceleration is 10 m/s^2.

State the acceleration of the ball at a time of 0.1 s after it started to fall.

.....[1]

(b) Fig. 3.1 shows the vertical forces that act on a large plastic ball as it is falling.

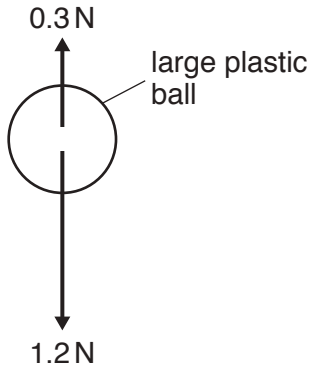

Fig. 3.1 (not to scale)

(i) State the name given to each of the forces shown in Fig. 3.1.

1. .....

2. .....
[1]

(ii) Calculate the size of the resultant force on the ball.

resultant force = ... N [1]

[Total: 6]

4 A lamp is attached to a wall, as shown in Fig. 4.1.

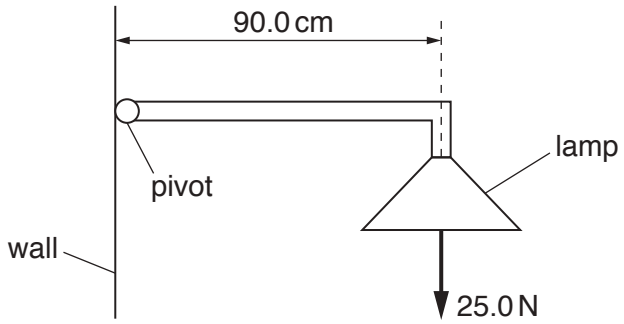

Fig. 4.1

Calculate the moment of the lamp about the pivot. Give the unit.

moment = ... [4]

[Total: 4]

5 **(a)** Fig. 5.1 shows a metal can containing air. The can is sealed with a lid.

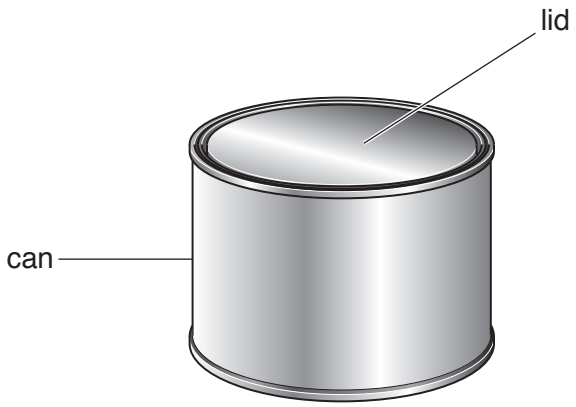

Fig. 5.1

The air in the can exerts a pressure of 20 000 N / m^2 on the lid. The area of the can lid is 0.09 m^2.

Calculate the force on the lid due to the air in the can.

force = ... N [3]

(b) The air in the can becomes warmer.

State and explain what happens to the pressure of the air in the can. Use your ideas about gas molecules.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 6]

6 A student investigates the thermal energy lost from two metal cans, X and Y. The cans are identical apart from their outside colour.

The student pours the same volume of hot water into each can and seals each can. The student records the temperature of the water in each can at regular time intervals for a period of 35 minutes.

The equipment is shown in Fig. 6.1.

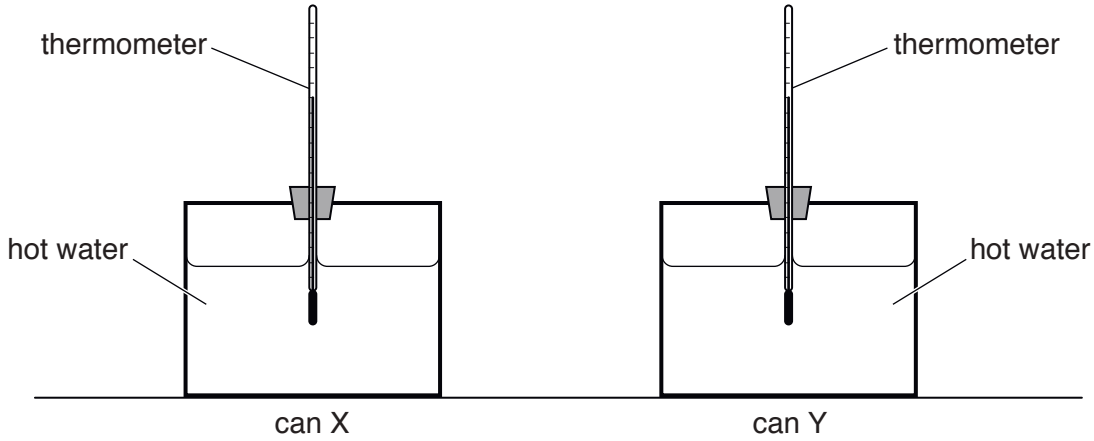

Fig. 6.1

Fig. 6.2 is a graph of the results from the investigation.

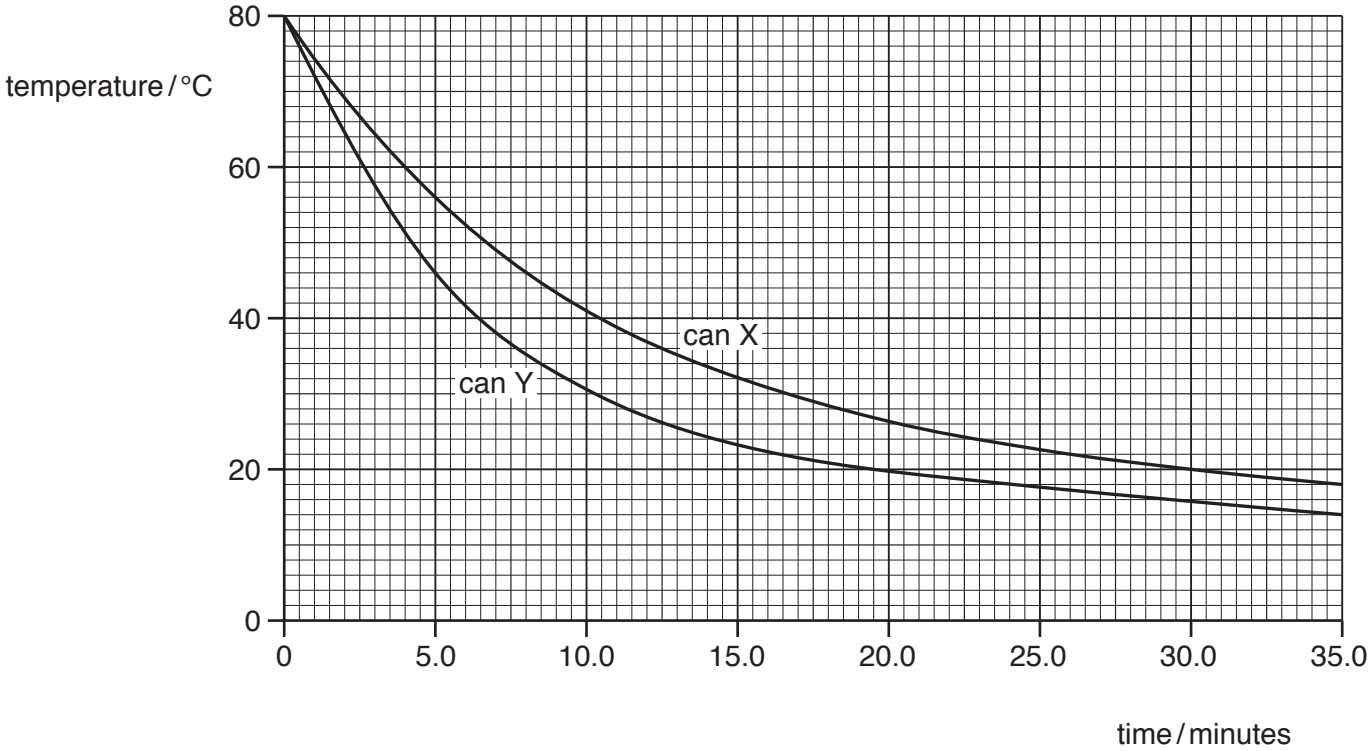

Fig. 6.2

(a) For can X, use Fig. 6.2 to determine the drop in temperature of the water

(i) in the first five minutes

.....[1]

(ii) in the last five minutes.

.....[1]

(b) Explain why the water cools at a greater rate during the first five minutes of the experiment, compared with the last five minutes.

.....

.....

.....[2]

(c) The outside of one can is dull black and the outside of the other is shiny white.

State the colour of can Y. .....

Explain your answer.

.....

.....

.....
[2]

[Total: 6]

7 Fig. 7.1 shows an incomplete diagram of the electromagnetic spectrum.

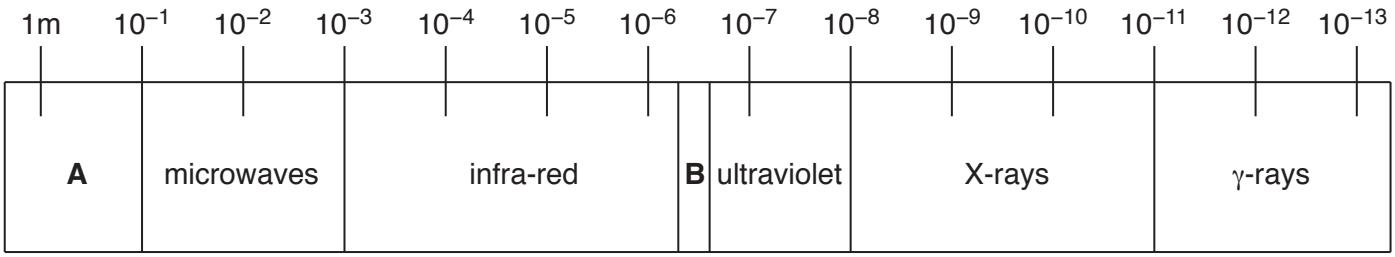

Fig. 7.1

(a) **(i)** In Fig. 7.1, section **A** and section **B** of the electromagnetic spectrum are not labelled.

State the names of these parts.

A .....

B .....
[2]

(ii) An electromagnetic wave has a wavelength of 1.0×10^{-9} m. Use Fig. 7.1 to identify the type of electromagnetic wave.

.....[1]

(b) All electromagnetic waves travel at the same speed in a vacuum.

State one other property that is the same for all electromagnetic waves.

.....[1]

(c) For each purpose, state one type of electromagnetic radiation that can be used.

(i) remote controllers for televisions

.....[1]

(ii) killing bacterial cells

.....[1]

[Total: 6]

8 **(a)** The boxes contain words about waves.

Complete each sentence. Choose a term from each box.

(i)

an electromagnetic	a longitudinal	a transverse

Sound travels as ..... wave. [1]

(ii)

amplitude	pitch	speed	wavelength

A loud sound has a large ..... . [1]

(iii)

amplitude	pitch	speed	wavelength

A student listens to two sounds. The sound with the higher frequency has a higher ..... . [1]

(b) Explain what is meant by the term *ultrasound*.

.....

.....[2]

[Total: 5]

9 A student magnetises a steel rod by using a permanent magnet.

(a) Describe a method that the student could use. You may draw a diagram to help you.

.....

.....

.....[2]

(b) Explain how the student could test that the steel rod has been magnetised.

.....

.....

.....

.....[2]

(c) Magnets can be made from soft iron or from steel.

State **one** difference between the magnetic properties of soft iron and steel.

.....

.....

.....[1]

[Total: 5]

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10 **(a)** Fig. 10.1 shows an electrical circuit.

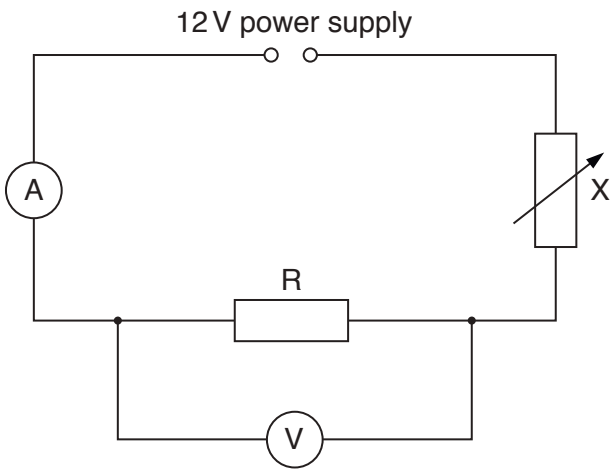


Fig. 10.1

(i) State the name for the component labelled X and state its function in this circuit.

name for component .....

function .....

.....
[2]

(ii) Describe how the circuit shown in Fig. 10.1 could be used to find the resistance of the fixed resistor R.

.....

.....

.....

.....

.....[3]

(b) An electrical heater has a resistance of 21.8 Ω when connected to a 240 V mains supply.

(i) Calculate the current in the heater.

current = ... A [3]

(ii) Suggest a rating for the fuse to be fitted to the mains plug for the heater.

fuse rating = ... A [1]

[Total: 9]

11 Fig. 11.1 shows a coil (solenoid) wrapped around a plastic tube. There is a current in the coil. The arrows show the direction of the current in the coil.

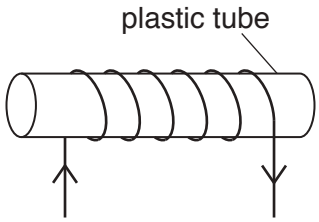


Fig. 11.1

(a) On Fig. 11.1, draw the pattern of the magnetic field lines around the coil.
Add arrows to show the direction of the magnetic field. [3]

(b) A long soft iron bar is placed inside the plastic tube. There is a current in the coil. This forms a device. State the name of the device.

.....[1]

(c) Fig. 11.2 shows a relay operated by switch S.

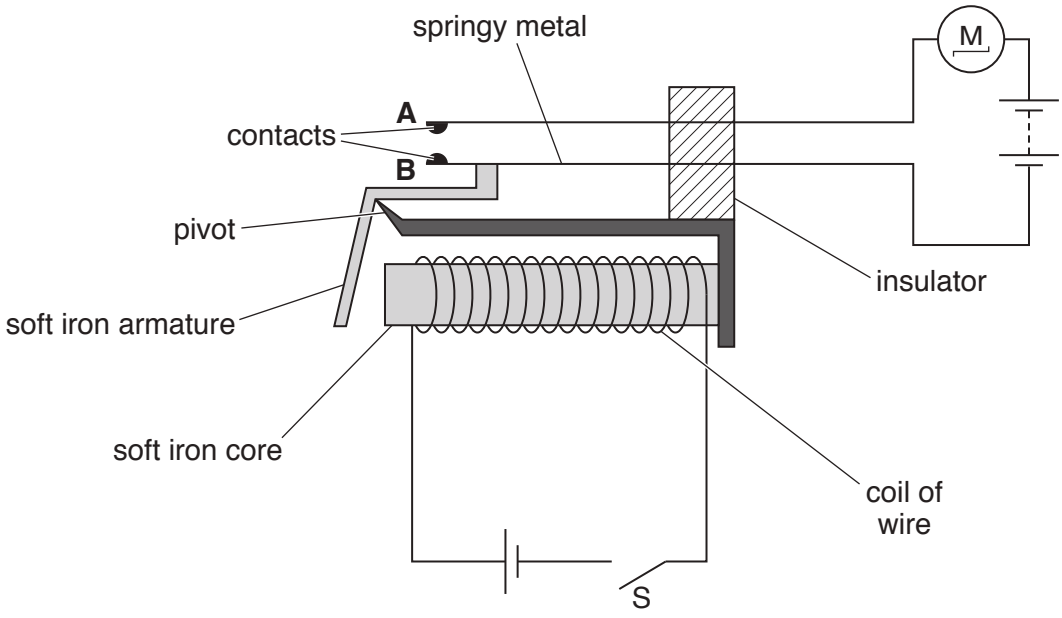


Fig. 11.2

Using Fig. 11.2, describe how closing the switch, S, causes the electric motor to operate.

.....

.....

.....

.....

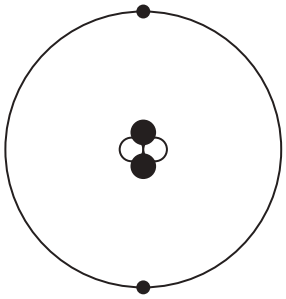
.....

.....

.....[4]

[Total: 8]

12 **(a)** Fig. 12.1 shows a diagram to represent a helium atom, and an incomplete key.



key

● proton .....

○ .....

• .....

Fig. 12.1

Complete the key in Fig. 12.1. State the name of each particle. [2]

(b) The table in Fig. 12.2 compares two isotopes of helium.

	$^{3}_{2}He$	$^{5}_{2}He$
number of protons		
number of neutrons		

Fig. 12.2

For each isotope, write the number of protons and the number of neutrons in the correct places in the table. [2]

(c) The nucleus of the helium atom in **(a)** is the same as an α-particle.

(i) Describe the penetrating ability of α-particles.

.....

.....[1]

(ii) Explain why it is dangerous to swallow a source that emits α-particles.

.....

.....

.....

.....[2]

[Total: 7]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/41**

Paper 4 Theory (Extended) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1 Fig. 1.1 shows the speed-time graph for a vehicle accelerating from rest.

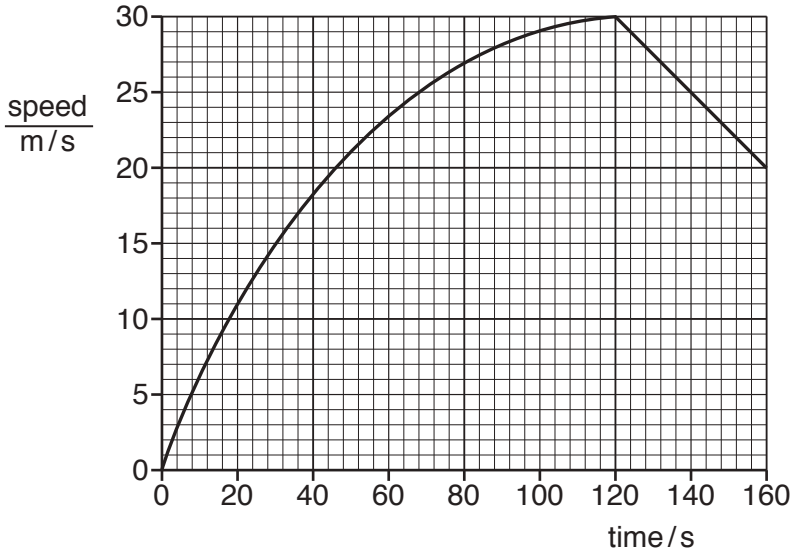

Fig. 1.1

(a) Calculate the acceleration of the vehicle at time = 30 s.

acceleration = ...[2]

(b) Without further calculation, state how the acceleration at time = 100 s compares to the acceleration at time = 10 s. Suggest, in terms of force, a reason why any change has taken place.

.....

.....

.....[3]

(c) Determine the distance travelled by the vehicle between time = 120 s and time = 160 s.

distance = ...[3]

[Total: 8]

2 Fig. 2.1 shows a fork-lift truck lifting a box.

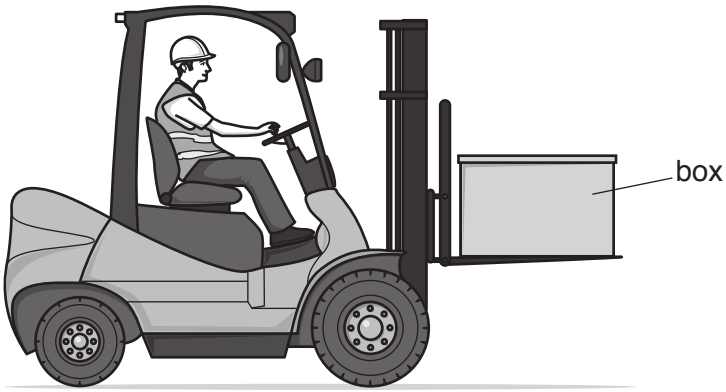

Fig. 2.1

The electric motor that drives the lifting mechanism is powered by batteries.

(a) State the form of the energy stored in the batteries.

.....[1]

(b) The lifting mechanism raises a box of mass 32 kg through a vertical distance of 2.5 m in 5.4 s.

(i) Calculate the gravitational potential energy gained by the box.

gravitational potential energy = ...[2]

(ii) The efficiency of the lifting mechanism is 0.65 (65%).

Calculate the input power to the lifting mechanism.

input power = ...[3]

(c) The batteries are recharged from a mains voltage supply that is generated in an oil-fired power station.

By comparison with a wind farm, state one advantage and one disadvantage of running a power station using oil.

advantage .....

.....

disadvantage .....

.....[2]

[Total: 8]

3 A rectangular container has a base of dimensions 0.12 m × 0.16 m. The container is filled with a liquid. The mass of the liquid in the container is 4.8 kg.

