Name: …….. ( ) Class: ……

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS)
5076 / 01

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LEVEL:	4 Express / 5 Normal (Academic)	**DATE:**	15 August 2018
CLASSES:	Sec 4/1, 4/2 & 5/1	**DURATION:**	1 hour (Both Physics & Chemistry)

Additional Materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES
Do not open this booklet until you are told to do so.

Write your NAME, INDEX NUMBER and CLASS at the top of this page and on the OAS paper. **Shade your index number on the OAS paper.**

There are 20 questions in this paper. Answer **ALL** questions. For each question, there are four possible answers A, B, C and D. Choose the correct answer and record your choice in soft or 2B pencil on the OAS paper provided. **DO NOT fold or bend the OAS paper.**

For Examiner's use:	
Paper 1	/ 20
Paper 2	/ 65
Paper 5	/ 15
Total	/ **100**

At the end of the examination, hand in your OAS paper and Question Papers separately.

This Question paper consists of 9 printed pages including this page.

[Turn Over

Answer **ALL** questions on the OAS paper provided.

1 A stone is dropped from the top of a building to the ground.
Which is a vector quantity?

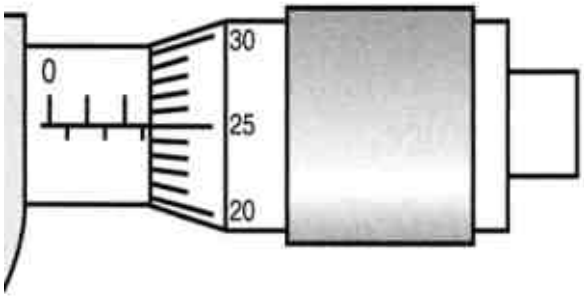
A gravitational potential energy to bring the stone to the top of the building

B kinetic energy of the stone as it reaches the ground

C time taken for the stone to reach the ground

D velocity of the stone as it reaches the ground

2 The diagram below shows the reading of a micrometer screw gauge.



What is the correct reading?

A 2.25 mm **B** 2.75 mm

C 5.25 mm **D** 5.75 mm

3 Which object has the greatest inertia?

A a 2 kg mass at rest

B a 5 kg mass moving at constant acceleration

C a 5 kg mass moving at constant velocity

D a 10 kg mass at rest

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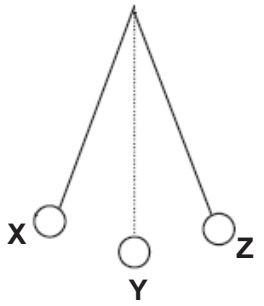
4 The diagram below shows a simple pendulum oscillating between positions **X** and **Z**.



Which sequence should be timed to measure the period of the pendulum?

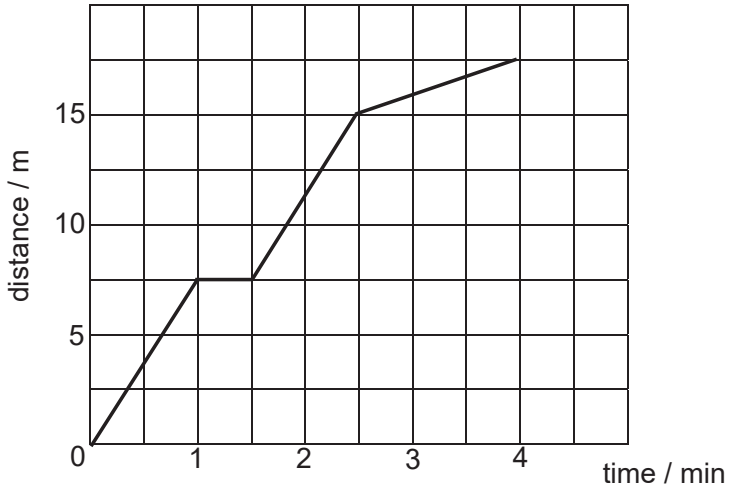
A **X → Y**

B **X → Z**

C **X → Z → Y**

D **X → Z → X**

5 The graph shows the distance-time graph of a cyclist who cycled towards the end of the park and back to the starting point.



Which statement correctly describes the motion of the cyclist in the stated time interval?

A From 0 to 1 min, the cyclist is moving at uniform acceleration.

B From 1 to 1.5 min, the cyclist is moving at uniform speed.

C From 1.5 to 2.5 min, the cyclist is moving at non-uniform speed.

D From 2.5 to 4 min, the cyclist is moving at uniform speed.

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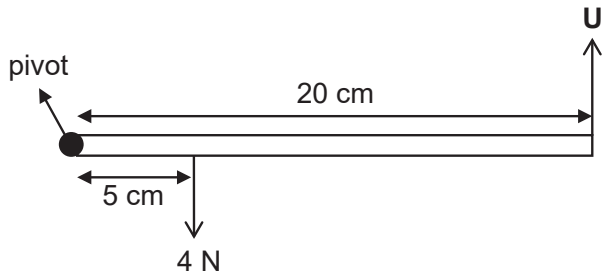
6 A force is applied to an object on a frictionless surface. It produces an acceleration of 3.5 m/s².
What are possible values for the applied force and for the mass of the object?

	force / N	mass / kg
A	2.0	1.5
B	2.0	7.0
C	7.0	0.5
D	7.0	2.0

7 A uniform beam 20 cm long is pivoted at one end. The weight of the beam is 3 N and a 4 N weight hangs 5 cm from the pivot.



An upward force **U** is needed to keep the beam horizontal.
What is the value of this force?

A 1 N
B 2.5 N
C 4 N
D 5 N

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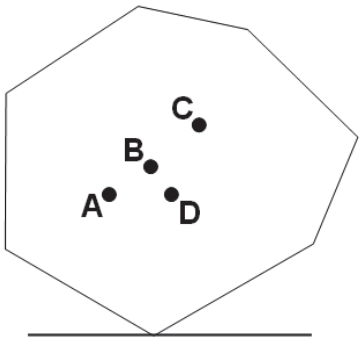
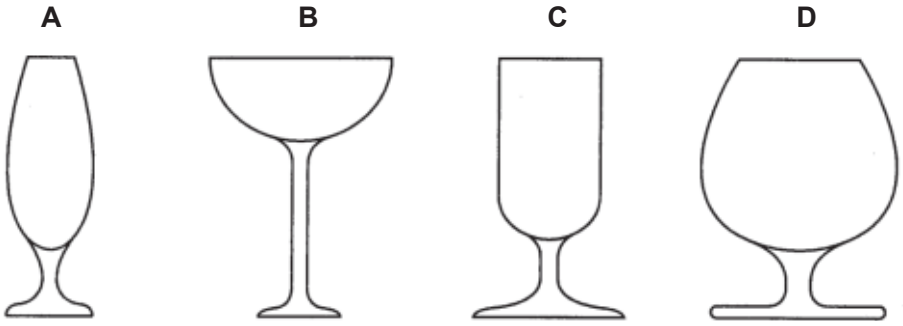
8 In the figure shown below, an object is tilted such that it is at the point of falling over. Where would be the likely position of the centre of gravity of the object?



9 The diagrams below show the cross-sections of different glasses. Which glass is the most stable when filled with water to the brim?



10 A builder carrying five bricks climbs a ladder. Each brick weighs 20 N and the builder climbs a vertical distance of 6.0 m in 25 s.

What is the average power used to raise the bricks?

A 4.8 W
B 24 W
C 120 W
D 15000 W

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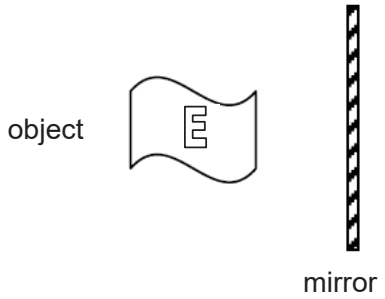
11 The following objects all lose heat.
Which object loses all of its heat by radiation?

A an iron block at 120 °C with black surface, in the air
B a shiny metal of a spaceship at 25 °C, in space
C a wooden block with white surfaces at 60 °C
D the heating element of a kettle at 150 °C, in water

12 Which statement about evaporation is true?

A Evaporation causes the temperature of a liquid to be higher.
B Evaporation occurs throughout the liquid.
C Evaporation takes place at any temperature.
D Evaporation takes place by releasing heat to the surroundings.

13 An object is placed in front of a plane mirror as shown below.



Which diagram shows the correct mirror image of the object?

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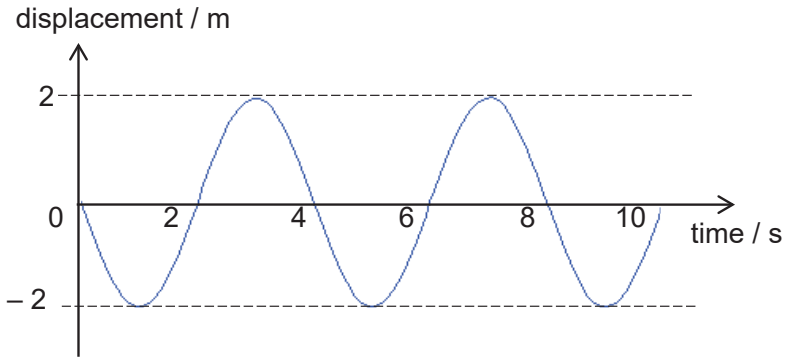
14 The diagram shows how displacement varies with time as a wave passes a fixed point.

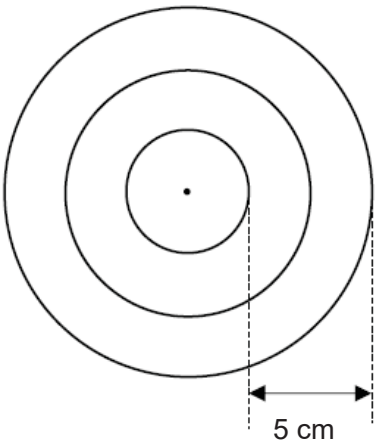


What is the frequency of this wave?

A 0.25 Hz **B** 0.50 Hz

C 2 Hz **D** 4 Hz

15 The dipper in a ripple tank vibrates at a frequency of 8 Hz and forms the wave pattern shown in the diagram below. The distance between the two crests as shown is 5 cm.



What is the speed of the wave?

A 1.6 cm/s **B** 3.2 cm/s

C 20 cm/s **D** 40 cm/s

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16 Which is an application of microwaves?

A used in global positioning system (GPS) to communicate with satellites

B used in scanning of luggage

C used in treatment of cancer

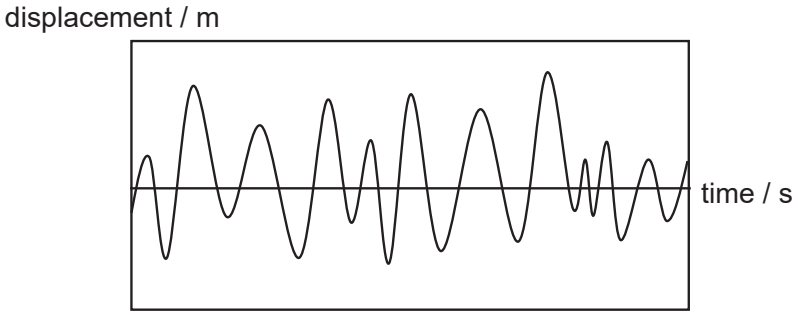
D used in TV-remote controllers

17 Radio waves, infra-red radiation and ultra-violet radiation are all part of the electromagnetic spectrum.

What is the correct order of increasing wavelength?

	shortest →		longest
A	radio waves	infra-red radiation	ultra-violet radiation
B	radio waves	ultra-violet radiation	infra-red radiation
C	ultra-violet radiation	infra-red radiation	radio waves
D	ultra-violet radiation	radio waves	infra-red radiation

18 The diagram below shows a displacement-time graph of a note produced by strumming a guitar string.



If the same note is produced again but at a louder volume, how will the wave change?

A The amplitude of the wave would decrease.

B The amplitude of the wave would increase.

C The peaks of the wave would be closer to one another.

D The peaks of the wave would be further from one another.

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19 The current in a hand dryer is 12 A. It is switched on for three minutes.
How much charge flows through the hand dryer?

A 0.0667 C
B 4 C
C 36 C
D 2160 C

20 A dry cell of e.m.f. 4.0 V has a wire connected to its terminals.
If 10 C of charge passes through the circuit, what is the amount of chemical energy transformed into electrical energy?

A 0.4 J
B 2.5 J
C 14 J
D 40 J

- END OF PAPER -

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ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS)
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LEVEL:	4 Express / 5 Normal (Academic)	**DATE:**	24 August 2018
CLASS(ES):	Sec 4/1, 4/2 & 5/1	**DURATION:**	1 hour 15 minutes

Additional Materials provided: NIL

INSTRUCTIONS TO CANDIDATES
Do not open this booklet until you are told to do so.

Write your NAME, INDEX NUMBER and CLASS at the top of this page. This paper consists of 2 sections.

SECTION A (45 marks)
Answer **all** questions. Write your answers in the spaces provided on the question paper.

SECTION B (20 marks)
Answer any **two** questions. Write your answers in the spaces provided on the question paper.

In calculations, you should show all the steps in your working, giving your answer at each stage.

For Examiner's use:	
Section A	/ 45
Section B	/ 20
Total	/ **65**

At the end of the examination, hand in this question booklet.

This Question paper consists of 17 printed pages including this page.

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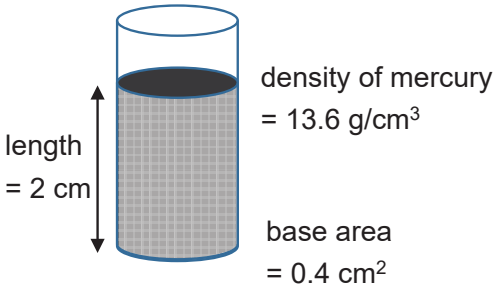
SECTION A (45 marks)

Answer **all** questions in the spaces provided on the question paper.

1 A vertical uniform cylinder contains some mercury, as shown below.



The cross-sectional area of the cylinder is 0.4 cm^2.
The vertical length of the liquid is 2 cm.
The density of the mercury is 13.6 g/cm^3.

(a) Calculate the mass of the mercury in the cylinder.

mass = ...g [2]

(b) Determine the weight of mercury in the cylinder. (Let the gravitational field strength be 10 N/kg.)

weight = ...N [2]

(c) Calculate the pressure exerted by the mercury on the base of the cylinder.

pressure = ...N/cm^2 [2]

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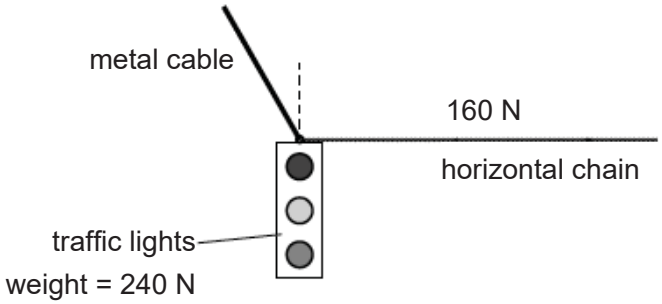
2 A set of traffic lights hangs from the end of a metal cable. A horizontal chain pulls the traffic lights to the right so that they are above the middle of the road. The diagram below shows the metal cable inclined to the vertical.



The weight of the traffic lights is 240 N and the tension in the horizontal chain is 160 N.

Use a scale diagram to determine the size of the resultant force of the weight and the tension in the chain. State the scale used for the diagram and the direction of the resultant force from the weight of the traffic lights.

scale = 1 cm represents ……N

resultant force = ……N

direction from weight of traffic lights = ……...

…….. [4]

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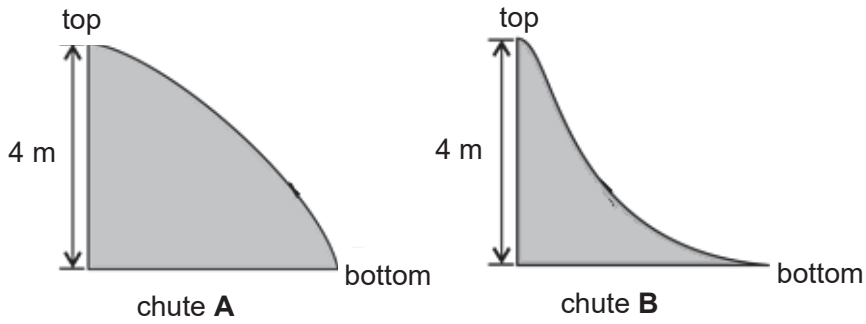
3 Annie visited a water-themed park. She found two different sliding chutes, **A** and **B**, in a swimming pool, which are both 4 m high. She has a mass of 45 kg. The gravitational field strength is 10 N/kg. Assume both slides are frictionless.



(a) Annie plays in chute **A**.
Calculate the gain in gravitational potential energy as she climbs to the top of the chute.

gravitational potential energy = ……J [1]

(b) Calculate the maximum speed of Annie as she slides to the bottom of chute **A**.

speed = ……m/s [2]

(c) Annie thinks that chute **B** will be more exciting than chute **A** as the maximum speed of chute **B** should be faster than chute **A** since the slide is "steeper".

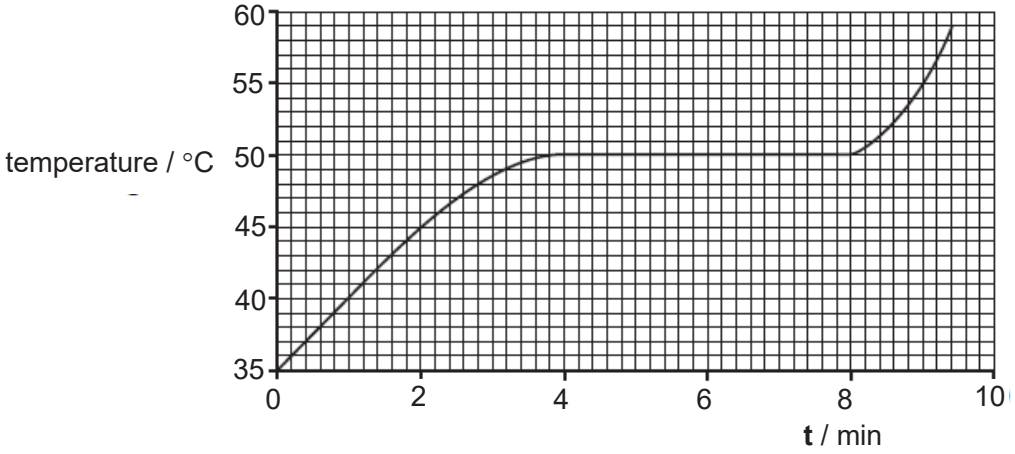
Do you agree with her? Explain.

…….....

……..

…….. [2]

4 A student slowly heats a sample of solid wax in a test tube.
The graph shows how the temperature of the wax varies with time **t**.



(a) State the melting point of the wax.

melting point = ……°C [1]

(b) Thermal energy passes into the wax throughout the experiment.

(i) Describe what effect this energy has on the kinetic energy and the potential energy of the wax particles between the time t = 0 and t = 4 min.

……...

……...

……...

……... [2]

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(ii) Describe the changes, if any, that occur to the arrangement and motion of the wax particles between t = 4 to t = 8 min.

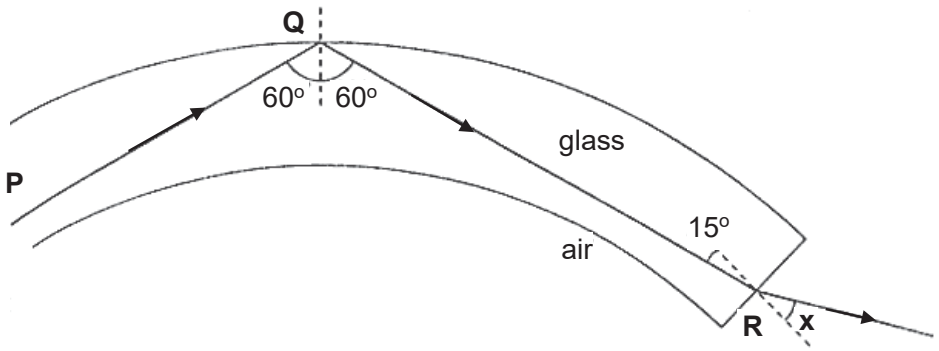
……...

……...

……...

……... [2]

5 The diagram below shows a ray of light travelling along **PQR** inside a simple optical fibre and emerges into the air at point **R**.



The refractive index of glass is 1.45.

(a) **(i)** Calculate the critical angle of glass.

angle = ……° [2]

(ii) Explain why the light ray did not emerge into the air after it is incident at point **Q**.

……...

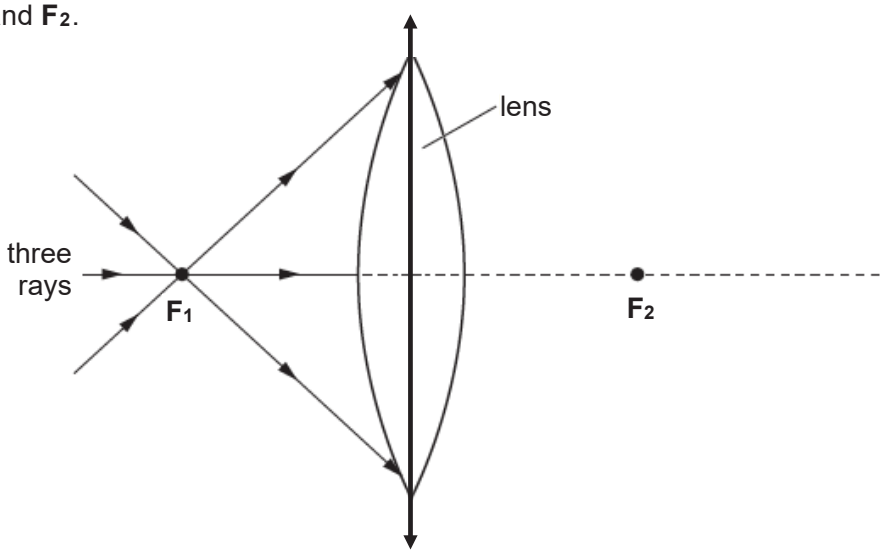
……...

……... [2]

(iii) The light ray makes an angle of 15° with the normal to the glass surface as it emerges from point **R**. Calculate the angle ***x***.

x = ……° [2]

(b) The diagram below shows a glass lens in air and its two focal points $\mathbf{F_1}$ and $\mathbf{F_2}$.



Three rays of light pass through $\mathbf{F_1}$ to the lens.

(i) On the diagram, continue the paths of the three rays through the lens and into the air. [2]

(ii) State what happens to the speed of light after leaving the lens and returning to the air.

……..... [1]

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6 The diagram below shows a siren located some distance from a tall building. The siren is sounded once briefly. A short while later, an observer standing next to the siren hears the reflected sound.

(a) The reflected sound is heard 4.86 s later. Given that the speed of sound in air is 330 m/s, calculate the distance between the siren and the tall building.

distance = …….m [2]

(b) Explain how the sound waves propagate from the siren to the tall building through air.

…….....

……..

……..

…….. [2]

7 **(a)** A refrigerator, when connected to a 240 V mains supply has a maximum power of 100 W.

(i) Calculate the maximum current for this refrigerator.

current = ……A [2]

(ii) The refrigerator is designed with a fuse as a safety device. Explain how the fuse works and suggest if a fuse rating of 1 A or 3 A is more suitable for the kettle.

……...

……...

……... [2]

(b) The refrigerator on average uses 1.1 kWh every 24 hours. The cost of electricity is about $0.22 for every kWh.

(i) Calculate the average output power.

power = ……W [2]

(ii) Calculate the cost of using the refrigerator each day.

cost = $…… [1]

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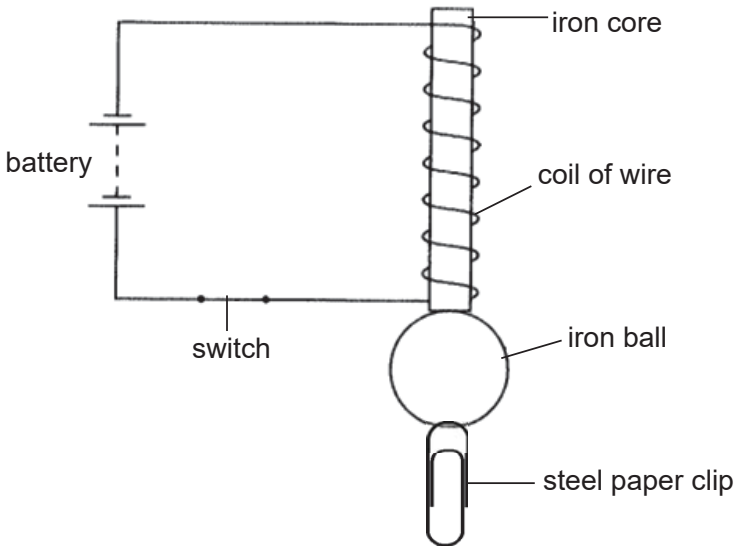
8 A simple electromagnet is shown below.



When the switch is closed, an iron ball is attracted to the iron core. The steel paper clip is attracted to the iron ball.

(a) **(i)** State the magnetic pole that is formed at the end of the iron core closest to the iron ball.

……..... [1]

(ii) Explain why there is an attractive force between the iron ball and the paper clip.

……...

……...

……... [2]

(b) The switch is now open. Predict and explain what would happen to both the iron ball and the steel paper clip.

…….....

……..

…….. [2]

Section B (20 marks)
Answer 2 out of 3 questions. Each question carries 10 marks. Write your answers in the spaces provided on the question paper.

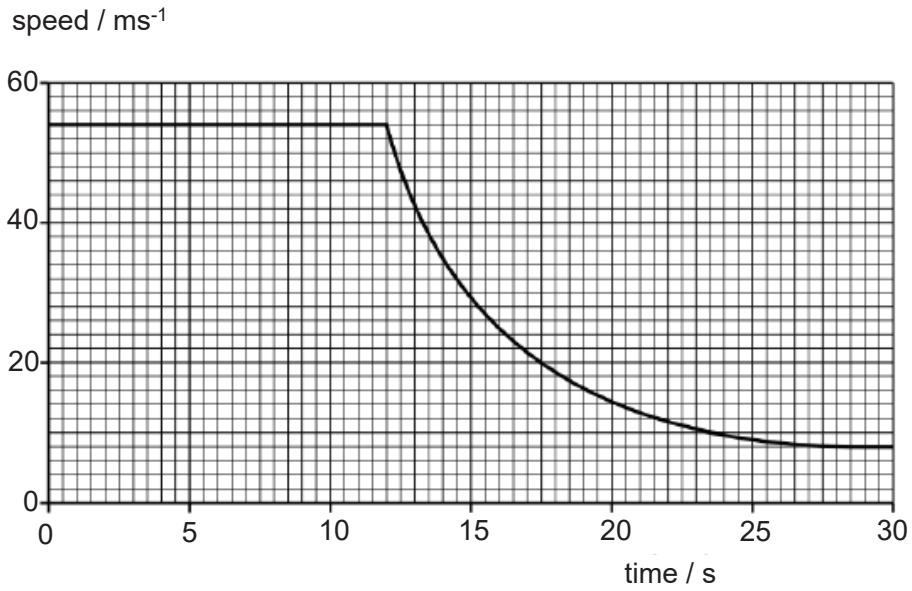
9 The diagram below shows a skydiver falling towards the Earth at constant speed, a long time after jumping from an airplane.

(a) **(i)** State the initial acceleration of the skydiver.

initial acceleration = …… [1]

(ii) On the diagram, draw and label all the vertical forces acting on the skydiver. [1]

(b) At time t = 0 s, he receives a radio signal. After a while, he opens his parachute. The speed-time graph for the skydiver is shown below.



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(i) State the time when the skydiver opens the parachute.

t = …… [1]

(ii) State the type of acceleration the skydiver undergoes from the time he receives the signal to the time he opens the parachute.

……..... [1]

(iii) Use your answer to **b(ii)** to explain how the weight of the skydiver relates to the air resistance before he opens the parachute.

……...

……...

……... [2]

(c) Calculate the total distance travelled by the skydiver after he receives the signal between t = 0 to t = 10 s.

total distance = …… [2]

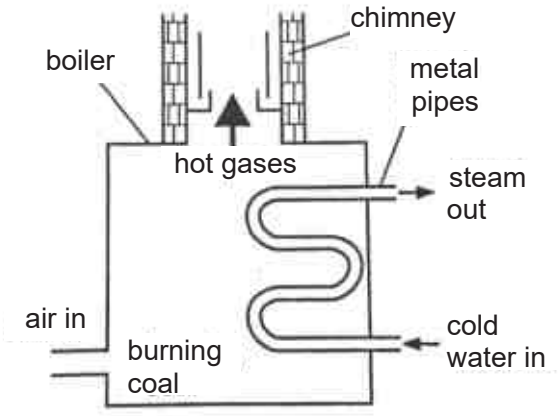
(d) Describe the motion of the skydiver after he opens his parachute.

……..

……..

…….. [2]

10 **(a)** The diagram below shows the boiler of a coal-fired power station. Hot gases rise and thermal energy from the hot gases heats the cold water inside the metal pipes, forming steam.



(i) Fill in the blanks to describe the energy conversions that take place as the coal burns.

……..... energy of the coal → thermal energy

of hot gases →…….. energy of the water particles [2]

(ii) Using ideas about particles, explain how heat is transferred through the metal pipes by conduction.

……...

……...

……... [2]

(iii) Suggest what might happen if cold water enters the boiler from the top of the metal pipes instead of the bottom.

Give a reason for your answer.

……...

……...

……... [2]

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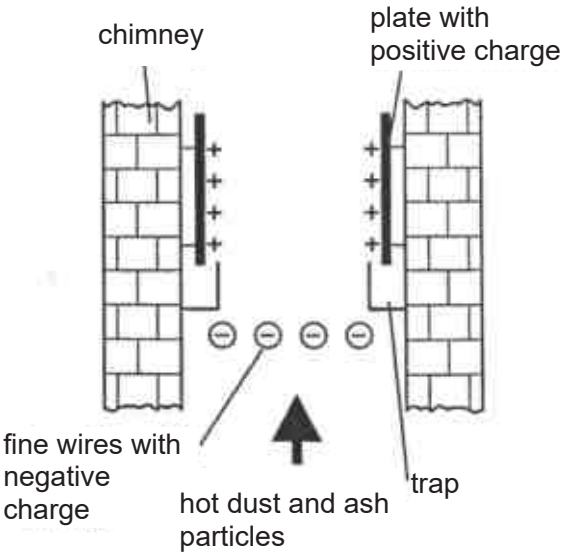
(b) The diagram below shows an electrostatic precipitator that stops dust and ash emerging from the chimney.

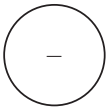


(i) Define *electric field*.

……...

……... [1]

(ii) On the diagram below, draw the electric field lines of a negatively charged particle.



[1]

(iii) Describe what would happen to the hot ash and dust particles after it passes through the fine wires. Explain your answer.

……...

……...

……... [2]

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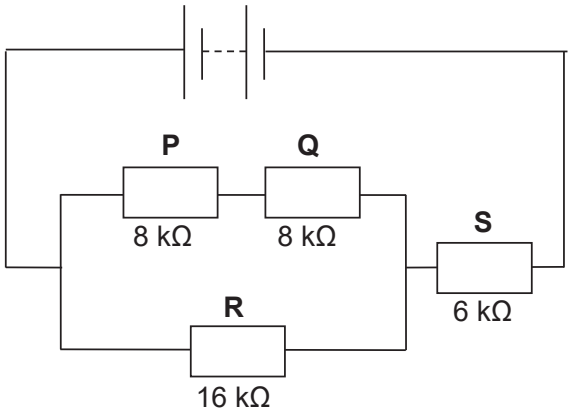
11 The diagram below shows a circuit containing four resistors **P**, **Q**, **R**, **S** and a battery of e.m.f. 8 V is connected as shown.



Resistors **P** and **Q** each has a resistance of 8 kΩ. Resistor **R** has a resistance of 16 kΩ and resistor **S** has a resistance of 6 kΩ.

(a) Fill in the blanks for the following statements.

(i) Resistor …… and Resistor **Q** have the same current in them. [1]

(ii) The potential difference across resistor **R** is the same as the sum of potential difference across resistor …… and resistor …… [1]

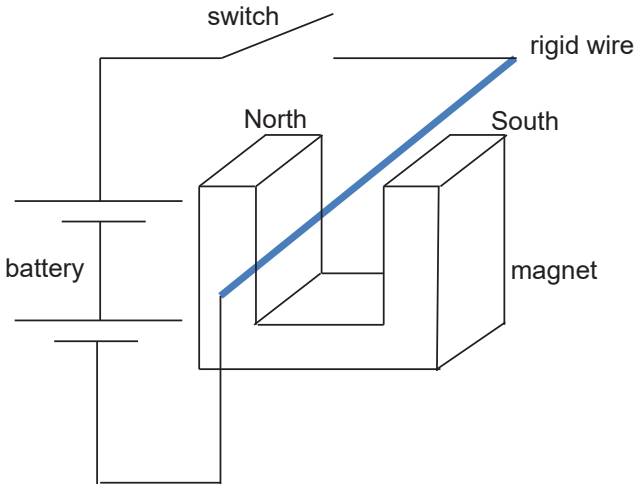
(b) **(i)** Show that the total resistance of the circuit is 14 kΩ.

[2]

(ii) Calculate the current in resistor **S**.

current = …… [2]

(c) The diagram below shows a rigid wire held between the poles of a magnet.



When the current is switched on, there is a force acting on the wire.

(i) State the direction of the force acting on the wire.

…….. [1]

(ii) Describe what would happen to the wire if the terminals of the batteries is reversed.

…….. [1]

(iii) Suggest two ways to increase the magnitude of the force acting on the wire.

……..

……..