(a) Calculate

(i) the weight of liquid in the container,

weight = ...[1]

(ii) the pressure due to the liquid on the base of the container.

pressure = ...[2]

(b) Explain why the total pressure on the base of the container is greater than the value calculated in **(a)(ii)**.

.....

.....[1]

(c) The depth of liquid in the container is 0.32 m.

Calculate the density of the liquid.

density = ...[2]

[Total: 6]

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4 **(a)** Describe the movement of the molecules in

(i) a solid,

.....

.....[1]

(ii) a gas.

.....

.....[2]

(b) A closed box contains gas molecules.

Explain, in terms of momentum, how the molecules exert a pressure on the walls of the box.

.....

.....

.....

.....

.....

.....[4]

[Total: 7]

5 **(a)** A ray of light in air is incident on a glass block. The light changes direction.

State

(i) the name of this effect,

.....[1]

(ii) the cause of this effect.

.....[1]

(b) Fig. 5.1, drawn to full scale, shows a thin converging lens of focal length 3.5 cm.

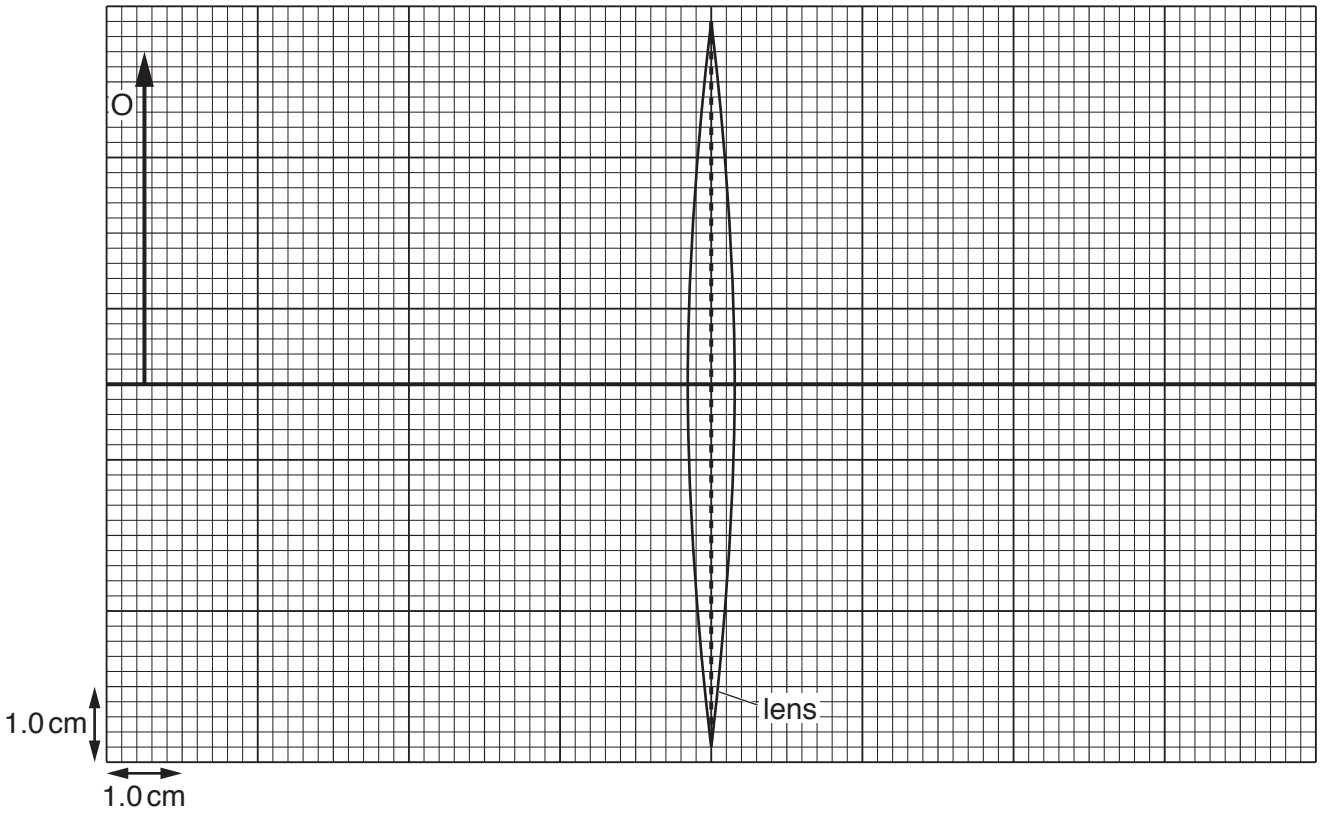

Fig. 5.1

(i) On Fig. 5.1, mark each of the two principal focuses and label each with the letter F. [1]

(ii) An object O of height 4.4 cm is placed a distance of 7.5 cm from the lens.

On Fig. 5.1, draw rays from the tip of the object O to locate the image. Draw and label the image. [3]

(iii) Determine the height of the image.

height of the image = ...[1]

(iv) State and explain whether the image is real or virtual.

.....

.....[1]

[Total: 8]

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6 **(a)** Fig. 6.1 shows wavefronts approaching a gap in a barrier.

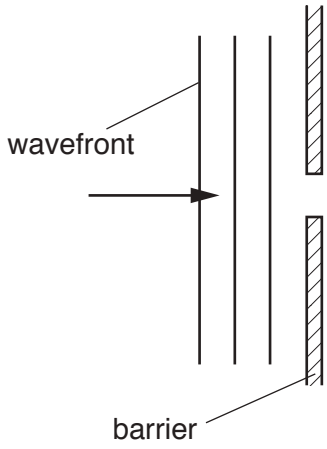

Fig. 6.1

(i) On Fig. 6.1, draw **three** wavefronts to the right of the barrier. [2]

(ii) Fig. 6.2 shows the gap in the barrier increased to five times the gap in Fig. 6.1.

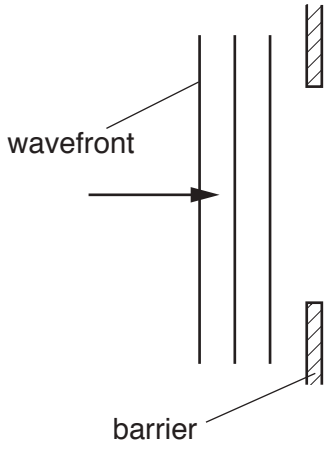

Fig. 6.2

On Fig. 6.2, draw **three** wavefronts to the right of the barrier. [2]

(b) Describe, with a labelled diagram, an experiment using water waves that shows the reflection of wavefronts that occur at a straight barrier.

.....

.....

.....

.....

.....

.....[4]

[Total: 8]

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7 **(a)** State, in terms of their structure, why metals are good conductors of electricity.

.....

.....[1]

(b) A cylindrical metal wire W_1, of length l and cross-sectional area A, has a resistance of 16 Ω.

A second cylindrical wire W_2 having length $\frac{l}{2}$ and cross-sectional area $2A$, is made from the same metal.

Determine

(i) the resistance of W_2,

resistance of W_2 = ...[2]

(ii) the effective resistance of W_1 and W_2 when connected in parallel.

resistance of parallel pair = ...[2]

(c) The parallel pair of resistors in **(b)(ii)** is connected to a battery that is made from three cells in series, each of electromotive force (e.m.f.) E. There is a current in each resistor.

(i) State the e.m.f. of the battery.

.....[1]

(ii) The current in the battery is I_B, the current in W_1 is I_1 and the current in W_2 is I_2.

Place a tick (✓) in **one** box to indicate how these three currents are related.

- [ ] $I_1 > I_2 > I_B$
- [ ] $I_1 > I_B > I_2$
- [ ] $I_2 > I_1 > I_B$
- [ ] $I_2 > I_B > I_1$
- [ ] $I_B > I_1 > I_2$
- [ ] $I_B > I_2 > I_1$
- [ ] $I_1 = I_2 = I_B$

[1]

[Total: 7]

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8 In a laboratory at normal room temperature, 200 g of water is poured into a beaker. A thermometer placed in the water has a reading of 22 °C.

Small pieces of ice at 0 °C are added to the water one by one. The mixture is stirred after each addition until the ice has melted. This process is continued until the temperature recorded by the thermometer is 0 °C.

The total mass of ice added to the water is found to be 60 g.

(a) The specific heat capacity of water is 4.2 J/(g °C).

Calculate the thermal energy lost by the water originally in the beaker.

thermal energy = ...[2]

(b) Assume that all the thermal energy lost by the water originally in the beaker is transferred to the ice.

Calculate the specific latent heat of fusion of ice.

specific latent heat of fusion of ice = ...[2]

(c) Suggest a reason for any inaccuracy in the value of the specific latent heat of fusion of ice calculated in **(b)**. Assume the temperature readings and the values for the mass of the water and the mass of the ice are accurate.

.....

.....[1]

[Total: 5]

9 **(a)** A student wants to demagnetise a permanent bar magnet. She suggests these steps:

1. Place the magnet in a long coil.
2. Switch on a large alternating current in the coil.
3. Switch off the current.
4. Remove the bar from the coil.

State and explain whether the steps will always be able to demagnetise the magnet.

.....

.....

.....

.....[3]

(b) **(i)** Fig. 9.1 shows a coil supplied with current using a split-ring commutator.

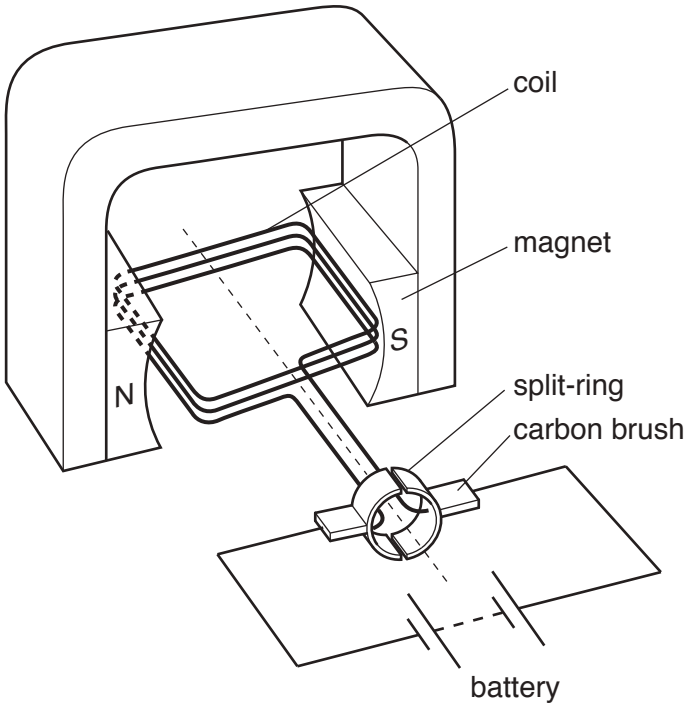

Fig. 9.1

State and explain any motion of the coil.

.....

.....

.....

.....

.....[3]

(ii) The coil in Fig. 9.1 consists of three turns of wire. The magnetic field strength of the magnet is *M*. With a current of 2.0 A in the coil, the coil experiences a turning effect *T*.

The first row of Table 9.1 shows this data.

Table 9.1

number of turns	current in the coil / A	magnetic field strength	turning effect
3	2.0	M	T
3	8.0	M	
6	2.0	M	
3	2.0	$\frac{M}{2}$	

Complete Table 9.1 to give the turning effect for the changes made to the arrangement shown in Fig. 9.1. Choose your answers from the box.

$\frac{T}{8}$	$\frac{T}{4}$	$\frac{T}{2}$	T	$2T$	$4T$	$8T$

[3]

[Total: 9]

10 **(a)** Explain why the voltage of the supply to the primary coil of a transformer must be alternating.

.....

.....

.....

.....[2]

(b) Fig. 10.1 shows a transformer.

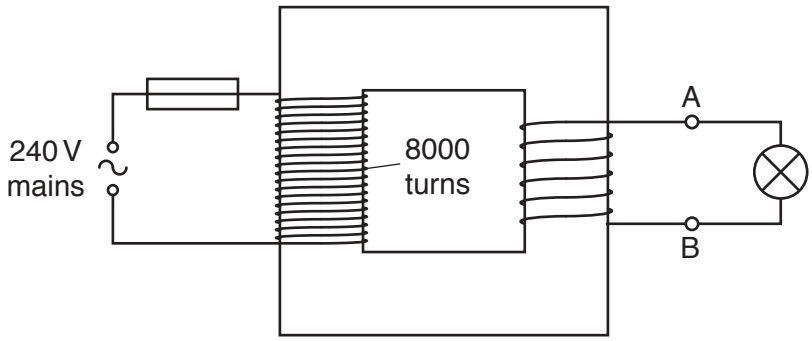

Fig. 10.1

There are 8000 turns in the primary coil of the transformer. The primary coil is connected to a 240 V mains supply. A 6.0 V lamp connected to the secondary coil operates at full brightness.

(i) Calculate the number of turns in the secondary coil,

number of turns = ...[2]

(ii) The current in the lamp is 2.0 A. The transformer operates with 100% efficiency.

Calculate the current in the primary circuit.

current = ...[2]

(iii) The primary circuit contains a 2 A fuse.

Calculate the maximum number of lamps, identical to the lamp in **(ii)**, that can be connected in parallel in the secondary circuit without blowing the fuse.

number of lamps = ...[1]

[Total: 7]

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11 Radon-222 is radioactive. It can be represented as $^{222}_{86}Rn$.

(a) For a neutral atom of radon-222, state

1. the number of protons, ...

2. the number of neutrons, ...

3. the number of electrons. .....

[2]

(b) A radon-222 nucleus decays by α-particle emission to a polonium (Po) nucleus.

Complete the equation for the decay of radon-222.

$$^{222}_{86}Rn \rightarrow$$ [2]

(c) Radon-222 has a half-life of 3.8 days.

At a certain time, a sample contains 6.4×10^6 radon nuclei.

Calculate the number of α-particles emitted by the radon nuclei in the following 7.6 days.

number = ...[3]

[Total: 7]

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CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/42**

Paper 4 Theory (Extended) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

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1 **(a)** Fig. 1.1 shows the axes of a distance-time graph for an object moving in a straight line.

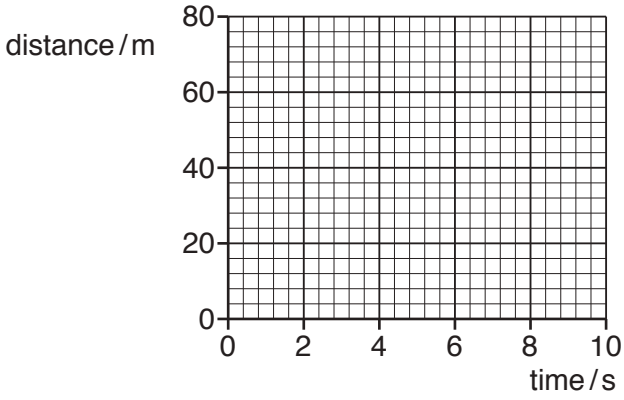


Fig. 1.1

(i) **1.** On Fig. 1.1, draw between time = 0 and time = 10 s, the graph for an object moving with a constant speed of 5.0 m / s. Start your graph at distance = 0 m.

2. State the property of the graph that represents speed.

.....
[2]

(ii) Between time = 10 s and time = 20 s the object accelerates. The speed at time = 20 s is 9.0 m / s.

Calculate the average acceleration between time = 10 s and time = 20 s.

acceleration = ...[2]

(b) Fig. 1.2 shows the axes of a speed-time graph for a different object.

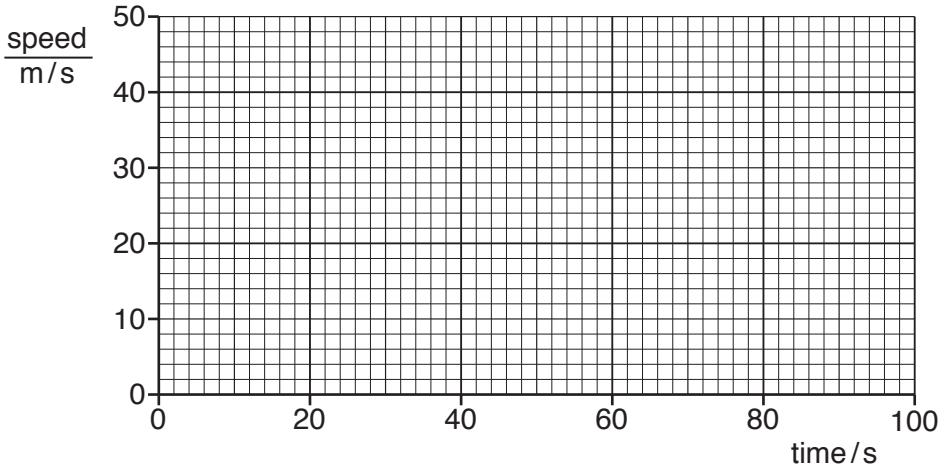


Fig. 1.2

(i) The object has an initial speed of 50 m/s and decelerates uniformly at 0.35 m/s^2 for 100 s.

On Fig. 1.2, draw the graph to represent the motion of the object. [2]

(ii) Calculate the distance travelled by the object from time = 0 to time = 100 s.

distance = ...[3]

[Total: 9]

2 Fig. 2.1 shows a hollow metal cylinder containing air, floating in the sea.

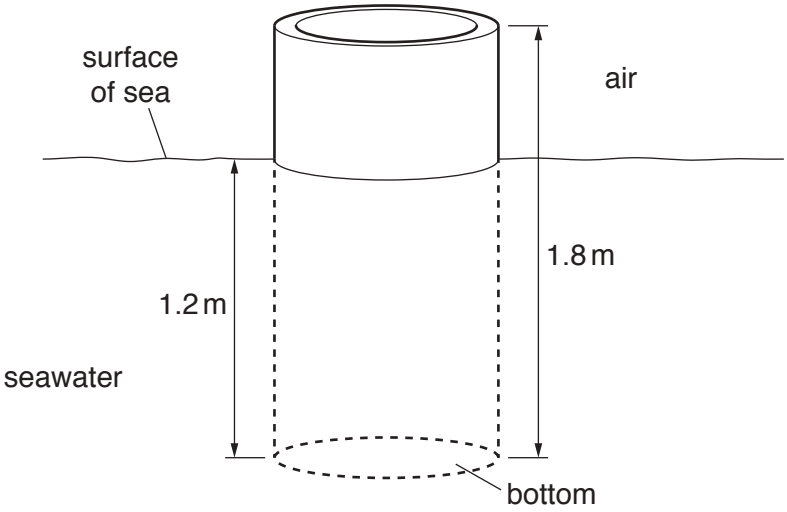


Fig. 2.1

(a) The density of the metal used to make the cylinder is greater than the density of seawater.

Explain why the cylinder floats.

.....

.....[1]

(b) The cylinder has a length of 1.8 m. It floats with 1.2 m submerged in the sea. The bottom of the cylinder has an area of cross-section of 0.80 m^2.

The density of seawater is 1020 kg / m^3. Calculate the force exerted on the bottom of the cylinder due to the depth of the seawater.

force = ...[4]

(c) Deduce the weight of the cylinder. Explain your answer.

weight = ...

explanation .....

.....
[2]

[Total: 7]

3 Fig. 3.1 shows an aircraft on the deck of an aircraft carrier.

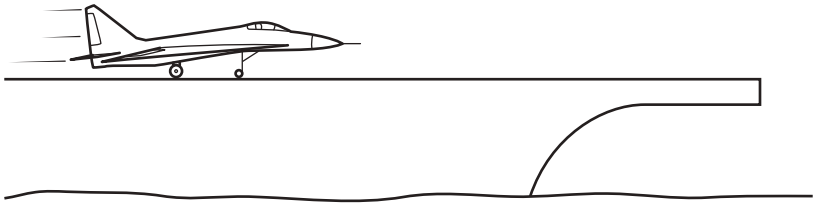


Fig. 3.1

The aircraft accelerates from rest along the deck. At take-off, the aircraft has a speed of 75 m/s. The mass of the aircraft is 9500 kg.

(a) Calculate the kinetic energy of the aircraft at take-off.

kinetic energy = ...[3]

(b) On an aircraft carrier, a catapult provides an accelerating force on the aircraft. The catapult provides a constant force for a distance of 150 m along the deck.

Calculate the resultant force on the aircraft as it accelerates. Assume that all of the kinetic energy at take-off is from the work done on the aircraft by the catapult.

force = ...[2]

[Total: 5]

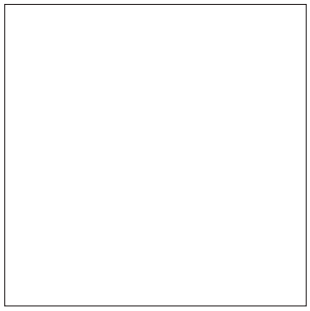
4 **(a)** Fig. 4.1 represents an atom.