…….. [2]

- END OF PAPER -

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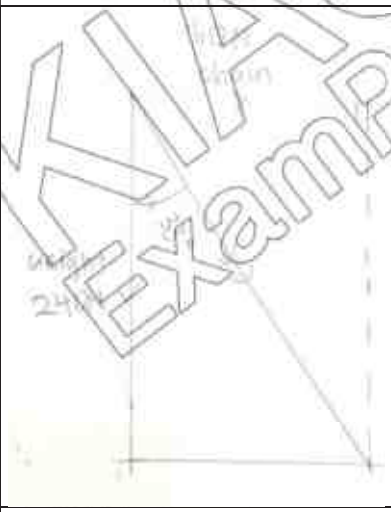
4E5N Sc(Physics) Prelim Marking Scheme 2018

Paper 1: MCQ [20]

1	2	3	4	5	6	7	8	9	10
D	**B**	**B**	**D**	**D**	**D**	**B**	**B**	**D**	**B**
11	12	13	14	15	16	17	18	19	20
A	**C**	**B**	**A**	**C**	**A**	**C**	**B**	**D**	**D**

Section a: Short Structured Questions [45]

Qn	Ans	Marks
1 (a)	Mass = density × volume Mass = 13.6 g/cm^3 × (0.4 cm^2 × 2 cm) Mass = 10.9 g (3sf)	 **C1** **A1**
1(b)	Weight = mg = 0.0109 kg × 10 N/kg (marks awarded for conversion to kg) = 0.109 N **(ECF)**	 **C1** **A1**
1(c)	$P = \frac{F}{A}$, $P = \frac{0.109}{0.4}$ *P* = 0.273 N/cm^2 **(ECF)** (Accept 0.272 if students use 108.8)	**C1** **A1**
2	 Accept any suitable scale (to draw vectors of 160 N and 240 N) Diagram drawn accurately using parallelogram or triangle method. Direction of vectors must be correct. Resultant = 288 N ± 4 N Direction = 33 ± 1º **anticlockwise** from 240 N weight	**B1** **B1** **B1** **B1**
3(a)	GPE = 45 kg × 4 m × 10 N/kg = 1800 J	**B1**
(b)	K.E = 1800 J $1800 = \frac{1}{2}mv^2$	**C1**

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	$v = \sqrt{\frac{1800 \times 2}{45}}$ $v = 8.94 m/s$	A1
(c)	I do not agree with her because the **height of both slides are the same**. Based on the conservation of energy, the amount of **gravitational potential energy being converted to kinetic energy is the same**. Hence there would be no difference in the speed.	B1 B1
4(a)	50 °C	B1
(b)(i)	The thermal energy **is converted into the kinetic energy (or cause the particles to vibrate faster)** of the particles and hence the **kinetic energy increases**. However, the **potential energy remains constant** as there is no change in state of the substance. (Marks not awarded if student mention change of state as substance just reach melting point)	B1 B1
(ii)	Motion: Instead of **vibrating about its fixed position**, the particles can now **move freely and randomly** (or particles slide across one another). Arrangement: The particles are **no longer arranged in a regular pattern (orderly manner)** although the particles are still closely packed.	B1 B1
5(a) **(i)**	$\sin c = \frac{1}{1.45}$ $c = 43.6°$	C1 A1
(ii)	Since the light ray is **travelling from an optically denser medium to an optically less dense medium** and the **angle of incidence is greater than the critical angle**, the light ray undergoes **total internal reflection** and therefore did not emerge into the air. (Any 1 point on traveling and critical angle give 1 m)	B1 B1
(iii)	$\frac{\sin x}{\sin 15} = 1.45$ $x = 22.0°$	C1 A1

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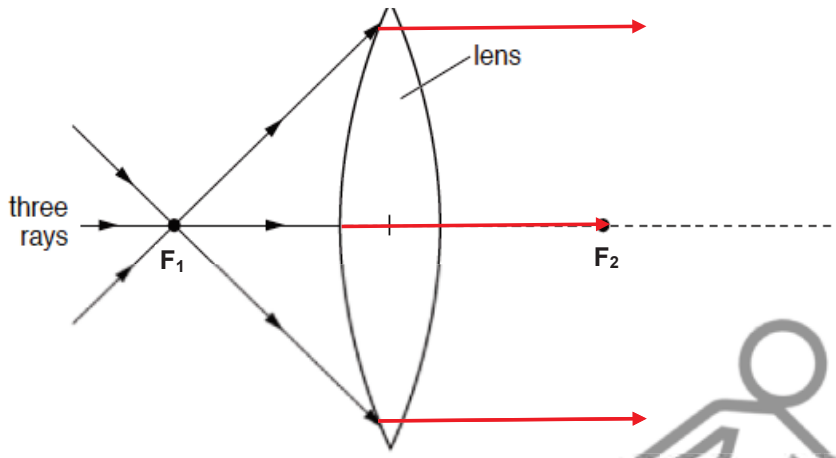
(b)(i)	 1 m for the light ray passing through the middle of the lens 1 m for the other two light rays to become parallel	 **B1** **B1**
(ii)	The speed of light increases. (Do not award marks if student say speed increases as its unclear)	**B1**
6(a)	$Distance = \frac{4.86 \times 330}{2}$ = 802 m	**C1** **A1**
(b)	As the siren **vibrates**, it causes the surrounding air particles to **vibrate in the direction parallel to the direction of wave travel**, producing a **longitudinal wave**. <u>Or</u> As the siren **vibrates**, it **displaces** the surrounding **air particles**, causing them to vibrate as well. The sound wave is propagated through the air through a series of **compressions and rarefactions** before it reaches the large building.	**B1** **B1** **B1**
7(a) **(i)**	100 W = 240 V × I I = 0.417 A	**C1** **A1**

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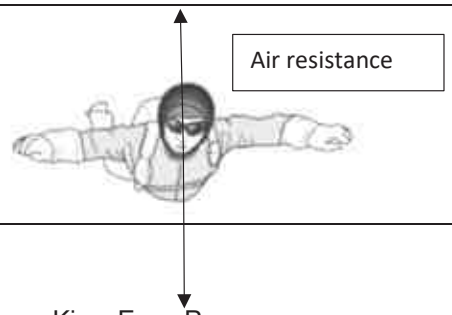
(ii)	A fuse **melts** when the current across it is greater than the fuse rating. This cause the **circuit to be open** and **prevents excessive current** from flowing to the electrical appliance. A 1 A fuse would be suitable for the kettle. (ECF)	**B1** **B1**
(b) **(i)**	1.1 kWh = P × 24 h P = 0.0458 kW, P = 45.8 W	**C1** **A1**
(ii)	$0.24 (Accept 0.242)	**B1**
8 **(a)(i)**	North	**B1**
(a)(ii)	The electromagnet attracts the iron ball and the **iron ball becomes an induced magnet**. (accept magnetized) The iron ball **behaves like a magnet** and hence it is able to attract the steel paper clip as **steel is a magnetic material**. (accept double induction)	**B1** **B1**
(b)	The iron ball would **drop off** from the electromagnet as it is a **soft magnetic material** The steel paper clip would **remain attach** to the iron ball as **its a hard magnetic material**. <u>Or</u> The paper clip will still attract the iron ball as it is a **hard magnetic material**. and the iron ball will continue to attract the iron core because of **induced magnetism**.	**B1** **B1** **B1** **B1**

<u>Section C: Free Response Answer</u> [30]

Qn	Ans	Marks
9 **(a)(i)**	10 m/s^2	**B1**
(a)(ii)		**B1**

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	Weight 1m awarded for highlighting each force. (Accept gravitational pull)	
(b)(i)	12 s	**B1**
(b)(ii)	The acceleration is **zero**. / no acceleration	**B1**
(b)(iii)	The **air resistance is equal to the weight** of the skydiver. The **resultant force acting on the skydiver would be zero**, hence based on Newton's first law, the acceleration would also be zero, therefore the skydiver would be travelling at constant speed.	**B1** **B1**
9(c)	The total distance travelled = Area under the graph = 54 × 10 = 540 m	 **C1** **A1**
(ii)	The skydiver is traveling at **decreasing deceleration** from t = 12 to t = 27.5 and it travels at **constant speed** from t = 27.5 to t = 30 s.	**B1** **B1**
10(a) **(i)**	**<u>Chemical potential energy</u>** of the coal → thermal energy of hot gases →**<u>internal</u>** energy of the water particles	**B1** **B1**
(ii)	As the hot air heats up the pipes, **the heat is converted into kinetic energy of the particles in the metal and it vibrates more vigorously**. It collides with its neighbouring particles and causes **them to vibrate more vigorously as well, passing the kinetic energy to them**. This continues until all the heat is transferred through the pipes.	**B1** **B1**
(iii)	Steam is **less dense than cold water and hence it would rise**. Therefore, most of the **steam would rise and escape from the top** thus reducing the efficiency of the boiler.	**B1** **B1**
(b)	It is a region where **an electric charge experiences a force**.	**B1**

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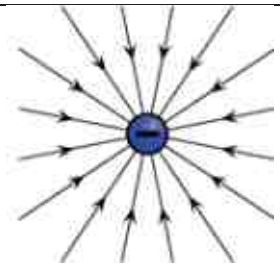
(i)		
(ii)	 1m for the direction of the arrows with straight lines	**B1**
(iii)	The dust becomes **negatively charged**. As **unlike charges attract**, it would be **attracted to the positively charged plate**.	**B1** **B1**
11(a)(i)	**P**	**B1**
(ii)	**P** and **Q**	**B1**
(b)(i)	$\frac{1}{16}+\frac{1}{16}=\frac{1}{R}$ $\frac{1}{R}=\frac{1}{8}, R=8\Omega$ Total resistance = 8 + 6 = 14 kΩ 1m for correct substitution for parallel resistors.	**C1** **A1**
(b)(ii)	14 kΩ = 14000 Ω $I=\frac{8V}{14000\Omega}$ I = 0.000571 A	**C1** **A1**
(c)(i)	It is acting **upwards**.	**B1**
(ii)	The wire would move **downwards**.	**B1**
(iii)	Increase the number of batteries Use a stronger magnet Thicker wire	**B1** **B1**

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BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018

4EXP

CANDIDATE NAME	
CLASS	
REGISTER NUMBER	

SCIENCE (BIOLOGY, CHEMISTRY)

Paper 1 (Biology, Chemistry)

5078/01

6 August 2018

1 hour

Candidates answer on the OMS.
No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the work you hand in.
Write in dark blue or black ink on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

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.

A copy of the Data Sheet is printed on page 18.

A copy of the Periodic Table is printed on page 19.

Setter: Ms. Cynthia Chong and Ms. Denise Wong

This document consists of **19** printed pages including this cover page.

[Turn Over

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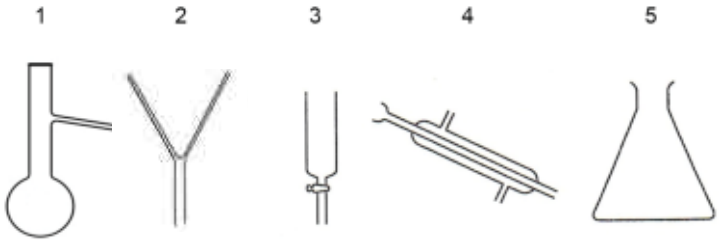
1 The diagram shows some laboratory apparatus.



Which apparatus are needed to produce and collect pure water from seawater?

A 2 and 5 **B** 3 and 5

C 1, 2 and 4 **D** 1, 4 and 5

2 Which substance, **A** to **D** undergoes changes in physical states from room temperature to 0°C?

	Melting point/°C	**Boiling point / °C**
A	-2	65
B	-23	4
C	50	250
D	-187	-165

3 Which statements are true about compounds?

1 They can be made from another compound.
2 They can be made from metals alone.
3 They can be made from non-metals alone.
4 They can be made from a metal and a non-metal.

A 1, 2 and 3 **B** 1, 2 and 4

C 1, 3 and 4 **D** 2, 3 and 4

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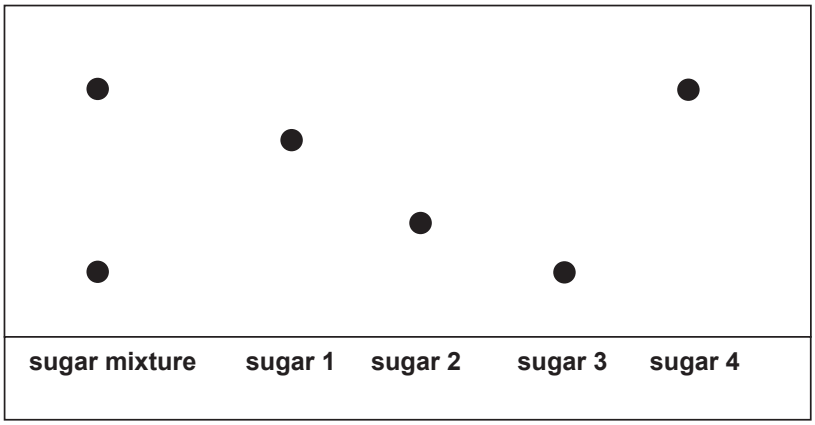
4 A sugar mixture was compared with four different simple sugars using chromatography. The results are shown in the diagram below. What types of sugars does the mixture contain?



A sugar 1 and 2 **B** sugar 1 and 4

C sugar 2 and 3 **D** sugar 3 and 4

5 Which compound contains three atoms?

A H_2O **B** HC*l*

C $CaSO_4$ **D** NO

6 Which of the following compounds has the highest percentage of nitrogen by mass?

A NH_4NO_3 **B** $(NH_4)_2CO_3$

C $CO(NH_2)_2$ **D** NH_4C*l*

7 A student dissolved 14.9g of potassium chloride, KCl, in 100 cm^3 of water. What is the concentration of the resulting potassium chloride solution in mol/dm^3?

A 0.002 mol/dm^3

B 0.01 mol/dm^3

C 0.15 mol/dm^3

D 2.0 mol/dm^3

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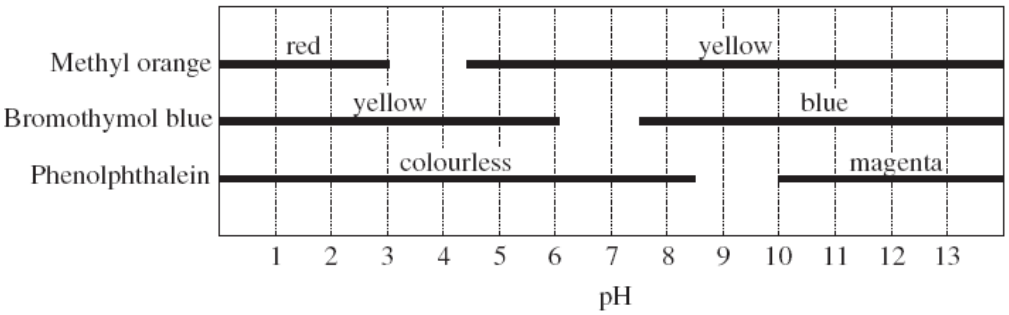
8 The graph below shows the colour ranges of the acid-base indicators methyl orange, bromothymol and phenolphthalein.



A solution, when placed in the three indicators separately, is yellow in methyl orange, yellow in bromothymol and colourless in phenolphthalein. What is the pH range of the solution?

A 2.5 to 3.5 **B** 4.5 to 5.5

C 7.5 to 8.5 **D** 9.5 to 10.5

9 Which of the following elements burns in air to produce a substance which can react with both hydrochloric acid and sodium hydroxide?

A lead **B** hydrogen

C iron **D** phosphorous

10 Which of the following reagents **cannot** be used to differentiate sodium hydroxide solution from sodium chloride solution?

A Aqueous iron(III) nitrate

B Aqueous copper(II) nitrate

C Aqueous lithium nitrate

D Aqueous ammonium nitrate

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11 Separate samples of hydrogen peroxide are added to aqueous potassium iodide and to acidified potassium manganate(VII). It is known that hydrogen peroxide is both an oxidising agent and a reducing agent.

What colour changes are seen?

	aqueous potassium iodide	acidified potassium manganate(VII)
A	colourless to brown	purple to colourless
B	brown to colourless	purple to colourless
C	colourless to brown	orange to green
D	brown to colourless	orange to green

12 **X**, **Y** and **Z** are elements in the same period of the Periodic Table.

X forms an acidic oxide, **Y** forms a basic oxide and **Z** forms an amphoteric oxide.

If **X**, **Y** and **Z** are placed in increasing order of atomic number (lowest atomic number first), which order is correct?

A **X**, **Y**, **Z**
B **Y**, **Z**, **X**
C **Y**, **X**, **Z**
D **X**, **Z**, **Y**

13 Rubidium is in the same group as sodium in the Periodic Table. What is a likely property of rubidium?

A It reacts with water to form hydrogen gas.
B It cannot be cut by knife.
C It reacts with chlorine gas to form a salt with the formula $RbCl_2$.
D It does not conduct electricity in the molten state.

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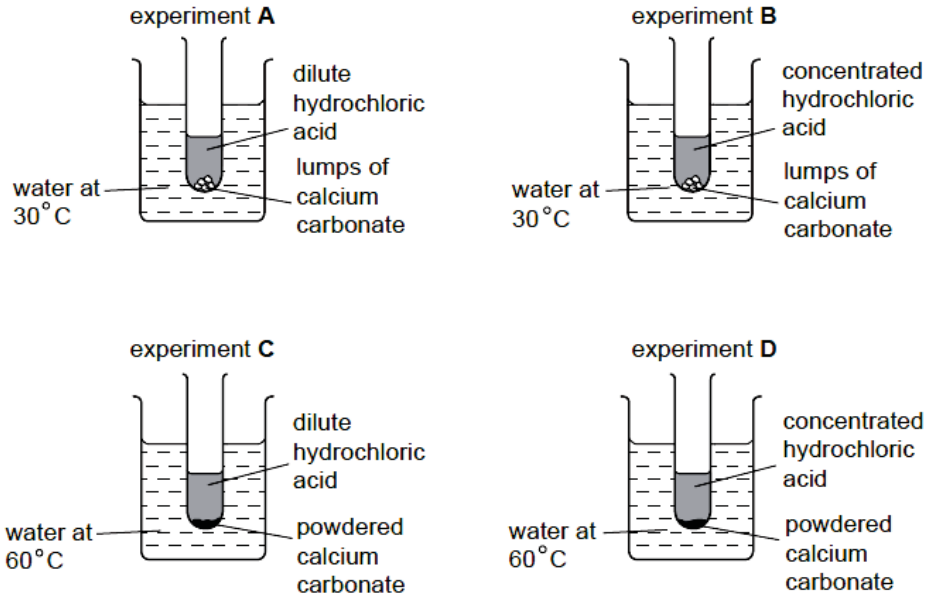
14 Which of the following experiment will have the fastest speed of reaction?

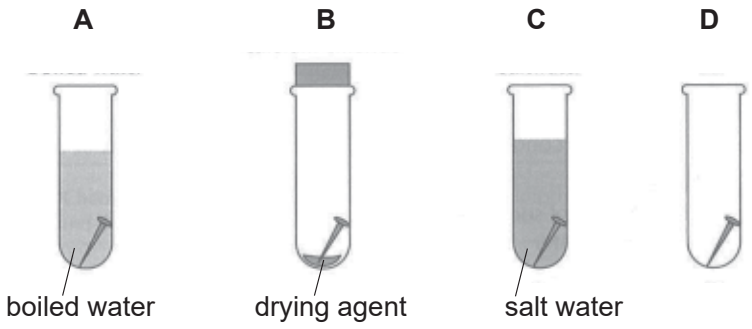


15 The element chromium produces hydrogen from dilute hydrochloric acid but it does not react with cold water. When a piece of chromium is placed in lead(II) nitrate solution, solid of lead appear.

What is the order of **decreasing** reactivity of the metals lead, calcium and chromium?

A calcium, chromium, lead
B calcium, lead, chromium
C chromium, calcium, lead
D lead, chromium, calcium

16 In which tube is the iron nail **not** likely to rust?



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17 Which of the following shows the correct percentage composition of oxygen, nitrogen and carbon dioxide found in dry unpolluted air?

	Oxygen	Nitrogen	Carbon dioxide
A	78	21	1
B	1	78	21
C	21	78	1
D	78	21	78

18 Which of the following shows the correct use of the different fractions of petroleum?

	Fraction	**Uses**
A	Petrol	used for making chemical feedstock
B	Bitumen	used for lubricating machine parts
C	Kerosene	used as fuel for aircraft
D	naphtha	used to pave road

19 Which of the following hydrocarbon undergoes substitution reaction?

A C_2H_4 **B** C_2H_6

C C_2H_5COOH **D** C_2H_5OH

20 Which of the following is the same for both ethanol and ethanoic acid?

A empirical formula

B functional group

C number of carbon

D homologous series

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21 The table below shows comparisons of features between a red blood cell and xylem vessel cell.

	feature	red blood cell	xylem vessel cell
1	cytoplasm present	no	no
2	cell wall present	yes	yes
3	nucleus present	no	no
4	chloroplast present	no	yes

Which comparison of features is / are correct?

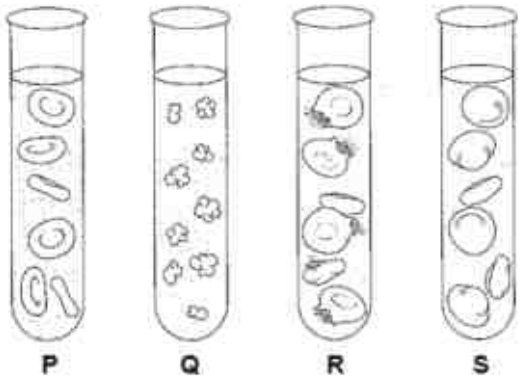
A **1** only

B **3** only

C **2** and **4** only

D **3** and **4** only

22 The diagram below shows red blood cells in four different salt solutions, **P**, **Q**, **R** and **S**.



Which correctly shows the solutions in order of increasing salt concentration?

	lowest	→		highest
A	Q	P	S	R
B	Q	S	P	R
C	R	P	S	Q
D	R	S	P	Q

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23 Which substance does not contain the element nitrogen?

A urea

B pepsin

C cellulase

D glycogen

24 Which fluid(s) collected from an individual is likely to give a brick-red precipitate when tested with Benedict's solution?

1 blood
2 saliva
3 secretions from the pancreas
4 secretions from the walls of the large intestine

A **1** only

B **1** and **3** only

C **2** and **4** only

D **1**, **3** and **4** only

25 Digestive juices were collected from three regions of the human alimentary canal. Drops of these digestive juices were added to three wells made in an agar of starch. After an hour, the wells were rinsed with distilled water and flooded with iodine solution. The results are shown below.

region around well	**1**	**2**	**3**
colour of iodine solution	yellowish-brown	blue-black	yellowish-brown

Which correctly identifies the regions of the alimentary canal that the three digestive juices were obtained from?

	1	**2**	**3**
A	mouth	small intestine	stomach
B	mouth	stomach	small intestine
C	stomach	mouth	small intestine
D	small intestine	mouth	stomach

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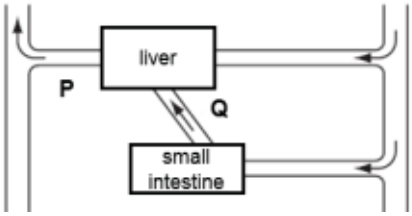
26 The diagram below represents some human organs and their associated blood vessels.



Which statement about the concentration of alcohol in the blood vessels **P** and **Q** after a man has consumed an alcoholic drink is true?

A There is no alcohol in both blood vessels.

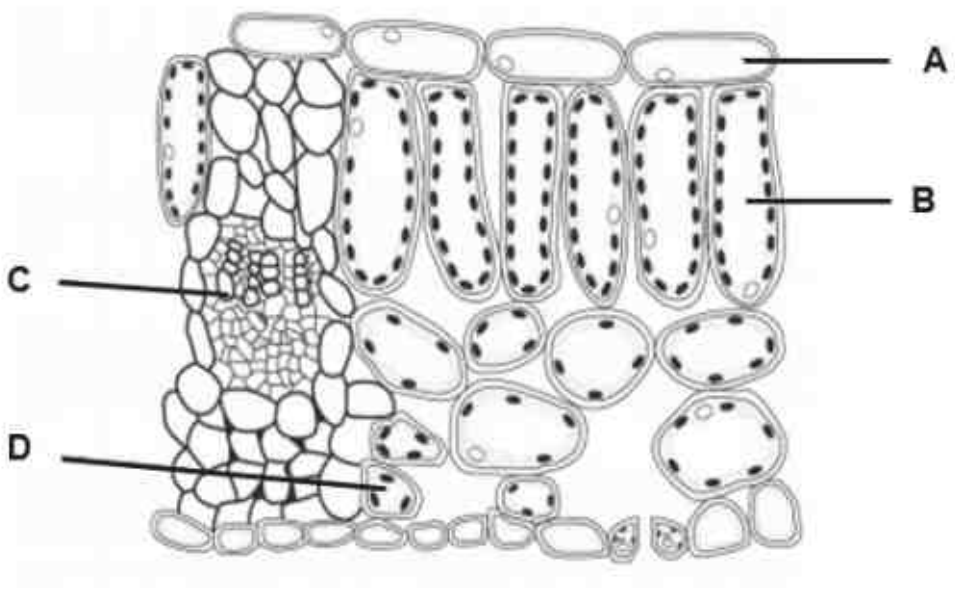
B The concentration of alcohol is higher in **P** than **Q**.

C The concentration of alcohol is lower in **P** than **Q**.

D The concentration of alcohol is equal in both blood vessels.

27 The diagram below shows a section through a leaf as seen under the microscope.

Which part of the plant has the lowest concentration of carbon dioxide on a warm, sunny day?



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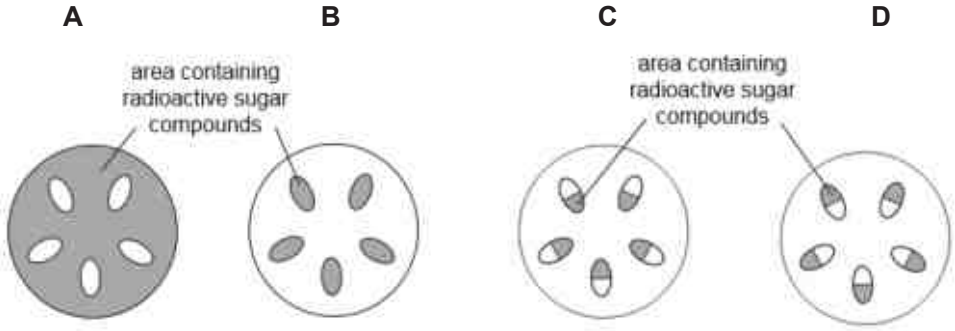
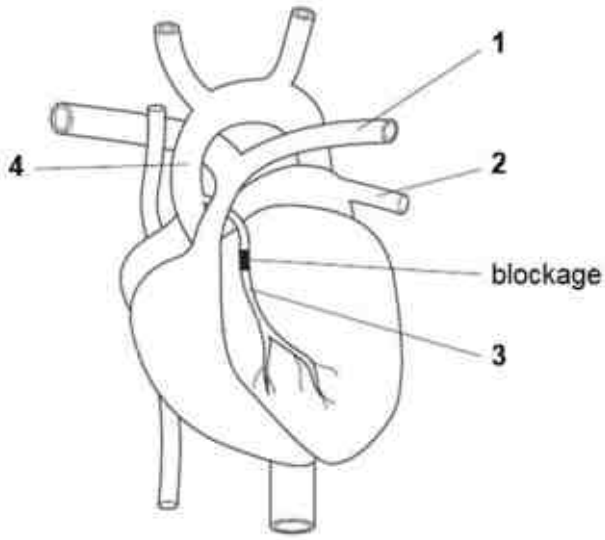
28 A plant shoot was exposed to radioactive carbon dioxide and sunlight for a few hours before sections of the stem were tested for the presence of radioactive sugar compounds.

Which correctly identifies the part of the stem that would contain the radioactive sugar compounds?



29 The diagram below shows an external view of the heart of a patient with a blockage of the coronary artery. This could be treated by inserting a tube to by-pass the blockage.



Which two blood vessels would be joined by this tube?

A **1** and **2**

B **1** and **4**

C **2** and **4**

D **3** and **4**

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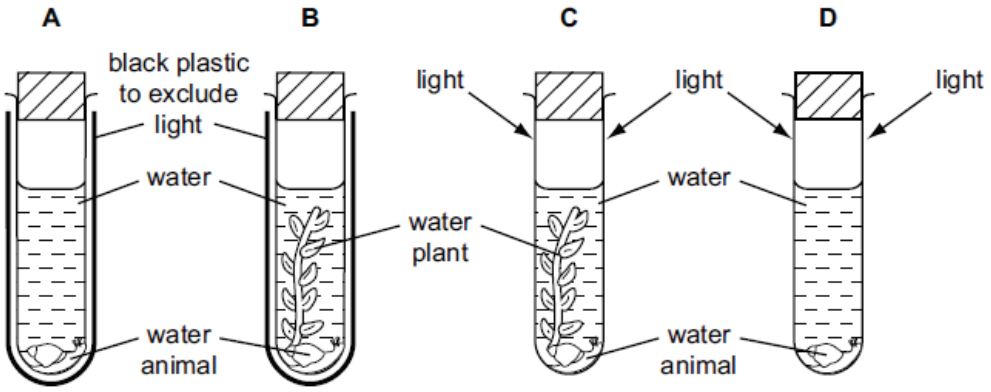
30 Four test tubes are set up as shown in the diagram below.

In which tube will the water animal survive for the longest period of time?



31 Three directions in which nerve impulses can travel in the nervous system are listed.

1 away from the central nervous system
2 towards the central nervous system
3 within the central nervous system

Which correctly identifies the direction of the nerve impulse in motor and relay neurones?

	motor neurone	**relay neurone**
A	1	2
B	1	3
C	2	1
D	2	3

[Turn Over

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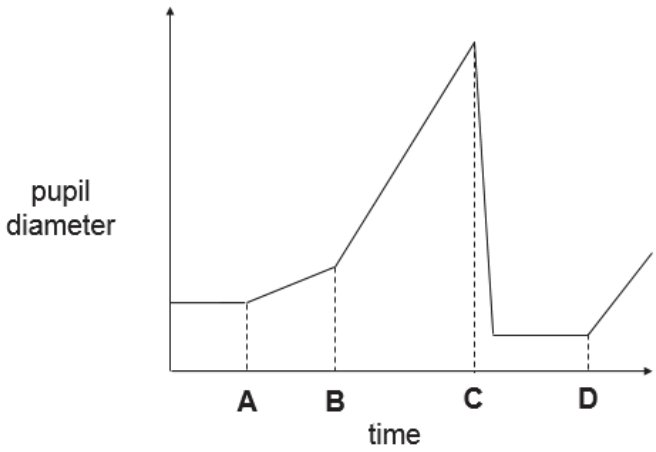
32 A man was wearing sunglasses on a bright sunny day. The graph below shows the change in diameter of the pupils of his eyes.

At which point in time did he remove his sunglasses?



33 Which difference between the endocrine and nervous system is **not** correct?

	endocrine system	**nervous system**
A	rapid response	delayed response
B	involves hormones	involves nerve impulses
C	always involuntary	may be voluntary or involuntary
D	usually affects more than one target organ	affects one target organ

[Turn Over

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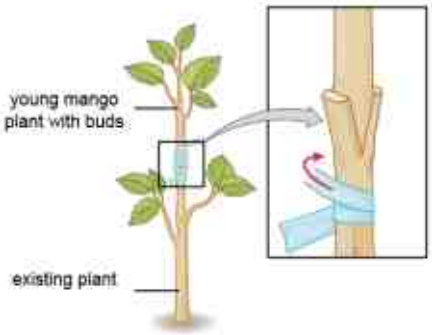
34 A mango tree can be grown by planting a mango seed directly into the soil or by asexual reproduction as shown in the diagram below. Trees produced by each of these methods produce mango fruits.



Which statement is true?

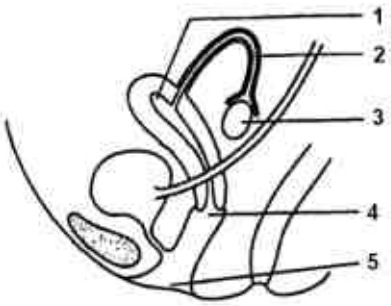
A Mangoes from trees grown from seeds and by grafting are genetically identical.

B Mangoes from trees grown from seeds have different characteristics while mangoes from trees grown by grafting have identical characteristics.

C Growing mango trees from seeds produces mangoes faster than growing mango trees by grafting.

D Growing mango trees from seeds requires only one parent plant but growing trees by grafting requires two parent plants.

35 The diagram shows a side view of the structures in the lower abdomen of a woman.



Which correctly identifies the structures in which fertilisation and implantation occur in?

	fertilisation	implantation
A	1	3
B	3	2
C	2	1
D	5	4

[Turn Over

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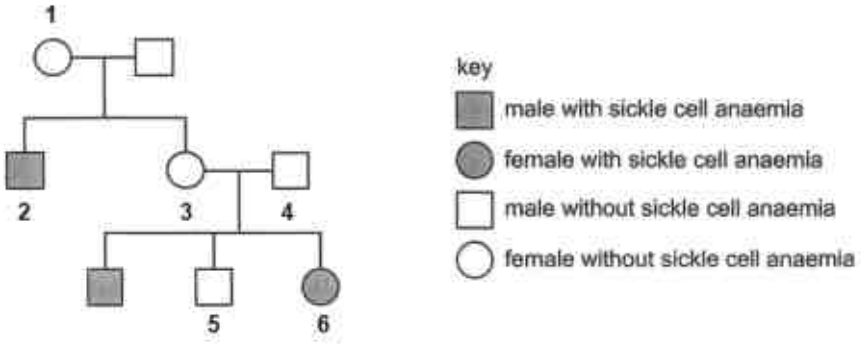
36 The diagram below shows a family tree in which some members have sickle cell anaemia. Sickle cell anaemia is a recessive condition.



Which person(s) is / are likely to be carriers?

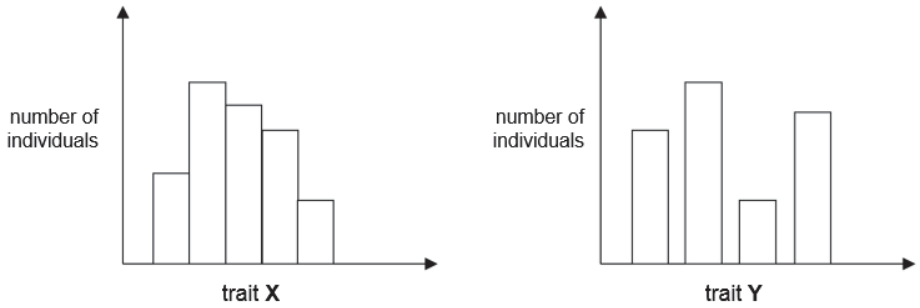
A **5** only

B **2** and **6** only

C **3** and **4** only

D **1**, **3** and **4** only

37 The diagram below shows the two types of variation in humans.



Which could trait **X** and trait **Y** represent?

	trait X	**trait Y**
A	weight	blood group
B	eye colour	hair colour
C	blood group	height
D	fingerprint pattern	intelligence

[Turn Over

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38 The diagram below shows part of the sequence of nucleotides taken before and after the DNA in the cells was treated.

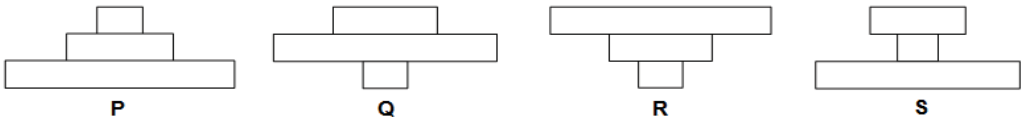
original DNA strand before treatment: A – G – **T** – **C** – C – A – T – T

mutated DNA strand after treatment: A – G – **A** – **G** – C – A – T – T

Which correctly identifies the type of mutation shown and cause of the mutation?

	type of mutation	**cause of mutation**
A	gene	exposure to heat
B	gene	exposure to UV light
C	chromosome	exposure to UV light
D	chromosome	exposure to mustard gas

39 The diagrams below show four ecological pyramids. In a food chain, a papaya tree provides food for caterpillars, and these caterpillars in turn become food for a few birds.



Which correctly represents the pyramid of numbers and biomass for the food chain?

	pyramid of numbers	**pyramid of biomass**
A	P	Q
B	Q	P
C	R	S
D	S	R

[Turn Over

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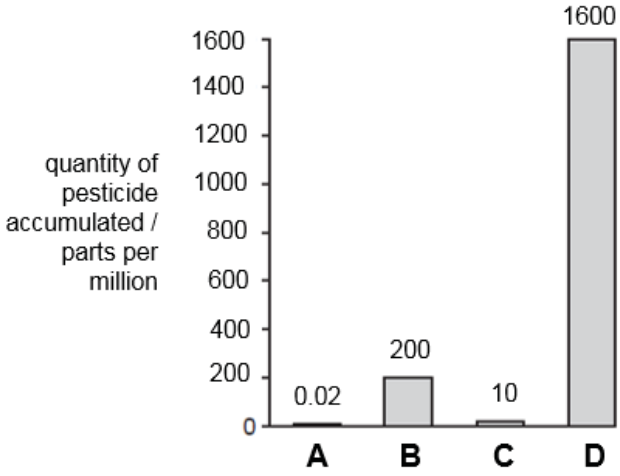
40 The graph shows the quantities of pesticide that accumulate in four populations, **A**, **B**, **C** and **D**, each at different trophic levels in a food chain.

Which population is most likely to be herbivores?



- END OF PAPER –

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DATA SHEET

Colours of some common metal hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

[Turn Over

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The Periodic Table of Elements

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018

4EXP

CANDIDATE NAME	

CLASS		REGISTER NUMBER	

SCIENCE (BIOLOGY, CHEMISTRY)
Paper 4 Biology

5078/04
2 August 2018

1 hour 15 minutes

Candidates answer on the Question Booklet.
No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the work you hand in.
Write in dark blue or black ink on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (45 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (20 marks)
Answer any **two** questions. Write your answers on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

Setter: Ms. Denise Wong

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Paper 1	
P4 Section A	
P4 Section B	
Paper 5	
Total	

This document consists of **16** printed pages including this cover page.

[Turn Over

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SECTION A (45 marks)
Answer **all** questions in the spaces provided.

1 **(a)** Fig. 1.1 shows part of the human digestive system.

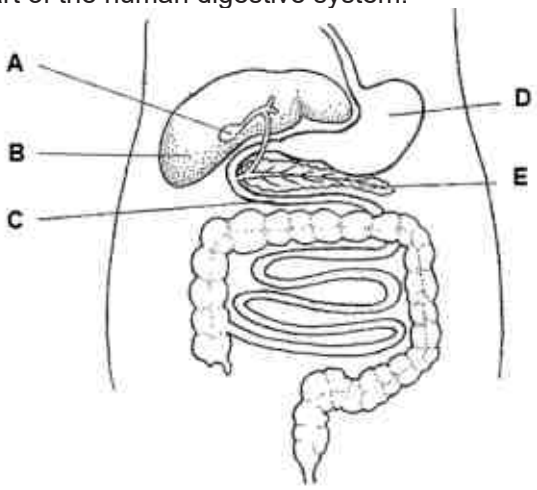

Fig. 1.1

(i) Table 1.1 lists some processes that occur in the human body. Complete the table by using letters from Fig. 1.1 to show where each process occurs.

Table 1.1

process	where process occurs
protein is first digested	
bile is stored	

[2]

(ii) A patient had surgery to remove part of organ **C**. Explain why the patient experienced weight loss in the weeks after the surgery.

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..... [2]

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For Examiner's Use

(b) Fig. 1.2 shows the blood vessels associated with organs **B** and **C**.

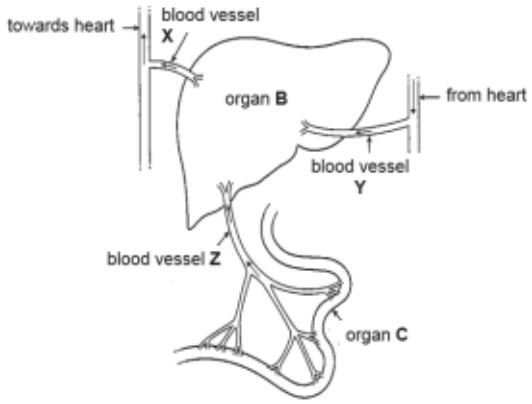

Fig. 1.2

(i) Identify blood vessels **Y** and **Z**.

Y …….....

Z ……..... [2]

(ii) Describe **one** structural difference between blood vessel **Y** and blood vessel **Z**. Explain how this difference helps blood vessel **Y** to perform its functions.

……..…….....

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……..…….....

……..……..... [2]

(iii) Explain why the concentration of glucose varies in blood vessel **Z** throughout the day while the concentration of glucose remains relatively constant in blood vessel **X**.

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……..……..... [3]

[Total: 11]

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2 Rennin is an enzyme found in the human alimentary canal that curdles milk by converting soluble milk proteins into insoluble milk proteins. An experiment was carried out to determine the effect of pH on the activity of rennin at 30 ºC. Table 2.1 shows the results of the experiment.

Table 2.1

pH	time taken for milk to curdle / min	rate of reaction / min^{-1}
1	4	0.25
2	2	0.50
3	3	0.33
4	7	0.14
5	13	

(a) **(i)** Calculate the rate of reaction for pH 5. Show your working.

rate of reaction = …… min^{-1} [1]

(ii) On the grid provided on the next page, plot a graph of rate of reaction against pH. Use the results in Table 2.1 and your answer to **(ai)**.

On your graph, use appropriate scales, label the axes and draw a line of best fit. [3]

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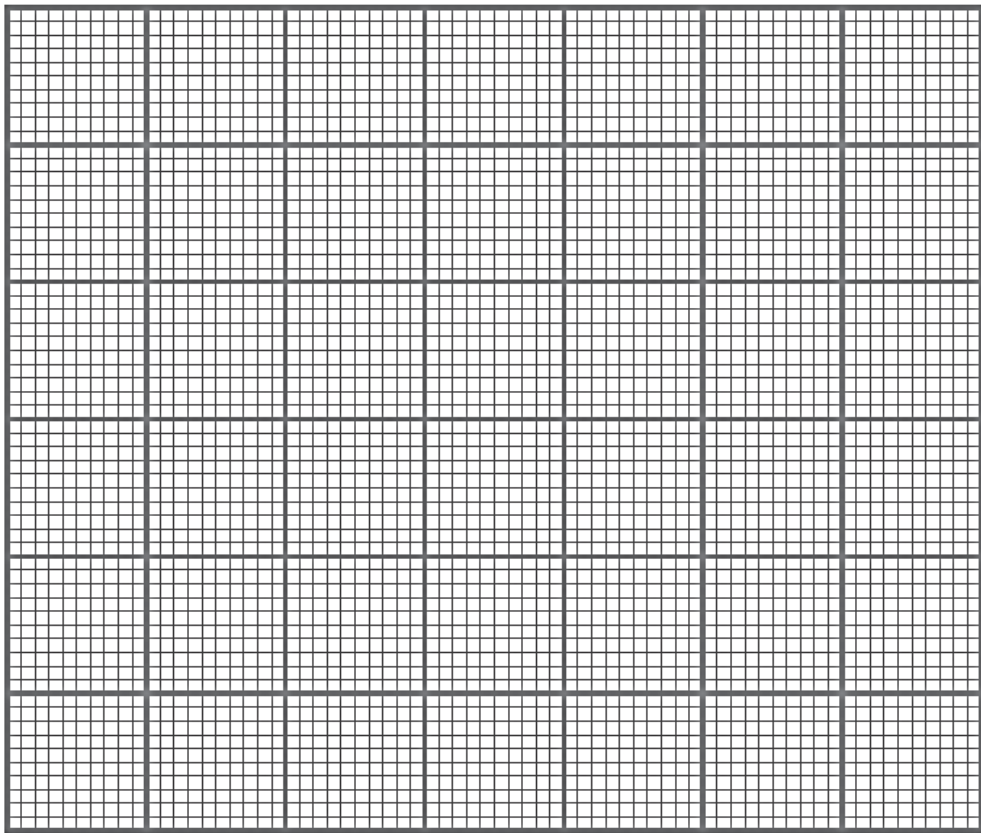

For Examiner's Use

(iii) From your graph, state the pH where rennin is the most active.

……..... [1]

(b) Describe the test that can be done to conclusively prove that rennin is protein in nature. State the results of the test.

…….....

…….....

…….....

……..... [2]

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(c) In another experiment, rennin was boiled and cooled down to 30 ºC before it was added to milk. Using your knowledge of the lock and key hypothesis, explain why the milk did not curdle.

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..... [3]

[Total: 10]

3 Fig. 3.1 shows an experiment set up to investigate the change in the mass of plants **A** and **B** potted in damp soil over a period of time.

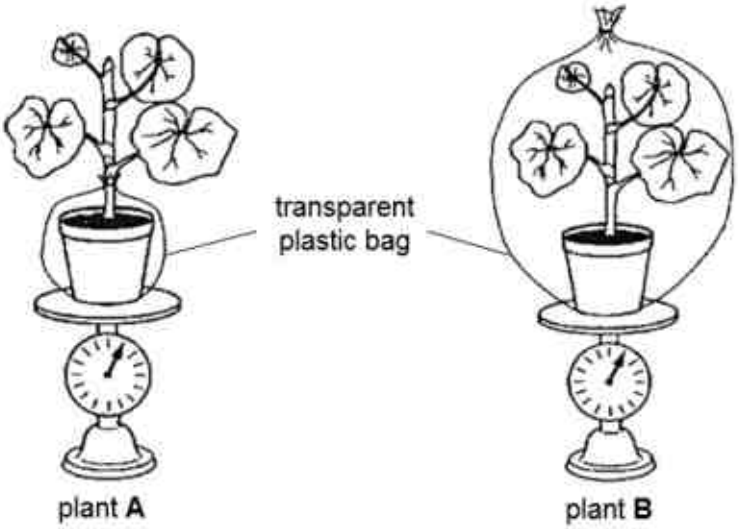

Fig. 3.1

The loss in mass was measured over a period of five days and the results are shown in Fig. 3.2.

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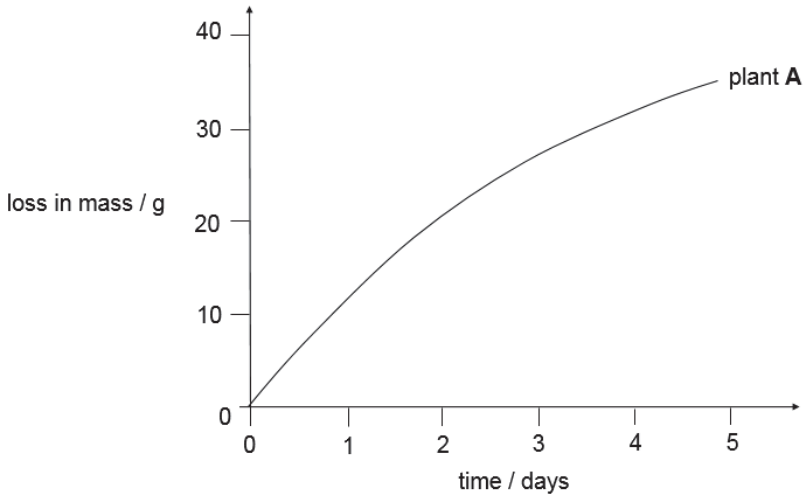

Fig. 3.2

(a) Define the process that caused the loss in mass observed in plant **A**.

.....

..... [1]

(b) **(i)** On Fig. 3.2, sketch a curve to show the results obtained for plant **B**. [1]

(ii) Explain the curve drawn in **(bi)**.

.....

.....

.....

..... [2]

(c) Explain why the rate of photosynthesis in plant **B** was found to decrease after 3 days.

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..... [2]

[Total: 6]

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For Examiner's Use

4 Fig. 4.1 shows the pressure changes in the aorta and chambers **X** and **Y** on the left side of the heart during one cardiac cycle in a healthy person.

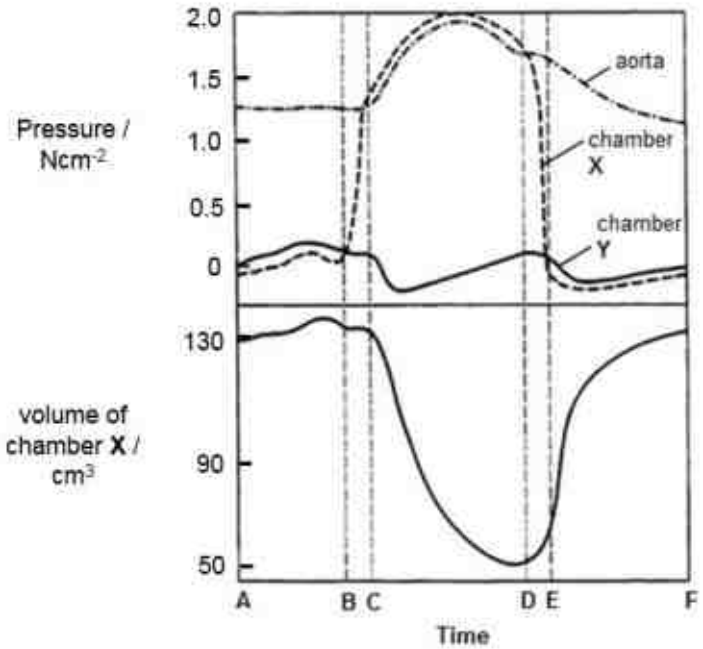

Fig. 4.1

(a) Identify chamber **X**. Explain how you arrived at your answer.

.....

.....

.....

..... [2]

(b) Describe and explain how the volume of the chamber **X** changes with pressure in chamber **X** from time **B** to **D**.

.....

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..... [2]

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(c) State the function of the valve that closes at **D**.

……

…… [1]

(d) It was observed that the increase in pressure in chamber **X** was greater in smokers than in healthy persons. By naming a component in cigarette smoke, explain this observation.

component ……

explanation ……

…… [2]

[Total: 7]

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For Examiner's Use

5 Colour blindness is controlled by a pair of alleles. The allele for normal vision (B) is dominant to the allele for colour blindness (b).

Fig. 5.1 shows the chromosomes found in the normal cells of a father and mother.

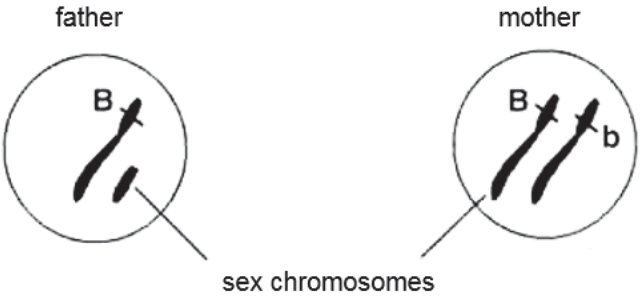

Fig. 5.1

(a) The genotype of the father is X^BY and that of the mother by X^BX^b. Use the genetic diagram in Fig. 5.2 to explain why colour blindness occurs more frequently in males than females.

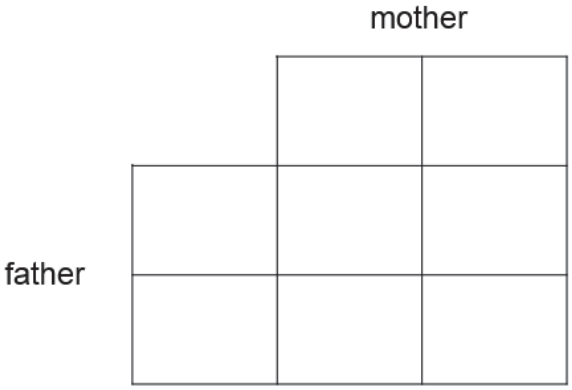

Fig. 5.2

.....

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.....

..... [4]

For Examiner's Use

(b) Fig. 5.3 shows part of the nucleotide sequence of alleles B and b.

allele B GGA TCG ***TC***T AGC

allele b GGA TCG ***GT***T AGC

Fig. 5.3

Using your knowledge of how protein synthesis occurs in cells, explain why the differences in nucleotide sequence results in different phenotypes observed.

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..... [2]

[Total: 6]

6 Fig. 6.1 shows the flow of energy through a food chain.

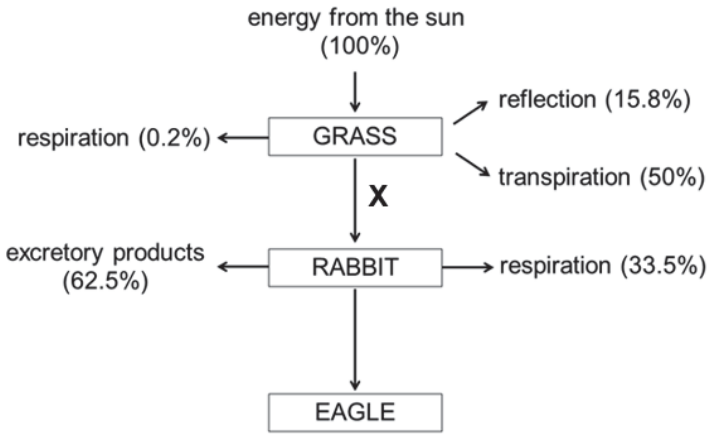

Fig. 6.1

(a) The arrow **X** represents the percentage of energy transferred from the grass to the rabbit.

Calculate the value of **X**. Show your working clearly.

[1]

For Examiner's Use

(b) With reference to Fig. 6.1, explain why the flow of energy in the food chain is non-cyclical.

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..... [2]

(c) Explain why most food chains are unable to support more than four trophic levels.

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..... [2]

[Total: 5]

- End of Section A -

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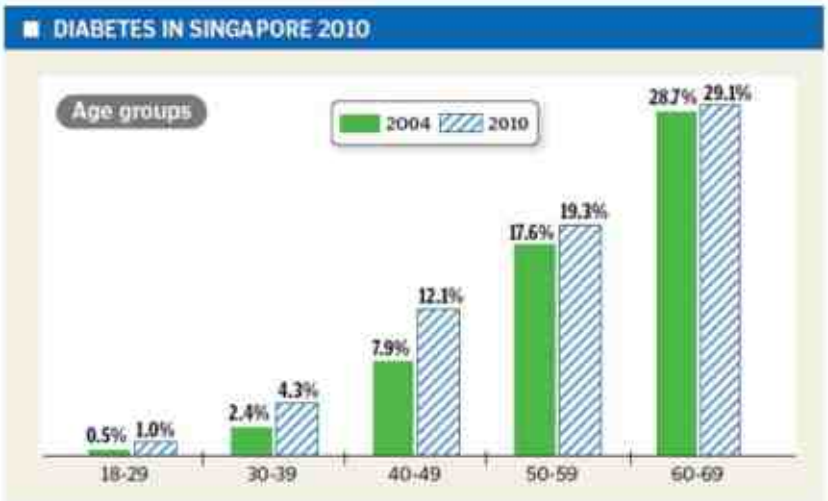
SECTION B (20 marks)

Answer any **two** questions in this section. Each question carries 10 marks.
Write your answers on the spaces provided.

For Examiner's Use

7 Fig. 7.1 shows some statistics on the incidences of diabetes in Singapore in 2004 and 2010.



Adapted from The Straits Times, 24 February 2012

Fig. 7.1

(a) Use the data shown in Fig. 7.1 to describe the trends shown in the data.

Briefly suggest a reason to account for these trends.

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..... [6]

[Turn Over

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(b) Diabetes can be treated by introducing the protein insulin into the body.

(i) Explain why insulin cannot be administered as an oral medication that is consumed.

.....

..... [1]

(ii) A nasal spray containing insulin has been recently developed as an alternative way of administering insulin. Insulin is inhaled into the lungs as a spray before it is absorbed into the bloodstream. Outline the pathway the insulin spray would take from the nose till it enters the bloodstream.

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..... [3]

[Total: 10]

[Turn Over

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For Examiner's Use

8 (a) Outline the sequence of events that take place in the uterus in a typical 28-day menstrual cycle in a woman who is not pregnant. Include the roles of the hormones oestrogen and progesterone in your answer.

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..... [6]

(b) Compare and contrast the process of fertilisation in flowering plants and in humans.

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..... [4]

[Total: 10]

[Turn Over

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For Examiner's Use

9 (a) With reference to the organelles in plant cells and events in the carbon cycle, explain why most life forms are dependent on living plants.

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..... [5]

(b) Destruction of the world's forests are increasing. Explain how this has affected the ecosystem and suggest reasons why it is important to conserve our forests.

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..... [5]

[Total: 10]

- END OF PAPER -

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BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
Secondary 4 Express
Science (Biology) 5078/1 and 5078/4
Marking Scheme

Paper 1

Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	D	D	A	B	C	B	D	D	C
Q31	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
B	C	A	B	C	D	A	B	B	C

Paper 4

Qn no.		Suggested answer	Comments to markers	Marks
1	a (i)	**process** / **where process occurs** protein is first digested — D [1] bile is stored — A [1]		2
		• *Many chose liver (B) for storage of bile*		
	a (ii)	**Max 2 marks:** • There will be less secretion of intestinal juice that contains digestive enzymes, reducing the efficiency of digestion. [1] • The digested food substances also cannot be efficiently absorbed by the villi in the small intestine. [1] • Thus, without absorption, assimilation of digested food substances to build new cells cannot occur effectively, resulting in weight loss. [1]	[1] less efficient digestion [1] less efficient absorption	2
		• *Many could not interpret the question in terms of functions of the small intestine – digestion and absorption* • *While those who answered in terms of function, many left out digestion and focused on absorption only* • *Common errors: writing that C was for transport of food to small intestine and not recognizing that C is the small intestine, writing about absorption of food (should be digested food), faster food digestion as length of intestine is shorter*		
	b (i)	• **Y**: hepatic artery [1] • **Z**: hepatic portal vein [1]	*A: minor spelling errors*	2
		• *Names of the blood vessels were not well learnt with many writing aorta / veins / capillaries or leaving out the term 'hepatic'*		
	b (ii)	**Any 1 structural point + correct comparison:** • Blood vessel **Y** (hepatic artery) has thicker, more muscular walls than blood vessel **Z** (hepatic portal vein). [1] • This allows the hepatic artery to withstand the high pressure of the blood being pumped out of the heart. [1]	*R: thicker walls* *No ECF (should be able to tell artery / vein as*	2

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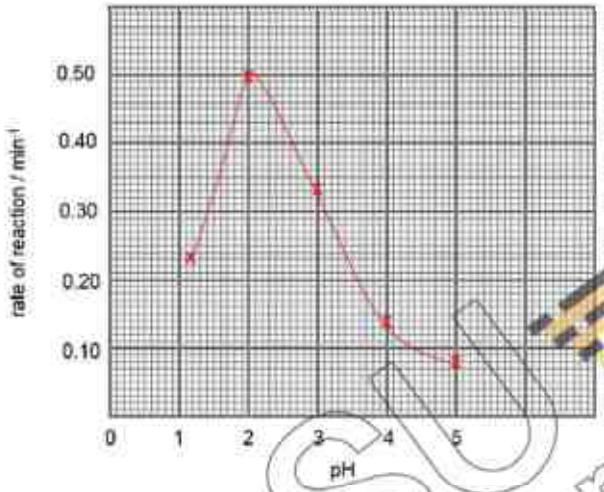
		• Blood vessel **Y** (hepatic artery) has elastic walls than blood vessel **Z** (hepatic portal vein). [1] • This allows the hepatic artery to stretch and recoil, helping to push the blood along the artery in spurts through further distances away from the heart. [1]	*direction was given)*	
		• *Many students write in terms of 'need to' but should take note that structure leads to effects which determines function (and not the other way round)* • *Explanation for the effect of muscular was not well crafted* • *Common error: writing that blood vessel is one cell thick focusing explanation on what Z has (valves) when question focus is on Y.*		
	b (iii)	**<u>Max 3 marks:</u>** • Glucose is absorbed into the blood capillaries at the ileum and transported by blood vessel **Z** (hepatic portal vein) to the liver [1]. • When carbohydrates are consumed and digested, more glucose will be absorbed and transported by the hepatic portal vein / When no carbohydrates are consumed, the level of glucose in the hepatic portal vein will decrease. [1] • However, the concentration of glucose remains constant in blood vessel **X** (hepatic vein) because of the action of insulin and glucagon. [1] • When glucose concentration is high, insulin is released to stimulate the conversion of excess glucose into glycogen / When glucose concentration is low, glucagon is released to stimulate the conversion of glycogen into glucose. [1]	*A: varies depending on glucose intake*	3
		• *Many students gained 1m for the concept that glucose concentration varies depending on food digested / absorbed* • *Most did not identify that glucose if absorbed into the blood at the villi* • *Some also did not explain that the glucose concentration remains constant due to the action of the hormones* • *Students to note that glucose concentration does not only increase due to glucose intake.*		
2	**a (i)**	• Rate of reaction = 1 / 13 = 0.08 min^{-1} [1]	R: fractions No [½] mark	1
		• *Common error: round of errors (not following 2 dp given in table)*		

	a (ii)	 • Accurate data points [1] • Correct axes labels [1] • Line of best fit [1]	[1] penalty for accuracy if graph does not occupy more than half the given graph space A: one inaccurate / missing data point / missing units on axes Cannot award best fit line if points are missing	3
		• Most were penalised for best fit line (straight line / extrapolate) • Common error: plotting time taken instead of reaction rate (not reading question), interchanging axes		
	a (iii)	• pH 2 [1]	A: ECF	1
		• *Generally well-answered*		
	b	• Add 2 cm^3 of Biuret solution to 2 cm^3 of rennin solution and shake well to mix. [1] • If Biuret solution turns from blue to violet, protein is present. [1]	A: equal volume / purple	1
		Common errors: not describing test but stating name of test, missing out 'equal volume', Benedict's test		
	c	• Enzymes (lock) have a specific shape of the active site such that only a substrate (key) with the complementary shape can bind to it. [1] • Boiling rennin (lock) would denature it so that the active site shape is altered. [1] • Hence, the milk protein substrates (key) that have a complementary shape to the active site cannot bind to it to cause curdling. [1]	[1] enzyme (lock) + substrate (key) + complementary [1] denaturation changes complementary active site shape [1] binding of enzyme to substrate	3
		• Most could explain denaturation and subsequent inability to bind well but did not identify the lock and key		

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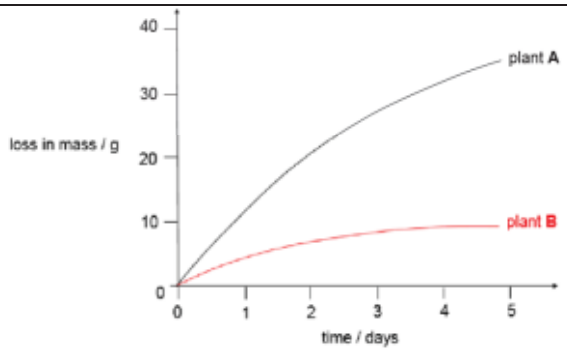
3	a	• Transpiration is the loss of water vapour from the aerial parts of the plant, especially through the stomata. [1]		1
		• *Many did not define but wrote the name of the process* • *A few also wrote photosynthesis* • *Definition also not well learnt with many leaving out key terms such as 'water vapour' or 'stomata'*		
	b (i)			1
		• *Many drew the graph such that the different between A and B was not significant even though plant B had a slower rate of mass loss*		
	b (ii)	• The transparent plastic bag increases the humidity of the air around the leaves of plant **B**. • Increasing the humidity of the air will decrease the water vapour concentration gradient between the intercellular air spaces in the leaf and the atmosphere. [1] • Rate of transpiration decreases so leaves of plant **B** lose less water vapour than leaves of plant **A**. [1]		2
		• *Most students could not give clear explanations based on the concept of water vapour concentration gradient and linking it to the reduced transpiration rate* • *Conceptual understanding of factors affecting transpiration is weak* • *Some students thought that the loss of mass will not be significant since water loss is trapped in the bag (but the bag is porous and some vapour will still escape)*		
	c	• A reduced transpiration rate results in less transpiration pull [1], hence less water absorbed for photosynthesis. [1]		2
		• *Most students wrote about the lack of availability of carbon dioxide the bag directly limits the plant from obtaining carbon dioxide (which is not true as it can be produced by the plant during respiration)* • *Some identified the lack of water but were unable to explain exactly why it is limiting (conceptual understanding of how water is absorbed by the plant is lacking – thinking that the bag directly limits the plant from obtaining water)*		
4	a	• Left ventricle [1] • The ventricular pressure is higher than atrial pressure [1] as the thicker more muscular walls of the ventricles generate a larger force to push blood out of the heart over a longer distance to the rest of the body.	A: ventricle A: ventricle pressure follows aorta pressure	2
		• *Many were able to identify highest / higher pressure but need to realise to avoid*		

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		writing that ventricle 'needs' to have higher pressure. Structure leads to effect which leads to function		
	b	• As the pressure in chamber **X** increases from 0 to 2.0 Ncm^{-2} from **B** to **D**, the volume in chamber **X** decreases from 130 to 50 cm^3. [1] • As the left ventricle contracts during systole, the increase in left ventricular pressure forces blood out of the left ventricle into the aorta, decreasing the volume within the ventricle. [1]	R: if no figures are quoted	2
		• *Descriptions were provided without quotes* • *Many also did not know how to express the relationship between pressure and volume and thus wrote from memory irrelevant points about the action of the valves*		
	c	• It prevents the backflow of blood from the aorta back into the left ventricle. [1]	*A: prevent backflow of blood (even if direction or ID of valve is incorrect)*	1
		• *Most could not deduce that the valve closing is the semilunar valve and did not state the direction of backflow*		
	d	**<u>Any 1 component + correct explanation:</u>** • Carbon monoxide [1] • Carbon monoxide reduces the oxygen-carrying ability of red blood cells / increases the risk of atherosclerosis such that the heart compensates by pumping harder with greater force. [1] • Nicotine [1] • Nicotine increases risk of blood clots in blood vessels / increase rate of fatty deposits in blood vessels / diameter reduction of blood vessel such that the heart compensates by pumping harder with greater force. [1]		1
		• *Most could name a correct component of cigarette smoke but could not clearly link the effects of the component to an increase in PRESSURE e.g. writing about nicotine causing increased heart rate* • *Common error: tar (carcinogen, cilia paralysis)*		
5	**a**	mother father X^B X^b X^B: $X^B X^B$, $X^B X^b$ Y: $X^B Y$, $X^b Y$ • Punnett square: correct separation of allele in parental gametes [1], correct combination [1] • Males have the Y chromosome that doesn't carry the allele for	A: X chromosome carries the alleles	4

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		colour vision. [1] • Hence, inheriting one copy of the recessive allele X^b from the mother is sufficient to result in colour blindness. [1]		
		• *Some were unable to complete the Punnett square with the correct symbols even though genotype was given to them (unable to transfer knowledge)* • *Most also could not explain clearly that inheritance of one copy in males is more detrimental and hence more common (focus on the answer should be on males not females)* • *To remind students that alleles (recessive / dominant) are found on chromosomes (entire chromosomes cannot be recessive / dominant)*		
	b	• Differences in nucleotide sequence between the alleles results a difference in the codons that code for one amino acid. [1] • Hence, during translation, a difference in the codons would result in a different sequence of amino acids that result in the formation of a different protein responsible for the phenotype. [1]		2
		• *Many could not explain that difference in codon sequence results in different sequence of amino acids and hence different protein (phenotype)* • *Many mentioned what genes are which is irrelevant to this question* • *Many also just simply rewrote what was given in the question – that different in nucleotide sequence results in different phenotypes (conceptual understanding is weak)* • *Usage of imprecise terms e.g. each protein consists of 3 nucleotides*		
6	**a**	• **X** = 100 – 15.8 – 0.2 – 50 = 34 % [1]		1
		• *Many made calculation errors e.g. using 10 % rule (3.4%)*		
	b	• As energy flows from the Sun to the producers and consumers, some of the energy is lost to the environment in e.g. the form of heat released during respiration (0.2 % or 33.5 %) / reflection (15.8 %) / transpiration (50 %) / excretory products (62.5 %). [1] • This energy lost as heat cannot be recycled / used again by the producers or consumers. [1]		2
		• *Most did not quote the figures as required by the question (with reference to 6.1)* • *Many also did not remember how to explain the non-cyclical flow and wrote about less energy available*		
	c	• About 10 % of the energy stored at one trophic level is transferred to the next trophic level in the form of biomass / About 90 % of energy is lost to the environment. [1] • Hence, there will not be enough energy available to support the final consumers in long food chains. [1]		2
		• *Common errors: not quoting the percentage of energy lost / transferred, not writing about the FINAL consumers*		

<u>SECTION C: Free Response Questions</u> (20 marks)