Fig. 4.1

Representing atoms by circles approximately the same size as in Fig. 4.1, sketch

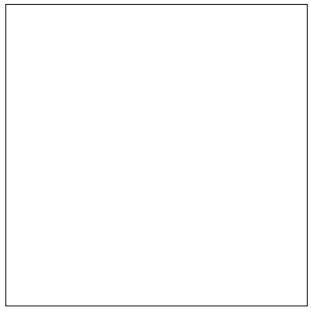
(i) on Fig. 4.2, the arrangement of atoms in a crystalline solid, [1]

(ii) on Fig. 4.3, the arrangement of atoms in a gas. [1]



solid

Fig. 4.2



gas

Fig. 4.3

(b) **(i)** Describe the motion of the atoms in a solid.

.....[1]

(ii) A sculptor makes a statue from a block of crystalline rock using a cutting tool. Explain why he must apply a large force to the tool to remove a small piece of rock.

.....

.....[2]

(c) A helium-filled balloon in the room of a house suddenly bursts.

State and explain, in terms of atoms, what happens to the helium from the balloon after the balloon has burst.

.....

.....

.....[2]

[Total: 7]

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5 A student wants to investigate good and bad absorbers of thermal radiation. She has the apparatus shown in Fig. 5.1, a supply of cold water and a metre rule.

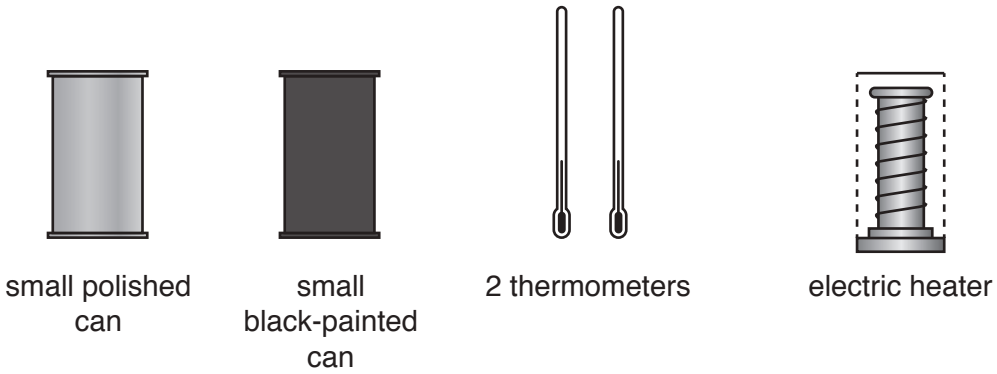

Fig. 5.1

Explain how the student could use the apparatus she has available to carry out her investigation. Describe the results she would expect to obtain. Draw a diagram of the set-up.

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 4]

6 **(a)** Circle **two** of the following that apply to an ultrasound wave travelling in air.

frequency 3.5 Hz frequency 350 Hz frequency 35 000 Hz longitudinal

transverse speed 1.5 m / s speed 1.5×10^3 m / s speed 1.5×10^6 m / s

[2]

(b) Calculate the wavelength in a vacuum of X-rays of frequency 1.3×10^{17} Hz.

wavelength = ...[3]

(c) A dentist takes an X-ray photograph of a patient's teeth. Explain why it is safe for the patient to be close to the source of X-rays, but the dentist must stand away from the source.

.....

.....

.....

.....[2]

(d) State, with a reason, why microwave ovens are designed only to work with the door closed.

.....

.....

.....[2]

[Total: 9]

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7 **(a)** Fig. 7.1 shows a ray of light in water that is incident on a submerged, transparent plastic block.

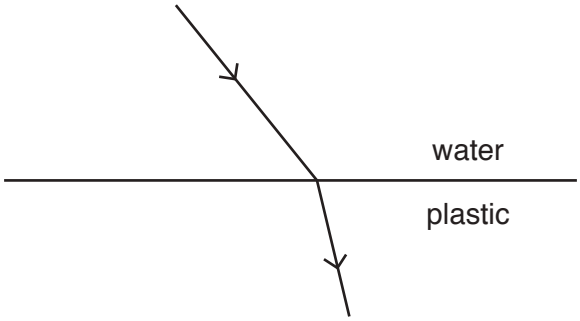

Fig. 7.1

State what happens to the speed of light as it enters the plastic block. Explain your answer.

.....

.....

.....[2]

(b) Fig. 7.2 shows the two principal focuses F_1 and F_2 of a thin converging lens.

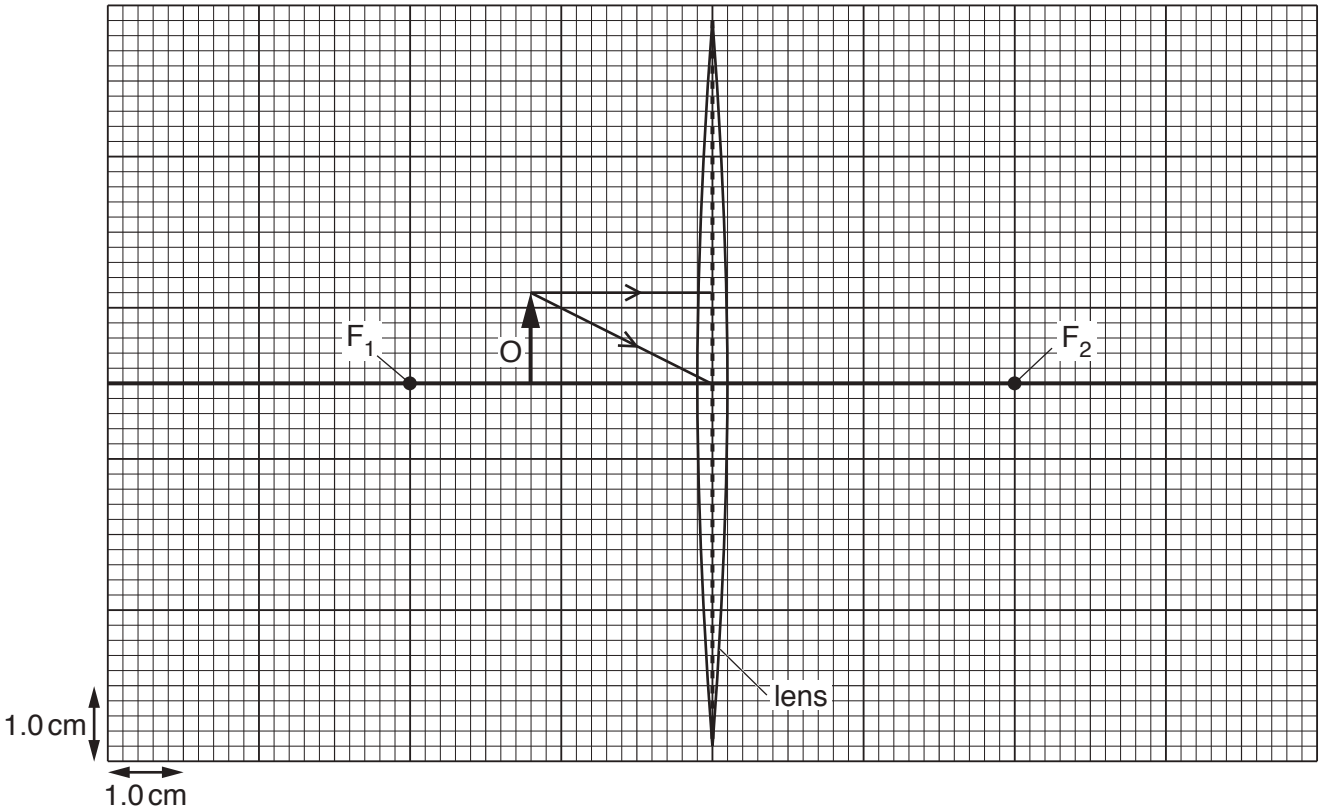

Fig. 7.2

Fig. 7.2 also shows an object O of height 1.2 cm placed close to the lens. Two rays from the tip of the object O are incident on the lens.

(i) On Fig. 7.2, continue the paths of these two rays for a further distance of at least 5 cm. [2]

(ii) Using your answer to **(b)(i)**, find and mark on Fig. 7.2 the image I of object O and label this image. [2]

(iii) Determine the height of image I.

height = ...[1]

(iv) State and explain whether I is a real image or a virtual image.

.....

.....[1]

[Total: 8]

8 Fig. 8.1 shows a circuit that contains a battery of electromotive force (e.m.f.) 6.0 V, an ammeter, a 20 Ω resistor and component X.

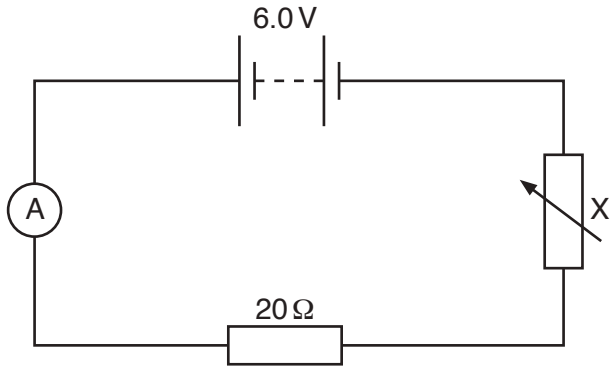

Fig. 8.1

(a) **(i)** State the name of component X.

.....[1]

(ii) The potential difference (p.d.) across the 20 Ω resistor is measured with a voltmeter.

On Fig. 8.1, draw the symbol for this voltmeter connected to the circuit. [1]

(b) The p.d. across the 20 Ω resistor is varied from zero to 6.0 V. For each value of p.d. a corresponding current is measured.

On Fig. 8.2, draw a line to indicate how the current measured by the ammeter depends on the p.d. across the 20 Ω resistor.

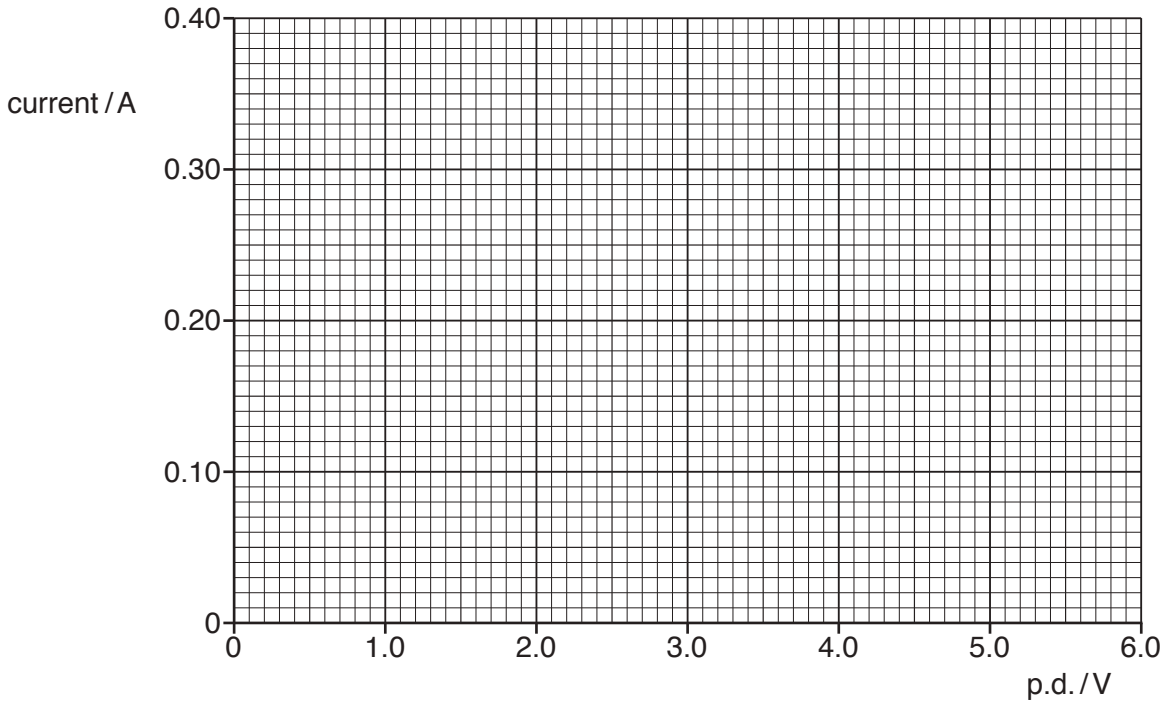

Fig. 8.2

[3]

(c) A second resistor is connected into the circuit in parallel with the 20 Ω resistor.

(i) State how the combined resistance of the two resistors in parallel compares with the resistance of each of the resistors on its own.

.....

.....[1]

(ii) The p.d. across the two parallel resistors is changed and the current in the battery for each value of the p.d. is measured. A second line could be drawn on Fig. 8.2 to indicate how the current measured by the ammeter depends on the p.d. across the two resistors in parallel.

State how the second line differs from the original line. You are **not** expected to draw this second line.

.....

.....[1]

[Total: 7]

9 **(a)** Fig. 9.1 shows a coil ABCD with two turns. The coil is in a magnetic field.

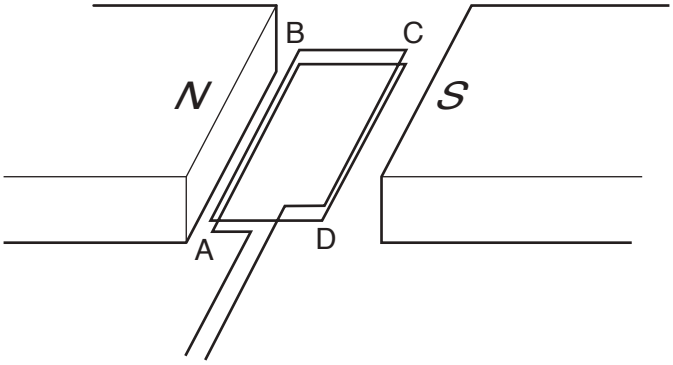

Fig. 9.1

When there is a current in the coil, the coil experiences a turning effect.

(i) Explain why there is a turning effect.

.....

.....

.....[1]

(ii) The value of the current is 3 A. Place **one** tick in each column of the table to indicate how the turning effect changes with the change described.

turning effect	number of turns on coil increased to six	current increased to 9 A	strength of magnetic field decreased by a factor of 2
decreased by factor of 4			
decreased by factor of 3			
decreased by factor of 2			
no change			
increased by factor of 2			
increased by factor of 3			
increased by factor of 4			

[3]

(b) Fig. 9.2 shows a magnet held just below a vertical coil connected to a galvanometer.

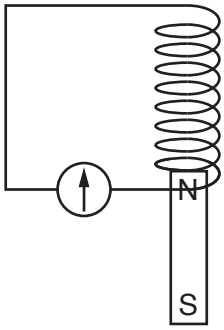

Fig. 9.2

The magnet is released.

(i) State any effect on the galvanometer.

.....

.....

.....[2]

(ii) State any effect on the magnetic field produced by the coil.

.....

.....

.....[2]

[Total: 8]

10 **(a)** An uncharged conducting metal plate rests on insulating supports. Fig. 10.1 shows the plate and a positively charged insulating plastic sheet placed on top of the metal plate.

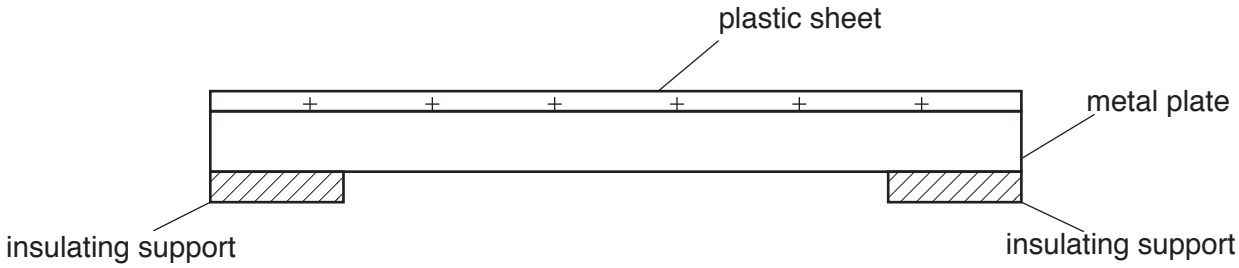

Fig. 10.1

(i) Describe any flow of charge that takes place when the plastic sheet is placed onto the metal plate.

.....

.....[1]

(ii) On Fig. 10.1, draw how charges are now arranged within the metal plate. [1]

(iii) State and explain if this arrangement of charge helps to keep the plastic sheet in place.

.....

.....

.....

.....[2]

(b) Fig. 10.2 shows two uncharged conducting spheres suspended on insulating threads.

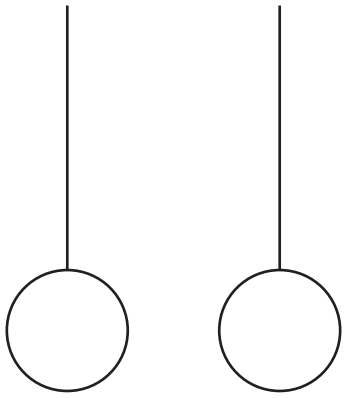

Fig. 10.2

1. The spheres are now both given positive charges. On Fig. 10.2, draw a possible position of each sphere and thread.

2. Explain the positions you have drawn.

.....

.....
[2]

[Total: 6]

11 **(a)** A radioactive nucleus of uranium-235 decays to a nucleus of thorium and emits an α-particle. Complete the equation.

$$^{235}_{92}U \longrightarrow \begin{matrix}\text{.....}\\ \text{.....}\end{matrix} Th + ^{4}_{2}\alpha$$

[2]

(b) A nucleus of uranium-235 undergoes nuclear fission in a reactor.

(i) State what is meant by *nuclear fission*.

.....

.....

.....[1]

(ii) Suggest why a nuclear reactor is surrounded by thick concrete walls.

.....

.....

.....

.....[2]

(iii) State one environmental advantage and one environmental disadvantage of using a fission reactor to generate electrical energy in a power station.

advantage .....

.....

disadvantage .....

.....

[2]

(c) The thorium produced by the decay in **(a)** is also radioactive and has a half-life of 26 hours. At a certain time, a pure sample of this isotope initially contains 4.8×10^9 atoms.

Calculate the number of atoms of this sample that decay in the following 52 hours.

number = ...[3]

[Total: 10]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/43**

Paper 4 Theory (Extended) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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This document consists of **15** printed pages and **1** blank page.

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CAMBRIDGE International Examinations

1 There is no atmosphere on the Moon.

A space probe is launched from the surface of the Moon. Fig. 1.1 shows the speed-time graph of the space probe.

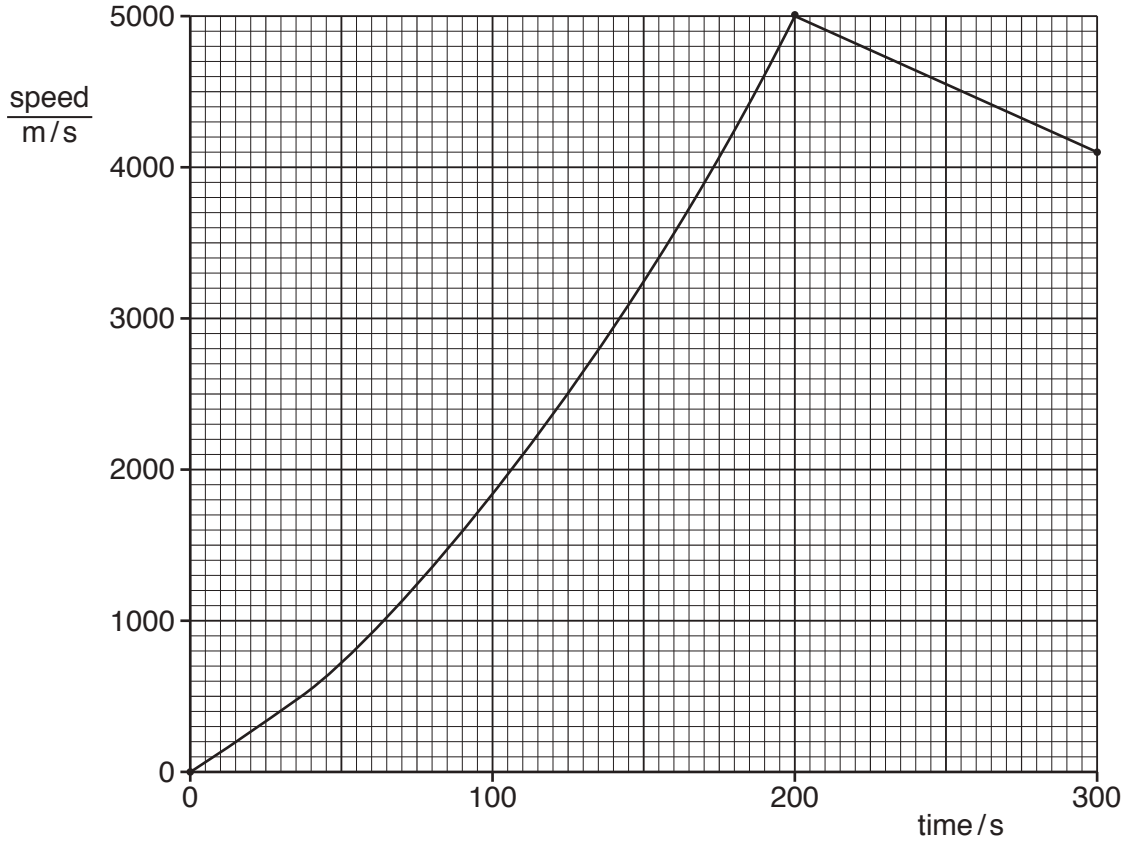

Fig. 1.1

(a) Determine the acceleration of the space probe at time = 0.

acceleration = ...[3]

(b) Between time = 0 and time = 150 s, the acceleration of the space probe changes.