Qn no.	Suggested answer	Comments to	Marks

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			markers	
7	a	**Max 2 descriptions with correct quoting of figures [4]:** • Number of incidences of diabetes has increased in each age group from 2004 to 2010 [1] • E.g. In people aged 50 – 59, number of incidences of diabetes has increased from 17.6 % in 2004 to 19.3 % in 2010. [1] • For any particular year, number of incidences of diabetes is higher in older people than in younger people. [1] • E.g. In 2010, 1 % of people aged 18 – 29 had diabetes while 29.1% of people aged 60 – 69 had diabetes. [1] • The onset of diabetes is occurring earlier. [1] • E.g. In 2004, 7.9 % of those aged 40 to 49 had diabetes while in 2010, the number had risen to 12.1 %. [1] **Max 2 marks for reasons:** • Lack of exercise / less active [1] • Diet high in carbohydrates / sugar [1] • Obesity / more affluent so can eat more [1] • Slowing down of metabolism / less responsive to insulin / less healthy liver in older people [1]		6
		• *Most are weak at identifying the trends or accurately articulating the trends and quoting appropriate figures to substantiate the trend observed* • *Many were able to give 1 reason for trend observed (slowing of metabolism)* • *Common error: liver produces insulin (not penalised)*		
	b	• Insulin will be digested in the stomach by the pepsin into polypeptides and will not function. [1]	A: will be digested	1
		• *Most could not make the connection given in the question that insulin is a protein and extend the understanding to the fact that it would be digested* • *Common errors: it would take a long time for insulin to be digested / longer time to absorb, cannot go to the site of action in the liver, no glucose in mouth to react with insulin*		
	c	• The insulin spray would move from the nasal cavity into the pharynx and then trachea. [1] • From the trachea, the spray would move into the bronchus, bronchiole and alveoli. [1] • The spray would then diffuse across the alveolar wall into the plasma in the blood capillaries. [1]		3
		• *Understanding of the structures in the respiratory system was weak* • *Irrelevant responses include the movement throughout the circulatory system till the liver*		
8	a	**Max six marks:** • From day 1 – 5, menstruation occurs due to the decrease in the levels of progesterone in the last few days of the previous cycle. [1] • During menstruation, the uterine lining breaks down and is	For each time period: [1] description of event	6

		discharged out of the vagina together with the unfertilized egg and blood. [1] • From day 6 to 13, the increase in oestrogen levels [1] stimulates the uterine lining to thicken / grow / repair and becomes vascularized. [1] • From day 15 to 24, the increase in progesterone levels [1] due to the presence of the corpus luteum maintains the thickness of / further thickens the uterine lining to prepare for possible implantation of the embryo. [1] • From day 24 to 28 (when no fertilisation occurs), the decrease in progesterone levels due to the breakdown of the corpus luteum stimulates the uterine lining to break down at the onset of menstruation. [1]	[1] explanation of role of hormone	
		• *Days of the cycle were not always included in the answers (penalised)* • *Common irrelevant responses include mention of ovulation (question's focus is on events in the uterus)* • *Common errors: writing that day 15 – 28 is when progesterone levels increases, writing in a non-chronological order*		
	b	**Similarities:** • In both plants and humans, the haploid male gamete fuses with the female gamete to form a diploid zygote. [1] **Differences (point to point, both sides of comparison):** • The site of fertilisation in plants is the ovule [1] while the site of fertilisation in humans is in the fallopian tube / oviduct. [1] • Two male gametes fuse with two nuclei during double fertilisation [1] in plants while only one male gamete fuses with the ovum to form the zygote in humans. [1] • In plants, it is possible for self-fertilisation to take place where the gametes are produced from the same parent [1] while in humans, self-fertilisation is not possible. [1]		4
		• *Question was challenging to most who could not find the common similarity or suitable points of comparison for differences about the event of fertilisation itself* • *Common irrelevant responses include writing about events leading to fertilisation e.g. pollination or writing about asexual reproduction* • *Writing that plants can self-pollinate and hence self-fertilize*		
9	a	**Max 5 marks:** • Plants are the only organisms that can convert carbon dioxide in the atmosphere into chemical energy in the form of glucose. [1] • During photosynthesis, the chloroplasts in plant cells trap light energy from the sun and use it to convert carbon dioxide into glucose. [1] • Glucose is used by the plants to form new cells and is thus converted into biomass. [1] • During feeding, energy in the form of biomass is transferred to consumers. [1]	[1] photosynthesis	5

		• In the mitochondria of living organisms, glucose is oxidized during respiration [1] to release the energy required for the organisms to carry out their activities and grow. [1]		
		• *Question was challenging to most to integrate processes in the carbon cycle to explain that plants are the only source of glucose for most other life forms* • *Irrelevant responses include production of oxygen (question's focus is on the carbon cycle)*		

	b	**<u>Max 3 points:</u>**
		• During photosynthesis, plants remove carbon dioxide from the atmosphere and convert it into glucose. [1]
		• With increasing deforestation, there will be fewer trees to remove carbon dioxide from atmosphere. [1]
		• This will lead to an overall increase in the amount of carbon dioxide remaining in the atmosphere. [1]
		• Organisms living in the forests lose their habitats and source of food and shelter. [1]
		• This can cause imbalances to the food chain. [1]
		• Organisms may eventually not survive and species become extinct. [1]
		
		<u>Max 1 key point with elaboration:</u>
		• To maintain biodiversity by preventing the extinction of species [1]
		  ○ A large gene pool is important as many wild plants and animals possess favourable genes. [1]
		  ○ Plants with better resistance to diseases and drought can be produced by crossing domestic species with wild species. [1]
		  ○ Many tropical plants are of great importance as they are sources of medicinal drugs. [1]
		
		• To allow for species diversity [1]
		  ○ This means to have a wide variety of different species of organisms living in a given area. [1]
		  ○ Each species has its role to play in maintaining the balance in the ecosystem. [1]
		
		• To maintain a stable and balanced ecosystem [1]
		  ○ This prevents disruption of natural cycles such as the carbon cycle, and also prevents global warning. [1]
		
		• For economic purposes [1]
		  ○ Tropical plants provide raw materials for industries. [1]
		  ○ Tropical rainforests also provide food for example, rice, pineapple and banana [1]
		
		• For scientific research [1]
				5

		○ The study of wildlife provides useful information to humans. [1]		
		• *A number of students completely left out reasons why conservation is important* • *Writing about soil erosion instead of the direct impact of deforestation or explaining how erosion impacts the ecosystem (not able to understand the term 'ecosystem')* • *Explaining that removal of trees removes oxygen for other organisms*		

- END OF PAPER -

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中正中学 义顺

CHUNG CHENG HIGH SCHOOL YISHUN

Preliminary Examination 2018

Secondary 4 Express / 5 Normal Academic

Candidate			
	Name	Register No	Class

Science Physics
Paper 1
5076, 5077

Date: 24 Aug 2018
Duration: 1 h
(with Chemistry/Biology)

READ THESE INSTRUCTIONS FIRST

Answer all questions in the OMS provided.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use paper clips, highlighters, glue or correction fluid.

For examiner's use
20

Setter: Mr Thong Nai Kee

This paper consists of **9** printed pages, INCLUDING the cover page.

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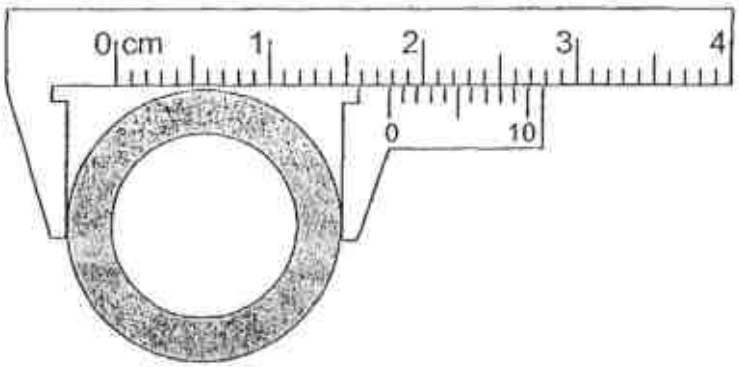
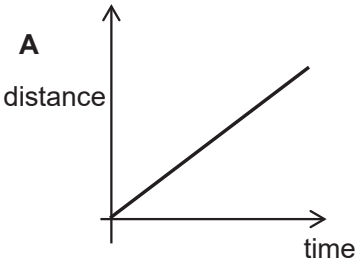
1. The diagram below shows a pair of vernier calipers set to measure a metal pipe. Given that the pipe has an internal diameter of 1.02 cm, what is the thickness of the wall of the metal pipe?



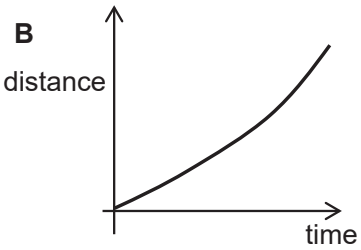
A 0.28 cm
B 0.38 cm
C 0.56 cm
D 0.76 cm

2. Which of the following distance-time graph best represents that of a rock, which is dropped from a tall building? Assume that air resistance is negligible

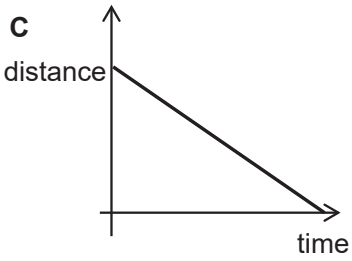
A



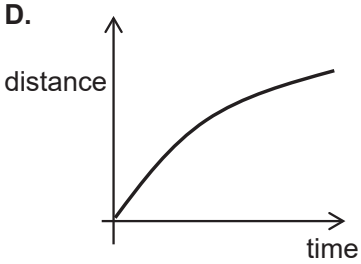
B



C



D.



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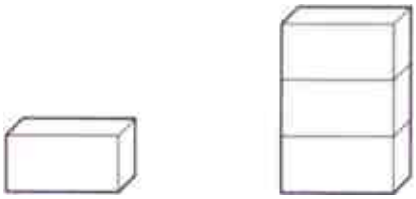
3. An object is moving to the right in a straight line with a constant speed.
Which of the following statements is true ?

A There are no forces acting on the object.
B There is a larger number of forces acting on the object to the right than to the left.
C There is only one force acting on the object and it is acting to the right.
D The resultant force acting on the object is zero.

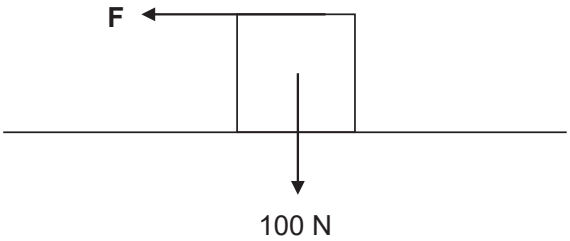
4. The diagram below shows a single brick and a pile of three bricks.
ALL the bricks are identical.

Which of the following statements is **true**?



A The pile of bricks has the same density but three times the volume and mass of the single brick.
B The pile of bricks has the same mass but three times the density and volume of the single brick.
C The pile of bricks has the same volume but three times the density and mass of the single brick.
D The pile of bricks has three times the mass, volume and density of the single brick

5. The diagram shows a uniform cube of weight 100 N on a rough surface.



What is the horizontal force **F** needed to just lift the cube?
A 50 N
B 100 N
C 200 N
D F depends on the friction between the cube and the rough surface.

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6. A girl of weight 450 N runs up a flight of 20 steps in 10.0 s. Each step has a height of 10 cm.
What is the average power developed by the girl ?

A 22.5 W
B 90 W
C 225 W
D 900 W

7. A girl of weight 450 N runs up a flight of 20 steps in 10.0 s. Each step has a height of 10 cm.
What is the average power developed by the girl ?

A 22.5 W
B 90 W
C 225 W
D 900 W

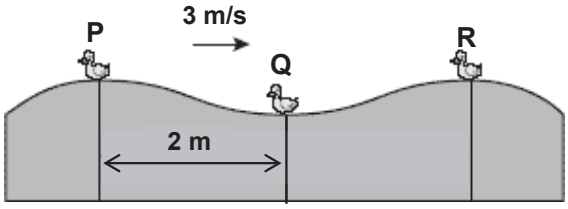
8. A cube of ice is heated to water, then to steam. Which of the following is true?

A The molecules expand as ice changes to steam.
B The molecules move closer to one another as ice changes to steam.
C The molecules move slower as ice changes to steam.
D The forces of attraction between molecules decreases as ice changes to steam.

9. A piece of aluminium foil is shiny on one side and dull on the opposite side. When it is used to wrap around food to be cooked in a barbecue fire, which side of the foil should face the fire and why?

	Side facing the fire	Reason
A	dull	better absorber of heat
B	dull	better conductor of heat
C	shiny	better reflector of heat
D	shiny	better conductor of heat

10. The diagram below shows three toy ducks floating on water, moving up and down as a wave travels to the right with a velocity of 3 m/s. The distance between **P** and **Q** is 2 m.



Which of the following is the frequency of the wave?

A 0.75 Hz
B 1.33 Hz
C 1.5 Hz
D 6.0 Hz

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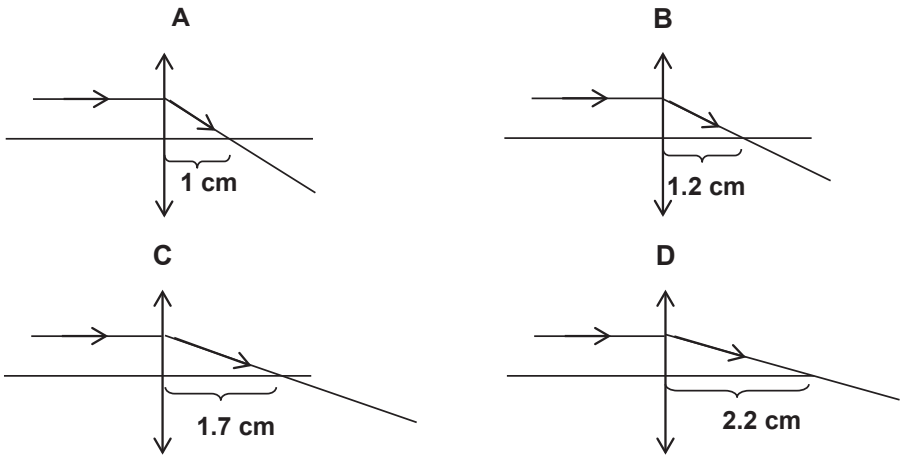
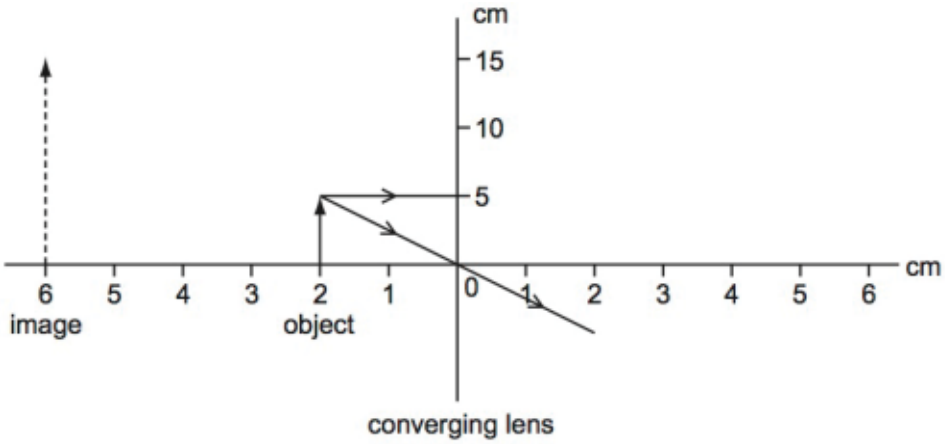
11. Which of the following is always **true** about wave motion?

A The particles always move perpendicular to the wave.
B The particles always move parallel to the wave.
C The particles always move along with the wave.
D Energy is transmitted as the wave moves.

12. Which of the following thin converging lens has the highest refractive index?



13. An object 5.0 cm high is placed 2.0 cm from a converging (convex) lens which is being used as a magnifying glass
The image produced is 6.0 cm from the lens and is 15 cm high.



What is the focal length of the lens?

A 2.0 cm
B 3.0 cm
C 4.0 cm
D 6.0 cm

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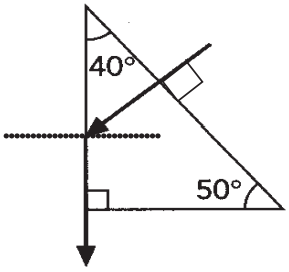
14. Which of the following system is **not** an application of electromagnetic waves?

A Sonar system
B Radar system
C Infra-red system for night navigation
D Wire-less telecommunication system

15. A ray of light enters a glass prism and travels along the path as shown in the figure below.



What is the refractive index of the glass?

A 1.40 **B** 1.46
C 1.50 **D** 1.56

16. X and Y are lamps with filaments made from the same material. The filament of lamp X is thicker and shorter than that of lamp Y.

When X and Y are connected to the mains and switched on, which is the brighter lamp and which lamp has the larger resistance?

	brighter lamp	larger resistance
A	X	X
B	X	Y
C	Y	X
D	Y	Y

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17. **Diagram 1** shows a resistor connected to a battery, an ammeter and a voltmeter. The ammeter reading is 0.5A and the voltmeter reading is 3.0 V
A second identical resistor is now connected in parallel with the first resistor, as shown in **diagram 2.**

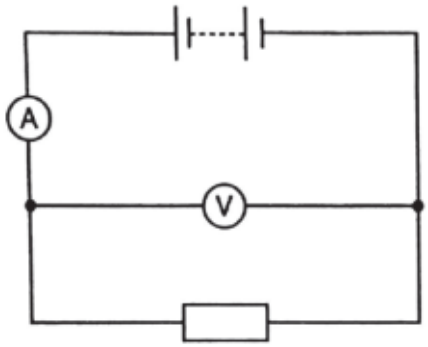


diagram 1

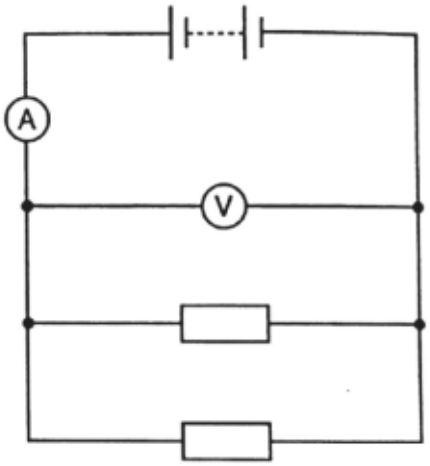
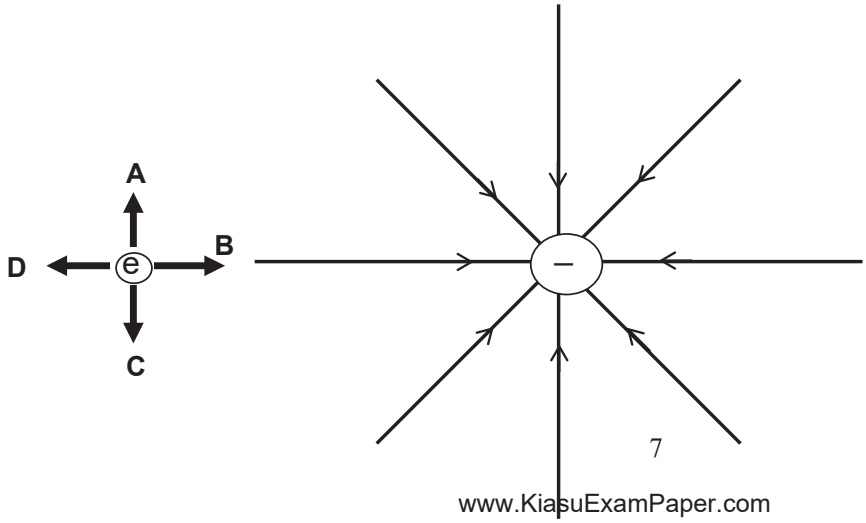


diagram 2

What are the ammeter and voltmeter readings in the circuit shown in diagram 2?

	ammeter reading / A	voltmeter reading / V
A	0.5	3.0
B	0.5	6.0
C	1.0	1.5
D	1.0	3.0

18. An electron is placed near a point charge as shown below. In which direction will the electron move?



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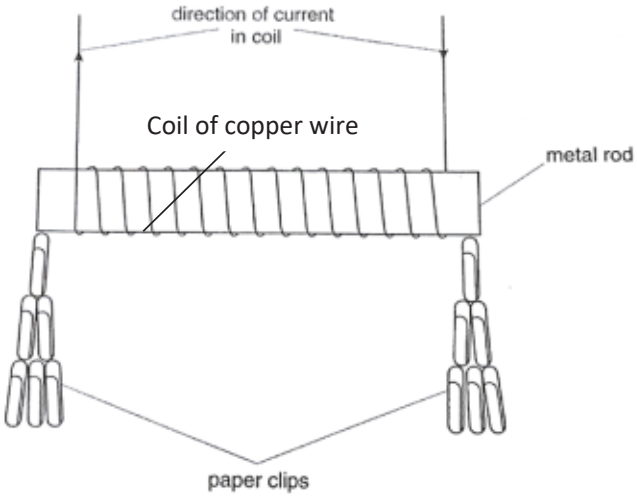
19. Four metal rods are placed, one at a time, inside of coil of copper wire.



The table below gives the results of the experiment.
Which rod would be the most suitable to use for the core of a coil in a circuit breaker?

metal rod	number of paper clips picked up when there is current in the coil	number of paper clips still attracted when the current is switched off
A	1	0
B	20	2
C	35	0
D	35	30

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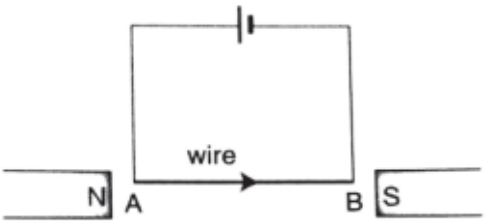
20. A wire is suspended between two magnets. The ends of the wire AB are connected to a d.c. supply and the current flows through the wire as shown in the figure.



Which of the following describes how the wire AB will move?

A Wire AB will move into the paper.
B Wire AB will move out of the paper.
C Wire AB will move towards the right
D Wire AB will remain stationary.

********** End of Paper 1 **********

MCQ Answers

SCIENCE PHYSICS

Q 1 – 5 : BBDAA	**Q 6 – 10 : BBDAA**
Q 11 – 15 : DABAD	**Q 16 – 20: BDDCD**

SCIENCE BIOLOGY

Q 21 – 15: ADBAC	**Q 26 – 30 : ACCBC**
Q 31 – 35: CDCAC	**Q 36 – 40 : CBCAD**

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中正中学 (义顺)

Preliminary Examinations (2018)
Secondary Four Express / Five Normal Academic

Candidate			
	Name	Register No.	Class

SCIENCE PHYSICS

Paper 2

5076/02, 5077/02

Date: 20 August 2018

Duration: 1 hr 15min

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces at the top of this page.
Write in dark blue or black pen.
You are to use a soft pencil for any diagrams or graphs.
Do not use paper clips, highlighters, glue, correction fluid or correction tape.

Section A (45 marks)
Answer **all** questions in the spaces provided.

Section B (20 marks)
Answer any **TWO** questions in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question. The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use	
Section A	
Section B	
Total	

Setter: Mr Thong Nai Kee

This paper consists of **16** printed pages , INCLUDING the cover page

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Section A [45 marks]
Answer ALL questions in this section in the spaces provided.

1. A compass needle is subject to two forces as shown in **Fig. 1**.

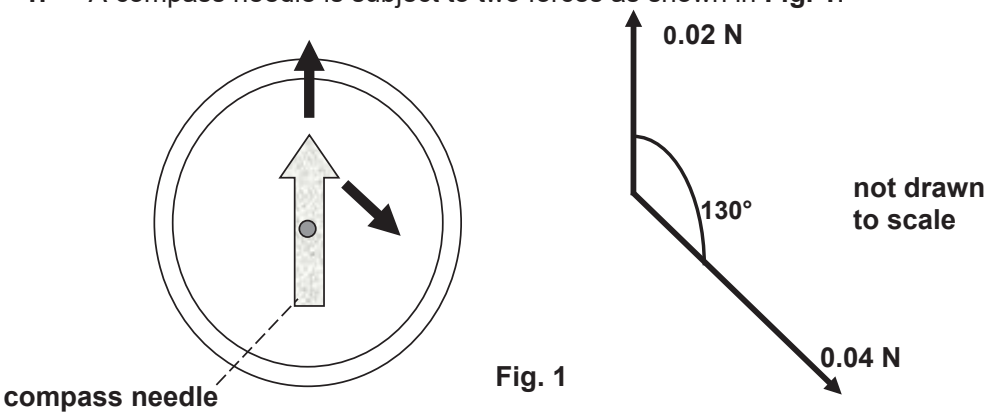

Fig. 1

By making a scale drawing on the space provided below, determine the resultant force on the needle.

Scale used: ……..
Diagram:

Magnitude of resultant force =…… [4]

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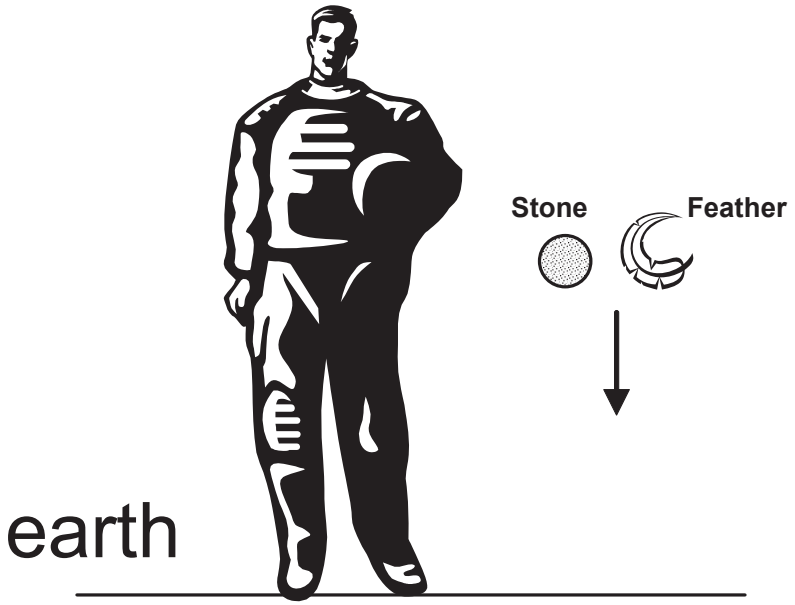
2 The diagram below shows a man dropping a stone and a feather on earth.



(a) State the initial acceleration of the stone and feather on Earth upon release?

…… [1]

(b) It is observed that the stone dropped faster than the feather.

(i) Explain the reason for the feather to fall at constant speed, in terms of forces acting on the feather.

...……

……

……[1]

(ii) Explain the reason for the stone to fall at acceleration, in terms of forces acting on the stone.

...……

……

……[1]

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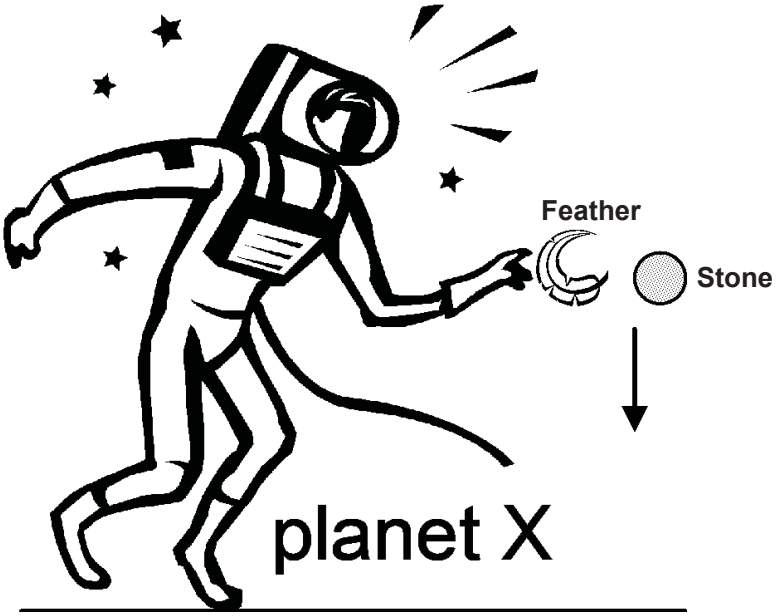
(c) The same stone and feather are brought to planet X with the same gravitational acceleration as earth but without air.



State two differences about the motion of the stone and the feather as compared to the motion when they are on Earth.

.....

.....

.....

.....

.....[2]

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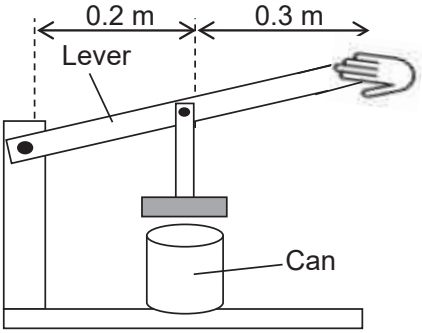
3. The diagram shows a simple machine used to crush cans. The lever is pushed downwards by the hand to crush a can.



(a) Explain how the design of this machine makes it easier to crush the cans.

……

……

……..[2]

(b) Mark on the diagram, **<u>two</u>** forces acting on the lever while a can is crushed. [2]

(c) A downward force of 50 N is applied at the handle. Calculate the force acting on the can. [2]

(d) If the radius of the can is 3 cm, calculate the pressure acting on the can in pascals. [2]

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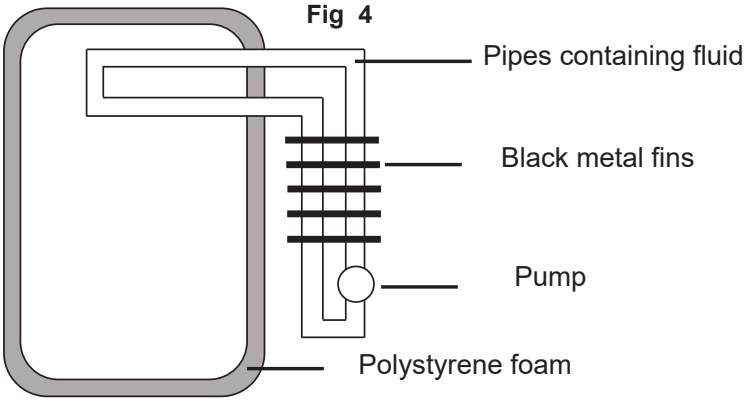
4. **Fig. 4** shows the inside of a refrigerator.

Fig 4



A fluid is pumped through the pipes, which takes the heat away from the top part of the refrigerator. The heat energy is released into the air through the black metal fins.

(a) Explain how the entire fridge is kept cool as heat is removed from the top part of the refrigerator.

……

……

……

……[3]

(b) Explain why the fins are painted black in colour.

……

……

……[2]

(c) Explain how the layer of polystyrene foam helps to keep the contents of the refrigerator cool.

……

……

……[2]

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5. **Fig. 5** shows an object that is placed in front of a thin converging lens.

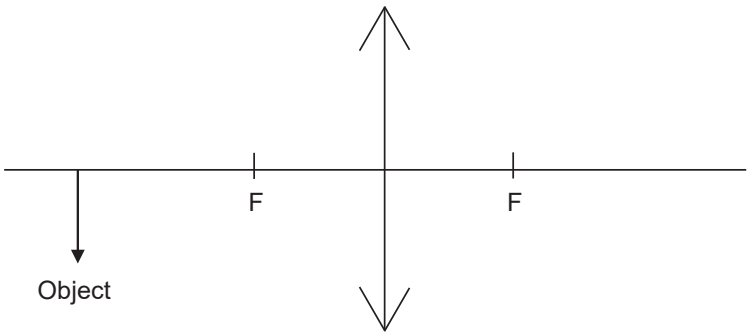

Fig. 5

(a) Construct a ray diagram to locate the image formed. [2]

(b) State three characteristics of the image formed.

……. [1]

(c) Describe how the following will change when the object is shifted nearer towards the focal point of the lens.

(i) Distance of image from the lens

……..……..…[1]

(ii) Focal length of the lens

..…… [1]

(iii) Size of image

…….. [1]

(iv) The frequency of light from the object does not change as it enters the lens. State what happens to the speed and wavelength of light as it enters the lens.

Speed : ..……..[1]

Wavelength: ……...……[1]

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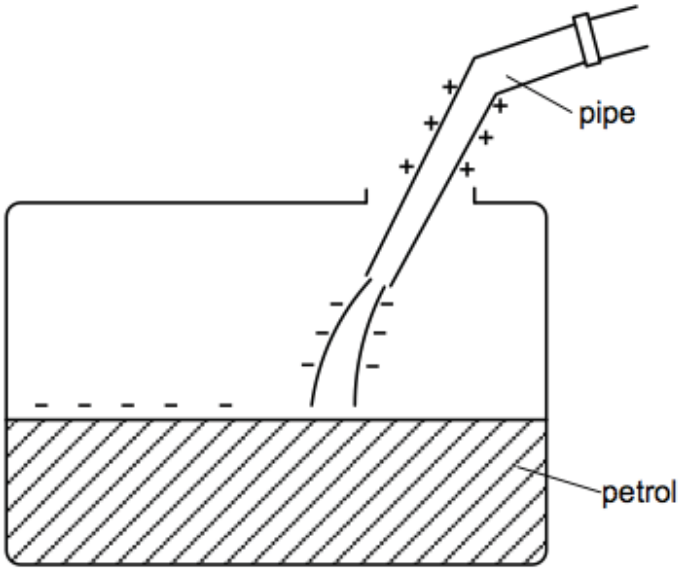
6. The diagram shows petrol being pumped into a can.



Electrostatic charges builds up on the petrol and the pipe.

(a) Explain how the pipe becomes positively charged and the petrol becomes negatively charged.

……

……

……[2]

(b) Explain why it is dangerous to allow the electrostatic charges to continue to build up.

……

……[1]

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7. **Fig 7.1** shows an electrical circuit with 4 resistors and a single bulb of resistance 4.0 Ω.

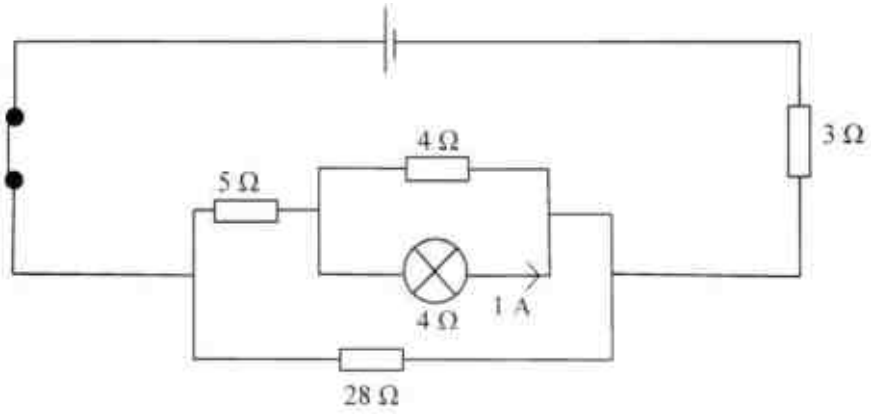

Fig 7.1

(a) Explain what is meant by the term ***electromotive force.***

……

……[1]

(b) Given that the current flowing through the bulb is 1.0 A, determine

(i) the current flowing through the 5.0 Ω resistor. [1]

(ii) the potential difference across the 28 Ω resistor [2]

(iii) the current flowing through the 3.0 Ω resistor, [1]

(iv) the power dissipated in the 3.0 Ω resistor. [2]

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8. A sound from an electronic organ is played into a microphone which is connected to a cathode-ray oscilloscope (c.r.o.). **Fig 8.1** shows the trace on the c.r.o. produced by the sound.

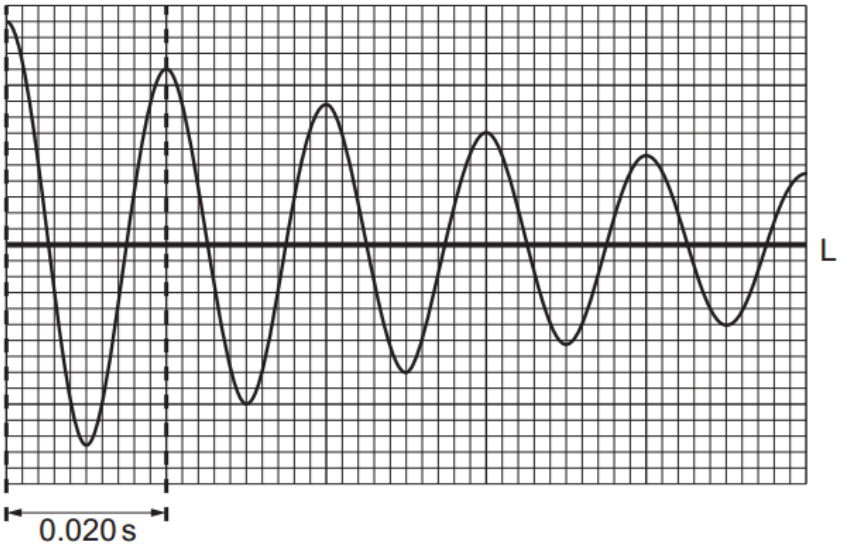

Fig 8.1

From **Fig 8.1,**

(a) state which property of the sound changes with time.

….....[1]

(b) state which property of the sound is kept constant.

.....[1]

(c) determine the time taken for the amplitude of the trace in **Fig. 8.1** to decrease to half its initial value.

Time = …….s [1]

********** **End of Section A** **********

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Section B (20 marks)
Answer any **two** questions in the spaces provided.

9. **(a) Fig. 9.1** shows a cable containing three wires colored brown, blue and yellow/green, and a mains plug with the cover removed.

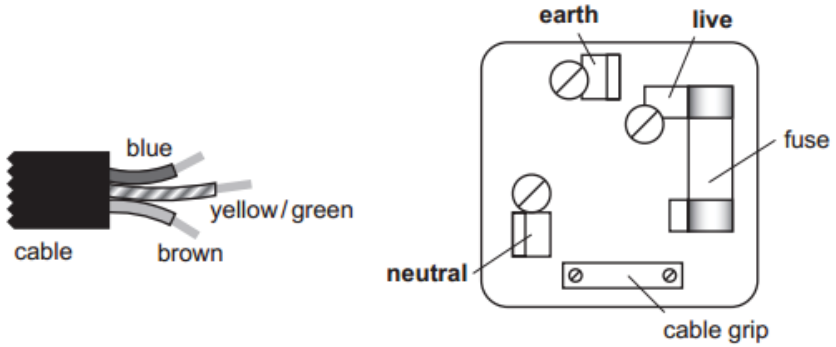

Fig 9.1

Describe how to connect the cable and the three wires correctly and safely to the plug.

.....

.....

.....

.....

.....[3]

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(b) The table lamp shown in **Fig. 9.2** is made from plastic. It has only two wires in the cable to connect it to the plug.

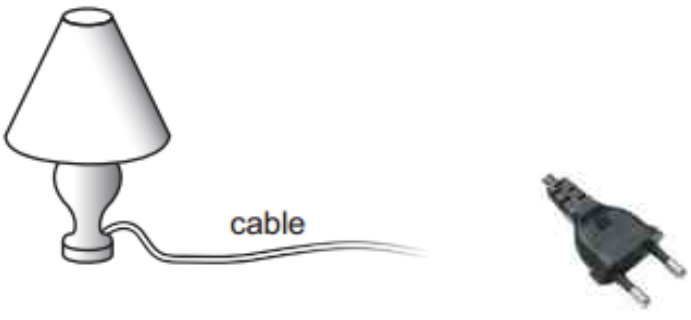

Fig 9.2

The lamp has a power rating of 100 W and is used with a 230 V supply.

(i) Which wire, earth, live or neutral, is not needed in the cable for the lamp?

……[1]

(ii) Explain why the lamp is safe to use even though it has only two wires in the cable.

……

……

…… [2]

(iii) Explain the working principle of a fuse.

……

……[1]

(iv) Suggest the value of the fuse that should be used in the plug for this lamp. Show your workings clearly.

fuse value = ……[3]

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10. **(a) Fig. 10.1** shows a wire passing through a hole in a horizontal, plastic board.

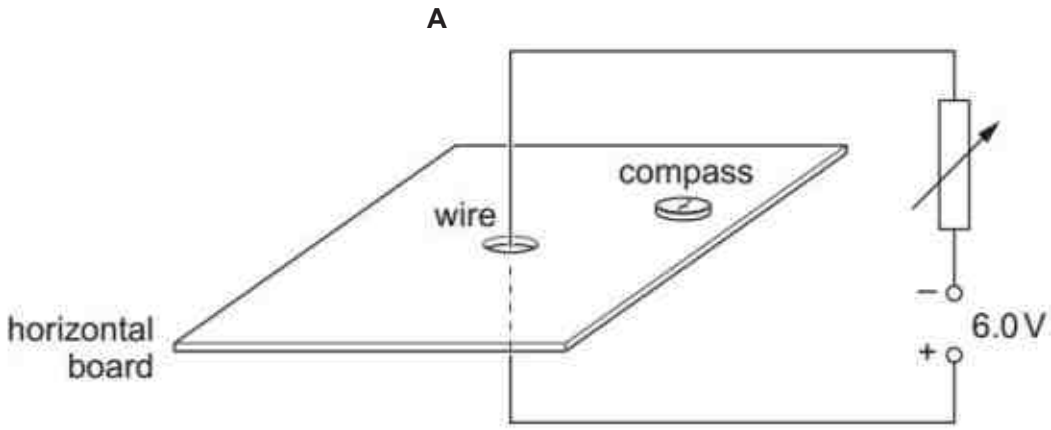

Fig 10.1

A student moves a small compass around the board and plots the magnetic field lines due to the current.

Draw a diagram of the board as seen from above (point **A)** and mark on it the magnetic field lines due to the current. [3]

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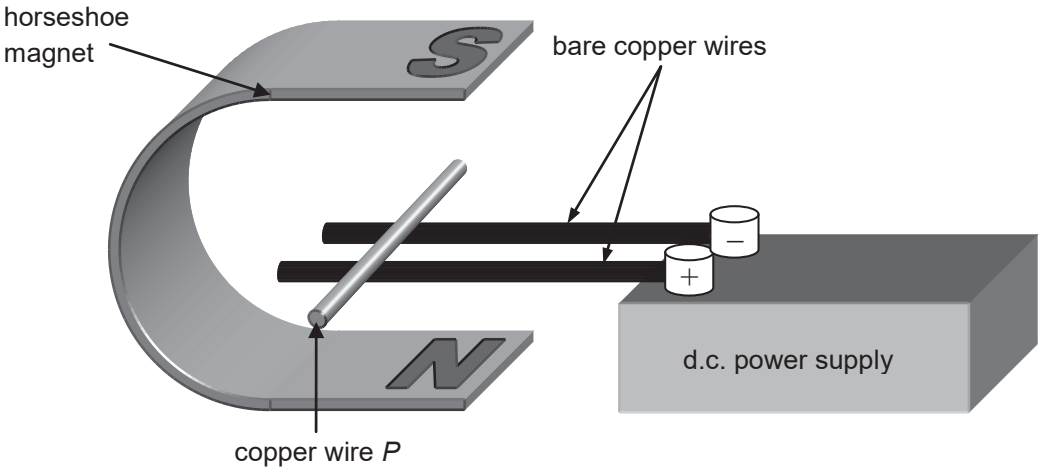
(b) **Fig 10.2** below shows an apparatus used to demonstrate the motor effect. *P* is a short length of bare copper wire resting on two other bare copper wires.

Fig. 10.2



(i) State the direction the copper wire P would roll when the **d.c**. power supply is switched on.

……[1]

(ii) Explain the observation made in **(i)**.

……[2]

(c) What difference would you notice if the following changes are made?

(i) The current is reversed.

……[1]

(ii) The magnetic field is reversed.

……[1]

(d) State and explain what is observed if the power supply is changed to an alternating current that has a low frequency.

……

……

……[2]

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11 **(a)** A petrol driven car accelerates from rest to its cruising speed along a straight level road.

(i) State the energy changes in the car.

…… [1]

(ii) The car now climbs a slope at a constant speed. State and explain, in terms of energy changes, whether the rate of petrol consumption will increase, stay the same or decrease.

……

……[2]

(b) **Fig. 11.1** below shows a roller coaster cart and a track. The mass of the cart is 250 kg and it starts from rest at point **A**.
The acceleration of free fall is 10 m/s^2.

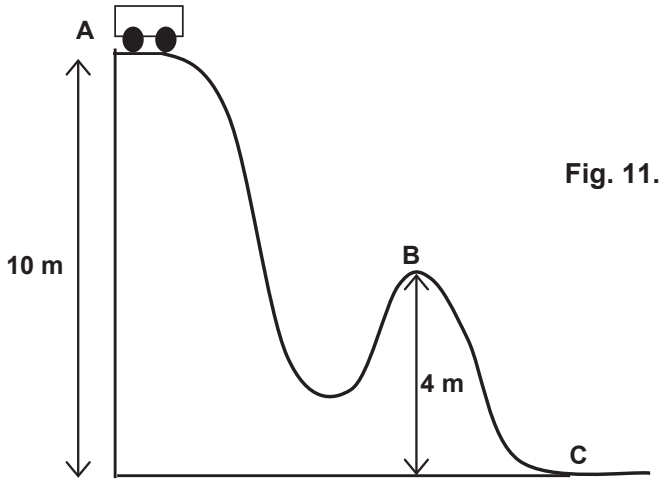

Fig. 11.1

(i) State the principle of conservation of energy.

……

……

……[1]

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(ii) Calculate the loss in gravitational potential energy of the cart between point **A** and **B**. [2]

(iii) The speed of the roller coaster at **B** is 10 m/s.
Calculate the increase in kinetic energy as the cart travels from **A** to **B**. [2]

(iv) Suggest why the loss in gravitational potential energy and the increase in kinetic energy are different and explain how the law of conservation of energy applies to this situation.

……

……

…… [2]

********** **End of Paper** **********

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Marking scheme (CCHY Prelim 2018 Science Physics

1. Scale (diagram should be at least half of the space provided. 1m
0.02 N and 0.04 N vectors correctly oriented 1m
Resultant force correctly 1m
Magnitude of resultant force = 0.031 N
(accept between 0.028N and 0.034N)

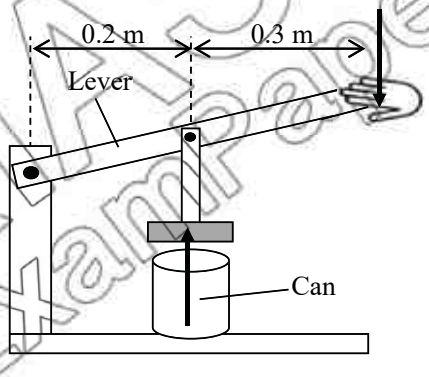
2. (a) 10 m/s^2 1m
(b) (i) The *weight of the feather is equal to the air resistance acting against it, hence resultant force acting on the feather is zero (zero acceleration).*

(ii) The *weight of the stone is higher than the air resistance acting against it.*

(c) - The speed of the stone and feather on planet X is faster than the speed of the stone and feather on Earth.
- The stone and feather on planet X drop at the same acceleration and hence hit the floor at the same speed and time.

3. (a) As the effort is far away from the pivot [1], this allow the hand to use a smaller force [1] to create the certain clockwise moment that produce a large crushing force on the can.

(b) **2**



Forces as shown in the diagram [1 m each]

(c) 50 x 0.5 = F X 0.2 [1]
F = 125 N [1]

(d) P = 125 / (3.14 x 0.03^2) [1]
= 44232
442 00 Pa (3sf)) [1]

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4 (a) As the air at the top is cooled, it contracts, become denser and sinks. 1m
The warmer air at the bottom is less dense and rises. 1m
As a result, this movement of air sets up a convection current which cools the fridge down. 1m

(b) Black surface is a good emitter of heat [1] and will increase the amount/rate of heat radiated into the air from the fluid.[1]
(c) Polystyrene is a poor conductor of heat [1] and will reduce the amount/rate of heat entering the refridgerator by conduction.[1]

5 (a) 1 ray to cut through optical center without bending. 1m
1 ray parallel axis to cut through focal point upon striking the lens.1m

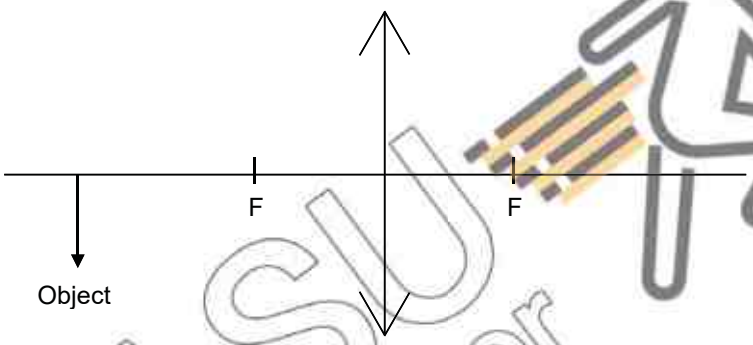

Fig. 5

(b) Diminished, real and inverted 1m
(c) (i) Increase 1m
(ii) Remain the same 1m
(iii)Increase 1m
(iv) Speed decreases. 1m
Wavelength decreases. 1m

6 (a) Charging by friction occurs when petrol rubs against [1] the pipe as it is being pumped. Electrons are transferred from pipe to the petrol [1] making the pipe positively charged and the petrol negatively charged.

(b) Sparks could be induced when the pipe is brought close to the can and this would ignite the petrol [1].

7 (a) Work done by the source in driving a unit charge around a complete circuit. 1m
(b) (i) $I_{5\Omega} = I_{4\Omega} + I_{bulb}$
$= 1 + 1$
$= 2A$
(ii) $V = IR_T$
$= 2\ (R_{5\Omega}$ in series with 2 parallel 4Ω resistors$)$
$= 2 \times 7 = 14V$

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(iii) $I_{3\Omega} = I_{5\Omega} + I_{28\Omega}$
$= 2 + 14/28$
$= 2.5A$

(iv) $P_{3\Omega} = I^2R$
$= (2.5)^2(3)$
$= 18.8$ W

8 (a) loudness [1]
(b) Pitch [1]
(c) 0.06s [1]

9 (a) Blue to neutral, yellow green to earth, brown to live wire to cable grip [3]

(b) (i) earth 1m
(ii) plastic/lamp/cover/base made from insulator/does not conduct electricity [1]
doubly insulated or plastic/lamp/cover/base cannot be live or cannot electrocute/shock [1]
(iii) The fuse consists of a wire that will melt when current exceeds its fuse rating an hence open the circuit.
(iv) P = VI (in any form numerical or algebraic)
0.43(48) [1]
Fuse: 0.5/1.0 A [1]

10 (a) at least 2 concentric, complete circles 1m
Increasing gap 1m
at least 1 anticlockwise arrow and none incorrect 1m

(b) (i) Roll to the ***right*** (towards the d.c. power supply) [**1**] [accept move to right]

(ii) When the power supply is switched on, ***current*** flows through wire *P* in a direction that is ***into*** the plane of the ***page*** which is ***perpendicular*** to the ***magnetic field*** direction (upward). [**1**]
By Fleming's Left-Hand-Rule, a ***force to the right*** acts on wire P. [**1**]

(c) (i) P rolls to the **left**. [**1**]
(ii) P rolls to the **left**. [**1**]

(d) P will **oscillate left and right repeatedly** as long as the a.c. is supplied. [**1**]
The **periodic change in direction of** the **current** in wire P will **cause** the **force** on the wire to **switch from left to right to left repeatedly**. [**1**]

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11 **(a) (i)** **Chemical potential energy** is converted to **kinetic energy**, (thermal energy and sound energy). [1]

(ii) rate of petrol consumption will **increase** [1]

More **chemical potential energy (from petrol)** is required to be converted to **gravitational potential energy as car climbs up the slope** [1]

(b) **(i)** Energy cannot be created or destroyed but converted from one form to another. [1]

(ii) use of mgh

= 250(10)(6) [1]

= 15000 J [1]

(iii) use of ½ mv^2

= ½ $(250)(10)^2$ [1]

= 12500 J [1]

(iv) slope is **not smooth / rough** [1]

gravitational potential energy is converted into kinetic, **thermal and sound energy**. [1]

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Centre Number: _____ Index Number: _____

KRANJI SECONDARY SCHOOL
Preliminary Examination
Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS/CHEMISTRY) **5076/01**
Paper 1 Multiple Choice

Monday **27 August 2018** **1 hour**

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READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
Do not use staples, paper clips, highlighters, glue or correction fluid.

INSTRUCTIONS TO CANDIDATES

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

INFORMATION FOR CANDIDATES

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.
The use of an approved scientific calculator is expected, where appropriate.

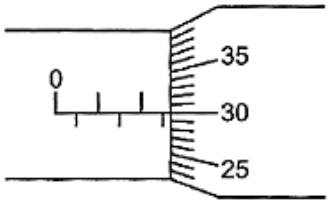
Take the acceleration due to gravity, g, to be 10 m/s^2.
A copy of the Data Sheet is printed on page 14.
A copy of the Periodic Table is printed on page 15.

Set by : Mr Guay Hansen / Mr Go Jun Hong

This question paper consists of 15 printed pages.

[Turn over

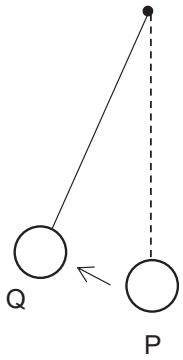
1 A micrometer is used to measure the diameter of a brass rod and its reading is shown in the diagram below.



What is the diameter of the brass rod?

A 2.30 mm **B** 2.80 mm **C** 5.30 mm **D** 5.80 mm

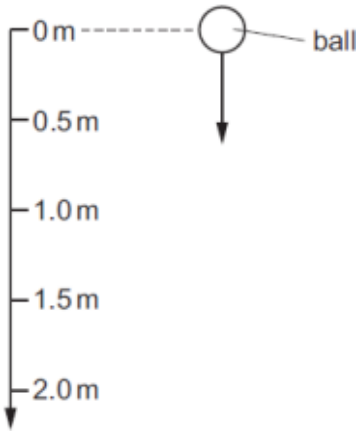
2 The time taken for a pendulum to swing from its lowest position, P, to position Q of its maximum displacement is 0.30 s.



How many complete periods of the pendulum are there in two minutes?

A 50 **B** 100 **C** 200 **D** 400

3 On Earth, a ball is dropped and falls 2.0 m in a vacuum.
The acceleration of the ball at 1.0 m is 10 m/s^2.



What is the acceleration of the ball at 0.5 m?

A 5.0 m/s^2 **B** 10 m/s^2 **C** 15 m/s^2 **D** 20 m/s^2

4 A boat is travelling at a uniform speed in a straight line across the surface of a lake.

Which statement about the boat is correct?

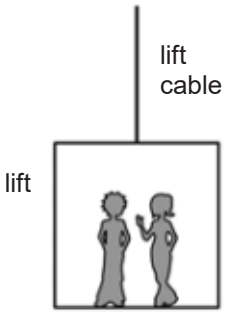
A The resultant force on the boat is in the direction of motion.

B The resultant force on the boat is in the opposite direction to its motion.

C The resultant force is greater than the resistive force between the boat and the water.

D The resultant force on the boat is zero.

5 Two students are in a lift that is accelerating upwards.



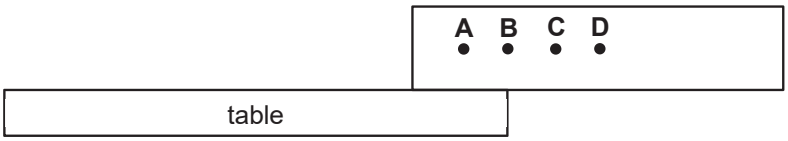
The total mass of the 2 students and the lift is 400 kg. The tension in the lift cable is 5000 N.

What is the acceleration of the lift?

A 2.5 m/s^2 **B** 11.5 m/s^2 **C** 12.5 m/s^2 **D** 22.5 m/s^2

6 The diagram shows a box which is balanced at the edge of a table. The box is just about to fall over.

Which point is most likely the centre of gravity of the box?



7 A dish of liquid is left on a laboratory bench. Some of the liquid evaporates.

What happens and why?

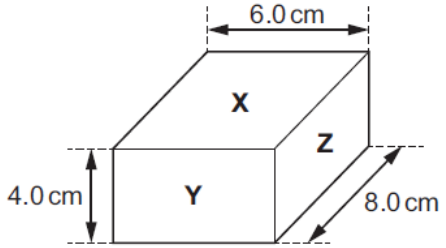
A The liquid cools because liquid molecules have more potential energy than gas molecules.

B The liquid cools because faster-moving molecules escape.

C The liquid warms because liquid molecules have less potential energy than gas molecules.

D The liquid warms because slower-moving molecules are left behind.

8 The diagram shows a 500 g box of dimensions 6.0 cm × 8.0 cm × 4.0 cm.

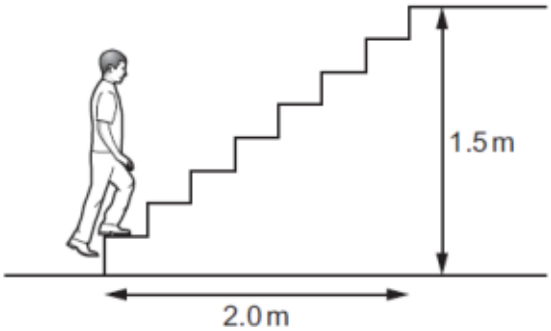


The box rests on a flat horizontal surface.

What is the maximum pressure the box can exert on the surface it rests on?

A 0.104 N/cm^2 **B** 0.208 N/cm^2 **C** 10.4 N/cm^2 **D** 20.8 N/cm^2

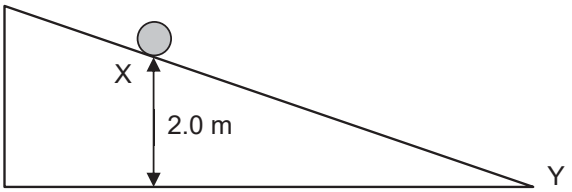
9 A student of mass 60 kg climbs some steps. He travels a horizontal distance of 2.0 m and a vertical distance of 1.5 m. The gravitational field strength g is 10 N/kg.



What is the work done against the force of gravity?

A 90 J **B** 120 J **C** 900 J **D** 1200 J

10 A ball rolls down a frictionless ramp as shown. The ball has a mass of 1.5 kg.



At point X, the ball has 5.0 J of kinetic energy.

How much kinetic energy does the ball possess at point Y?

A 5.0 J **B** 25 J **C** 30 J **D** 35 J

11 A student stands 240 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?

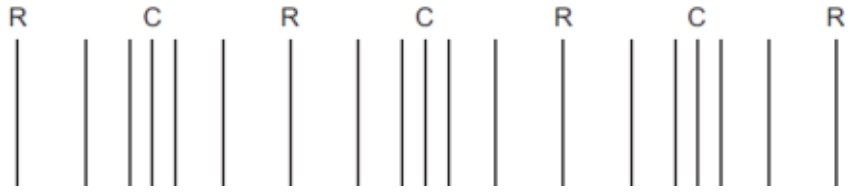
A 160 m/s **B** 320 m/s **C** 360 m/s **D** 720 m/s

12 As a sound wave travels from one medium to another, its wavelength increases.

What happens to the frequency and to the speed of the sound?

	frequency	speed
A	decrease	decrease
B	decrease	increase
C	stay constant	decrease
D	stay constant	increase

13 A sound wave in a solid is represented by a series of lines. The diagram shows compressions C and rarefactions R at one instant in time.



Which of the following statements is true?

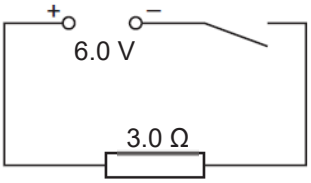
A All particles on one line move in the same direction at the same time.

B The direction of travel of the sound wave is parallel to the lines.

C The distance between a compression and its adjacent rarefaction is a wavelength.

D The pressure at R is greater than the pressure at C.

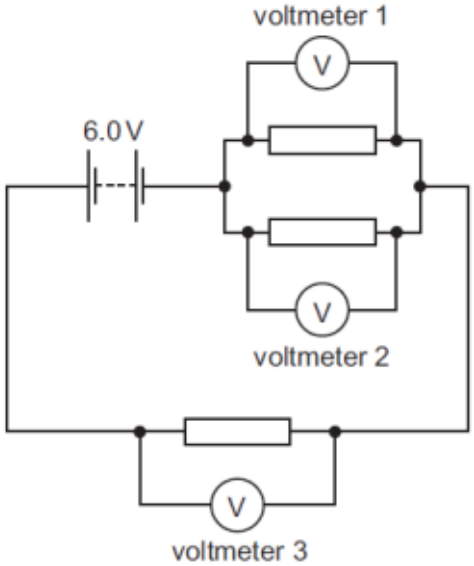
14 The circuit shown is switched on for 1.0 minute.



How much charge passes through the 3.0 Ω resistor?

A 2.0 C **B** 12 C **C** 120 C **D** 720 C

15 A 6.0 V battery, three resistors and three voltmeters are connected in the circuit shown.



Which of the following are possible readings of voltmeter 1, 2 and 3?

	voltmeter 1	voltmeter 2	voltmeter 3
A	2.0 V	2.0 V	2.0 V
B	2.0 V	2.0 V	4.0 V
C	2.0 V	4.0 V	6.0 V
D	6.0 V	6.0 V	6.0 V

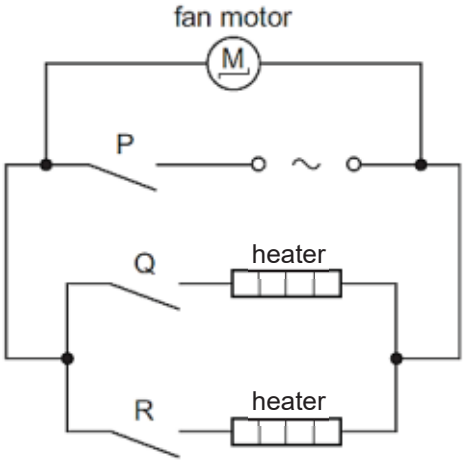
16 A piece of wire has a resistance of 16 Ω.

The wire is 20 cm long and has a cross-sectional area of 2.0 mm^2.

Which wire of the same material has a resistance of 8.0 Ω?

	length / cm	cross-sectional area / mm^2
A	10	1.0
B	10	4.0
C	20	1.0
D	20	4.0

17 The diagram shows the circuit for a hair-dryer.

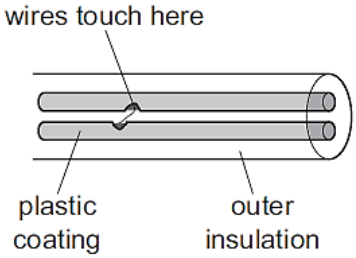


The fan motor has a power rating of 0.10 kW and the heaters each have a rating of 0.40 kW. The cost of electricity is 8.0 cents per kWh.

What is the cost of running the hair-dryer for two hours with switches P and Q closed and switch R open?

A 1.6 cents **B** 4.0 cents **C** 6.4 cents **D** 8.0 cents

18 Each wire inside a cable leading from an electric socket to a hairdryer is covered with a plastic coating. This plastic coating splits and the two wires inside the cable touch each other.



What could happen because of this?

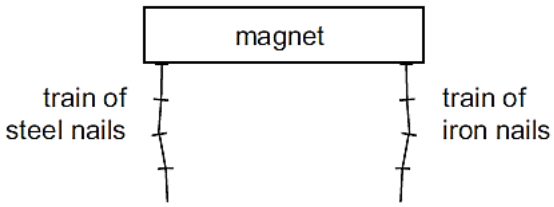
A An appliance plugged into a different socket could become switched on.

B The hairdryer plugged into the socket could be damaged.

C A person near the hairdryer could receive an electric shock.

D The circuit breaker could trip.

19 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.

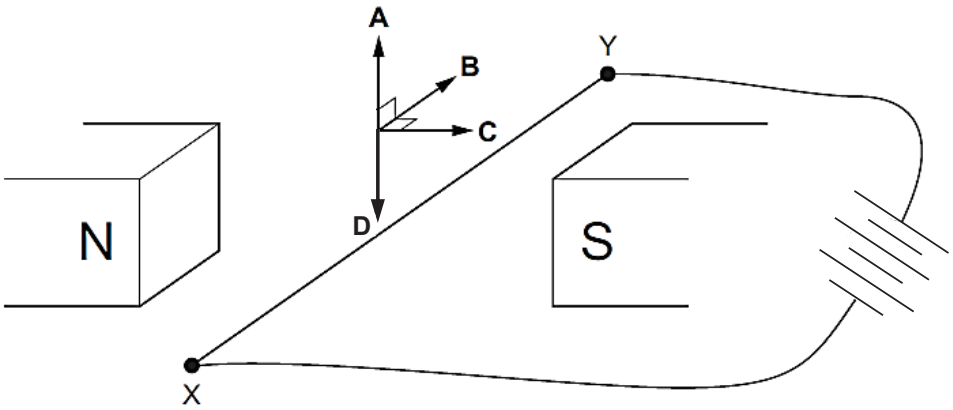
What happens to the trains?

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.

20 The diagram shows a wire XY lying between the poles of a magnet.

The ends of the wire are connected to a battery. The wire experience a force and moves.

In which direction does the wire move?



Name: _____ ( ) Class: _____

Centre Number: _____ Index Number: _____

4E/5N

KRANJI SECONDARY SCHOOL
Preliminary Examination 2
Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS)
Paper 2 **5076/02**

Tuesday **21 Aug 2018** 1 hour 15 minutes

KRANJI SECONDARY

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, index number and class in the spaces at the top of this page.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

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.

Take the acceleration due to gravity, g, to be 10 ms^{-2}.

FOR EXAMINER'S USE	
TOTAL	65

Set by: Ms Felicia Mah

This question paper consists of 17 printed pages.

[Turn over

Section A [45 marks]

Answer **all** the questions in the spaces provided.

1 Fig. 1.1 shows the velocity-time graph of a moving car.

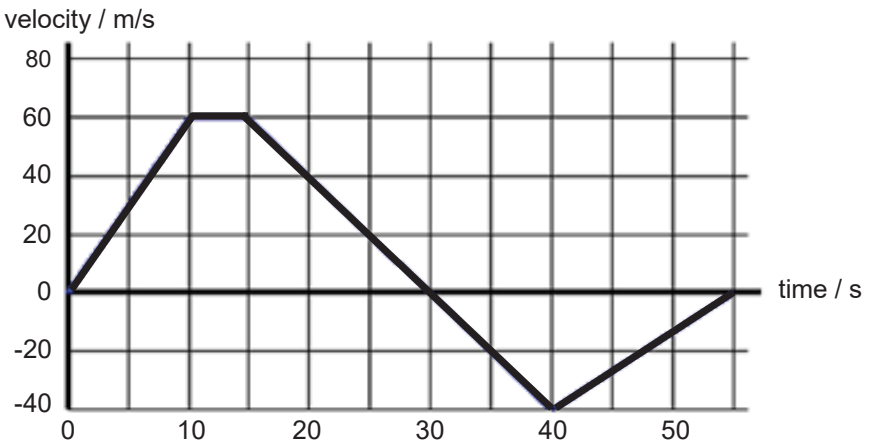


Fig. 1.1

(a) State what is meant by *acceleration*.

……

…….... [1]

(b) Calculate the acceleration of the car from 0 to 10 seconds.

acceleration = ……..... [2]

(c) Calculate the total distance travelled by the car from 0 to 55 seconds.

total distance = ……..... [2]

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(d) By considering the forward force and resistive forces on the car, explain why the speed of the car remains constant between 10 to 15 seconds.

……

……

……

…….. [2]

2 Fig. 2.1 shows a raft of 20 kg being pulled along by two boats in a still river. The forces acting on the raft by the two boats are perpendicular to each other.

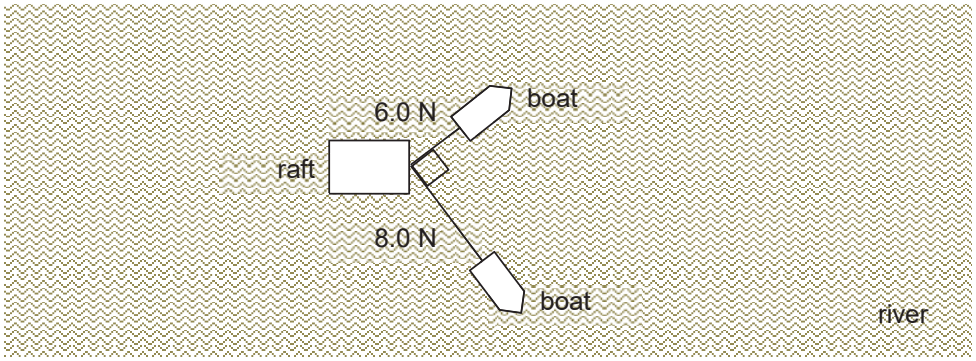

Fig. 2.1

(a) In the space below, draw a suitable vector diagram to determine the magnitude of the resultant force exerted on the raft by the two boats. State the scale used clearly.

scale = …….. : …….. [1]

resultant force = ……....… [3]

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(b) Calculate the acceleration of the raft at this moment.

acceleration = ……..... [1]

3 Fig. 3.1 represents how water is funneled into a pipe and directed to a turbine at a hydro-electric power plant. The force of the falling water rotates the turbine. Each second, 250 m^3 of water is funnelled down a vertical shaft to the turbine. The vertical height through which the water falls upon reaching the turbine is 150 m.

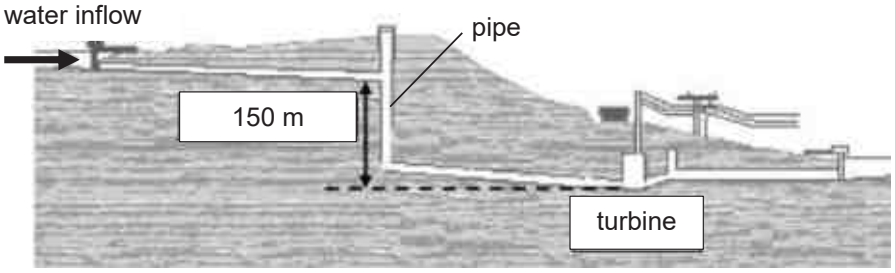

Fig. 3.1

(a) The density of water is 1000 kg/m^3.