(i) Without calculation, state how the graph shows this.

.....

.....[1]

(ii) During this time, the thrust exerted on the space probe by the motor remains constant.

State one possible reason why the acceleration changes in the way shown by Fig. 1.1.

.....

.....[1]

(c) Calculate the distance travelled by the space probe from time = 200 s to time = 300 s.

distance = ...[3]

[Total: 8]

2 A rifle fires a bullet of mass 0.020 kg vertically upwards through the air. As it leaves the rifle, the speed of the bullet is 350 m / s.

(a) Calculate

(i) the kinetic energy of the bullet as it leaves the rifle,

kinetic energy = ...[3]

(ii) the maximum possible height that the bullet can reach.

maximum height = ...[2]

(b) The actual height reached by the bullet is less than the value calculated in **(a)(ii)**.

(i) Explain, in terms of the forces acting on the bullet, why this is so.

.....

.....

.....[2]

(ii) As the bullet rises through the air, its kinetic energy decreases.

State what happens to this energy.

.....

.....

.....[2]

[Total: 9]

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3 On a particular day, the atmospheric pressure is 1.0×10^5 Pa. A bubble of gas forms at a point 5.0 m below the surface of a lake. The density of water is 1000 kg / m^3.

(a) Determine

(i) the total pressure at a depth of 5.0 m in the water,

pressure = ...[3]

(ii) the pressure of the gas in the bubble.

pressure = ...[1]

(b) As the bubble rises to the surface, the mass of gas in the bubble stays constant. The temperature of the water in the lake is the same throughout.

Explain why the bubble rises to the surface and why its volume increases as it rises.

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

4 A beaker contains some water at room temperature. A student places a mercury-in-glass thermometer in the water with the bulb of the thermometer just beneath the surface of the water.

Fig. 4.1 shows the arrangement.

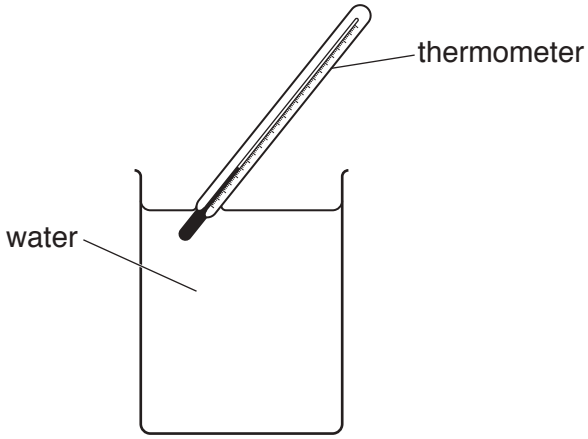

Fig. 4.1

The student uses an electric fan to blow air across the open top of the beaker. She notices that the reading on the thermometer begins to decrease.

(a) Explain, in terms of water molecules, why the temperature of the water at the surface begins to decrease.

.....

.....

.....

.....

.....[3]

(b) The student places the thermometer near the bottom of the beaker. The electric fan continues to blow air across the top of the beaker. After some time, the student observes that the temperature of the water at the bottom of the beaker is decreasing.

State the name of the thermal transfer method causing this and explain what is happening in the water.

.....

.....

.....

.....

.....[3]

(c) The thermometer used in this experiment has a small range and a large sensitivity.

(i) State what is meant by

1. *range*,

.....

.....[1]

2. *sensitivity*.

.....

.....[1]

(ii) State and explain the effect on the range of the thermometer of using a smaller bulb that contains less mercury.

.....

.....[1]

[Total: 9]

5 **(a)** A microscope that produces a very high magnification is used to observe the Brownian motion of smoke particles in air.

Fig. 5.1(a) shows the apparatus used with the microscope. Fig. 5.1(b) represents the view through the microscope and shows one of the smoke particles being observed.

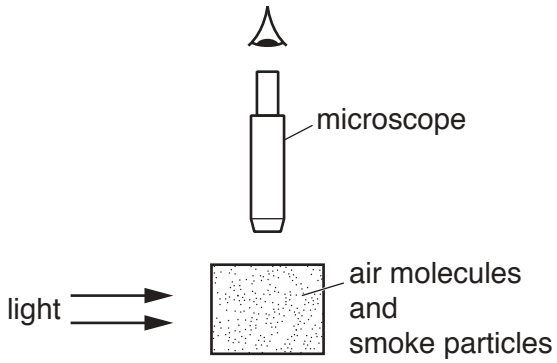

Fig. 5.1(a)

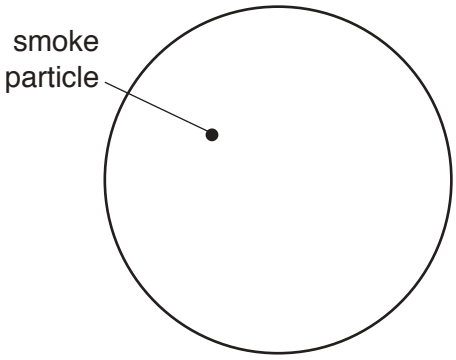

Fig. 5.1(b)

(i) On Fig. 5.1(b), draw a possible path for the smoke particle. [2]

(ii) Describe how air molecules cause the smoke particle to follow the observed path.

.....

.....

.....

.....[2]

(b) Fig. 5.2 shows a volume of gas in a cylinder.

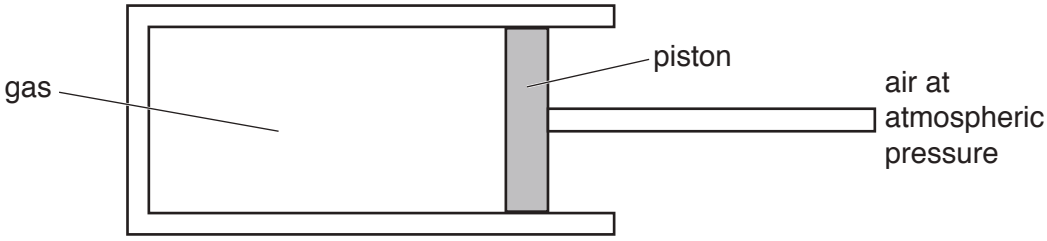

Fig. 5.2

The piston in the cylinder is free to move. The piston moves to the left when the temperature of the gas is decreased.

Explain, in terms of the molecules of the gas, why this happens.

.....

.....

.....

.....

.....[4]

[Total: 8]

6 Sound is a longitudinal wave.

(a) Sketch a representation of a longitudinal wave. On your sketch

- indicate and label a distance to show the wavelength,
- mark and label the centre of one compression,
- mark and label the centre of one rarefaction.

[3]

(b) A longitudinal wave passes from one medium into another medium. The speed of the wave is slower in the second medium.

State what happens to

(i) the frequency of the wave,

.....[1]

(ii) the wavelength of the wave.

.....[1]

(c) State a typical value for the speed of sound in air.

.....[1]

[Total: 6]

7 **(a)** A ray of light travelling in air strikes a glass block at an angle of 30° to the normal. The light slows down as it enters the glass block.

State and explain, in terms of wavefronts, what happens to the light.

.....

.....

.....

.....[3]

(b) The speed of light in this block of glass is 1.9×10^8 m/s.

Calculate the refractive index of the glass.

refractive index = ...[2]

[Total: 5]

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8 **(a)** A thin converging lens is used to produce an image I of object O.

Fig. 8.1 shows O, I and the screen on which the image is produced.

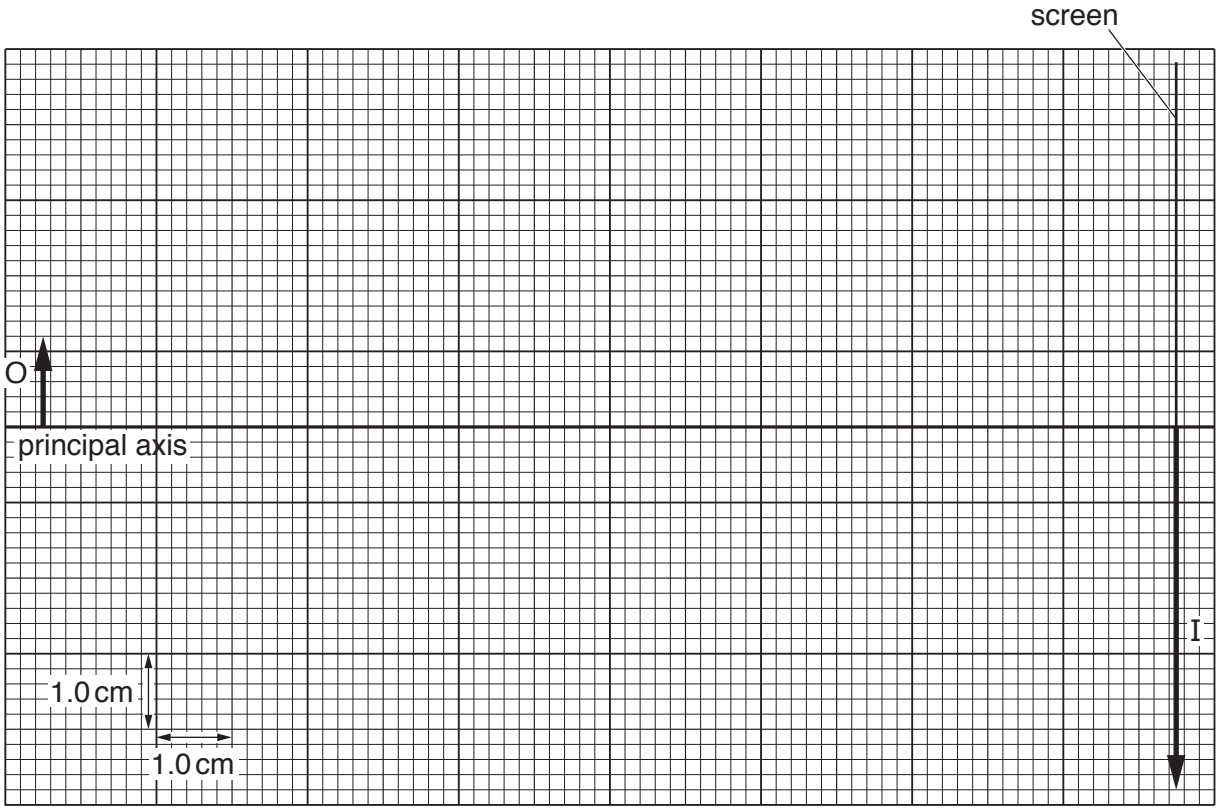

Fig. 8.1

(i) On Fig. 8.1, draw a straight line to represent a ray from the tip of the arrowhead of O to the tip of the arrowhead of I. Draw a vertical dotted line to indicate the position of the lens. This dotted line must extend above and below the principal axis. [2]

(ii) Draw a second ray from the tip of the object O to the tip of image I. This ray should pass through a principle focus. Label the principle focus, F. [1]

(iii) Determine the focal length of the lens.

focal length = ...[1]

(iv) Image I is further from the lens than object O is from the lens. Image I is described as enlarged and inverted.

State and explain one other characteristic of I.

.....

.....[1]

(b) Fig. 8.2 shows a spherical fishbowl, full of water, by a window. A black curtain hangs behind the fishbowl.

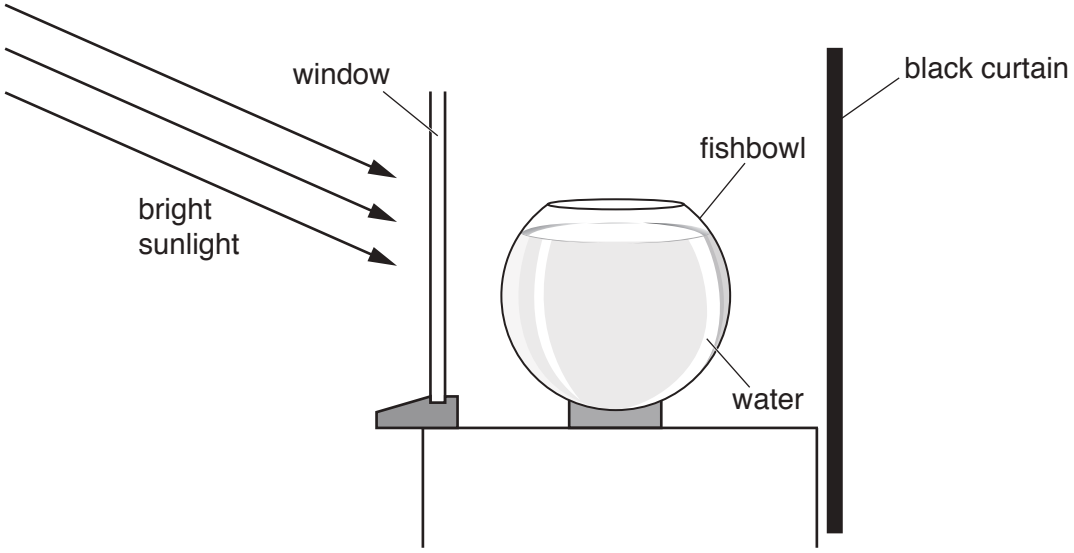

Fig. 8.2

When full of water, the fishbowl can act as a converging lens.

Suggest one possible hazard of leaving the fishbowl next to the window in bright sunlight.

.....

.....[1]

[Total: 6]

9 Fig. 9.1 shows a circuit that includes a battery of electromotive force (e.m.f.) 12 V.

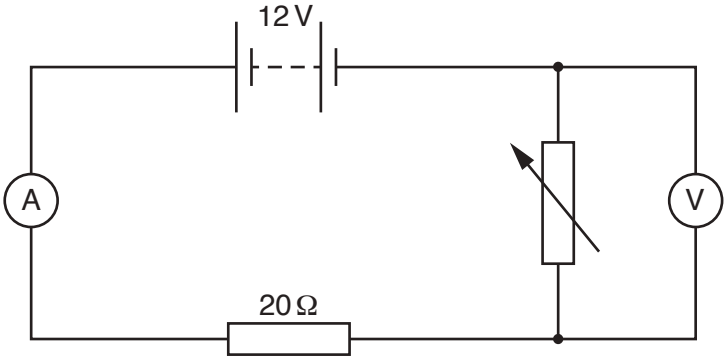

Fig. 9.1

The reading on the ammeter is 0.15 A.

(a) Calculate the resistance of the circuit.

resistance = ...[2]

(b) The variable resistor is adjusted so that its resistance decreases.

(i) State what happens to the reading on the ammeter.

.....[1]

(ii) State and explain what happens to the reading on the voltmeter.

.....

.....

.....[2]

(c) The battery is formed from cells of electromotive force (e.m.f.) 1.5 V.

(i) Explain, in terms of electrical energy, what is meant by an *electromotive force* (*e.m.f.*) *of 1.5 V*.

.....

.....[2]

(ii) State how many 1.5 V cells are connected in series to form the battery.

.....[1]

[Total: 8]

10 **(a)** A bar magnet is held with its N-pole just inside one end of a coil.

Fig. 10.1 shows the coil connected to a galvanometer that has the zero mark in the centre of the scale.

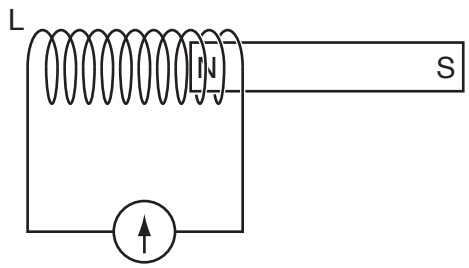

Fig. 10.1

The magnet is pulled horizontally to the right at a constant speed through a large distance.

(i) State what happens to the galvanometer reading as time passes.

.....

.....

.....[2]

(ii) As the magnet moves, an N-pole is produced at the left-hand end L of the coil.

Explain why the pole at L is an N-pole.

.....

.....

.....[2]

(b) A transformer has N_P turns on the primary coil and N_S turns on the secondary coil. The transformer is used in a school laboratory as a 12 V alternating current (a.c.) supply. The transformer is powered from the 240 V a.c. mains supply.

(i) Determine the turns ratio N_P / N_S of the transformer.

N_P / N_S = ...[2]

(ii) The laboratory 12 V a.c. supply is rectified to produce a direct current (d.c.) supply.

Underline the component that the rectification circuit must include.

AND gate **diode** **NOT gate** **potentiometer** **thermistor**

[1]

[Total: 7]

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11 **(a)** State the type of radioactive emission that causes

(i) the proton number of a nuclide to increase by 1,

.....[1]

(ii) the nucleon number of a nuclide to decrease by 4,

.....[1]

(iii) no change in the proton number and no change in the nucleon number of a nuclide.

.....[1]

(b) The isotope radon-220 is radioactive and it decays by α-particle emission.

(i) Fig. 11.1 shows a beam of α-particles entering the electric field between two charged plates.

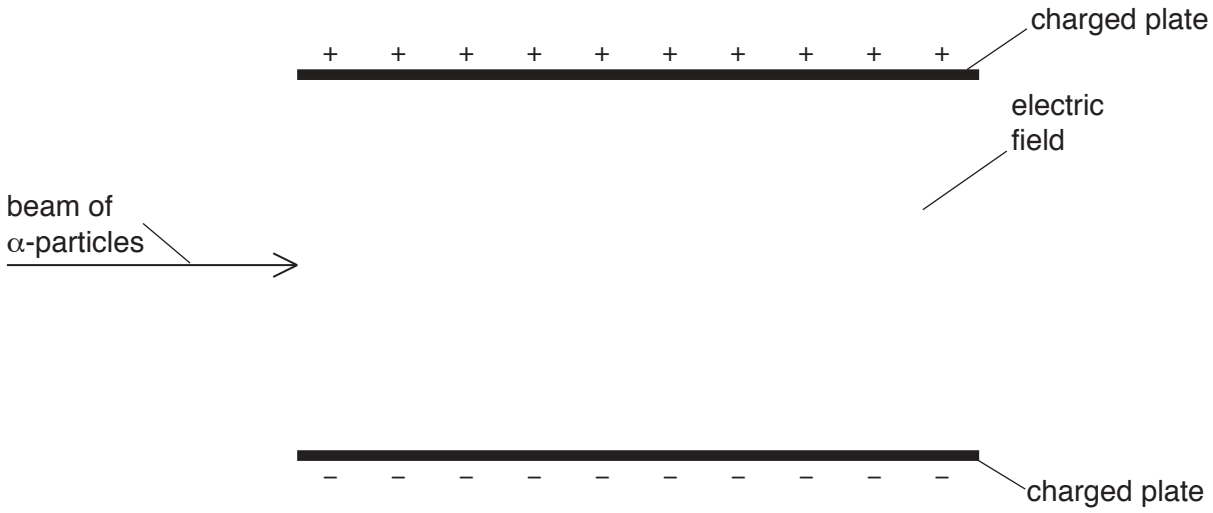

Fig. 11.1

On Fig. 11.1, sketch the path that the beam of α-particles follows in the electric field. [1]

(ii) The half-life of radon-220 is 56 s.

A sample of this isotope contains 7.2×10^6 atoms.

Predict the number of α-particles that the radon-220 in the sample emits in the next 168 s.

number of α-particles emitted = ...[3]

[Total: 7]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/51**

Paper 5 Practical Test **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of the page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You are advised to spend about 20 minutes on each of questions 1 to 3, and 15 minutes on question 4.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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[Turn over

1 In this experiment, you will determine the acceleration of free fall g using a pendulum. Carry out the following instructions, referring to Fig. 1.1 and Fig. 1.2.

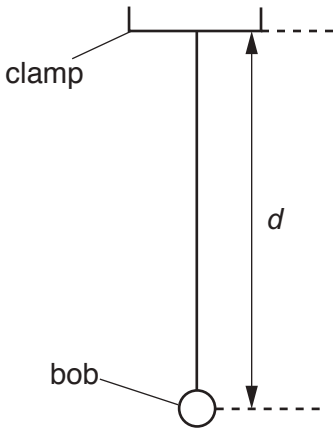

Fig. 1.1

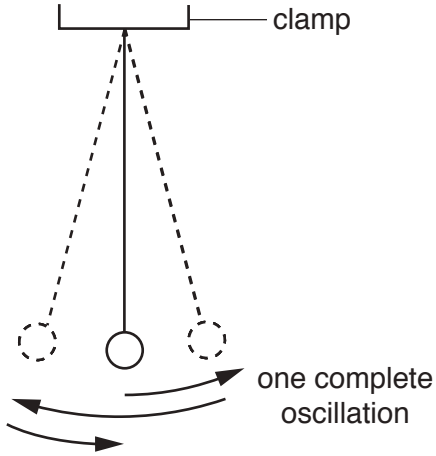

Fig. 1.2

A pendulum has been set up for you as shown in Fig. 1.1.