Calculate the mass of water that enters the turbine each second.

mass = …….. [1]

(b) Calculate the loss of gravitational potential energy when the mass of water in **(a)** falls through the vertical height of 150 m.

loss of gravitational potential energy = …….. [2]

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(c) Calculate the maximum speed at which the mass of water in **(a)** reaches the turbine.

maximum speed = ……..... [2]

(d) State **one** assumption made during your calculation for part **(c)**.

…… [1]

4 Fig. 4.1 shows a man standing in an airport queue with his wheeled bag. The mass of the bag is 50 kg.

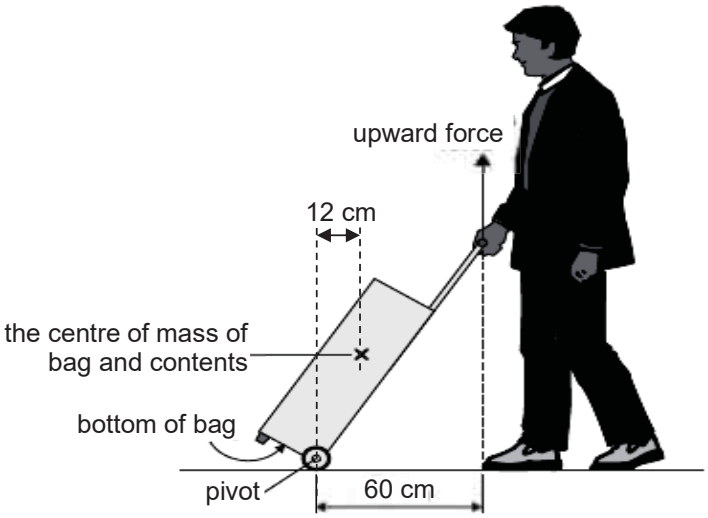

Fig. 4.1

(a) On Fig. 4.1, draw an arrow to indicate the action of the weight of the bag. [1]

(b) The man applies an upward force to the handle of his bag to stop the bag from falling.

Calculate the upward force the man applies to the handle of his bag.

upward force = ……..... [2]

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(c) Explain why the bag falls and hits the floor when the man lets go of the bag handle.

……

……

…….... [2]

5 A pure solid substance is heated into a liquid from 30°C to 90°C. The substance has a melting point of 60°C. The heating curve of the substance on the temperature-time graph is shown in Fig. 5.1.

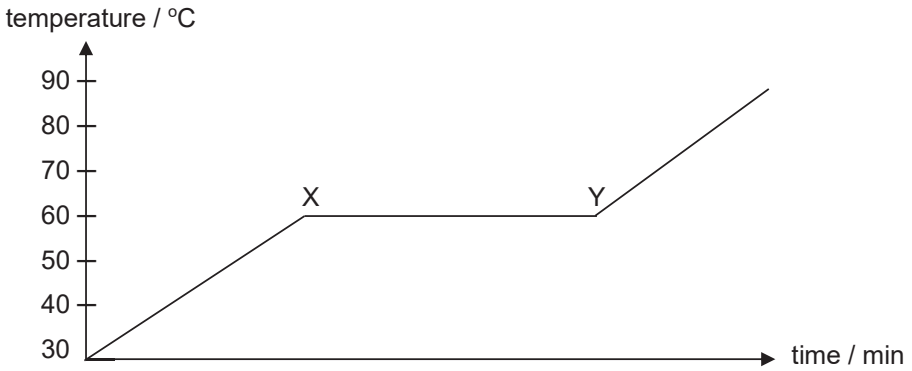

Fig. 5.1

(a) Describe the differences between the particles of the substance at 40°C and 80°C in terms of motion and arrangement.

……

……

……

……

…….... [2]

(b) Explain why the thermal energy gained by the substance during XY did not bring about a change in temperature.

……

……

…….... [2]

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6 Fig. 6.1 shows an electric kettle with its exterior made of a material of poor thermal conductivity.

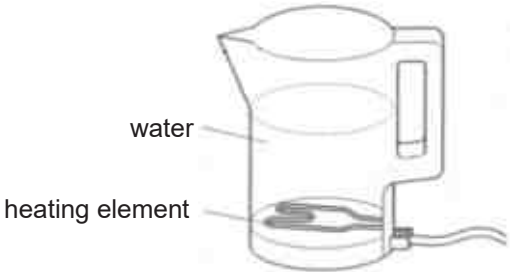

Fig. 6.1

(a) Explain how the heating element heats up all the water in the kettle.

……

……

……

……

…….. [2]

(b) The exterior of the kettle is made from white plastic.

Explain how the exterior is suitable in reducing heat loss from the kettle.

……

……

……

……

…….. [2]

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7 Fig. 7.1 shows circular wavefronts produced at the centre of a circular ripple tank. Two corks, **A** and **B**, float on the water in the ripple tank. The distance between successive wavefronts produced is 8.0 cm. Fig. 7.2 shows how the displacement of the wave varies with time.

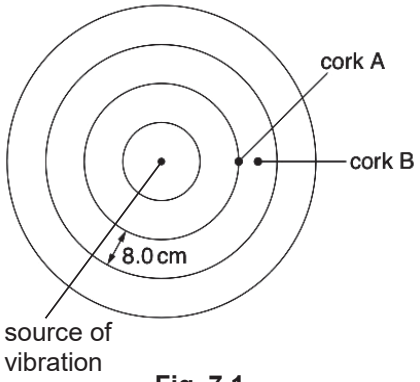

Fig. 7.1

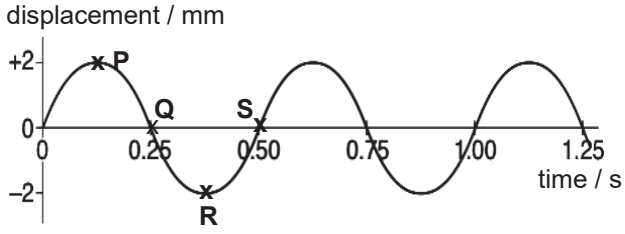

Fig. 7.2

(a) Define the term *wavefront*.

……

…… [1]

(b) Locate the possible points, **P**, **Q**, **R** or **S** as shown in Fig. 7.2 that corks **A** and **B** are positioned at that moment.

cork **A** : ……

cork **B** : …….. [1]

(c) Calculate the speed of the wave produced.

speed = ……. [2]

(d) Describe and explain what would happen to the distance between successive wavefronts when they enter a deeper region of water.

……

…… [2]

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8 **(a)** Fig. 8.1 shows an isolated positive charge.

Fig. 8.1

(i) On Fig. 8.1, draw the electric field pattern due to the charge. Show the direction of the field clearly. [1]

(ii) Explain what is meant by an *electric field*.

……..……..

……[1]

(b) Fig. 8.2 shows a child sliding down a slide made of plastic.

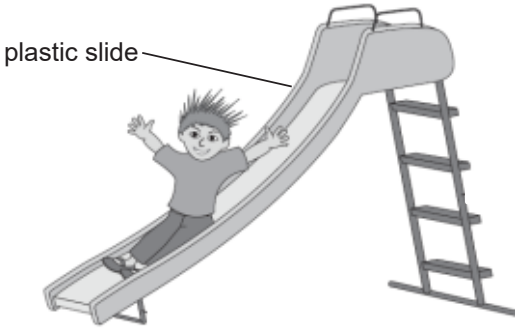

Fig. 8.2

(i) When the child slides down, he becomes positively-charged.

Explain how this happens.

……..……..

……..……..

……[2]

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(ii) Explain why the child's hair stands and spreads apart **after** going down the slide.

……..……..

……[1]

9 Fig. 9.1 shows an object and its image formed by a thin converging lens.

Fig. 9.1

(a) On Fig. 9.1 draw rays to locate accurately the following:

(i) optical centre (**C**), [1]

(ii) principal focus (**F**). [1]

(b) State how the image changes as the object is moved closer to the thin converging lens, before it reaches the focal point.

……

…… [1]

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Section B [20 marks]

Answer any **two** questions from this section.

10 **(a)** Fig. 10.1 shows a ray of light entering the surface AB of a right-angled glass prism. The refractive index of the glass is 1.49. The figure is not drawn to scale.

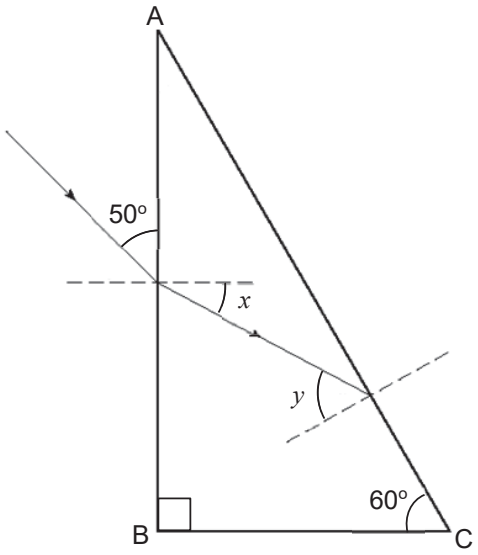

Fig. 10.1 (not to scale)

(i) Explain why the light ray bends in such a manner when it enters surface AB.

……..

…… [2]

(ii) Calculate the angle of refraction x at side AB.

angle of refraction x = …….. [1]

(iii) Calculate the critical angle of the glass block.

critical angle = …….. [1]

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(iv) State the two conditions for total internal reflection.

1. ……..

   …….. [1]

2. ……...

   …….. [1]

(v) The value of angle y is 55.6 ° .

On Fig. 10.1, continue the ray to show the path of the light after leaving surface AC. [1]

(b) The hair dryer shown in Fig 10.2 has a casing made from metal. The hair dryer has a power rating of 900 W and is used on a 240 V supply.

Fig. 10.2

(i) The hair dryer requires an earth wire in the cable.

Explain clearly the function of the earth wire.

……..

……..

……..

……..

…… [2]

(ii) The cost of using one kWh of energy is 9 cents.

Calculate the cost of using the hair dryer for 10 min.

cost = …….. cents [1]

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11 **(a)** **RA**dio **D**etection **A**nd **R**anging (**RADAR**) has many applications. It is a system used to detect and determine the distance of objects such as aircrafts. The RADAR station transmits strong radiowaves, while a receiver in the station listens for any echoes.

Fig. 11.1 shows an aircraft flying towards the radar station.

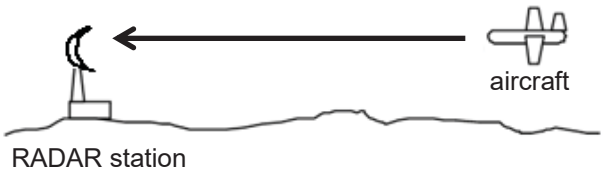

Fig. 11.1

Fig. 11.2 shows the display of the wave. **A** represents the pulse of the emitted radiowaves while **B** represents the echo of the pulse received by the RADAR station.

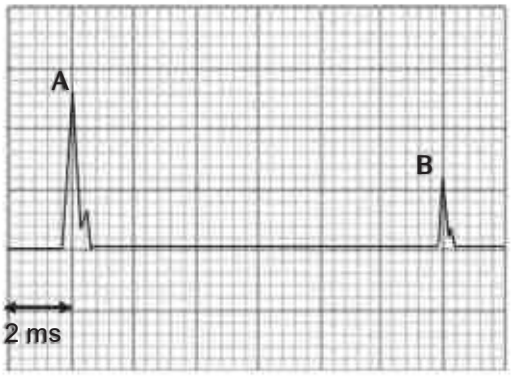

Fig. 11.2

(i) State the speed of radiowaves in vacuum.

speed = …….. [1]

(ii) Determine the distance of the aircraft from the radar station.

distance = …….. [2]

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(iii) Two minutes later, pulses **A** and **B** are only 10 ms apart.

Determine the speed of the aircraft **in m/s**.

speed = ……..m/s [2]

(iv) Suggest a reason why sound waves cannot be used to replace radiowaves in this application.

……..

…… [1]

(b) A circuit consisting of 3 different bulbs and a 12 V d.c. supply is set up as shown in the Fig. 11.3 below.

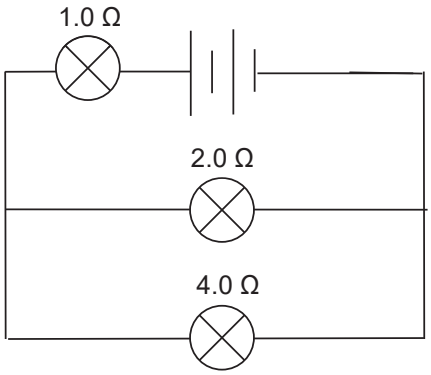

Fig. 11.3

(i) Calculate the effective resistance of the circuit.

effective resistance = …….. [1]

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(ii) Calculate the current passing through the 1.0 Ω bulb.

current = …….. [1]

(iii) An additional 3.0 Ω bulb is added in parallel to the 4.0 Ω bulb.

Explain what happens to the brightness of the 1.0 Ω bulb.

……..

…… [2]

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12 **(a)** A student sets up the apparatus as shown in Fig. 12.1 to demonstrate how a door bell works.

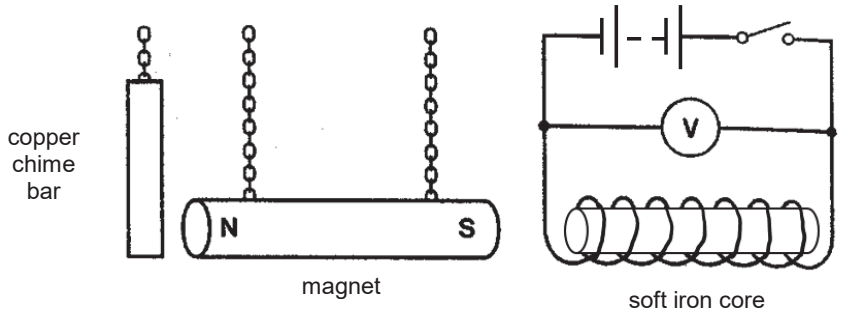

Fig. 12.1

(i) Explain why the magnet moves towards the iron core when the switch is open.

……..

……..

…… [2]

(ii) Explain why the magnet hits the copper chime bar when the switch is closed.

……..

……..

…… [2]

(iii) The battery of the electromagnet is replaced with an alternating current (a.c.) supply. Describe and explain why the door bell will ring continuously when the switch is closed.

……..

……..

……..

…… [2]

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(b) A current-carrying wire is placed between two electromagnets as shown in Fig. 12.2.

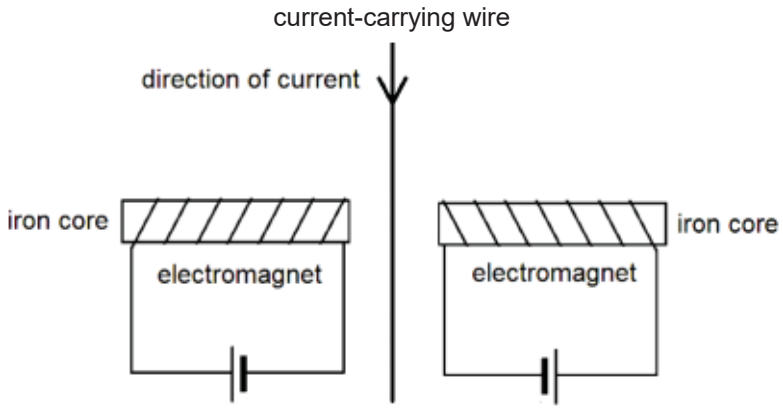

Fig. 12.2

When current flows through both coils, the current-carrying wire experiences a force.

(i) On Fig. 12.2, label the magnetic polarities on the ends of both electromagnets with "S" and "N". [1]

(ii) Explain why the current-carrying wire will experience a force.

……..

……..

…… [1]

(iii) State the direction of the force experienced by the current-carrying wire.

…… [1]

(iv) Suggest **one** way to increase the strength of the force experienced by the current-carrying wire.

…… [1]

End of Paper

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1	2	3	4	5	6	7	8	9	10
B	B	B	D	A	B	B	B	C	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
B	D	A	C	B	D	D	D	C	A

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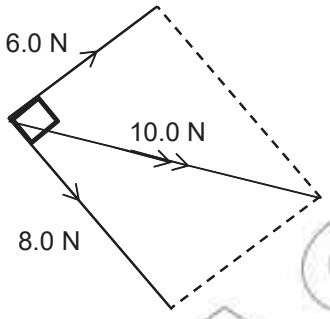
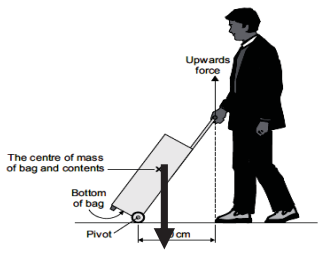
Sec 4E/5N Sci(Physics) Prelim Paper 2 2018 Answers

No formula -1m
Wrong/missing unit -1m
No 2/3 sf -1m

Section A [45 marks]

1a	Acceleration is the rate of change of velocity.	1
1b	a = (v – u)/t = (60 – 0)/10 = **6.0 m/s^2**	 1 1
1c	Distance = area under graph = ½(5+30)(60) + ½(25)(40) = **1550 m**	 1 1
1d	The **forward force is equals to the resistive forces** acting on the car, hence there is no resultant force. This means the car has **no acceleration** as F = ma. Hence, the speed of the car remains constant.	1 1
2a	 scale = 1 cm : 1 N resultant force = 10cm x 1N = 10 N	1 for scale 3 for drawing (must include arrows and labels)
2b	F = ma 10 = 20a a = **0.50 m/s^2** (allow ecf)	 1
3a	density = mass/volume 1000 = mass/250 Mass = 1000 x 250 = **250000 kg**	 1
3b	GPE = mgh = 250000 x 10 x 150 = **375 000 000 J**	
3c	GPE lost = KE gained 375 000 000 = ½ mv^2 375 000 000 = ½ (250000)(v^2) v = 54.77 = **54.8 m/s (3 s.f.)**	 1 1
3d	No energy is lost to the surroundings. / All the GPE is converted to KE.	1
4a		1 for arrow
4b	Sum of ACWM = Sum of CWM F x 60 = 500 x 12 F = 6000 / 60 = **100 N**	 1 1

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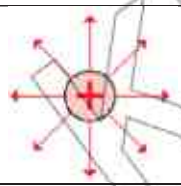
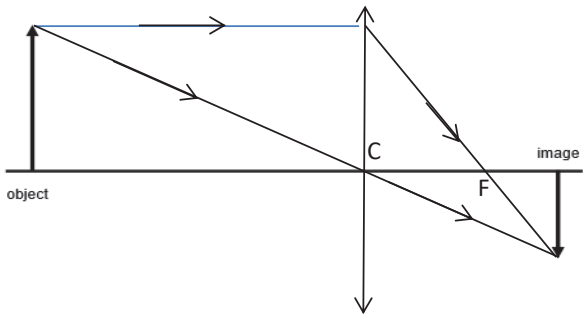
4c	The **<u>line of action of weight of the bag lies to the right of the pivot / outside the base area (bottom of bag)</u>**, which **<u>produces a clockwise moment</u>** about the pivot, hence the bag will fall and hit the ground.	1 1
5a	At 40°C, the substance is a solid. Motion: vibrate about its fixed positions Arrangement: closely packed in an orderly arrangement At 80°C, the substance is a liquid. Motion: slide past one another freely Arrangment: closely packed in an inorderly arrangment	1 for all 3 1 for all 3
5b	At XY, the substance is melting. Energy taken in is used to overcome forces of attraction between particles. KE remains constant, hence temperature remains constant.	1 1
6a	When the water near the heating element is heated, it **expands**, becomes **less dense** and **rises**. The **cooler** water at the top which is **denser** will **sink** to take its place. The **process repeats** until all the water is heated up via **convection**.	2 (-1 if answer is not fully complete)
6b	Plastic is a **poor conductor of heat**. Hence, it **decreases the rate of thermal energy loss** via conduction. White surface is a **poor emitter of infrared radiation**. This **decreases the rate of thermal energy loss** via radiation.	1 1
7a	An imaginary line that joins all adjacent points in phase. **OR** An imaginary line that joins all crests.	1
7b	P and R **OR** Q and S	1 for any pair
7c	v = fλ = (1/0.5)(8) = **<u>16 cm/s or 0.16 m/s</u>**	 1 1
7d	As the wave travels at a **<u>faster speed</u>** in deeper region, the **<u>wavelength will be longer</u>** since v = fλ and frequency remains the same.	1 1
8ai		
8aii	It is a region where an electric charge experiences an electric force.	1
8bi	When the child slides down, friction causes **<u>negatively-charged electrons to move from the child to the plastic slide</u>.** Since the child has a **<u>deficit of negative charges</u>**, the child is positively-charged.	
8bii	Since the child's hair is positively-charged, they will move away from each other as **<u>like charges repel</u>**.	1
9a		1 for C 1 for F
9b	The image becomes larger.	1

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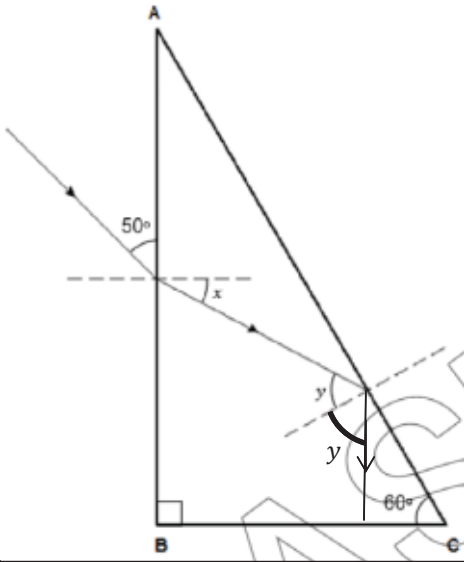
Section B [20 out of 30 marks]

10ai	When the light ray travels from an **optically less dense medium (air) to denser medium (glass)**, it will **bend towards the normal** as its **speed decreases**.	2 for all 3 points
10aii	n = sin i / sin r 1.49 = sin 40 / sin x x = $\sin^{-1}$((sin 40) /1.49) = 25.5565 = **25.6° (3 s.f.)**	1
10aiii	n = 1/sin c 1.49 = 1/sin c c = $\sin^{-1}$(1/1.49) = 42.155 = **42.2^0 (3 s.f.)**	1
10aiv	1. The angle of incidence must be greater than the critical angle. 2. The light ray must be travelling from an optically denser to less dense medium.	1 1
10av		1 for ray correctly drawn, showing that TIR occurred and angle of incidence = angle of reflection
10bi	When a fault occurs and the live wire touches the metal casing, the metal casing will become "live". The earth wire will conduct the current from the metal casing to the ground. The current will melt the fuse and break the circuit, disconnecting the circuit from the high voltage supply. This prevents user from electric shock.	2 (2 points = 1m)
10bii	E = Pt = 0.9 x 1/6 = 0.15 kWh cost = 0.15 x 9 = **1.35 cents**	1
11ai	3.0 x 10^8 m/s	1
11aii	d = s x t = 3.0 x 10^8 x 12 x 10^{-3} = **3 600 000 m or 3.6 x 10^6 m**	1 1
11aiii	d = s x t = 3.0 x 10^8 x 10 x 10^{-3} = **3 000 000 m or 3.0 x 10^6 m** 3 600 000 – 3 000 000 = 600 000 m Speed = 600 000/120 = **5000 m/s**	1 1
11aiv	Sound waves take a longer time to be transmitted and received, hence position of aircraft is not accurate. **OR** Position of aircraft would have changed when the echo is received.	1
11bi	R = 1 + (½ + ¼)$^{-1}$ = **2.33 Ω**	1 1
11bii	V = IR 12 = I(2.33)	

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	I = 12/2.33 = 5.1428 = **5.14 A (3 s.f.)**	1
11biii	The bulb will become **brighter**. The **total resistance of the circuit will decrease**, causing the total current flowing through the 1.0 Ω bulb to increase.	1 1
12ai	When the switch is open, the soft iron core which is near the magnet will be induced with a N-pole on the left. Since unlike poles attract, the magnet will be attracted and move towards the iron core.	1 1
12aii	When switch is closed, current flows through the coil, producing a strong magnetic field with a S-pole of the left side. Since like poles repel, the magnet will be repelled and move away from the iron core.	1 1
12aiii	When switch is closed, the **direction of current will change** continuously, causing the **magnetic poles of the iron core to change** continuously as well. This causes the magnet to be **attracted and repelled continuously**. The magnet will then hit the copper chime bar, causing the door bell to ring continuously .	1 1
12bi	N S N S	1
12bii	The current-carrying wire will experience a force due to the **interaction** between the magnetic field of the electromagnets and the magnetic field produced by the current-carrying wire.	1
12biii	Into the page	1
12biv	Increase the current flowing through wire / increase current flowing through the coils / increase number of turns per unit length of the coils	1

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O Level Centre/ Index Number /	Class	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

SCIENCE (PHYSICS, CHEMISTRY) **5076/01**
Paper 1 **24 August 2018**
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class, index number and Centre number on the Answer Sheet in the spaces provided.

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.

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.
A copy of the Periodic Table is printed on page 15.
The use of an approved scientific calculator is expected, where appropriate.

The total number of marks for this paper is 40.

For Examiner's Use
40

This document consists of **15** printed pages.

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1 Figure 1a shows the zero reading of the micrometer screw gauge. Figure 1b shows the reading of the same micrometer screw gauge when it measures the thickness of a wire.

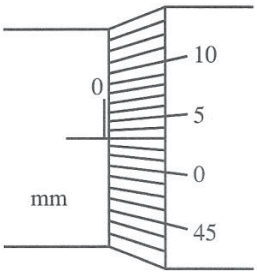


Figure 1a

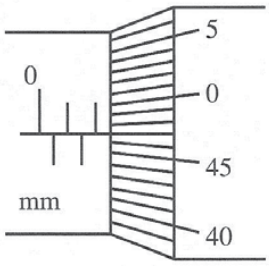


Figure 1b

What is the thickness of the wire?

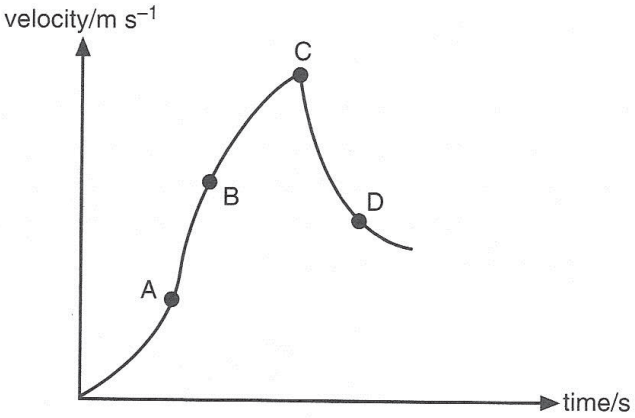
A 2.44 mm

B 2.47 mm

C 2.50 mm

D 2.97 mm

2 The graph shows how the velocity of an object changes with time. Which point on the graph shows the object moving with the greatest acceleration?



3 The weight of a piece of rock on a planet where the gravitational acceleration on the planet is 4 m/s^2 is 20 N. What is the weight of the rock on earth where the gravitational acceleration on earth is 10 m/s^2?

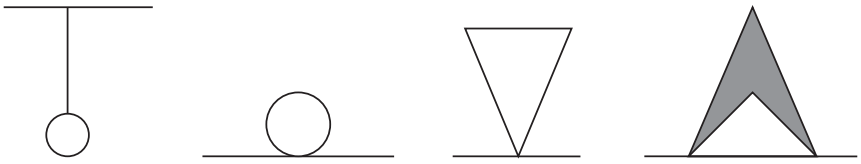
A 2 N

B 20 N

C 40 N

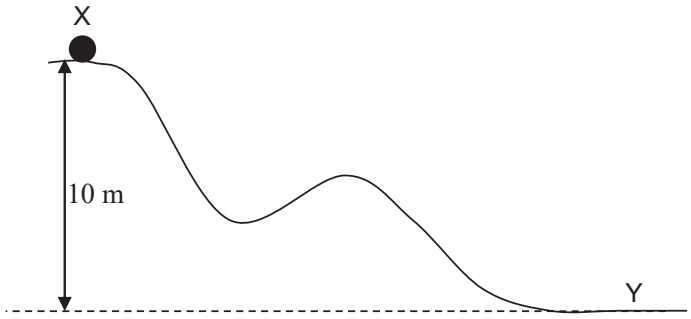
D 50 N

4 Which option best represents the stable equilibrium?



A **B** **C** **D**

5 A ball bearing is placed at point X on a smooth track as shown in the diagram below. The ball moves from rest down the track and passes a point Y which is 10 m below point X. Taking *g* as 10 ms^{-2}.



What is the speed of the ball at point Y?

A 10.0 m/s

B 14.1 m/s

C 100 m/s

D 141 m/s

6 Brownian motion of dust particles in the air is caused by

A convention current in the air.

B dust particles falling towards the ground.

C random collisions between the dust particles.

D random collisions of air molecules with the dust particles.

7 Internal energy of a body is

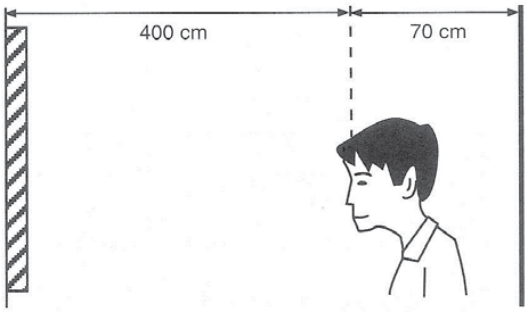
A the total kinetic energy of all the particles in the body.

B the total potential energy of all the particles in the body.

C the total kinetic energy and potential energy of all the particles in the body.

D the energy needed to keep the internal part of the body at room temperature.

8 The diagram below shows a plane mirror placed at a distance of 400 cm in front of a man.



If the doctor's test card is fixed at 70 cm behind the eyes of the man, what is the distance of the test card's image from the man?

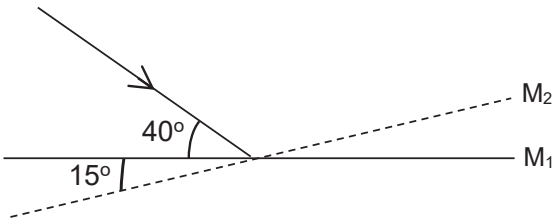
A 470 cm

B 800 cm

C 870 cm

D 940 cm

9 A ray of light strikes a plane mirror M_1 at an angle of 40°. The mirror is now rotated anticlockwise through an angle of 15° to a new position M_2 without changing the direction of the incident light ray.



What is the angle of reflection when the mirror is rotated to a new position M_2?

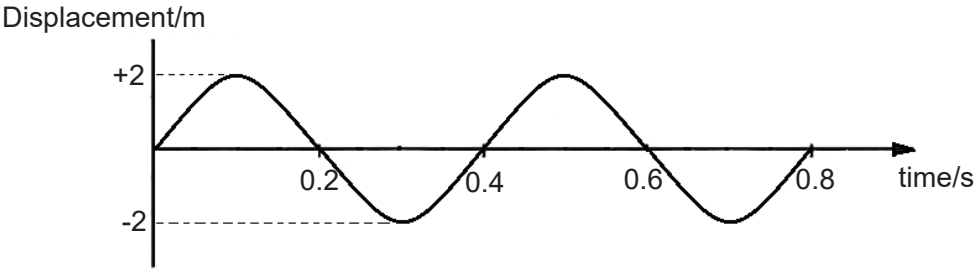
A 15°

B 35°

C 50°

D 55°

10 The graph represents the displacements of a particle that is along a transverse wave traveling at a speed of 5 m/s.



What is the frequency of the vibration of the particle?

A 1.25 Hz

B 2.5 Hz

C 5.0 Hz

D 12.5 Hz

11 The diagram shows different regions of the electromagnetic spectrum.

Gamma rays		**X**	Visible light		**Y**	Radio waves

What regions do **X** and **Y** represent?

	X	**Y**
A	Ultraviolet	Infrared
B	Infrared	X-ray
C	X-ray	Microwave
D	Ultraviolet	Microwave

12 One of the following devices does not make use of electromagnetic waves in its operation. Which one is it?

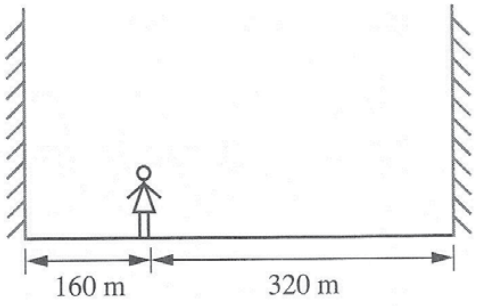
A A camera

B A radio set

C A loudspeaker

D A television set

13 A student stands between two walls and claps his hands once. The speed of sound in air is 320 m/s.



What is the time interval between the first echo and the second echo?

A 0.5 s

B 1.0 s

C 2.0 s

D 3.0 s

14 When an ebonite rod is rubbed with a duster, the rod becomes negatively charged. Why is this so?

A The duster loses electrons.

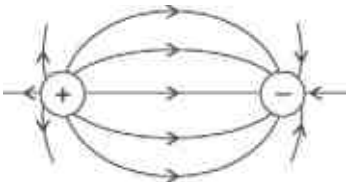
B The duster gains protons.

C The rod loses electrons.

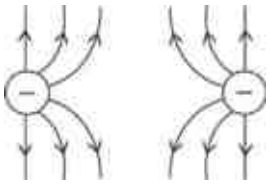
D The rod gains protons.

15 Which of the diagrams illustrating the electric field between two charged objects is **<u>incorrect</u>**?

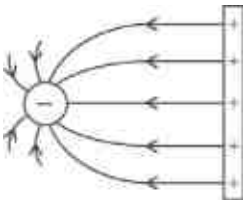
A



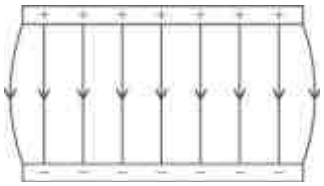
B



C



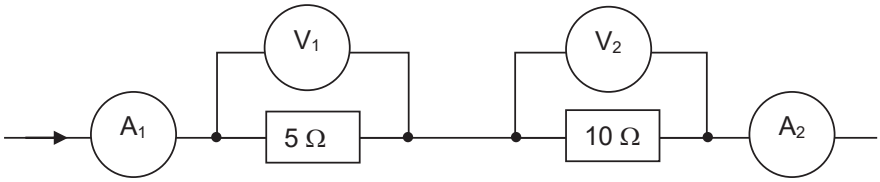
D



16 A piece of 0.50 m iron wire has a cross-sectional area of 1.0 mm^2. Which iron wire has twice the resistance?

	Length / m	Area / mm^2
A	0.25	2.0
B	0.50	2.0
C	0.50	0.5
D	1.00	2.0

17 Current flows in two resistors connected in series as shown in the diagram, A_1 and A_2 are the readings on the ammeters. V_1 and V_2 are the readings on the voltmeters.