(a) Adjust the length of the pendulum until the distance d measured to the centre of the bob is 50.0 cm.

Displace the bob slightly and release it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.

(i) Measure the time t for 10 complete oscillations.

t = ... [1]

(ii) Calculate the period T of the pendulum. The period is the time for one complete oscillation.

T = ... [1]

(iii) Calculate T^2.

T^2 = ... [2]

(iv) Calculate the acceleration of free fall g using the equation $g = \frac{20}{T^2}$.

g = ... [1]

(b) Adjust the pendulum until the distance *d* measured to the centre of the bob is 100.0 cm.

(i) Repeat the procedure in **(a)(i)**, **(a)(ii)** and **(a)(iii)**.

t = ...

T = ...

T^2 = ...
[1]

(ii) Calculate the acceleration of free fall g using the equation $g = \frac{40}{T^2}$.

g = ...
[2]

(c) A student states that repeating the experiment improves the reliability of the value obtained for g.

Suggest **two** changes that you would make to improve the reliability. The stopwatch cannot be changed.

1. .....

.....

2. .....

.....

[2]

(d) State **one** precaution that you took in this experiment in order to obtain accurate readings.

.....

.....[1]

[Total: 11]

2 In this experiment, you will investigate resistance.

The circuit shown in Fig. 2.1 has been set up for you.

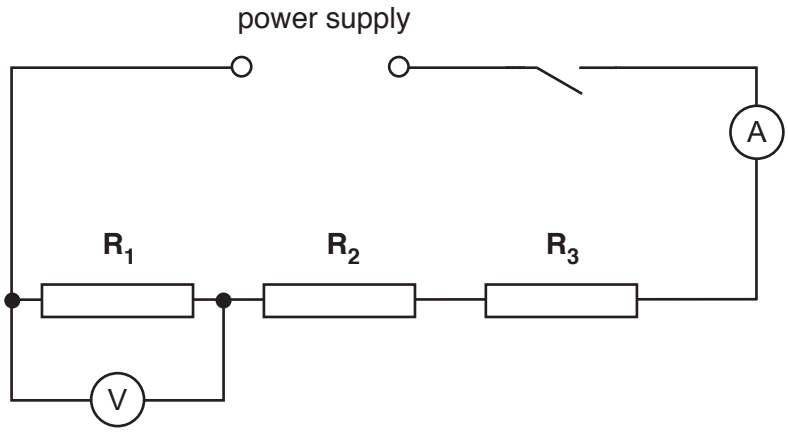

Fig. 2.1

(a) **(i)** Switch on. Measure and record the potential difference V_1 across the resistor $\mathbf{R_1}$ and the current I in the circuit. Switch off.

V_1 = ...

I = ...
[2]

(ii) Calculate the resistance of the resistor $\mathbf{R_1}$ using the equation $R_1 = \frac{V_1}{I}$.

R_1 = ... [1]

(b) Disconnect the voltmeter.

Connect the voltmeter across the resistor $\mathbf{R_2}$. Switch on.

(i) Measure and record the potential difference V_2 across the resistor $\mathbf{R_2}$. Switch off.

V_2 = ...

(ii) Calculate the resistance of the resistor $\mathbf{R_2}$ using the equation $R_2 = \frac{V_2}{I}$.

R_2 = ... [1]

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(c) Disconnect the voltmeter.

Connect the voltmeter across the resistor $\mathbf{R_3}$. Switch on.

(i) Measure and record the potential difference V_3 across the resistor $\mathbf{R_3}$. Switch off.

V_3 = ...

(ii) Calculate the resistance of the resistor $\mathbf{R_3}$ using the equation $R_3 = \frac{V_3}{I}$.

R_3 = ... [1]

(iii) Calculate the resistance R of resistors $\mathbf{R_1}$, $\mathbf{R_2}$ and $\mathbf{R_3}$ connected in series, using the equation $R = R_1 + R_2 + R_3$. Give your answer to a suitable number of significant figures for this experiment.

R = ... [1]

(d) State whether your results suggest that the three resistors have the same value of resistance. Justify your statement by reference to your results.

statement .....

justification .....

.....

.....
[2]

(e) Complete the circuit diagram in Fig. 2.2 to show:

- the three resistors connected in parallel
- the voltmeter connected to measure the potential difference across the resistors
- a variable resistor connected to control the current in all three resistors.

You are **not** required to set up this circuit.

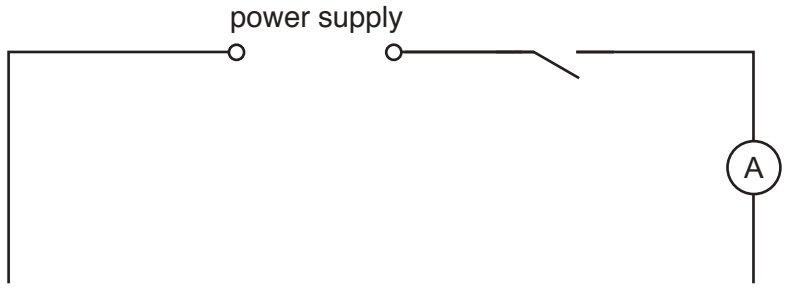

Fig. 2.2

[3]

[Total: 11]

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3 In this experiment, you will determine the focal length *f* of a lens.

Carry out the following instructions referring to Fig. 3.1.

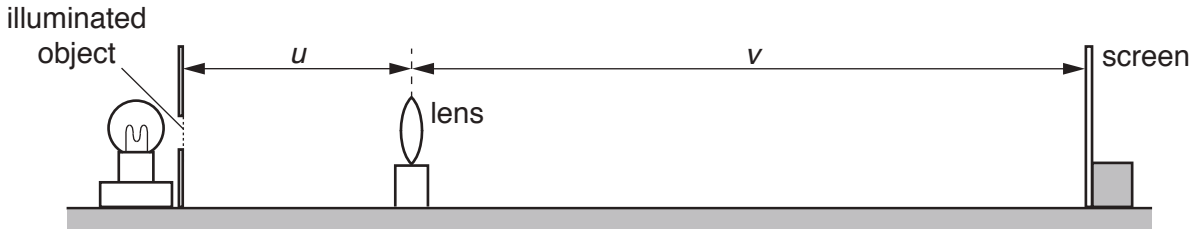


Fig. 3.1

(a) • Place the screen a distance $D = 70.0$ cm from the illuminated object.

• Place the lens between the object and the screen so that the lens is very close to the screen.

• Move the lens slowly away from the screen until a clearly focused image is formed on the screen.

(i) • Measure, and record in Table 3.1, the distance *u* between the centre of the lens and the illuminated object.

• Measure, and record in the table, the distance *v* between the centre of the lens and the screen.

(ii) Calculate the product *uv*. Record your answer in the table.

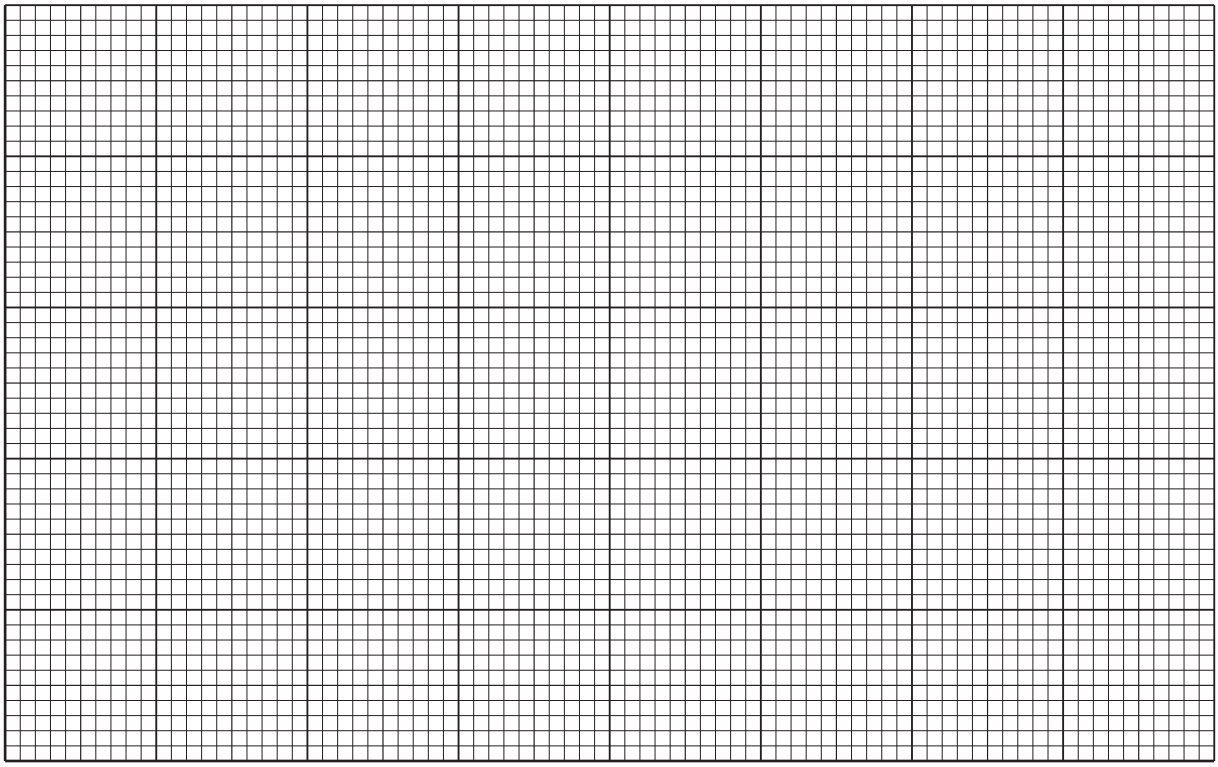
(iii) Repeat the procedure using values for *D* of 75.0 cm, 80.0 cm, 85.0 cm and 90.0 cm.

Table 3.1

D / cm	*u* / cm	*v* / cm	*uv* / cm^2
70.0			
75.0			
80.0			
85.0			
90.0			

[3]

(b) Plot a graph of uv/cm^2 (y-axis) against D/cm (x-axis). You do **not** need to start your axes at the origin (0,0).



[4]

(c) The focal length f of the lens is numerically equal to the gradient of the line.

Determine the gradient G of the line. Show clearly on the graph how you obtained the necessary information.

G = ...[2]

(d) Suggest **two** difficulties in this experiment when trying to obtain accurate readings.

1. .....

.....

2. .....

.....

[2]

[Total: 11]

4 A student is investigating the effect of double-walled insulation on the rate of cooling of hot water in a copper container. The student places the copper container inside a larger metal container. He is investigating the effect of the size of the air gap between the copper container and larger metal containers.

Plan an experiment to investigate the effect of the size of the air gap between the copper container and larger metal containers on the rate of cooling of hot water.

The following apparatus is available:

a copper container
a number of metal containers of different diameters (all larger than the copper container)
a thermometer
a stopwatch
a measuring cylinder
a supply of hot water.

You can also use other apparatus and materials that are usually available in a school laboratory.

You are **not** required to carry out this investigation.

In your plan, you should:

- explain briefly how you would carry out the investigation
- state the key variables that you would control
- draw a table, or tables, with column headings, to show how you would display your readings (you are not required to enter any readings in the table)
- explain how you would use your readings to reach a conclusion.

You may draw a diagram if it helps your explanation.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/52**

Paper 5 Practical Test **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of the page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You are advised to spend about 20 minutes on each of questions 1 to 3, and 15 minutes on question 4.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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[Turn over

1 In this experiment, you will determine the density of water.

Carry out the following instructions, referring to Fig. 1.1.

You are provided with a plastic drinks cup.

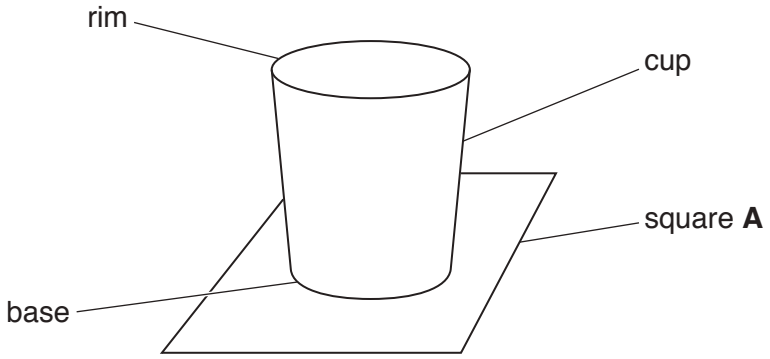

Fig. 1.1

(a) **(i)** Place the cup, with the base at the bottom, in square **A** on this page. Draw carefully around the base of the cup. Remove the cup from the paper. Take measurements from your drawing to determine an accurate value for the diameter D_B of the base of the cup.

Square **A**

D_B = ... cm [2]

(ii) Place the cup, with the rim at the bottom, in square **B** on this page. Draw carefully around the rim of the cup.

Remove the cup from the paper. Take measurements from your drawing to determine the diameter D_T of the rim of the cup.

Square **B**

D_T = ... cm [1]

(iii) Calculate the average diameter D of the cup using the equation $D = \frac{D_B + D_T}{2}$.

D = ... cm [1]

(b) (i) Measure the vertical height h of the cup.

h = ... cm [1]

(ii) 1. Calculate the volume V of the cup using the equation $V = 0.785\,D^2 h$.

V = ... cm^3

2. Calculate $V/2$.

$V/2$ = ... cm^3
[1]

(c) You are provided with water in beaker **W**.

Pour a volume $V/2$ of water into the measuring cylinder. Pour this water into the cup.

(i) Use the balance provided to measure the mass m of the cup containing the water.

m = ... g [1]

(ii) Determine the density ρ of water using the equation $\rho = \frac{2m}{V}$.

Give your answer to a suitable number of significant figures for this experiment. Include the unit.

ρ = ... [3]

(d) A student carries out all the instructions for this experiment with care, but his value for the density of water ρ is not equal to the expected value.

Suggest, with a reason, a part of the procedure, **(a)**, **(b)** or **(c)** that could give an unreliable result.

part .....

reason .....

.....
[1]

[Total: 11]

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2 In this experiment, you will investigate the cooling of water.

Carry out the following instructions referring to Fig. 2.1.

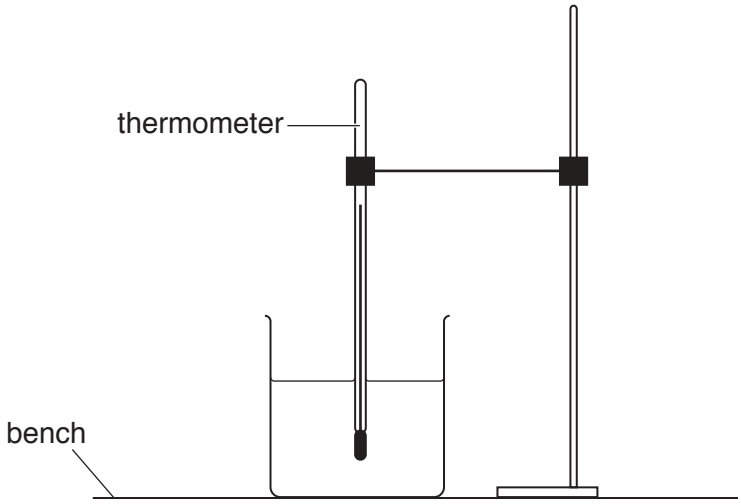


Fig. 2.1

(a) Use the thermometer to measure room temperature θ_R.

θ_R = ... [1]

(b) Pour 200 cm^3 of hot water into the beaker. Place the thermometer in the beaker of hot water.

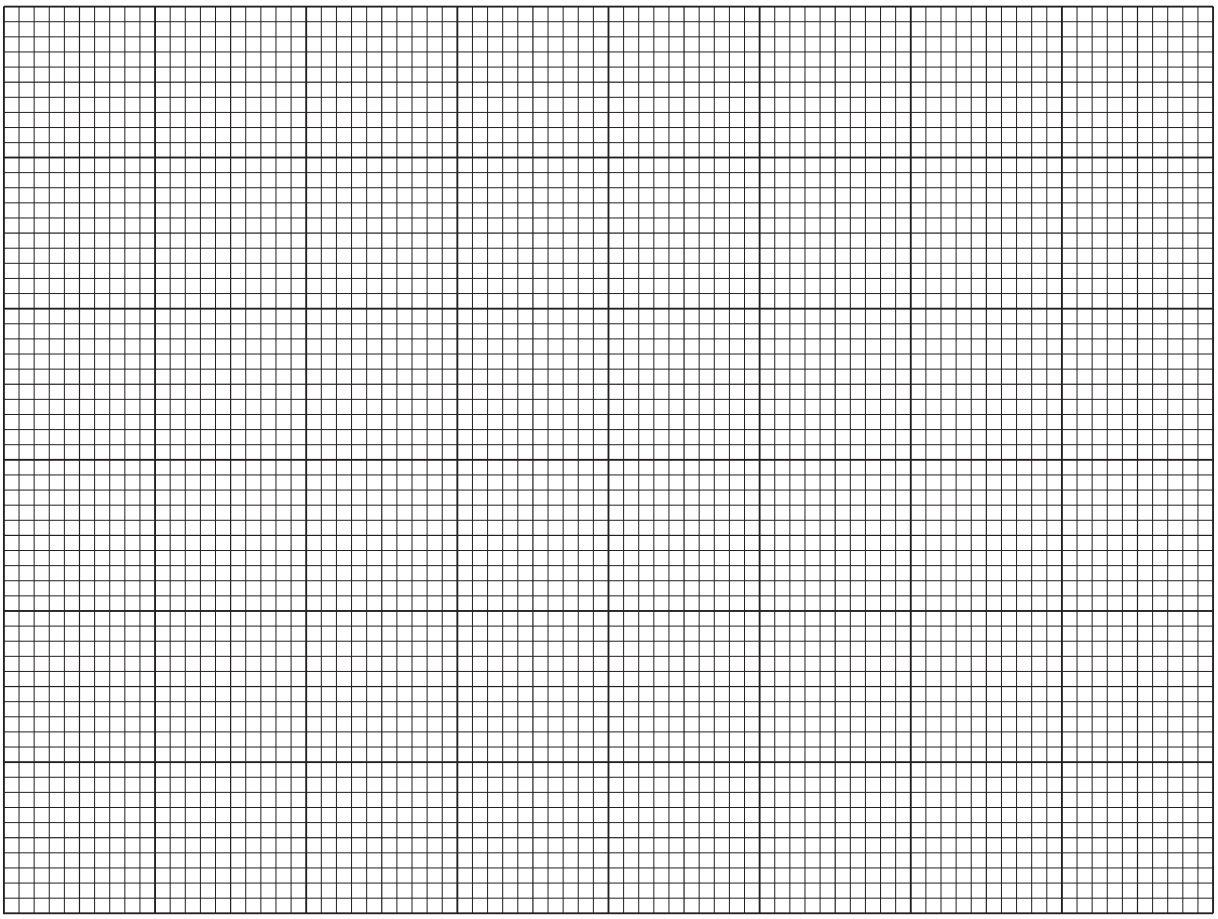
- Record in Table 2.1 the temperature θ of the hot water at time t = 0 s. Immediately start the stopclock.
- After 30 s, measure the temperature θ shown on the thermometer. Record the time t = 30 s and the temperature reading in the table.
- Continue recording the time and temperature readings every 30 s until you have six sets of readings.

[2]

Table 2.1

t/s	θ/°C
0	

(c) Plot a graph of θ/°C (*y*-axis) against *t*/s (*x*-axis). You do **not** need to start the *y*-axis at the origin (0,0) but the value of room temperature θ_R must be marked on the *y*-axis.



[4]

(d) Draw a horizontal line across the graph grid to show the value of room temperature θ_R during the experiment. [1]

(e) A student plans to repeat the experiment using the same thermometer and the same volume of water. Suggest **two** changes to the apparatus or the procedure that would increase the rate of cooling of the water.

1. .....

.....

2. .....

.....

[2]

(f) State **one** precaution that you took in order to record accurate readings.

.....

.....[1]

[Total: 11]

3 In this experiment, you will determine the focal length f of a lens.

Carry out the following instructions referring to Fig. 3.1.

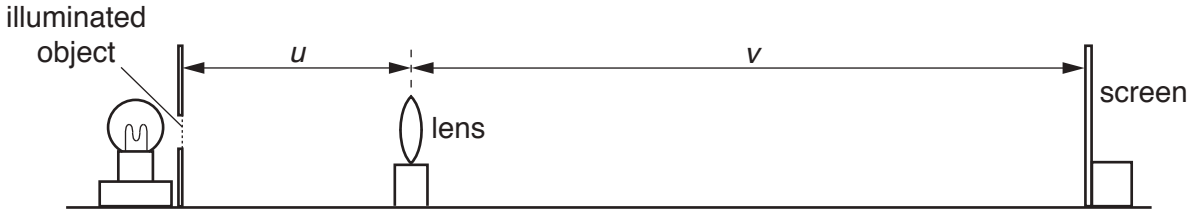


Fig. 3.1

(a)
- Place the screen about 100 cm from the illuminated object.
- Place the lens between the object and the screen so that the centre of the lens is at a distance u_1 = 20.0 cm from the object.
- Adjust the position of the screen until a clearly focused image is formed on the screen.

(i) Measure the distance v_1 between the centre of the lens and the screen.

v_1 = ... [1]

(ii) Calculate the focal length f_1 of the lens using the equation $f_1 = \frac{u_1 v_1}{(u_1 + v_1)}$.

f_1 = ... [1]

(b) **(i)** Repeat the procedure in **(a)**, placing the lens between the object and the screen so that the centre of the lens is at a distance u_2 = 30.0 cm from the object.

v_2 = ... [1]

(ii) Calculate the focal length f_2 of the lens using the equation $f_2 = \frac{u_2 v_2}{(u_2 + v_2)}$.

f_2 = ... [2]

(c) Calculate the average value of the focal length f of the lens, using the two results from parts **(a)** and **(b)**. Give your answer to a suitable number of significant figures for this experiment.

f = ... [2]

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(d) The student states that taking more measurements improves the reliability of the value obtained for *f*.

Suggest additional values for *u* that you would use.

.....

.....

.....[2]

(e) State **two** precautions that should be taken in this experiment to obtain accurate readings.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

4 A student is investigating whether the distance that a toy truck will travel along a horizontal floor, before stopping, depends on its mass.

The following apparatus is available to the student:

a ramp
blocks to support the ramp as shown in Fig. 4.1
toy truck
a selection of masses
other standard apparatus from the physics laboratory.

Plan an experiment to investigate whether the distance that the toy truck will travel along a horizontal floor, before stopping, depends on its mass.

You are **not** required to carry out this investigation.

In your plan, you should:

- explain briefly how you would carry out the investigation
- state any apparatus that you would use that is not included in the list above
- state the key variables that you would control
- draw a table, or tables, with column headings to show how you would display your readings (you are **not** required to enter any readings in the table).

You may add to the diagram in Fig. 4.1 to help your description.

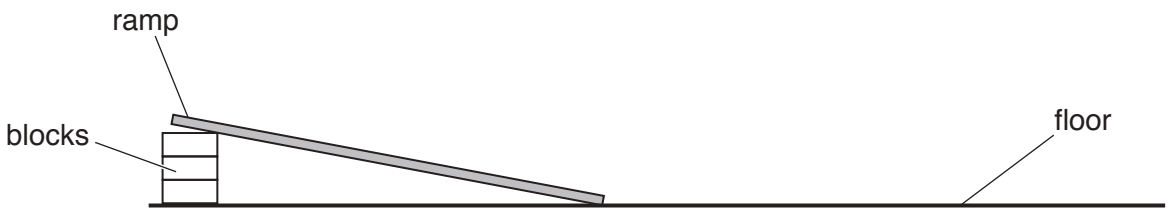

Fig. 4.1

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PHYSICS **0625/53**

Paper 5 Practical Test **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You are advised to spend about 20 minutes on each of questions 1 to 3, and 15 minutes on question 4.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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[Turn over

1 In this experiment, you will investigate how partly covering the surface of the water in a beaker affects the rate at which the water cools.

Carry out the following instructions, referring to Fig. 1.1.

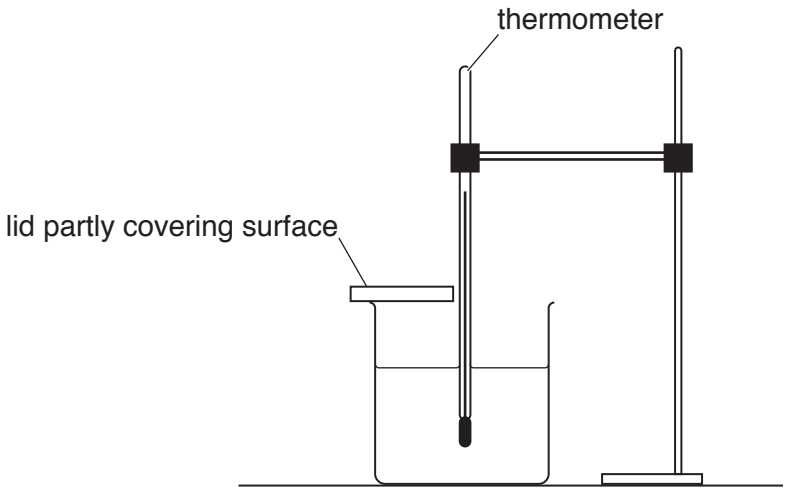

Fig. 1.1

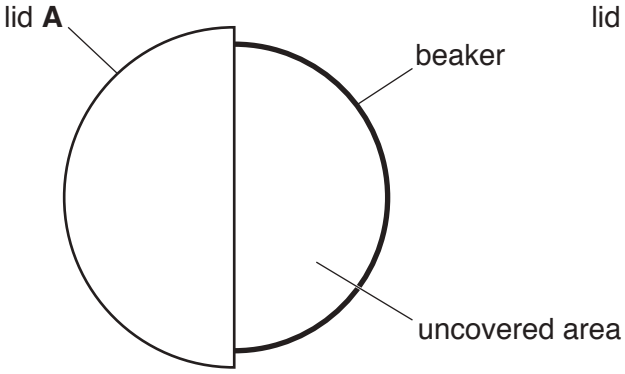

Fig. 1.2

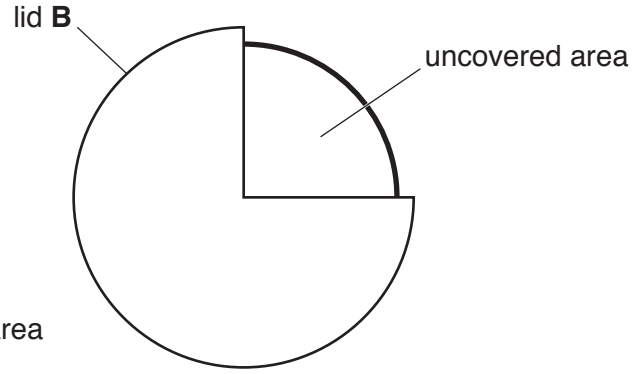

Fig. 1.3

(a)
- Pour 100 cm^3 of hot water into the beaker and cover half of it with lid **A** as shown in Fig. 1.2. This leaves 50 % of the water surface uncovered.
- Place the thermometer into the hot water and record, in the first row of Table 1.1, the temperature θ of the water at time $t = 0$. Immediately start the stopclock.
- Record, in the table, the temperature θ of the water at times t = 30 s, 60 s, 90 s, 120 s, 150 s and 180 s.
- Pour the water out of the beaker.

[1]

(b) **(i)** Repeat **(a)**, using lid **B** instead of lid **A** to cover more of the beaker as shown in Fig. 1.3. This leaves only 25 % of the water surface uncovered. [1]

(ii) Complete the headings and the time *t* column in the table. [2]

Table 1.1

	beaker with lid **A**	beaker with lid **B**
t /	θ /	θ /
0		

(c) **(i)** Write a conclusion to this experiment, stating for which lid the cooling rate is greater. Explain your answer by reference to your results.

.....

.....

.....

.....[2]

(ii) Suggest a change to the **apparatus** that could produce a greater difference between the rates of cooling for lid **A** and lid **B**.
Explain why the change might produce a greater difference.

change .....

.....

explanation .....

.....
[2]

(d) A student thinks that the cooling rate is directly proportional to the percentage of the surface area uncovered. He wants to draw a graph of cooling rate against the percentage of uncovered area to investigate this.

Describe how his graph line will show whether the cooling rate and the percentage of surface area uncovered are directly proportional.

.....

.....[2]

(e) Students in other countries are carrying out the same experiment.

Suggest a factor that they should keep the same if they are to obtain similar readings.

.....

.....[1]

[Total: 11]

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2 In this experiment, you will investigate a circuit containing resistors.

The circuit has been set up for you.
The fixed resistor must remain connected throughout the experiment.
Resistor **X** has a resistance $R = 1\,\Omega$.

Carry out the following instructions, referring to Fig. 2.1.

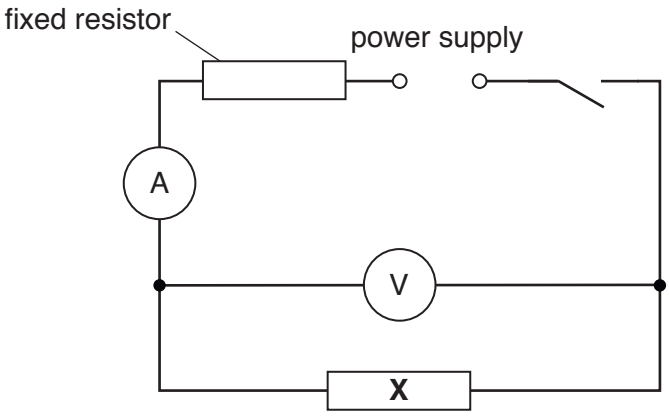

Fig. 2.1

(a)
- Switch on.
  Measure, and record in Table 2.1, the value of the current I in the circuit and the value of the potential difference V across resistor **X**.
  Switch off.
- Replace resistor **X** with resistor **Y** of value $R = 3\,\Omega$.
  Repeat the above procedure.
- Replace resistor **Y** with resistor **Z** of value $R = 10\,\Omega$.
  Repeat the above procedure.

[3]

Table 2.1

Resistor	R/Ω	$I/$	$V/$
X	1		
Y	3		
Z	10		

(b) Add appropriate units to the column headings in the table. [1]

(c) Calculate the power P supplied to each of the resistors **X**, **Y** and **Z**.
Use your readings from **(a)** and the equation $P = I \times V$.
Give your answers to a suitable number of significant figures.

Power P supplied to resistor **X** = ... W

Power P supplied to resistor **Y** = ... W

Power P supplied to resistor **Z** = ... W
[3]

(d) Describe how the value of the power P changes as R increases.

.....

.....

.....[2]

(e) A student wishes to investigate the relationship between P and R in more detail.
Suggest **two** modifications to the procedure that will enable him to do this.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

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3 In this experiment, you will investigate the image produced by a converging lens.

Carry out the following instructions, referring to Fig. 3.1.

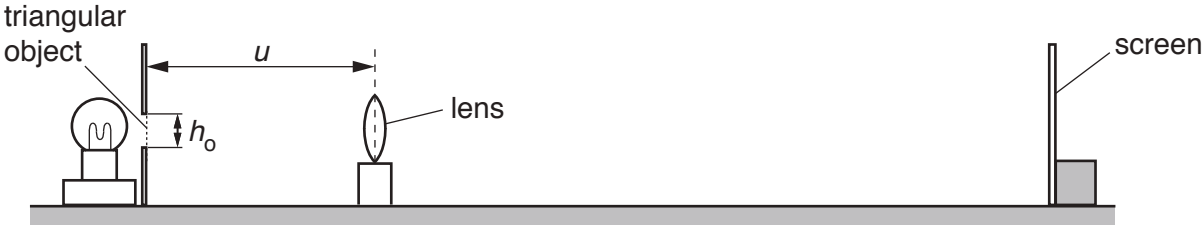


Fig. 3.1

(a) • Measure and record the height h_o of the triangular object.

h_o = ...cm

• Switch on the lamp.

• Set the distance between the triangular object and the lens, u, to 30.0 cm. Move the screen until a clear focused image of the triangular object is seen. Measure, and record in Table 3.1, the height h_I of the image.

• Repeat the procedure for u values of 35.0 cm, 40.0 cm, 45.0 cm and 50.0 cm.

• Switch off the lamp.

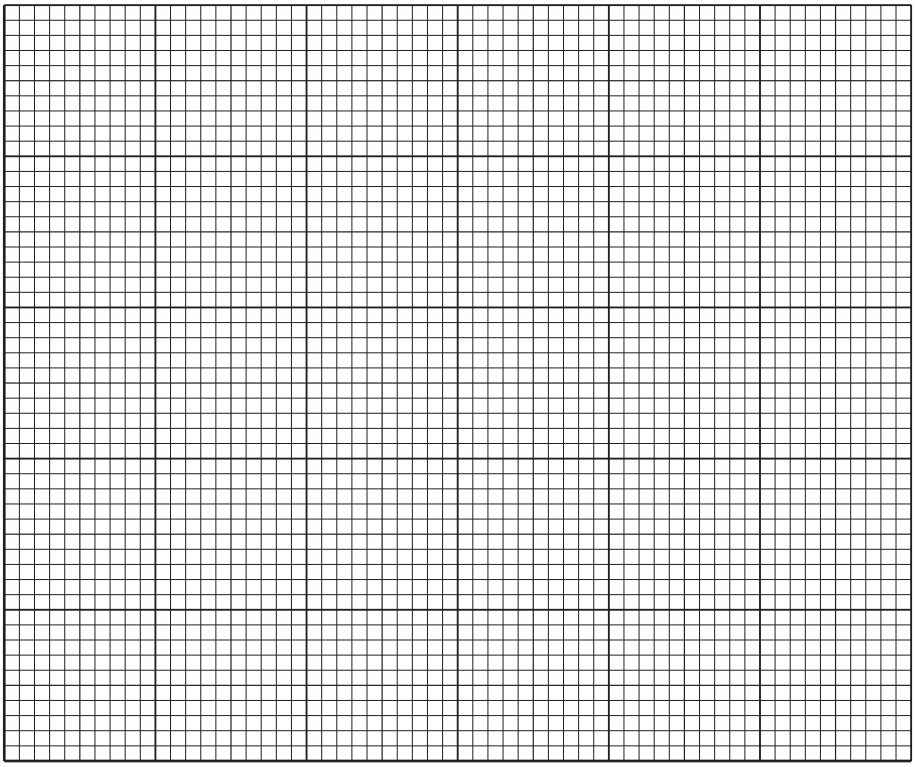
Table 3.1

u/cm	h_I/cm	N
30.0		
35.0		
40.0		
45.0		
50.0		

[2]

(b) For each distance u, calculate, and record in the table, a value N using your results from **(a)** and the equation $N = \frac{h_o}{h_I}$. [1]

(c) Plot a graph of u/cm (y-axis) against N (x-axis). You do not need to start your axes at the origin (0,0).



[4]

(d) Determine the gradient G of the graph.
Show clearly on the graph how you obtained the necessary information.

G = ...[2]

(e) Describe **one** difficulty that might be experienced when measuring the height of the image h_I.
Suggest an improvement to the apparatus to overcome this difficulty.

difficulty .....

.....

improvement .....

.....
[2]

[Total: 11]

4 A student is investigating the force needed to **just** slide a block across a surface.

Plan an experiment which will enable him to investigate how the force needed varies with the mass of the block.

The apparatus available includes:

a light, flat wooden block fitted with a hook as shown in Fig. 4.1

a pulley which can be clamped to a bench.

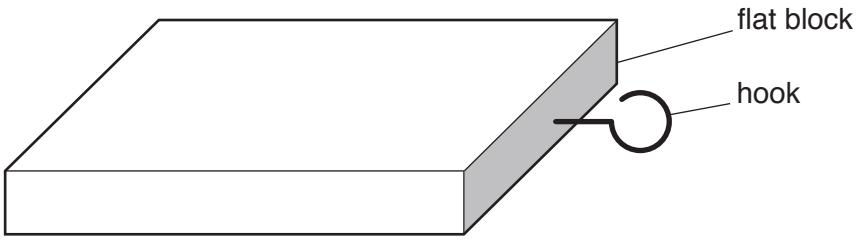


Fig. 4.1

In your plan, you should:

- list any additional apparatus needed
- draw a clearly labelled diagram of how the apparatus will be arranged
- give brief instructions for carrying out the experiment
- describe any precautions which should be taken to ensure reliable results
- suggest a graph which could be drawn.

You are **not** required to carry out the experiment.

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/61**

Paper 6 Alternative to Practical **May/June 2018**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1 A student is determining the acceleration of free fall *g* using a pendulum. Fig. 1.1 shows the pendulum. Fig. 1.2 shows one complete oscillation of the pendulum.

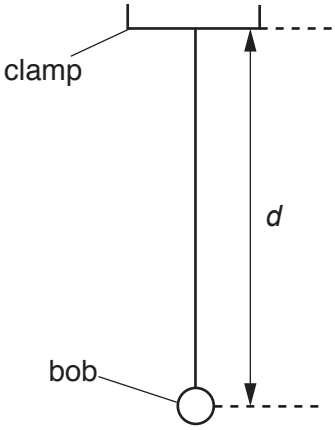

Fig. 1.1

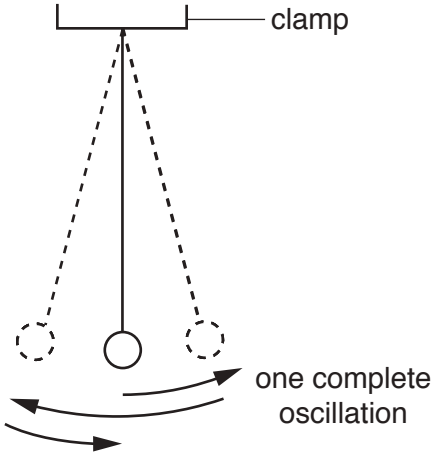

Fig. 1.2

(a) On Fig. 1.1, measure the distance *d*.

d = ... cm [1]

(b) Fig. 1.1 is drawn 1/10th actual size.

(i) Calculate the actual distance *D* from the bottom of the clamp to the centre of the bob.

D = ... cm [1]

The student displaces the bob slightly and releases it so that it swings. He measures the time *t* for 10 complete oscillations. The time *t* is shown on the stopwatch in Fig. 1.3.

Fig. 1.3

(ii) Write down the time *t* shown in Fig. 1.3.

t = ... [1]

(iii) Calculate the period *T* of the pendulum. The period is the time for one complete oscillation.

T = ... [1]

(iv) Calculate T^2.

T^2 = ... [1]

(v) Calculate the acceleration of free fall g using the equation $g = \frac{20}{T^2}$.

g = ... [1]

(c) The student adjusts the pendulum until the distance D measured to the centre of the bob is 100.0 cm.

He repeats the procedure and obtains another value of T^2.

T^2 = ...3.94.....

(i) On the dotted line above, write the unit for T^2. [1]

(ii) Calculate the acceleration of free fall g using the equation $g = \frac{40}{T^2}$ and the value of T^2 from **(c)**. Give your answer to a suitable number of significant figures for this experiment.

g = ... [1]

(d) Another student states that repeating the experiment improves the reliability of the value obtained for g.

Suggest **two** changes that you would make to improve the reliability. The stopwatch cannot be changed.

1. .....

.....

2. .....

.....
[2]

(e) State **one** precaution that you would take in this experiment in order to obtain accurate readings.

.....

..... [1]

[Total: 11]

2 A student is investigating resistance.

She uses the circuit shown in Fig. 2.1.

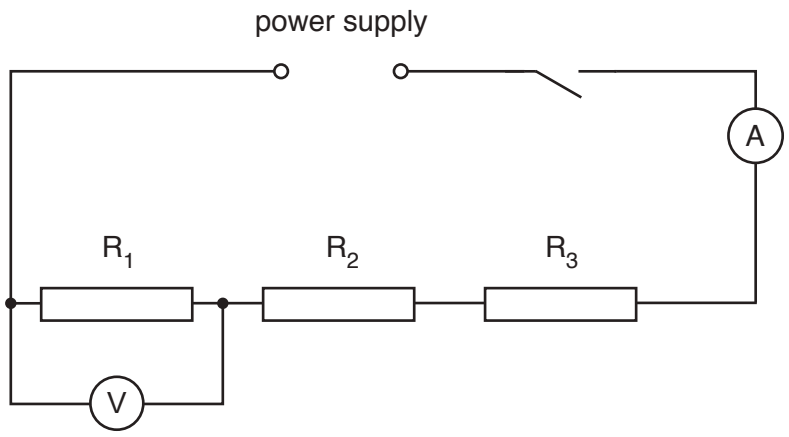

Fig. 2.1

(a) She measures the potential difference V_1 across the resistor R_1 and the current I in the circuit.

Figs. 2.2 and 2.3 show the voltmeter and ammeter readings.

(i) Write down the readings shown on the meters in Figs. 2.2 and 2.3.

V_1 = ...