Which of the following correctly describes the ammeter and voltmeter readings?

	Ammeter readings	Voltmeter readings
A	A_1 is less than A_2	V_1 is less than V_2
B	A_1 is less than A_2	V_1 is greater than V_2
C	A_1 is equal to A_2	V_1 is less than V_2
D	A_1 is equal to A_2	V_1 is equal to V_2

18 An electric heater is connected to a 3-pin socket. The current in the live wire is 1 A. The potential difference between the live and neutral wire is 240 V. Which of the following correctly describes the current in neutral wire and the potential difference between the neutral and earth wire?

	Current in neutral wire / A	Potential difference between neutral and earth wire / V
A	0	240
B	1	240
C	0	0
D	1	0

19 Which of the following methods is used to confirm that an object is a magnet?

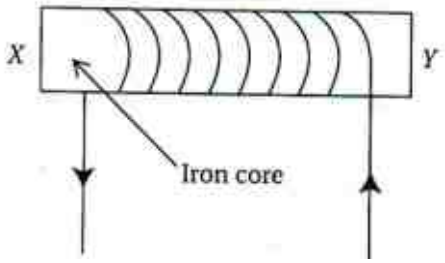
A It can attract an iron rod but not a wooden spoon.

B It can attract the north pole of another magnet.

C It can repel the south pole of another magnet.

D It can repel a magnetic material.

20 The figure below shows a current flowing through a solenoid wrapped around an iron core.



Which statement is **not** true?

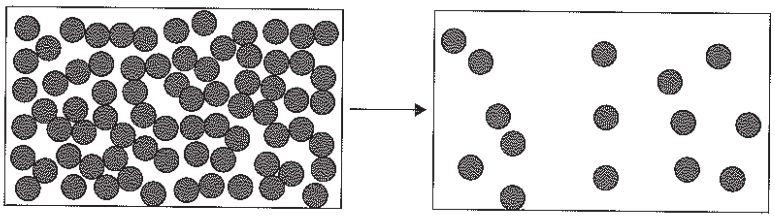
A The end X becomes a south pole.

B The increase in current can increase the strength of the magnetic field produced.

C The strength of the magnetic field becomes weaker if the iron core is replaced with an insulator.

D A compass placed near end X and later near end Y shows the same direction of deflection.

21 The diagram below represents a change in the arrangement of particles in two different physical states.



Which of the following statements is true about the change?

A The particles lose energy.

B The forces of attraction between the particles become weaker.

C The temperature of the surroundings rises due to the change.

D There is an increase in the orderliness of the particles.

22 An ion X^{2+} has a nucleon number 40 and 18 electrons.

What will the nucleus of the ion X^{2+}contain?

	number o f protons	number of neutrons
A	18	22
B	19	21
C	20	20
D	21	19

23 Element X has a proton number of 13. Element Y has a proton number of 8.

What is the chemical formula of the compound formed when X and Y react?

A XY_3

B X_2Y_3

C X_3Y

D X_3Y_2

24 Hydrogen sulfide burns in oxygen according to the following equation:

$$2H_2S(g) + 3O_2(g) \rightarrow 2H_2O(g) + 2SO_2(g)$$

48 dm^3 of hydrogen sulfide is burned.

Calculate the volume of oxygen needed to burn 48 dm^3 of hydrogen sulfide completely.

A 24 dm^3 **B** 48 dm^3

C 72 dm^3 **D** 96 dm^3

25 Which ionic equation represents the reaction between hydrochloric acid and magnesium ribbon?

A $Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$

B $Mg^{2+}(aq) + 2Cl^-(aq) \rightarrow MgCl_2(aq)$

C $Mg^{2+}(aq) + 2HCl(aq) \rightarrow MgCl_2(aq) + 2H^+(aq)$

D $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

26 A salt is prepared by titrating an acid with a base.

Which of the following is correct about the acid and the base?

	acid	base
A	insoluble	insoluble
B	insoluble	soluble
C	soluble	insoluble
D	soluble	soluble

27 A red-brown precipitate was produced when an excess of aqueous sodium hydroxide was added dropwise to salt **B**.

In another experiment, a white precipitate was produced when dilute nitric acid and aqueous barium nitrate were added to salt **B**.

What is the identity of salt **B**?

A iron(II) chloride

B iron(II) sulfate

C iron(III) chloride

D iron(III) sulfate

28 What does **not** increase across a period of the Periodic Table?

A the nucleon number

B the number of protons

C the number of electron shells

D the number of valence electrons

29 Caesium is a Group I element in the Periodic Table and its relative atomic mass is greater than that of potassium.

Which of the following statements concerning caesium is **incorrect**?

A Caesium has a higher melting point than potassium.

B Caesium has a higher density than potassium.

C Caesium reacts with water more violently than potassium.

D Caesium corrodes in air to form an oxide, Cs_2O.

30 Brass is an alloy of copper and zinc.

Which statement is correct?

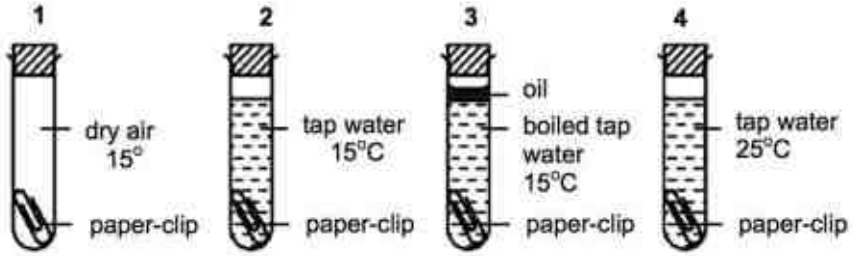
A Brass can be represented by a chemical formula.

B Brass has a fixed melting point and boiling point.

C Brass is formed by a chemical reaction between copper and zinc.

D Brass is stronger and harder than pure copper and pure zinc.

31 Four paper clips are placed in four different test-tubes as shown below.



Which two test-tubes can be used to show that oxygen is needed for iron to rust?

A 1 and 2 **B** 2 and 3

C 2 and 4 **D** 3 and 4

32 Equal masses of calcium carbonate was reacted with an excess of dilute hydrochloric acid at room temperature.

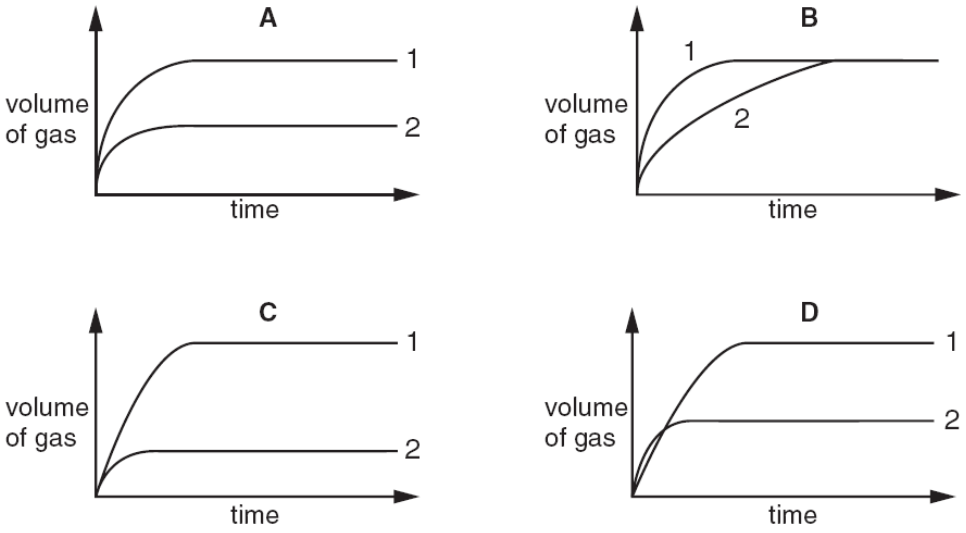
$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

Two experiments were carried out.

Experiment 1: 50 cm^3 of 0.200 mol/dm^3 hydrochloric acid was used.

Experiment 2: 50 cm^3 of 0.100 mol/dm^3 hydrochloric acid was used.

Which of the graphs best represents the results?



33 Four different solids Q, R, S and T, are dissolved in equal volumes of water at 25 ^{0}C.
The table shows the change in temperature of the surrounding when each solid dissolves.

	Q	R	S	T
change in temperature of the surrounding / ^{0}C	-5	+7	+12	-8

Which row describes the energy changes when each solid is dissolved in water?

	solid which dissolves	type of energy change	solid which dissolves	type of energy change
A	S	endothermic	Q	exothermic
B	T	exothermic	R	endothermic
C	R	endothermic	Q	exothermic
D	S	exothermic	T	endothermic

34 Which underlined substance in the following reactions acts as an oxidising agent?

A $H_2 + \underline{CuO} \rightarrow H_2O + Cu$

B $\underline{2\ Fe^{2+}} + Cl_2 \rightarrow 2\ Fe^{3+} + 2\ Cl^-$

C $\underline{Zn} + Pb^{2+} \rightarrow Zn^{2+} + Pb$

D $2H^+ + \underline{MgO} \rightarrow Mg^{2+} + H_2O$

35 A sample of polluted air collected from a factory is bubbled through water. The pH of the solution formed is less than 7.

Which gas could have caused this?

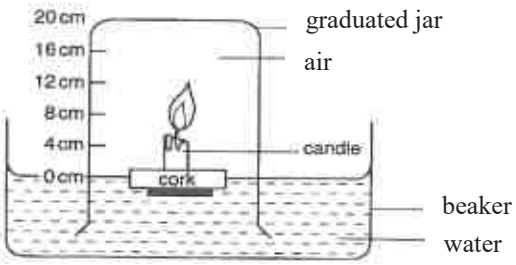
A methane

B carbon monoxide

C nitrogen dioxide

D unburnt hydrocarbon

36 A wax candle was fixed to a weighted piece of cork and floated on water. The candle was then lit and covered with a graduated jar.



What will be the water level when the flame extinguishes?

A 4 cm **B** 8 cm

C 12 cm **D** 16 cm

37 The table shows the boiling points of two fractions, X and Y, obtained when crude oil is distilled.

fraction	X	Y
boiling point / ^{0}C	35 – 75	higher than 250

Which statement regarding the two fractions is correct?

A Fraction X is less viscous than fraction Y.

B Fraction X is less flammable than fraction Y.

C Fraction X is in lower demand than fraction Y.

D Fraction X contains molecules of larger molecular size than fraction Y.

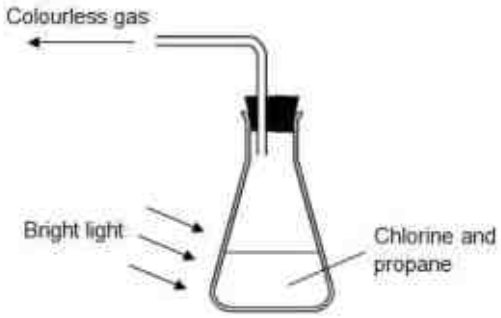
38 Long chain alkanes were cracked and the following useful products were obtained.

I **X** (used as a fuel)
II **Y** (used to make plastics)
III other products

What could be the possible identities for products **X** and **Y**?

	X	**Y**
A	methane	ethane
B	methane	ethene
C	naphtha	ethane
D	naphtha	ethene

39 A mixture of chlorine and excess propane was exposed to bright light. When the light was switched on, the mixture in the flask began to bubble, giving off a colourless gas.



What is the gas evolved?

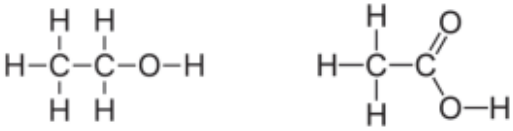
A chlorine

B propane

C hydrogen

D hydrogen chloride

40 The structural formulae of two compounds are shown below.



Which of the following substances can be used to distinguish the two compounds?

A limewater

B marble chips

C aqueous bromine

D aqueous sodium hydroxide

The Periodic Table of Elements

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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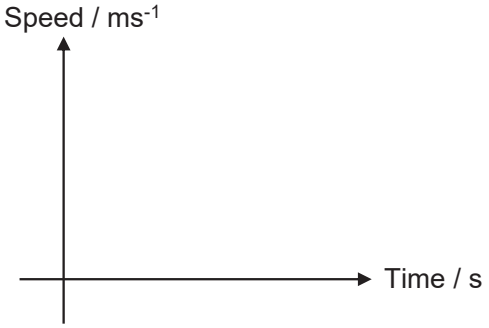
Section A

Answer **all** the questions in the spaces provided.

1 A tennis ball of mass 80 g moved up a smooth ramp with an initial speed of 12 m/s and stopped after 6 seconds.

(a) Sketch the speed-time graph for the first 6 seconds of the ball's motion. [1]



(b) Calculate the acceleration of the tennis ball as it moved up the ramp.

acceleration = …….…….. m/s^2 [2]

(c) Calculate the resultant force acting on the tennis ball as it moved up the ramp.

resultant force = …….…….. N [1]

(d) Calculate the greatest distance of the tennis ball from its starting point.

distance = …….…….. m [2]

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[Turn over

2 200 cm^3 of a sugar solution A of density 1 200 kg/m^3 is mixed with 300 cm^3 of another sugar solution B of density 1.10 g/cm^3.

(a) Calculate the mass of sugar solution A and another sugar solution B.

mass of sugar solution A = …….…….. g

mass of sugar solution B = …….…….. g [2]

(b) Hence, calculate the density of the mixture.

density of the mixture = …….…….. g/cm^3 [2]

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3 Fig. 3.1 shows a man of mass 60 kg standing on one end of a plank, getting ready to cross a stream. The plank is pivoted at point X. The gravitational field strength is 10 N / kg.

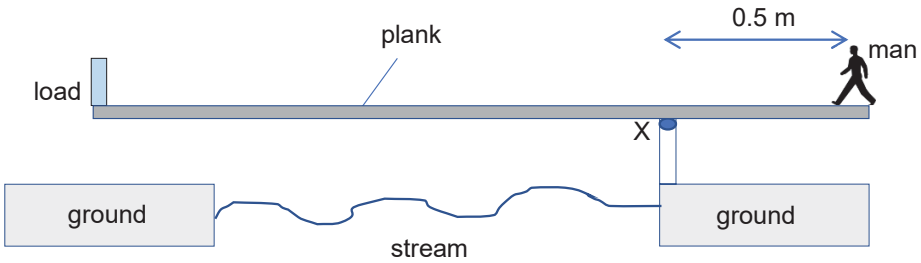

Fig. 3.1

The plank has a mass of 20 kg and is 2.5 m long with a uniform cross-section. One end is 0.5 m from the pivot at X. A load is placed on the other end to balance the plank horizontally.

(a) **1.** Calculate the anticlockwise moment due to the weight of the plank.
2. Hence, using Principle of Moments to determine the weight of the load to balance the plank horizontally.

anticlockwise moment = …….. Nm
[2]
weight = …….. N

(b) Explain why the load touches the ground when the man walks towards the pivot at X.

……

……

……

……

…… [2]

4 Fig. 4.1 shows an electric motor of power 100 W used to pull a load of 60 kg up an incline plane at a constant speed. The motor takes 30 s to move the load through a distance of 5.0 m on the incline and through a height of 4.0 m.

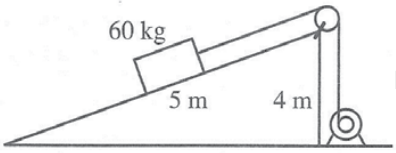

Fig. 4.1

(a) Calculate the energy dissipated by the motor.

energy = …….. J [2]

(b) Determine the gain in potential energy of the load.

potential energy = …….. J [2]

(c) Explain why there is a difference in the answers calculated in **(a)** and **(b)**.

……...……

……... [1]

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5 The interior of a refrigerator is shown in Fig. 5.1.

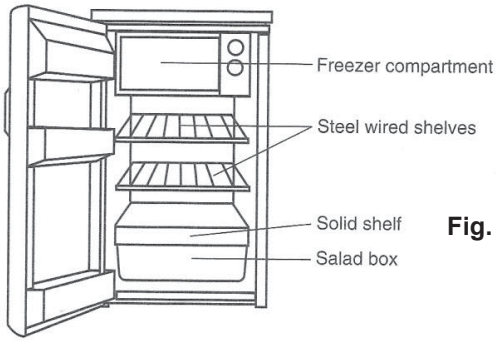

Fig. 5.1

(a) Explain how the refrigerator is cooled by convection.

……

……

……

……

…… [2]

(b) Give two reasons why steel wired shelves are used rather than solid shelves in the centre of the refrigerator.

……

……

……

…… [2]

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(c) The refrigerator walls are insulated using both expanded polystyrene and aluminium foil as shown in Fig. 5.2.

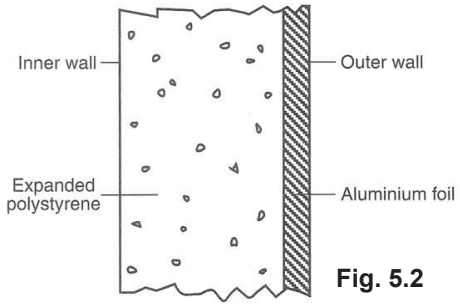

Fig. 5.2

Explain how these two materials reduce thermal energy entering the refrigerator.

……

……

……

…… [2]

6 Fig. 6.1 shows the path of light ray as it passes through a glass prism.

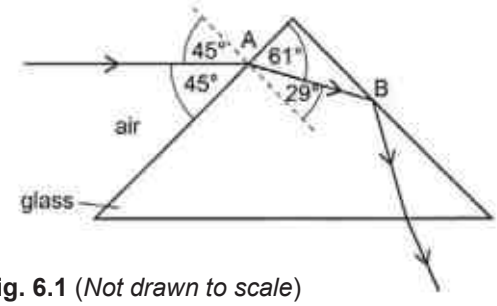

Fig. 6.1 (*Not drawn to scale*)

(a) Using angles from Fig. 6.1, calculate the refractive index of the glass.

refractive index = …… [1]

(b) Calculate the critical angle of the glass prism.

critical angle = ... [1]

(c) Explain why the ray does not emerge from the prism at **B**.

.....

.....

.....

.....

..... [2]

7 The potential difference against current characteristic graphs for three conductors P, Q and R are shown in Fig. 7.1.

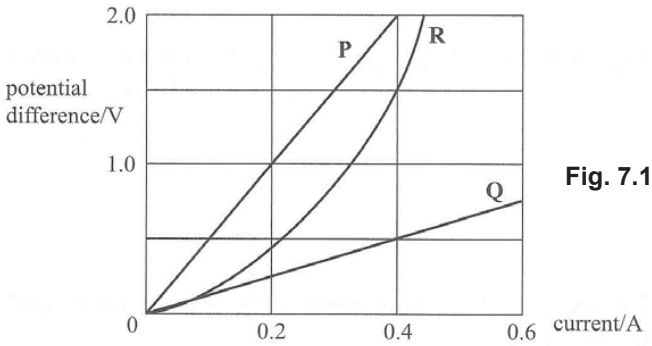

Fig. 7.1

(a) Using Fig. 7.1, state which of the conductor(s) obey(s) Ohm's Law. Explain your answer.

.....

.....

.....

..... [2]

(b) Calculate the resistance of conductor P.

resistance = ……. Ω [1]

(c) If the conductors R and Q are connected in series, with a current of 0.4 A flowing, state what would be the potential difference across

(i) R,
(ii) Q,
(iii) the series combination of R and Q.

potential difference across R = ……. V

potential difference across Q = ……. V

potential difference across the series combination of R and Q = ……. V
[1]

8 Fig. 8.1 shows an electric circuit.

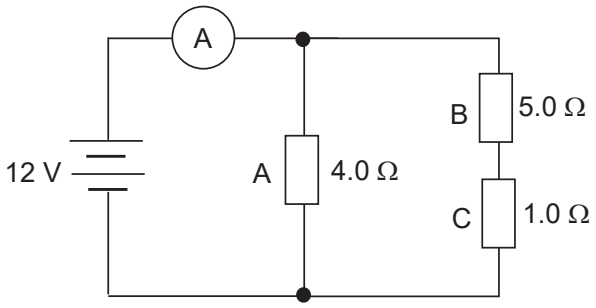

Fig. 8.1

(a) Determine the ammeter reading in the circuit.

ammeter reading = ……. A [2]

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(b) Find the current flowing through resistor C.

current = ……. A [1]

(c) Calculate the potential difference across resistor B.

potential difference = ……. V [1]

(d) Calculate the amount of charge flowing through resistor A in 30 s.

amount of charge = ……. C [2]

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9 **(a)** Fig. 9.1 shows a circuit breaker with the contact closed.

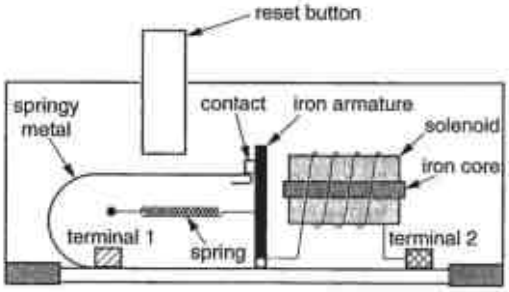

Fig. 9.1

Fig. 9.2 shows the same circuit breaker after a large current has passed through the circuit.

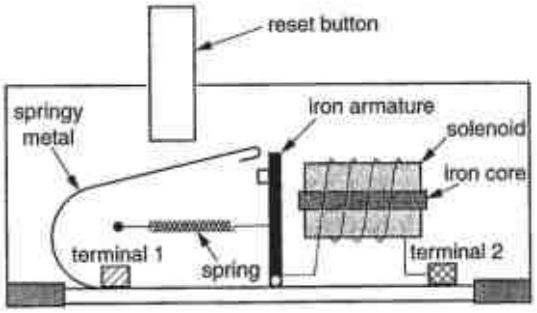

Fig. 9.2

Describe how the circuit breaker is able to switch off the current when a fault causes the current to become too large.

……

……

……

……

……

…… [3]

(b) Fig. 9.3 shows a rigid wire is held between the poles of a magnet. When the current is switched on, there is a force on the wire in an upward direction as shown in Fig. 9.3.

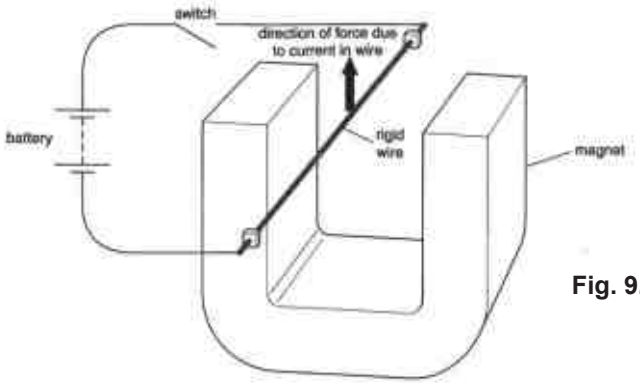

Fig. 9.3

(i) Explain why there is a force acting on the wire.

.....

.....

.....

.....

..... [2]

(ii) On Fig. 9.3, draw an arrow to show the direction of the current flowing in the rigid wire and label the north pole of the magnet with the letter **N**. [1]

Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

10 **(a)** A mass of weight 7.0 N hanging on the end of a string is pulled sideways so that the string makes an angle of 30° with the vertical as shown in Fig. 10. 1.

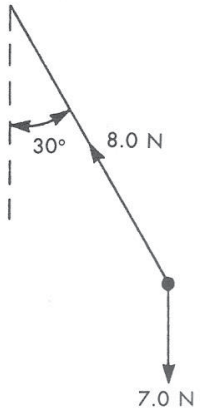

Fig. 10.1
(Not drawn to scale)

By means of a scale diagram, determine the resultant force due to the tension in the string and the weight of the mass.

resultant force = …….. [3]

(b) Fig. 10. 2 shows a block of mass of 4.0 kg resting on a table. A force of 5.0 N is applied to the block pulling it at a constant speed of 1.5 m/s. Assume that g = 10 N/kg.

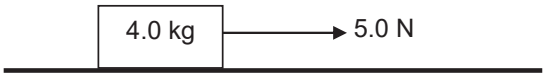

Fig. 10.2

(i) State the size of the frictional force acting on the block and explain how you obtain the answer.

……

……

……

……

…… [2]

(ii) State the direction of this frictional force.

……

…… [1]

(iii) The applied force is increased until the block moves at an acceleration of 2 m/s^2. Calculate the new applied force.

applied force = …….. [2]

(iv) Find the pressure of the block acting on the table if the dimension of the base of the block is 1.0 m by 0.5 m.

pressure = …….. [2]

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[Turn over

11 **(a)** Thermal energy is supplied at a constant rate using a 40 W electric heater to a liquid in a beaker. A graph of temperature recorded by the thermometer against the time is plotted as shown in Fig. 11.1.

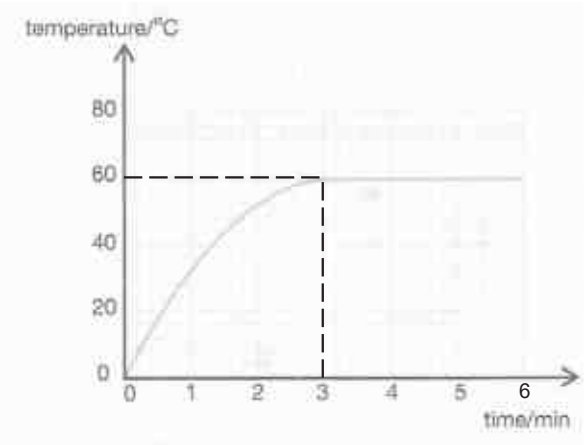

Fig. 11.1

(i) State the boiling point of the liquid in the beaker.

..... [1]

(ii) Explain why the temperature remained constant for the period between 3 min and 6 min.

.....

.....

.....

.....

..... [2]

(iii) State and explain whether there will be any change in the temperature recorded by the thermometer if the 40 W heater in the above experiment is replaced by a 80 W heater.

.....

.....

.....

.....

..... [2]

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(iv) State one difference between boiling and evaporation.

.....

.....

..... [1]

(b) A sound wave has a frequency of 400 Hz. The speed of sound in air is 320 m/s.

(i) Calculate the wavelength of the sound wave in air.

wavelength = ... [2]

(ii) A sound wave of the same frequency is produced in water. Describe and explain how the wavelength of the wave will be different from that in part **(i)**.

.....

.....

..... [2]

12 **(a)** Fig. 12.1 shows the image **I** of an object **O** produced by a converging lens.

Fig. 12.1

On Fig. 12.1, complete the ray diagram by drawing two rays passing from the object to the image. Mark the positions of the lens **L** and the relevant focal point **F** on Fig. 12.1. [3]

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(b) Fig. 12.2 shows part of a household electric installation, where an electric heater is used to heat the water in a metal tank.

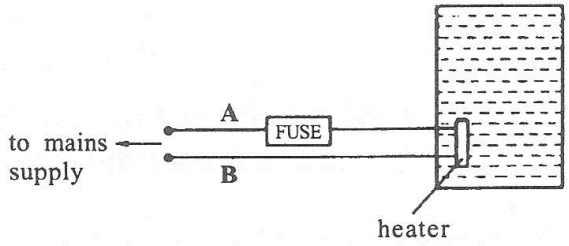

Fig. 12.2

(i) Explain which wire, **A** or **B**, should be the live wire of the supply.

.....

..... [2]

(ii) Explain in detail how a fuse acts as a safety device.

.....

.....

.....

.....

..... [2]

(iii) When connected to the 240 V mains supply, the heater drew a current of 8.0 A. Calculate the rate of production of heat (power).

power = ... [1]

(iv) Hence, calculate the cost of using the heater for 6 hours if the cost of 1.0 kWh is $0.25.

cost = ... [2]

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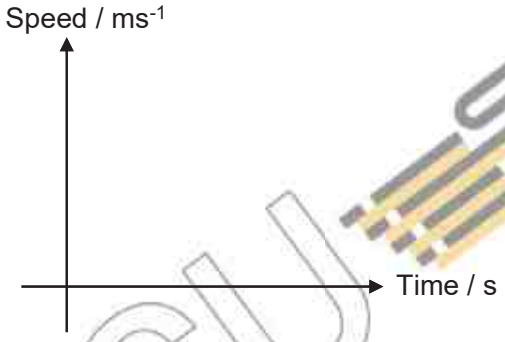
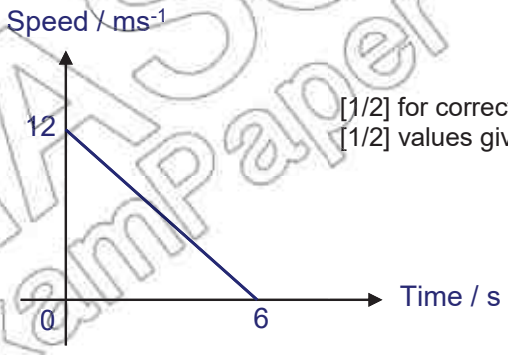
Section A

Answer **all** the questions in the spaces provided.

1 A tennis ball of mass 80 g moved up a smooth ramp with an initial speed of 12 m/s and stopped after 6 seconds.

(a) Sketch the speed-time graph for the first 6 seconds of the ball's motion. [1]





[1/2] for correct graph drawn
[1/2] values given

(b) Calculate the acceleration of the tennis ball as it moved up the ramp. [2]

$$a = \frac{v-u}{t}$$

$$a = \frac{(0-12)ms^{-1}}{6}$$

$$a = -2ms^{-2}$$

(c) Calculate the resultant force acting on the tennis ball as it moved up the ramp. [1]

$$F = ma$$

$$F = (0.08kg)(2ms^{-2})$$

$$F = 0.16N$$

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(d) Calculate the greatest distance of the tennis ball from its starting point. [2]

$$Dis\tan ce = Area\ under\ speed - time\ graph \quad [1/2]$$

$$Dis\tan ce = \frac{1}{2}\times 6\times 12 \quad [1]$$

$$Dis\tan ce = 36m \quad [1/2]$$

2 200 cm^3 of a sugar solution A of density 1 200 kg/m^3 is mixed with 300 cm^3 of another sugar solution B of density 1.10 g/cm^3.

(a) Calculate the mass of sugar solution A and another sugar solution B. [2]

Mass of sugar solution A = density × volume
= 1.20 gcm^{-3} × 200 cm^3
= 240 g

Mass of sugar solution B = density × volume
= 1.10 gcm^{-3} × 300 cm^3
= 330 g

(b) Hence, calculate the density of the mixture. [2]

Density of Mixture = Total mass / Total volume
= (240 + 330) g / (200 + 300) cm^3
= **1.14 gcm^{-3}**

3 Fig. 3.1 shows a man of mass 60 kg standing on one end of a plank, getting ready to cross a stream. The planl is pivoted at point X. The gravitational field strength is 10 N / kg.

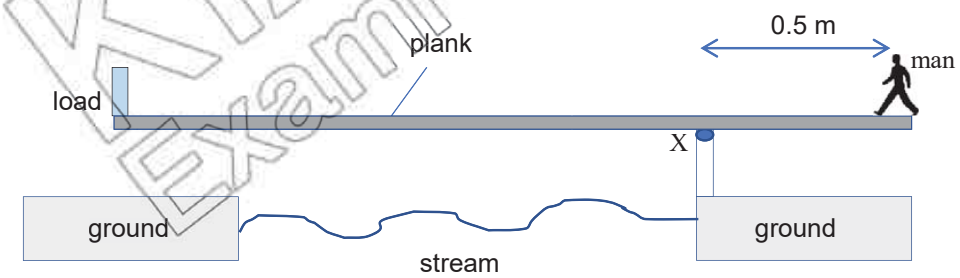

Fig. 3.1

The plank has a mass of 20 kg and is 2.5 m long with a uniform cross-section. One end is 0.5 m from the pivot at X. A load is placed on the other end to balance the plank horizontally.

(a) **1.** Calculate the anticlockwise moment due to the weight of the plank. [2]
2. Hence, using Principle of Moments to determine the weight of the load to balance the plank horizontally.

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Anticlockwise moment due to weight of the plank
= F × d
= 200 × 0.75 m [1/2]
= 150 Nm

In equilibrium, taking moment about the pivot,
Sum of anticlockwise moments = Sum of clockwise moments [1/2]
$W \times 2$ m + 150 Nm = 600 N × 0.5 m [1/2]
***W* = 75 N [1/2]**

(b) Explain why the load touches the ground when the man walks towards the pivot at X. [2]

As the man walks towards X, the **clockwise moment about the pivot decreases** [1/2] as the **perpendicular distance from the line of action of force to the pivot decreases**.[1/2]
Thus the **sum of anticlockwise moments about the same pivot is larger than the clockwise moment**,[1/2] causing the **plank to turn anticlockwise**.[1/2]

4 Fig. 4.1 shows an electric motor of power 100 W used to pull a load of 60 kg up an incline plane at a constant speed. The motor takes 30 s to move the load through a distance of 5.0 m on the incline and through a height of 4.0 m.

Fig. 4.1

(a) Calculate the energy dissipated by the motor. [2]

Energy dissipated = P × t
= 100 W × 30 s
= **3 000 J**

(b) Determine the gain in potential energy of the load. [2]

Gain in potential energy = mgh
= 60 kg × 10 ms^{-1} × 4 m
= **2 400 J**

(c) Explain why there is a difference in the answers calculated in **(a)** and **(b)**. [1]

There is energy lost as heat and work done against friction.

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5 The interior of a refrigerator is shown in Fig. 5.1.

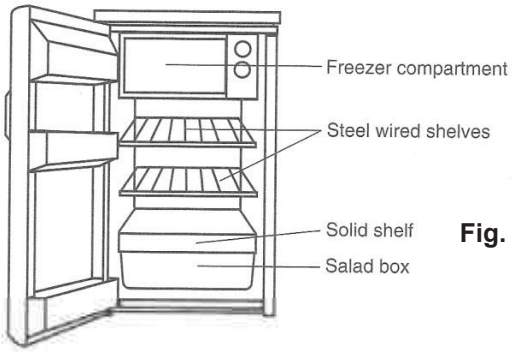

Fig. 5.1

(a) Explain how the refrigerator is cooled by convection. [2]

Cold air being denser at the top of freezer compartment sinks while the warm and less dense air at the bottom rises to the freezer compartment to be cooled. This sets up a convection current due to difference in densities and the whole process is repeated until the refrigerator is cooled.

(b) Give two reasons why steel wired shelves are used rather than solid shelves in the centre of the refrigerator. [2]

It is to allow for the convection current to flow through. As steel is a better conductor of heat, so it conducts the heat present in the refrigerator away, keeping the refrigerator cool.

(c) The refrigerator walls are insulated using both expanded polystyrene and aluminium foil as shown in Fig. 5.2.