I = ...
[2]

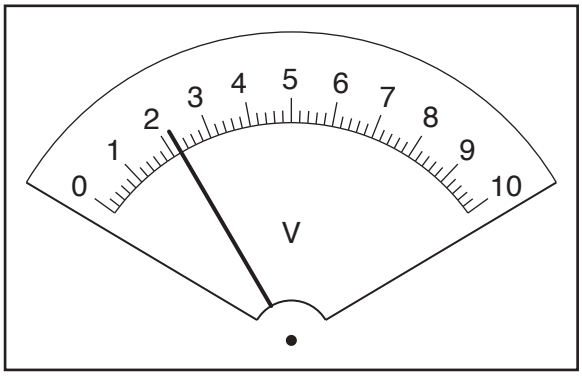

Fig. 2.2

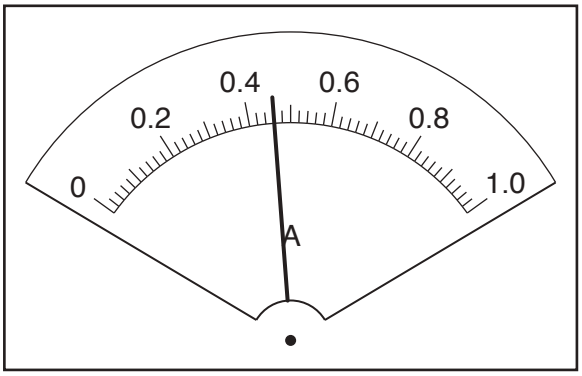

Fig. 2.3

(ii) Calculate the resistance of the resistor R_1 using the equation $R_1 = \frac{V_1}{I}$.

R_1 = ... [1]

(b) The student measures the potential difference across each resistor in turn. She calculates values for the resistance R_2 and R_3 of the resistor R_2 and of the resistor R_3. She records her values as:

R_2 = ...4.75 Ω.....

R_3 = ...4.81 Ω.....

State whether the results suggest that the three resistors have the same value of resistance. Justify your statement by reference to the results.

statement .....

justification .....

.....

.....
[2]

(c) Calculate the combined resistance R of resistors R_1, R_2 and R_3 connected in series, using the equation $R = R_1 + R_2 + R_3$. Give your answer to a suitable number of significant figures for this experiment.

R = ... [2]

(d) The student checks her result by connecting the voltmeter across all three resistors connected in series. Tick the potential difference reading you would expect to be closest to the reading she obtains.

- [ ] $\frac{V_1}{3}$
- [ ] V_1
- [ ] $3V_1$

[1]

(e) Complete the circuit diagram in Fig. 2.4 to show

- the three resistors connected in parallel
- the voltmeter connected to measure the potential difference across the resistors
- a variable resistor connected to control the current in all three resistors.

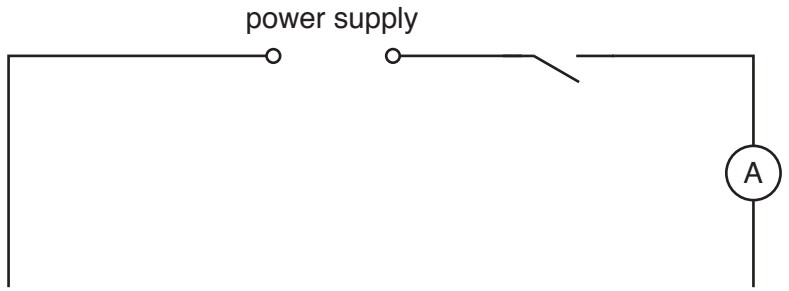

Fig. 2.4

[3]

[Total: 11]

Question 3 starts on the next page.

3 A student is determining the focal length *f* of a lens.

Fig. 3.1 shows the apparatus.

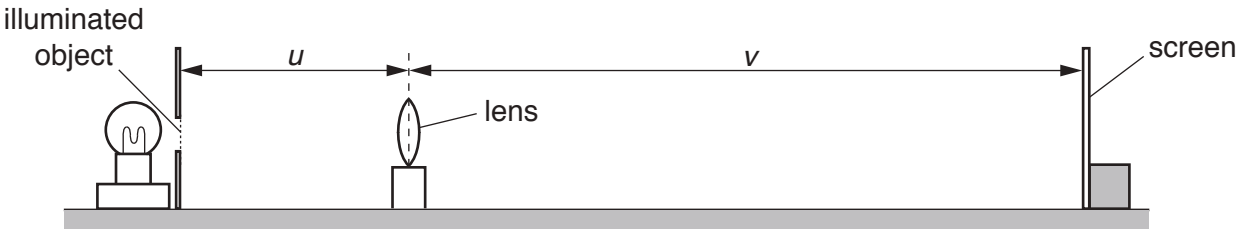

Fig. 3.1

(a) The student places the screen a distance $D = 70.0$ cm from the illuminated object.

He places the lens close to the screen and moves the lens slowly away from the screen until a clearly focused image is formed on the screen.

He measures the distance *u* between the centre of the lens and the illuminated object.

He measures the distance *v* between the centre of the lens and the screen.

He repeats the procedure using values for *D* of 75.0 cm, 80.0 cm, 85.0 cm and 90.0 cm.

The readings are shown in Table 3.1.

Calculate, and record in Table 3.1, *uv* for each value of *D*.

Table 3.1

D / cm	*u* / cm	*v* / cm	*uv* / cm^2
70.0	22.0	48.4	
75.0	20.7	54.5	
80.0	20.0	60.0	
85.0	19.5	65.8	
90.0	19.0	71.2	

[1]

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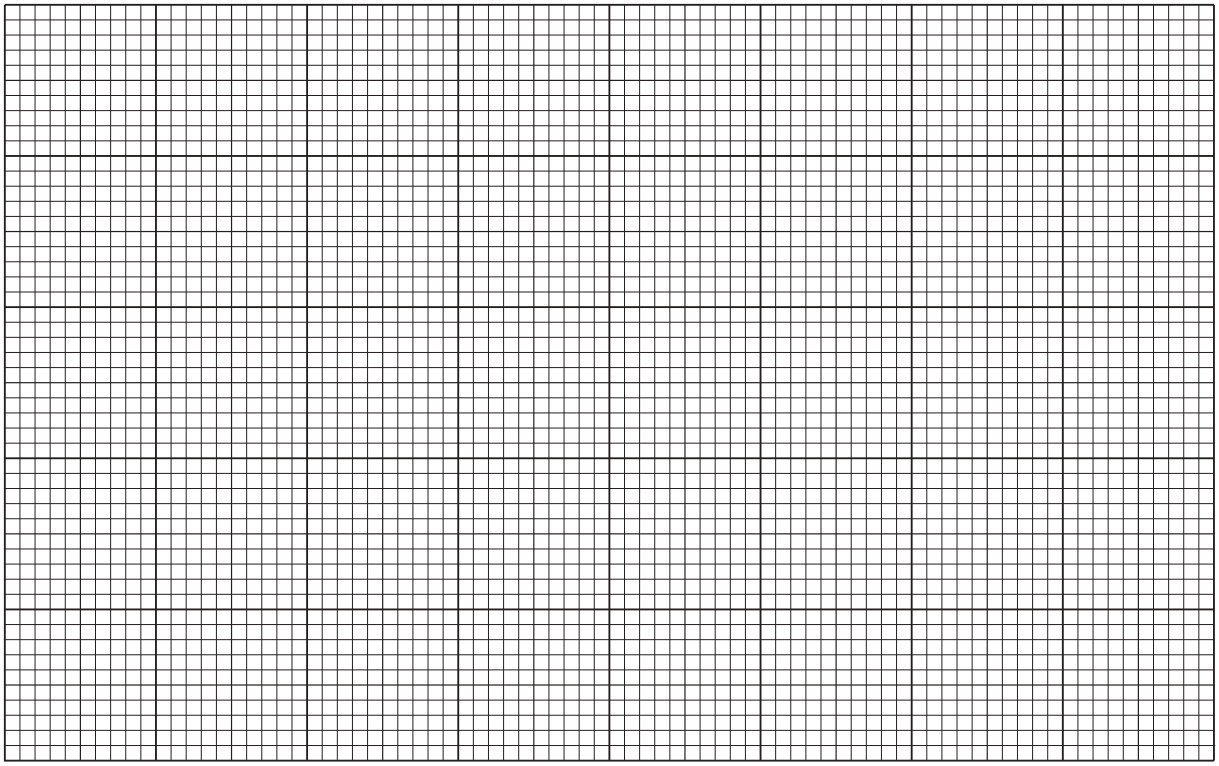
(b) Plot a graph of uv/cm^2 (y-axis) against D/cm (x-axis). You do **not** need to start your axes at the origin (0,0).



[4]

(c) Determine the gradient G of the line. Show clearly on the graph how you obtained the necessary information.

G = ... [2]

(d) The focal length f of the lens is numerically equal to the gradient G of the graph. Write down a value for the focal length f of the lens. Give your answer to a suitable number of significant figures for this experiment.

f = ... [2]

(e) Suggest **two** difficulties in this experiment when trying to obtain accurate readings.

1. .....

.....

2. .....

.....

[2]

[Total: 11]

4 A student is investigating the effect of double-walled insulation on the rate of cooling of hot water in a copper container. The student places the copper container inside a larger metal container. He is investigating the effect of the size of the air gap between the copper container and larger metal containers.

Plan an experiment to investigate the effect of the size of the air gap between the copper container and larger metal containers on the rate of cooling of hot water.

The following apparatus is available:

a copper container
a number of metal containers of different diameters (all larger than the copper container)
a thermometer
a stopwatch
a measuring cylinder
a supply of hot water.

You can also use other apparatus and materials that are usually available in a school laboratory.

In your plan, you should:

- explain briefly how you would carry out the investigation
- state the key variables that you would control
- draw a table, or tables, with column headings, to show how you would display your readings (you are not required to enter any readings in the table)
- explain how you would use your readings to reach a conclusion.

You may draw a diagram if it helps your explanation.

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.....[7]

[Total: 7]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/62**

Paper 6 Alternative to Practical **May/June 2018**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
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DO **NOT** WRITE IN ANY BARCODES.

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[Turn over

1 A student is determining the density of water. She is provided with a plastic cup, shown in Fig. 1.1.

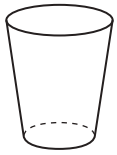

Fig. 1.1

(a) She draws around the base of the cup. Her drawing is shown in Fig. 1.2.

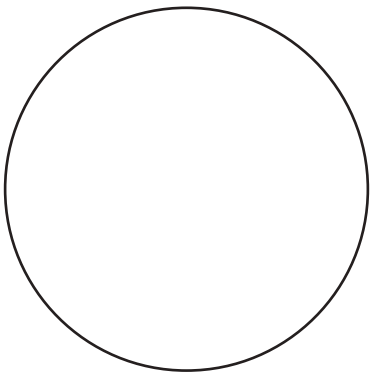

Fig. 1.2

(i) From Fig. 1.2, take and record measurements to determine an accurate value for the diameter D_B of the base of the cup.

D_B = ... cm [2]

(ii) The student places the cup upside down and draws around the rim of the cup.
She determines the diameter D_T of the rim of the cup.

D_T = ...7.2 cm.....

Calculate the average diameter D of the cup using the equation $D = \frac{D_B + D_T}{2}$.

D = ... cm [1]

(b) **1.** On Fig. 1.3, measure the vertical height *h* of the cup.

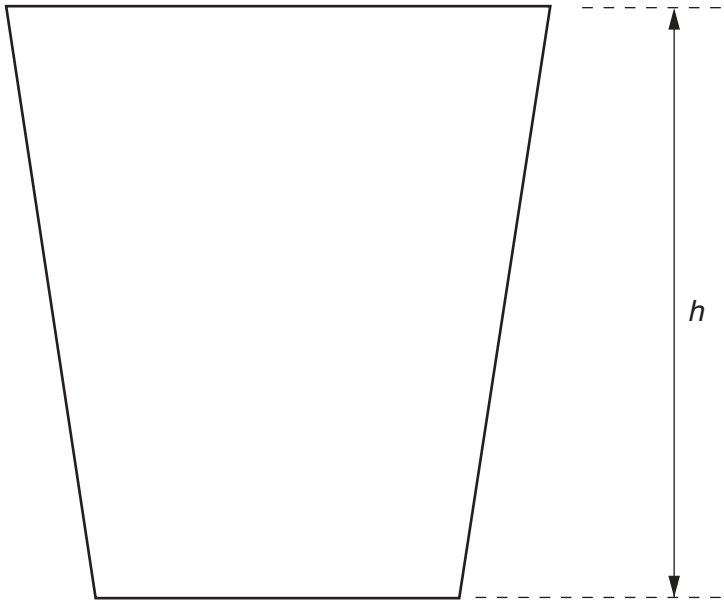

Fig. 1.3

h = ... cm

2. Calculate the volume *V* of the cup using the equation $V = 0.785\,D^2\,h$.

V = ... cm^3
[1]

(c) The student fills the cup with water. The mass of the cup with the water is shown in Fig. 1.4.

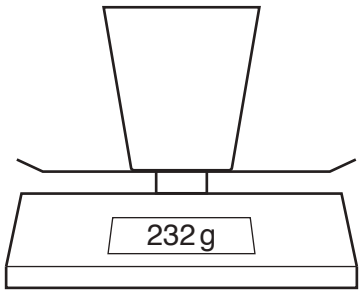

Fig. 1.4

Determine the density ρ of water using the equation $\rho = \frac{m}{V}$ and your value from **(b)2**.

Give your answer to a suitable number of significant figures for this experiment. Include the unit.

ρ = ... [3]

(d) Suggest, with a reason, a part of the procedure **(a)**, **(b)** or **(c)** that could give an unreliable result for the density of water.

part .....

reason .....

.....

[1]

(e) The student pours the water from the cup into a measuring cylinder.

Draw a diagram to show water in a measuring cylinder. Show clearly the meniscus and the line of sight the student should use to obtain an accurate value for the volume of the water.

[2]

[Total: 10]

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2 A student is investigating the cooling of water.

Fig. 2.1 shows the apparatus used.

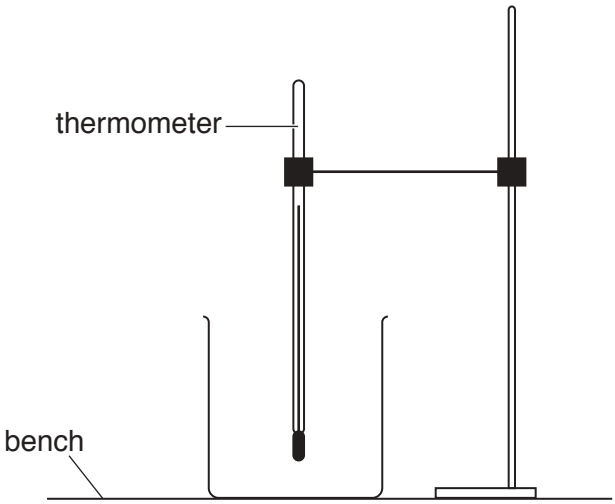


Fig. 2.1

(a) The thermometer in Fig. 2.2 shows room temperature θ_R at the beginning of the experiment. Record θ_R.

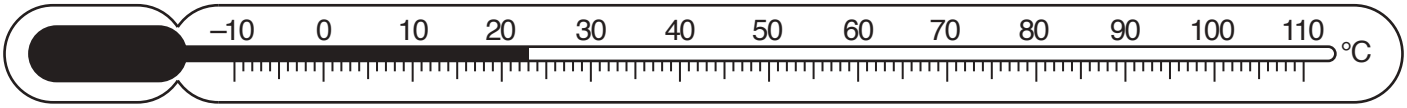


Fig. 2.2

θ_R = ... [1]

(b) The student pours 200 cm^3 of hot water into the beaker.

He records the temperature θ_H of the hot water at time t = 0 and immediately starts a stopclock.

He continues recording the temperature readings every 30 s. The readings are shown in Table 2.1.

(i) Explain why the student should wait a few seconds after placing the thermometer in the hot water before taking the first temperature reading.

.....

..... [1]

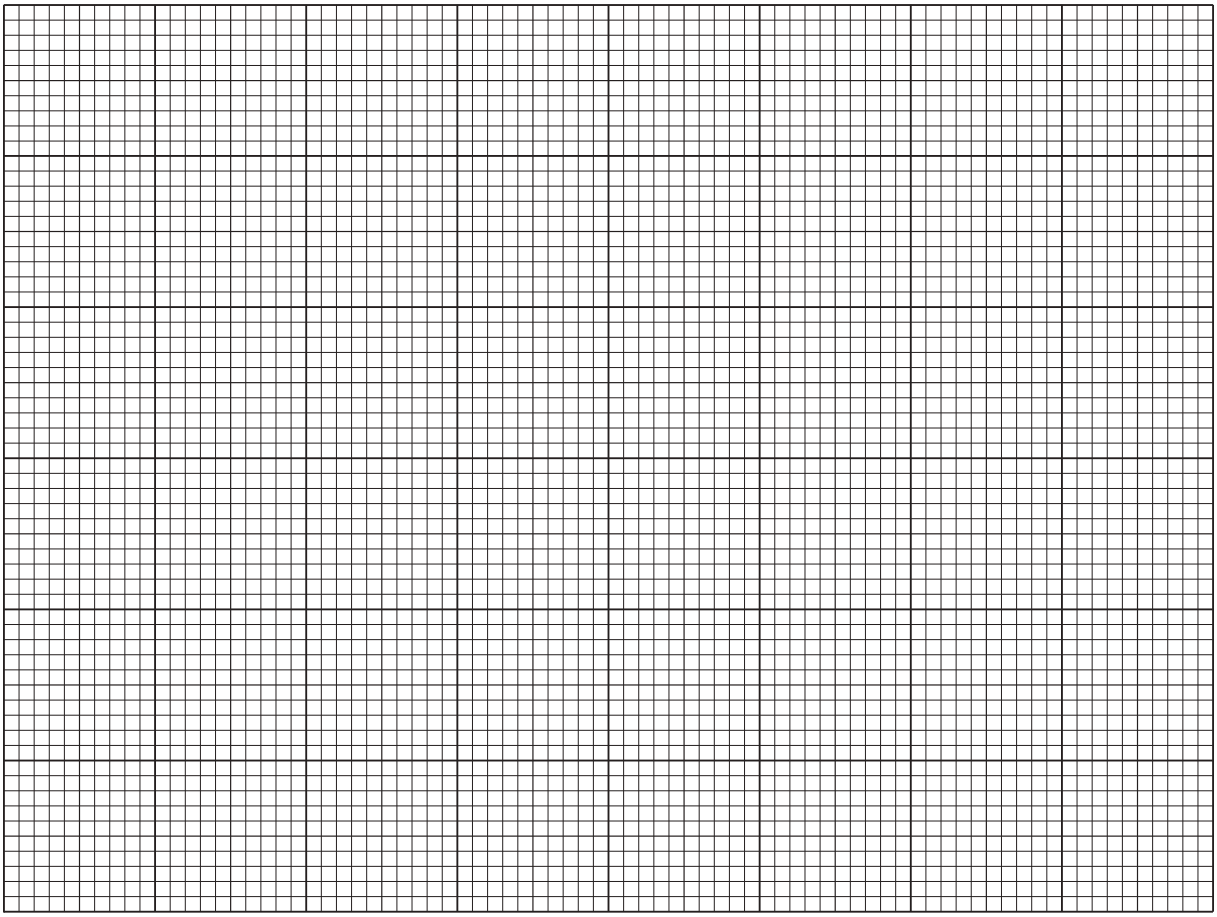
(ii) Complete the column headings in Table 2.1. [1]

(iii) Complete the time column in Table 2.1. [1]

Table 2.1

t/	θ/
0	70
	60
	52
	49
	46
	43

(iv) Plot a graph of θ/°C (y-axis) against t/s (x-axis). You do **not** need to start the y-axis at the origin (0,0) but the value of room temperature θ_R must be marked on the y-axis.



[4]

(c) Draw a horizontal line across the graph grid to indicate the value of room temperature θ_R, as shown by the thermometer in Fig. 2.2. [1]

(d) State **two** precautions that you would take in order to obtain accurate readings in this experiment.

1. .....

.....

2. .....

.....
[2]

(e) A student plans to repeat the experiment using the same thermometer and the same volume of water.

Suggest **two** changes to the apparatus or the procedure that would **increase** the rate of cooling of the water.

1. .....

.....

2. .....

.....
[2]

[Total: 13]

3 A student is determining the focal length of a lens.

Fig. 3.1 shows the apparatus used.

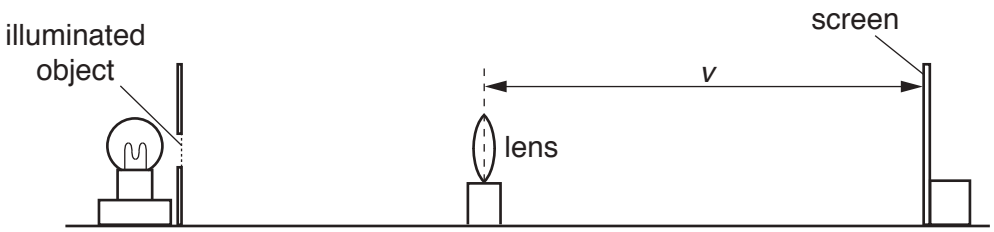


Fig. 3.1

(a) The student adjusts the position of the screen until a clearly focused image is formed on the screen.

(i) On Fig. 3.1, measure the distance *v* between the centre of the lens and the screen.

v = ... [1]

(ii) Fig. 3.1 is drawn 1/5th actual size.

Calculate *V*, the actual distance from the lens to the screen

V = ... [1]

(iii) With a clearly focused image formed on the screen, the actual distance from the centre of the lens to the illuminated object, *U* is 20.0 cm.

Calculate the focal length f_1 of the lens using the equation $f_1 = \frac{UV}{(U + V)}$.

f_1 = ... [2]

(b) The student repeats the procedure in **(a)**, using a different distance *U*. She obtains another value for the focal length f_2.

f_2 = ...12.2 cm.....

Calculate the average value f_A of the focal length of the lens, using f_2 and your value for f_1 in **(a)(iii)**. Give your answer to a suitable number of significant figures for this experiment.

f_A = ... [2]

(c) The student states that taking more measurements improves the reliability of the value obtained for f_A.

Suggest additional values for U that you would use.

.....

.....

..... [2]

(d) State **two** precautions that you would take in this experiment to obtain accurate readings.

1. .....

.....

2. .....

.....
[2]

[Total: 10]

4 A student is investigating whether the distance that a toy truck will travel along a horizontal floor, before stopping, depends on its mass.

The following apparatus is available to the student:

a ramp
blocks to support the ramp as shown in Fig. 4.1
toy truck
a selection of masses
other standard apparatus from the physics laboratory.

Plan an experiment to investigate whether the distance that the toy truck will travel along a horizontal floor, before stopping, depends on its mass.

In your plan, you should:

- explain briefly how you would carry out the investigation
- state any apparatus that you would use that is not included in the list above
- state the key variables that you would control
- draw a table, or tables, with column headings to show how you would display your readings (you are **not** required to enter any readings in the table).

You may add to the diagram in Fig. 4.1 to help your description.

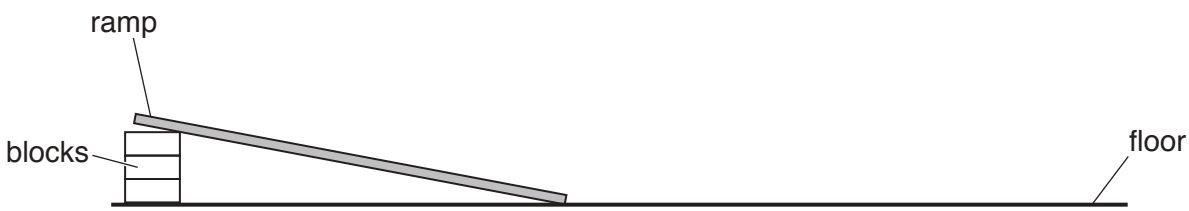


Fig. 4.1

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.....[7]

[Total: 7]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

PHYSICS **0625/63**

Paper 6 Alternative to Practical **May/June 2018**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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[Turn over

1 A student is investigating how partly covering the surface of the water in a beaker affects the rate at which the water cools.

The apparatus used is shown in Fig. 1.1.

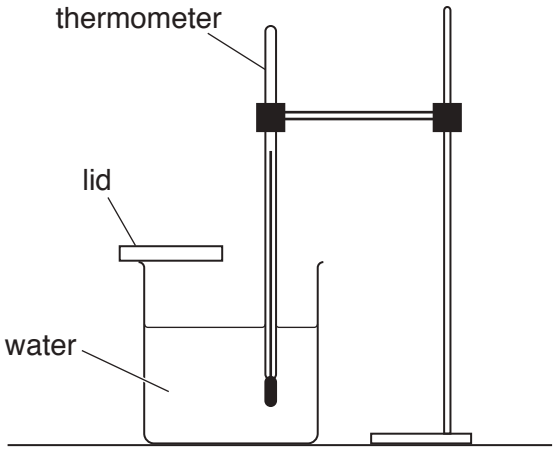

Fig. 1.1

(a)

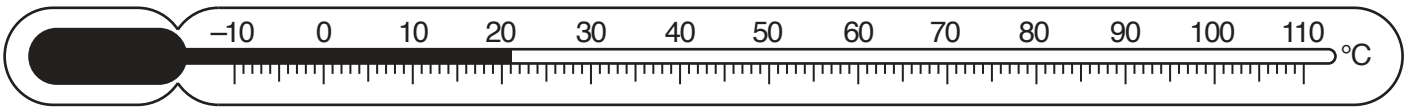

Fig. 1.2

Record the room temperature θ_R, shown on the thermometer in Fig. 1.2.

θ_R = ... [1]

(b) The student pours 100 cm^3 of hot water into a beaker. She places lid **A** on the beaker. This leaves half of the water surface uncovered, as shown in Fig. 1.3.
She records the temperature of the water in the beaker and immediately starts a stopclock.
She records the temperature θ of the water every 30 s. Her readings are shown in Table 1.1.
She repeats the procedure using lid **B**. This leaves a quarter of the water surface uncovered, as shown in Fig. 1.4.

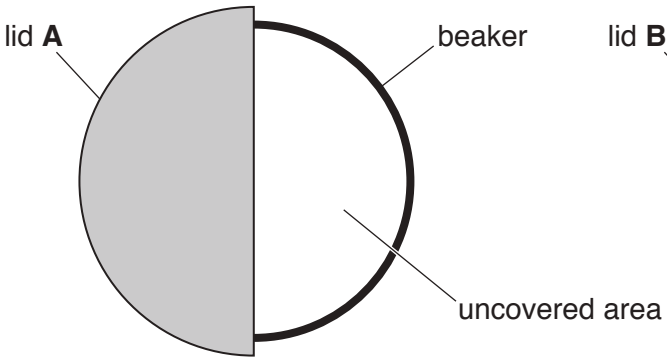

Fig. 1.3

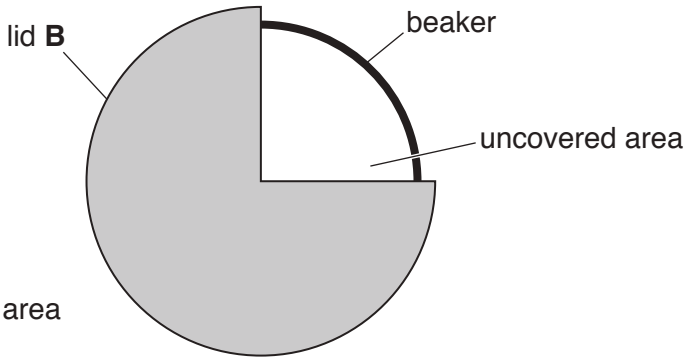

Fig. 1.4

Complete the headings and the time *t* column in Table 1.1. [2]

Table 1.1

	beaker with lid **A**	beaker with lid **B**
t /	θ /	θ /
0	80.0	81.0
	77.0	79.0
	74.5	77.5
	72.5	76.0
	70.5	75.0
	69.0	74.0
	68.0	73.5

(c) Describe a precaution that should be taken to ensure that the temperature readings are as accurate as possible in the experiment.

.....

..... [1]

(d) **(i)** Write a conclusion to this experiment, stating for which lid the rate of cooling is greater. Explain your answer by reference to the results.

.....

.....

.....

..... [2]

(ii) Suggest a change to the **apparatus** that could produce a greater difference between the rates of cooling for lid **A** and lid **B**.

Explain why the change might produce a greater difference.

change .....

.....

explanation .....

.....

[2]

(e) A student suggests that the rate of cooling is directly proportional to the percentage of the uncovered surface area. He wants to draw a graph of cooling rate against the percentage of uncovered area to investigate this.

Describe how his graph line will show whether the rate of cooling and the percentage of uncovered surface area are directly proportional.

.....

..... [2]

(f) Students in other countries carry out the same experiment.

Suggest **one** factor that they should keep the same if they are to obtain similar readings.

.....

..... [1]

[Total: 11]

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2 A student is investigating a circuit containing resistors.

He is using the circuit shown in Fig. 2.1.
Resistor **X** has a resistance $R = 1\,\Omega$.

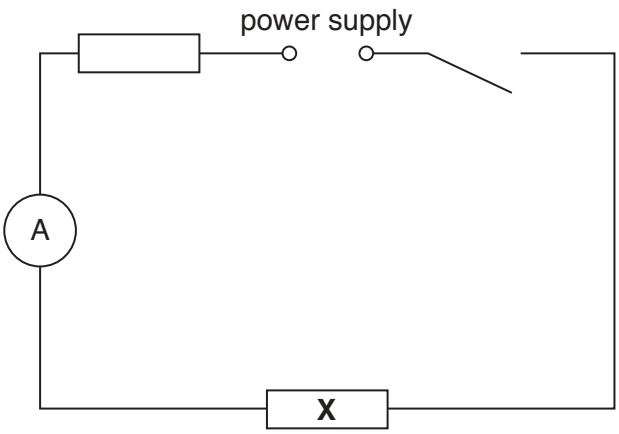


Fig. 2.1

(a) On Fig. 2.1, draw a voltmeter connected so that it measures the potential difference (p.d.) across resistor **X**. [1]

(b) The student uses the ammeter to measure the current in the circuit and uses the voltmeter to measure the potential difference (p.d.) across resistor **X**. The readings are shown in Fig. 2.2 and Fig. 2.3.

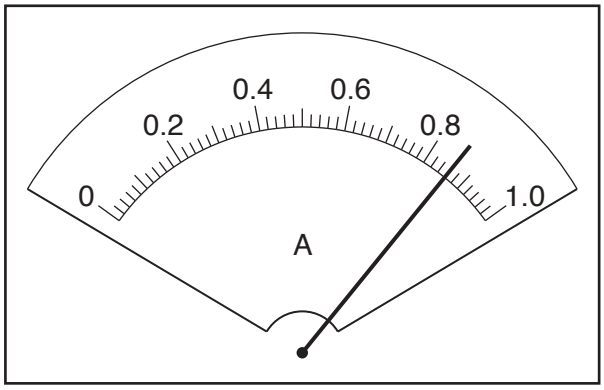


Fig. 2.2

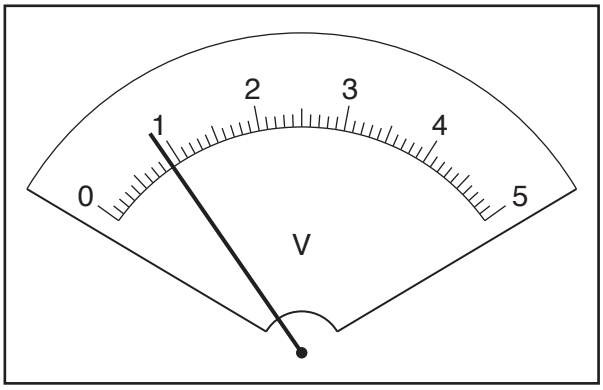


Fig. 2.3

(i) The student repeats the procedure using resistors **Y** and **Z**.
His readings are shown in Table 2.1.

Record, in Table 2.1, the value of the current I in the circuit and the value of the potential difference (p.d.) V across resistor **X** shown in Fig. 2.2 and Fig. 2.3.

Table 2.1

resistor	R /	I /	V /
X	1		
Y	3	0.55	1.7
Z	10	0.24	2.4

[2]

(ii) Add units to the column headings in Table 2.1. [2]

(c) Calculate the power P supplied to each of the resistors **X**, **Y** and **Z**.

Use the readings from Table 2.1 and the equation $P = I \times V$.
Give your answers to a suitable number of significant figures.

power P supplied to resistor **X** = ... W

power P supplied to resistor **Y** = ... W

power P supplied to resistor **Z** = ... W
[2]

(d) Describe how the value of the power P changes as R increases.

.....

.....

..... [2]

(e) Another student plans to investigate the relationship between P and R in more detail.
Suggest **two** modifications to the procedure that will enable her to do this.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

3 A student is investigating the image produced by a converging lens.

She is using the apparatus shown in Fig. 3.1.

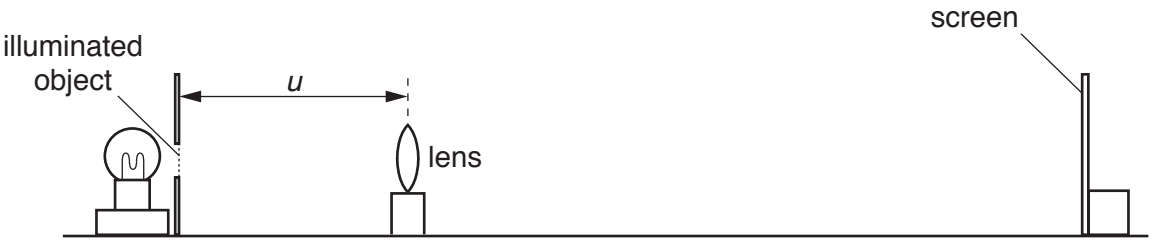


Fig. 3.1

(a) The illuminated object consists of a triangular-shaped hole in a piece of card. Fig. 3.2 shows, full size, the illuminated object. Measure and record the height h_o of the triangular-shaped hole.

h_o = ... cm [1]

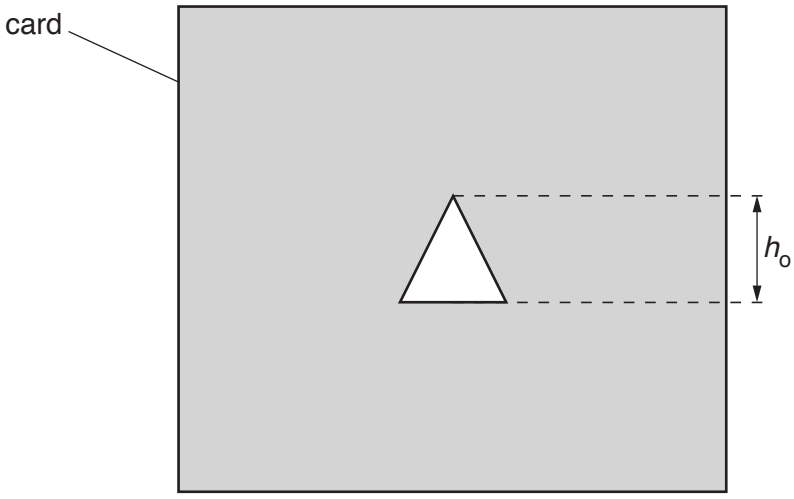


Fig. 3.2

(b) The distance u between the triangular object and the centre of the lens is set to 20.0 cm. The screen is moved until a focused image of the illuminated object is seen, as shown in Fig. 3.3.

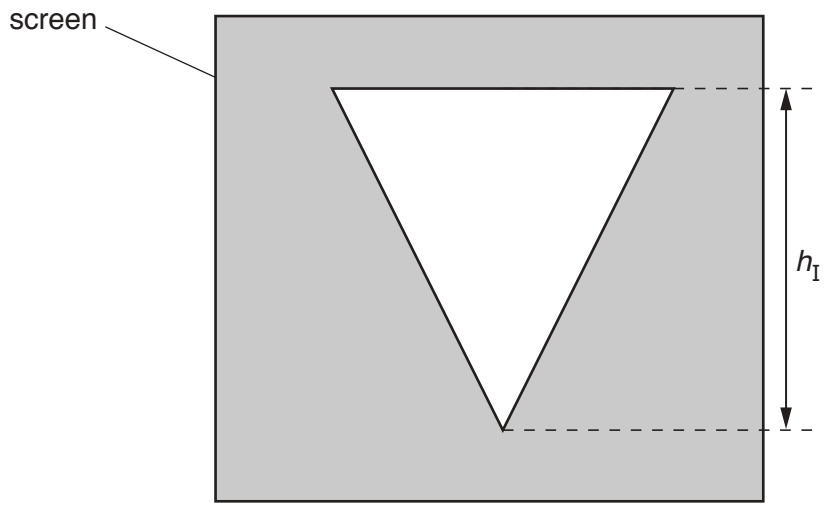


Fig. 3.3

The student repeats the procedure for u values of 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm. Her results are shown in Table 3.1.

(i) Measure and record in the first row of Table 3.1, the height h_I of the image. [1]

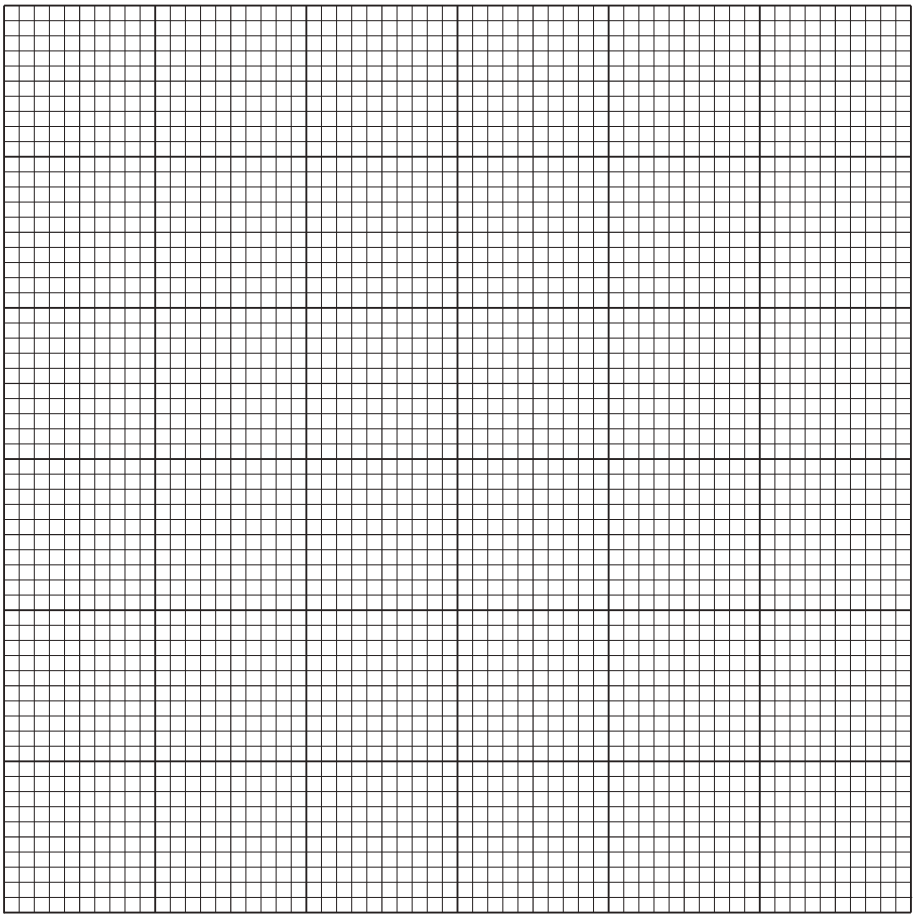
(ii) Calculate, and record in the table, a value N using your measurements for h_o and h_I and the equation $N = \frac{h_o}{h_I}$.

Table 3.1

u/cm	h_I/cm	N
20.0		
30.0	1.5	0.93
40.0	0.9	1.6
50.0	0.6	2.3
60.0	0.5	2.8

[1]

(c) Plot a graph of u/cm (y-axis) against N (x-axis). You do not have to start your graph at the origin (0, 0).



[4]

(d) Determine the gradient G of the graph.
Show clearly on the graph how you obtained the necessary information.

G = ... [2]

(e) Describe **one** difficulty that might be experienced when measuring the height of the image h_I. Suggest an improvement to the apparatus to overcome this difficulty.

difficulty .....

.....

improvement .....

.....
[2]

[Total: 11]

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4 A student is investigating the force needed to **just** slide a block across a surface.

Plan an experiment that will enable him to investigate how the force needed varies with the mass of the block.

The apparatus available includes:

a light, flat wooden block with a hook fitted as shown in Fig. 4.1

a pulley which can be clamped to a bench.

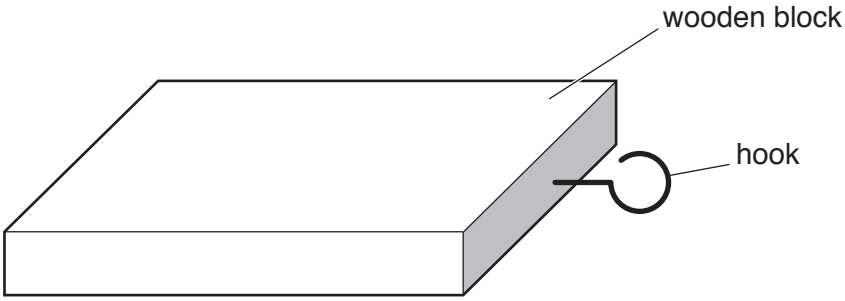

Fig. 4.1

In your plan, you should:

- list any additional apparatus needed
- draw a clearly labelled diagram of how the apparatus will be arranged
- give brief instructions for carrying out the experiment
- describe any precautions which should be taken to ensure reliable results
- suggest a graph which could be drawn.

..... [7]

[Total: 7]

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