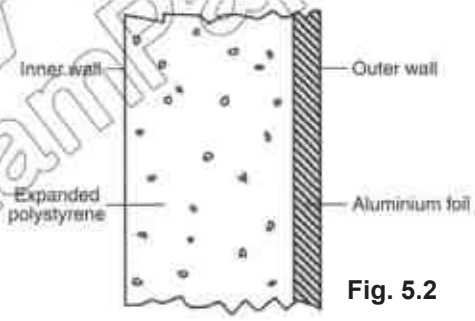

Fig. 5.2

Explain how these two materials reduce thermal energy entering the refrigerator. [2]

Aluminium foil is a poor absorber / good reflector of radiant heat so rate of heat gain is reduced due to radiation.
Expanded polystyrene traps air, which is a poor conductor of heat, so it reduces heat gain due to conduction and convection.

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6 Fig. 6.1 shows the path of light ray as it passes through a glass prism.

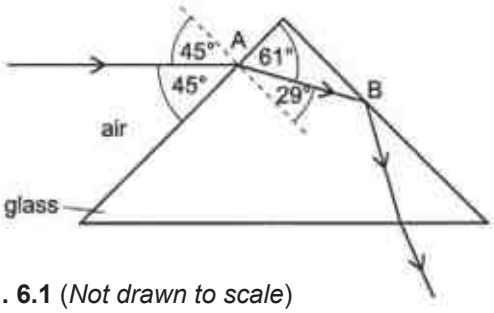

Fig. 6.1 (*Not drawn to scale*)

(a) Using angles from Fig. 6.1, calculate the refractive index of the glass. [1]

n = sin i / sin r
= sin 45° / sin 29° [1/2] with formula
= 1.46 [1/2]

(b) Calculate the critical angle of the glass prism. [1]

sin c = 1 / n
= 1 / 1.46 [1/2] with formula
c = 43° [1/2]

(c) Explain why the ray does not emerge from the prism at **B**. [2]

Total internal reflection occurs at B. [1/2]
The **angle of incidence in glass at B [1/2] is greater than the critical angle of glass**.[1/2] The light ray is travelling **from optically denser medium to optically less dense medium.** [1/2]

7 The potential difference against current characteristic graphs for three conductors P, Q and R are shown in Fig. 7.1.

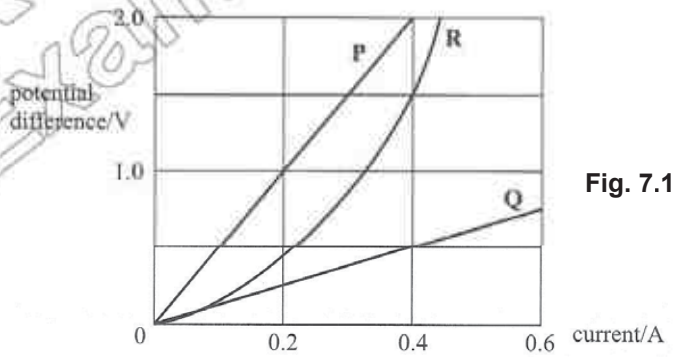

Fig. 7.1

(a) Using Fig. 7.1, state which of the conductor(s) obey(s) Ohm's Law. Explain your answer. [2]

Conductors P and Q obey Ohm's Law. It is because the graphs are straight lines passing through the origin showing the current flowing through is directly proportional to the potential difference across its ends.

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(b) Calculate the resistance of conductor P. [1]

R = V / I
= 1.0 V / 0.2 A
= 5.0 Ω

(c) If the conductors R and Q are connected in series, with a current of 0.4 A flowing, state what would be the potential difference across [1]
(i) R,
(ii) Q,
(iii) the series combination of R and Q.

R, **1.5** V
Q, **0.5** V
the series combination of R and Q? **2.0** V

8 Fig. 8.1 shows an electric circuit.

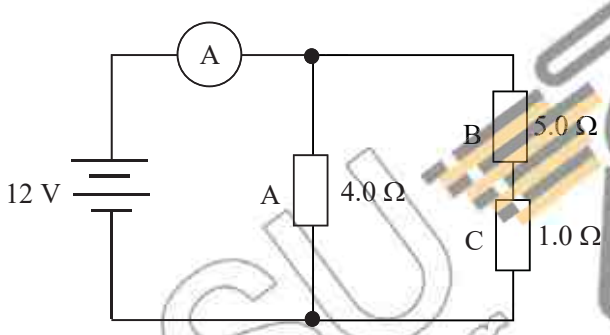

Fig. 8.1

(a) Determine the ammeter reading in the circuit. [2]

$$\frac{1}{R_T} = \frac{1}{4.0} + \frac{1}{6.0}$$

$$\frac{1}{R_T} = \frac{5}{12}$$

$$R_T = \frac{12}{5} = 2.4\Omega$$

Ammeter reading = V / R
= 12 V / 2.4 Ω
= **5.0 A**

(b) Find the current flowing through resistor C. [1]

I = V / R
= 12 V / 6.0 Ω
= **2.0 A**

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(c) Calculate the potential difference across resistor B. [1]

Potential difference across resistor B = IR
= 2.0 A × 5.0 Ω
= **10 V**

(d) Calculate the amount of charge flowing through resistor A in 30 s. [2]

Current flowing through resistor A = 5.0 A – 2.0 A
= 3.0 A

Q = It
= 3.0 A × 30 s
= **90 C**

9 **(a)** Fig. 9.1 shows a circuit breaker with the contact closed.

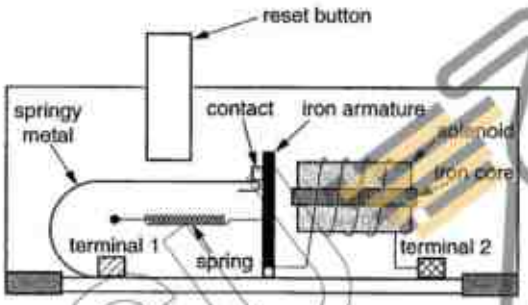


Fig. 9.1

Fig. 9.2 shows the same circuit breaker after a large current has passed through the circuit.

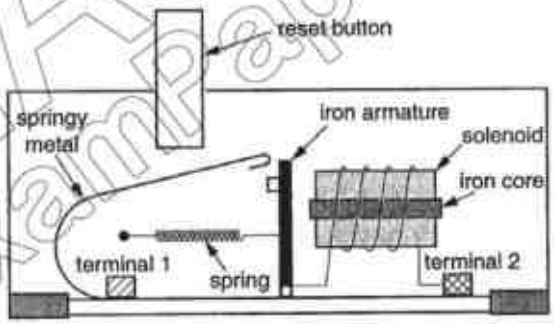


Fig. 9.2

Describe how the circuit breaker is able to switch off the current when a fault causes the current to become too large. [3]

When the current becomes too large, the **iron core/ solenoid becomes a strong electromagnet [1/2]**. This causes the **iron armature to be attracted to the electromagnet.** [1/2] This **releases the springy metal** [1/2] and **disconnects from the contact on the iron armature**.[1/2] There is an open circuit between terminal 1 and terminal 2 [1/2] and the **current stops flowing**. [1/2]

(b) Fig. 9.3 shows a rigid wire is held between the poles of a magnet. When the current is switched on, there is a force on the wire in an upward direction as shown in Fig. 9.3.

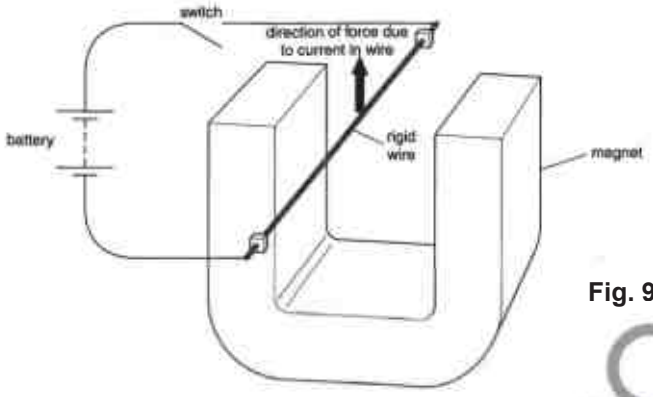
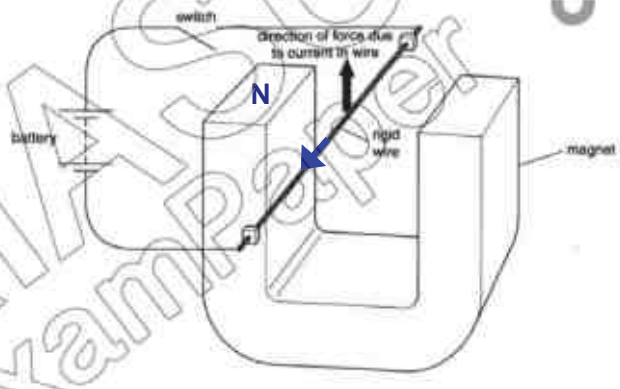


Fig. 9.3

(i) Explain why there is a force acting on the wire. [2]

There is an **interaction of two magnetic fields [1/2] due to current-carrying wire and permanent magnet** [1/2] and an unbalanced magnetic field is produced around the wire. A **force will act in the direction of a stronger magnetic field to a weaker magnetic field**. [1]

(ii) On Fig. 9.3, draw an arrow to show the direction of the current flowing in the rigid wire and label the north pole of the magnet with the letter **N**. [1]



[1/2] for correct N labelled
[1/2] for correct current drawn

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Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

10 **(a)** A mass of weight 7.0 N hanging on the end of a string is pulled sideways so that the string makes an angle of 30° with the vertical as shown in Fig. 10. 1.

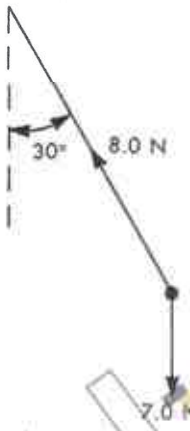

Fig. 10.1
(Not drawn to scale)

By means of a scale diagram, determine the resultant force due to the tension in the string and the weight of the mass. [3]

Scale: 1 cm represents 2 N

Resultant of the tension in the string and the weight of mass is **4 N (± 0.1 N)** and is 61° to 8.0 N force OR 88° to 7.0 N

[1/2] appropriate Scale given
[1/2] correct diagram
[1/2] draw arrows (resultant force must indicate by double arrows)
[1/2] label necessary angle(s)
[1/2] label forces on diagram
[1/2] answer for resultant force

(b) The figure below shows a block of mass of 4.0 kg resting on a table. A force of 5.0 N is applied to the block pulling it at a constant speed of 1.5 m/s. Assume that g = 10 N/kg.

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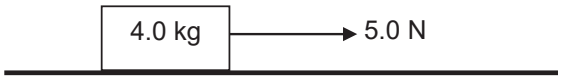


Fig. 10.2

(i) State the size of the frictional force acting on the block and explain how you obtain the answer. [2]

The frictional force acting on the block is 5.0 N [1/2]. It is because the block moves with a constant speed of 1.5 ms^{-1} [1/2] so the acceleration is zero [1/2] and according to Newton's Second Law, the resultant force is zero as F = ma.[1/2] Therefore, frictional force is equal to the pulling force.

(ii) State the direction of this frictional force. [1]

The direction of the frictional force is opposite to the pulling force. [1]
OR
The direction of the frictional force is towards the left as the block is pulled towards the right.

(iii) The applied force is increased until the block moves at an acceleration of 2 m/s^2. Calculate the new applied force. [2]

F = ma [1/2]
New applied force – frictional force = ma
New applied force – 5 N = 4 kg × 2 ms^{-2} [1]
New applied force – 5 N = 8 N
New applied force = 13 N [1/2]

(iv) Find the pressure of the block acting on the table if the dimension of the base of the block is 1.0 m by 0.5 m. [2]

P = F / A [1/2]
Pressure = weight of block / area
Pressure = (4 kg × 10 N/kg) / (1.0 × 0.5) m^2 [1]
Pressure = 80 Pa or 80 Nm^2 [1/2]

11 **(a)** Thermal energy is supplied at a constant rate using a 40 W electric heater to a liquid in a beaker. A graph of temperature recorded by the thermometer against the time is plotted as shown in Fig. 11.1.

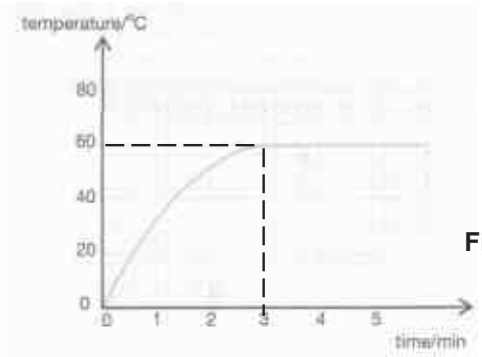


Fig. 11.1

(i) State the boiling point of the liquid in the beaker. [1]

The boiling point is 60 °C. [1]

(ii) Explain why the temperature remained constant for the period between 3 min and 6 min. [2]

The temperature remained constant because latent heat of vaporisation / thermal energy is absorbed [1/2] to separate the water molecules [1/2], as well as provide energy for the molecules to push back on the surroundings [1/2] to escape into the air as there is a change of state from liquid to gaseous. [1/2] The average kinetic energy of the particles remains constant and hence the substance remains at the same temperature.

(iii) State and explain whether there will be any change in the temperature recorded by the thermometer if the 40 W heater in the above experiment is replaced by a 80 W heater. [2]

There will be no change in the temperature [1/2] recorded by the thermometer because the boiling occurs at a fixed temperature, boiling point. [1/2] A higher power heater will only decrease the time [1/2] needed to change its state from liquid to gaseous.[1/2]

(iv) State one difference between boiling and evaporation. [1]

Boiling	**Evaporation**
Occurs at a particular temperature	Occurs at any temperature
Relatively fast	Relatively slow
Takes place throughout the liquid	Takes place only at liquid surface
Bubbles are formed	No bubbles are formed
Temperature remains constant	Temperature may change
External thermal energy source required	External thermal energy source not required

(b) A sound wave has a frequency of 400 Hz. The speed of sound in air is 320 m/s.

(i) Calculate the wavelength of the sound wave in air. [2]

$v = f\lambda$ [1/2]
320 m/s = 400 Hz $\times$ λ [1/2]
λ = **0.80 m [1/2] + [1/2] unit**

(ii) A sound wave of the same frequency is produced in water. Describe and explain how the wavelength of the wave will be different from that in part **(i)**. [2]

The **speed of sound in water is higher than speed of sound in air**.[1] Therefore, the **wavelength of the sound wave in water is longer than that in air [1/2]** using **$v = f\lambda$.[1/2]**

12 **(a)** Fig. 12.1 shows the image **I** of an object **O** produced by a converging lens.

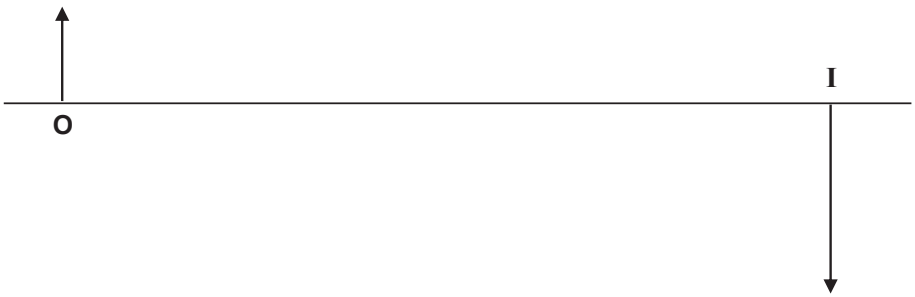
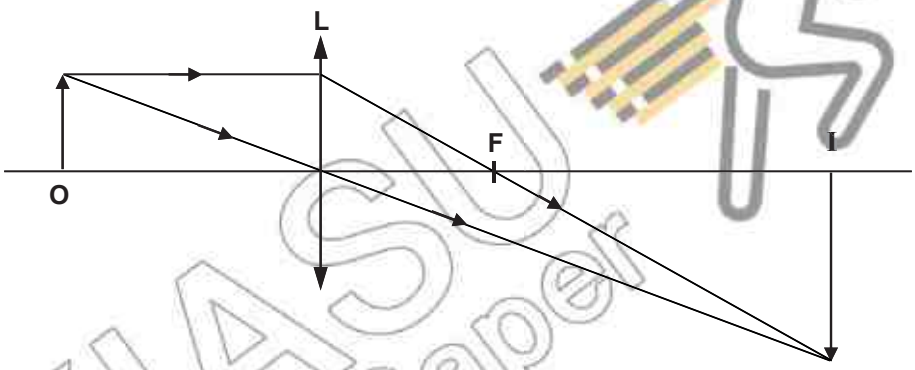


Fig. 12.1

On Fig. 12.1, complete the ray diagram by drawing two rays passing from the object to the image. Mark the positions of the lens **L** and the relevant focal point **F** on Fig. 12.1. [3]



(b) Fig. 12.2 shows part of a household electric installation, where an electric heater is used to heat the water in a metal tank.

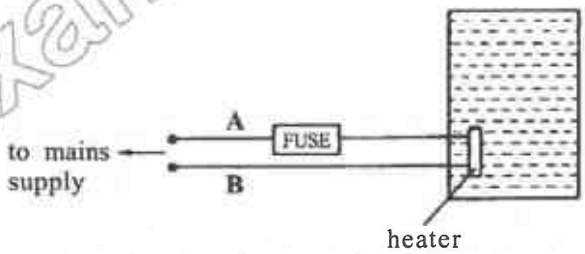


Fig. 12.2

(i) Explain which wire, **A** or **B**, should be the live wire of the supply. [2]

Wire A. [1] It is because fuse should be placed along the live wire. [1]

(ii) Explain in detail how a fuse acts as a safety device. [2]

The fuse melts and breaks the circuit [1/2] and disconnect from the high voltage of the main supply [1/2] when the current flowing in the appliance exceeds the fuse rating.[1/2] This can prevent overheating / damage to the electrical appliance.[1/2]

(iii) When connected to the 240 V mains supply, the heater drew a current of 8.0 A. Calculate the rate of production of heat (power). [1]

P = VI
= 240 V × 8 A [1/2] with formula
= **1920 W** **[1/2]**

(iv) Hence, calculate the cost of using the heater for 6 hours if the cost of 1.0 kWh is $0.25. [2]

Cost = energy x rate
= P × t × rate [1/2]
= (1.92 kW × 6 h) × 0.25 [1]
= **$ 2.88** **[1/2]**

Science Physics Paper 1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A	***A***	***D***	***A***	***B***	***D***	***C***	***C***	***B***	***B***
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
D	***C***	***B***	***A***	***B***	***C***	***C***	***D***	***C***	***A***

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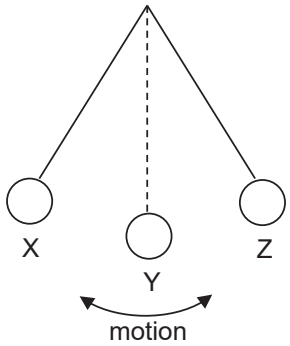
1 The diagram shows a simple pendulum. It swings between X and Z.



What sequence should be timed to measure the period of the pendulum?

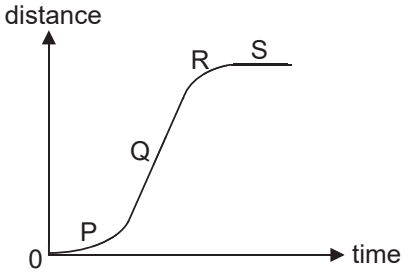
A X → Y
B X → Z
C X → Z → Y
D X → Z → X

2 The diagram shows a vernier V placed against a scale S.

What is the vernier reading?

A 5.23cm
B 5.33cm
C 5.36cm
D 5.63cm

3 The graph shows how the distance travelled by a motorcycle changes with time.

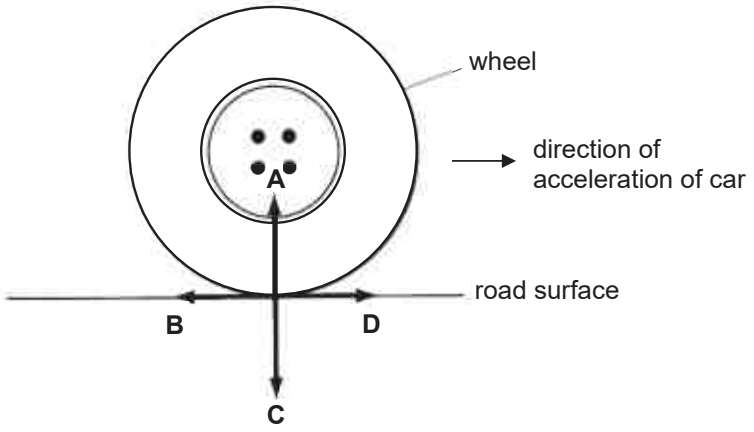


Which statement is correct?

A at P, the motorcycle is decelerating
B at Q, the motorcycle has constant acceleration
C at R, the motorcycle is slowing down
D at S, the motorcycle has constant speed

4 The wheel of a moving car is driven by the engine. The car is accelerating in the direction shown.

In which direction does the frictional force between the wheel and the road surface act?



5 An object with a mass of 15kg on the Earth is taken to Mars.

The gravitational field strength on the Earth is 10N/kg and on the Mars is 3.7N/kg.

What are the mass and weight of the object on the Mars?

	mass / kg	weight / N
A	15	56
B	15	150
C	41	15
D	41	150

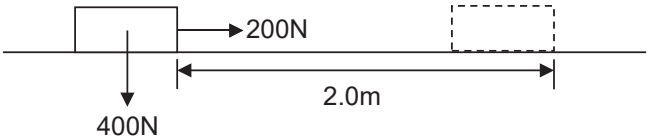
6 A chair weighing 50N stands on four legs, each having an area of contact of $0.0020m^2$.

What is the pressure of the chair on the floor?

A 6250Pa
B 10 000Pa
C 12 500Pa
D 25 000Pa

7 When a 200N force is applied to a box weighing 400N, the box moves 2.0m horizontally in 20s.

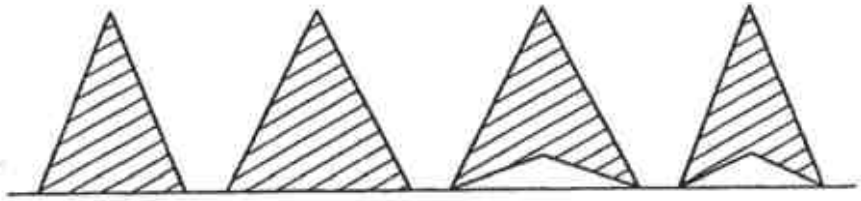
What is the average power?



A 20W
B 400W
C 60W
D 1200W

8 The diagrams show cross-sections of four solid objects.

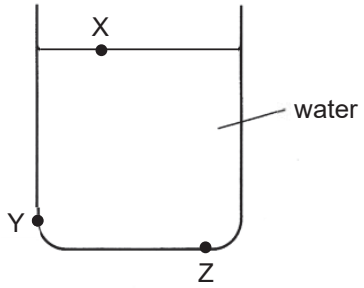
Which object is the least stable?



A **B** **C** **D**

9 A student has a large tank of water in which he wants to set up a convection current.

Which arrangement would **not** allow him to do this?



A cooling at X
B heating at X
C heating at Y
D heating at Z

10 A solid is heated.

Which statement is incorrect?

A The average distance between the molecules increases.
B The average speed of the molecules increases.
C The molecules expand.
D The molecules gain energy.

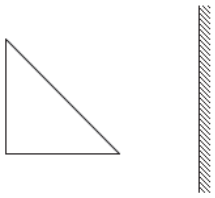
11 It takes 0.20s to generate one complete wave in a ripple tank.

The wavelength of each wave produced is 4.0cm.

What is the speed of the wave?

A 0.80cm/s
B 1.3cm/s
C 5.0cm/s
D 20cm/s

12 The diagram shows an object placed in front of a plane mirror.



Which diagram shows the correct mirror image of the object as seen in the plane mirror?

A **B** **C** **D**

13 A projector has a converging lens that projects an image from the visualiser onto a screen.

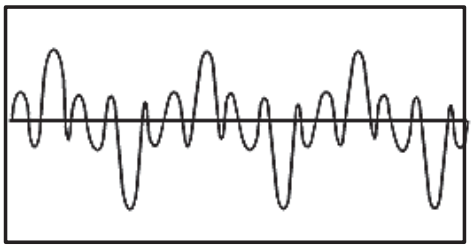
What type of image is produced?

A real, inverted, magnified
B real, upright, same size
C virtual, inverted, same size
D virtual, upright, magnified

14 Which of the following sets of electromagnetic waves have higher frequencies than visible light?

A Radio waves, infrared radiation, ultraviolet radiation
B Radio waves, microwaves, infrared radiation
C X-rays, gamma rays, ultraviolet radiation
D X-rays, microwaves, infrared radiation

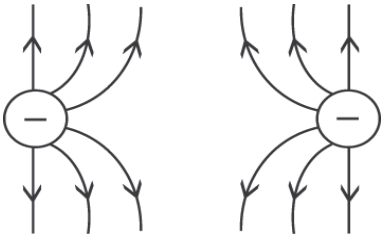
15 The diagram shows a cathode-ray oscilloscope trace for a note emitted by a guitar.



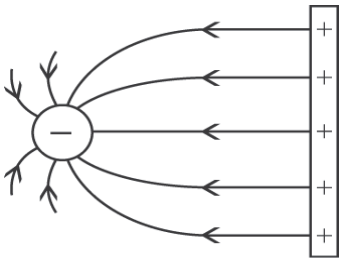
If the same note is played again, but softer, how will the trace change?

A The peaks will be closer together.
B The peaks will be further apart.
C The peaks will be higher.
D The peaks will be lower.

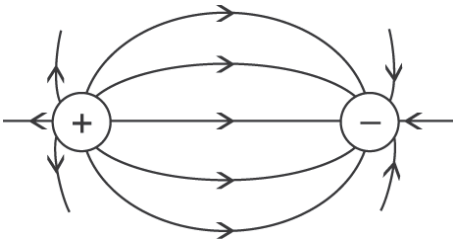
16 Which diagram shows the incorrect electric field lines between 2 charged objects?



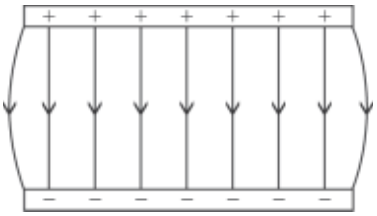
A



C



B



D

17 A 0.40m length of resistance wire with a cross-sectional area of 0.20mm^2 has a resistance of 2.0Ω.

Which wire of the same material will also have a resistance of 2.0Ω?

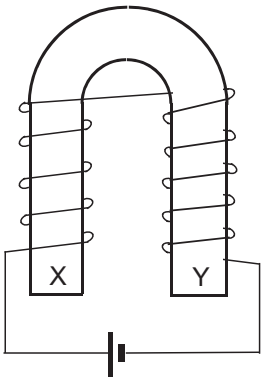
wire	length / m	area / mm^2
A	0.20	0.20
B	0.20	0.40
C	0.80	0.10
D	0.80	0.40

18 An electric oven is connected to the mains supply using insulated copper wires.
The wires become very warm.

What can be done to reduce the amount of heat produced in the insulated copper wires?

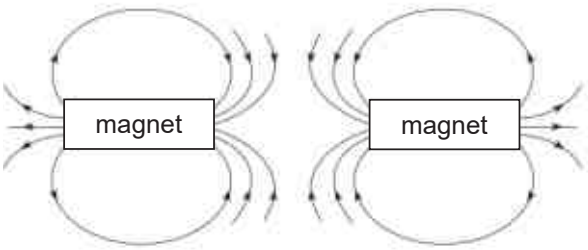
A use thicker copper wires
B use thicker insulation
C use thinner copper wires
D use thinner insulation

19 What are the poles of the electromagnet at X and Y?



	X	Y
A	North	North
B	North	South
C	South	North
D	South	South

20 The diagram shows the magnetic field pattern between two bar magnets.



Which two bar magnets produce this pattern?

A	S N	S N
B	S N	N S
C	N S	S N
D	N S	N S

Section A (45 marks)

Answer **all** the questions in the spaces provided.

1 Fig. 1.1 shows a stone supported by two strings. The tensions in the two strings are 3.0N and 4.0N.

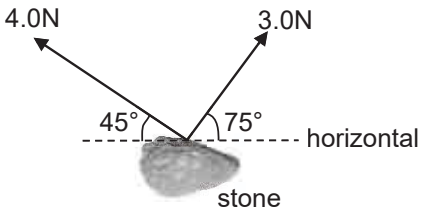


Fig. 1.1 (not to scale)

(a) In the space below, draw a labelled diagram to show the resultant of the two tensions. [2]

Determine the size and direction of the resultant force.

scale: ..... [1]

resultant force = …….N [1]

direction of resultant force = ... [1]

(b) State the weight of the stone.

weight = ...N [1]

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2 A boy pulls a crate along a table with a force *P*, as shown in Fig. 2.1. When the crate is moving, there is a frictional force of 1.0N acting as shown. Fig. 2.2 shows how the acceleration, *a* of the crate varies with *P*.

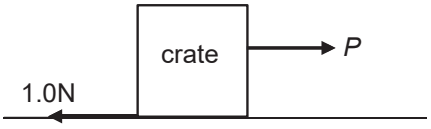

Fig. 2.1

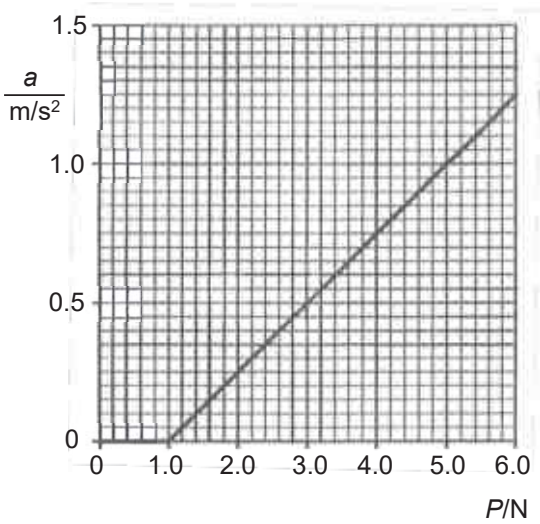

Fig. 2.2

(a) Explain why *P* must be greater than 1.0N for the crate to accelerate.

.....

..... [1]

(b) By using *P* = 6.0N in Fig. 2.2, calculate the mass of the crate, *m*.

m = ... kg [2]

(c) The force *P* is reduced to 1.0N.

State and explain what happens to the crate.

.....

.....

..... [2]

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3 The 'torture tool' shown in Fig. 3.1 was used in medieval times as an instrument of torture by lowering the victim, strapped to the seat, into the cold water of the sea. The total mass of the torture tool is 120kg. The torture tool can be balanced, when no victim is present, by a flat stone of mass 100kg placed at a distance of 2.0m from the pivot.

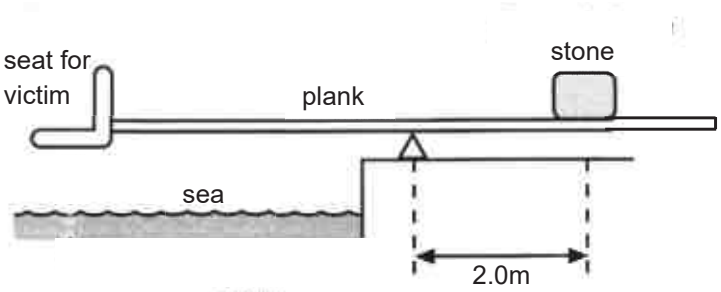

Fig. 3.1

(a) Explain what is meant by *centre of gravity*.

.....

..... [1]

(b) **(i)** On Fig. 3.1, draw and label a possible position of the weight of the torture tool to keep it balanced. [1]

(ii) Hence, calculate the distance of the centre of gravity of the torture tool to the pivot.
(gravitational field strength, g = 10N/kg)

distance = ...m [2]

(c) A victim is strapped onto the seat. The torture tool starts to rotate anticlockwise about the pivot.

Suggest and explain one method that the operator can do to keep the torture tool horizontal again.

.....

.....

.....

.....

..... [2]

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4 Fig. 4.1 shows the design of the rail of a roller-coaster with a mass of 2000kg.

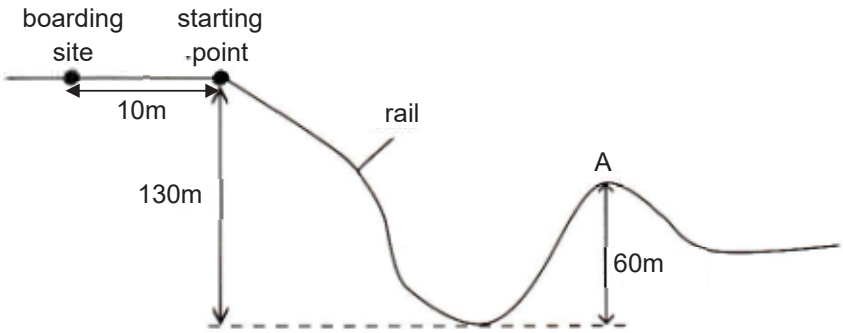

Fig. 4.1

(a) The roller-coaster starts to accelerate from rest at a constant rate after the passengers are on board at the boarding site. The distance between the boarding site and the starting point is 10m. The roller-coaster passes through the starting point at a speed of 1.5m/s.

(i) On Fig. 4.2, sketch the speed-time graph to show the motion of the roller-coaster between the boarding site and the starting point. Label all necessary value(s) on the axes. [1]

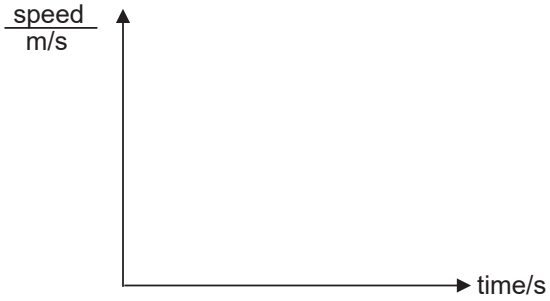

Fig. 4.2

(ii) Using Fig. 4.2, show that the time taken for the roller-coaster to accelerate to a speed of 1.5m/s is 13s. [2]

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(iii) Hence, calculate the acceleration of the roller-coaster in the first 13s.

acceleration = ...m/s^2 [2]

(b) The distance along the rail from the starting point to point A is 180m and the average friction acting on the roller-coaster is 350N.

(i) Calculate the work done against friction when the roller-coaster travels from the starting point to point A.

work done against friction = ...J [2]

(ii) Hence, calculate the kinetic energy of the roller-coaster at point A.

kinetic energy = ...J [3]

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5 Fig. 5.1 shows a transparent block in air.

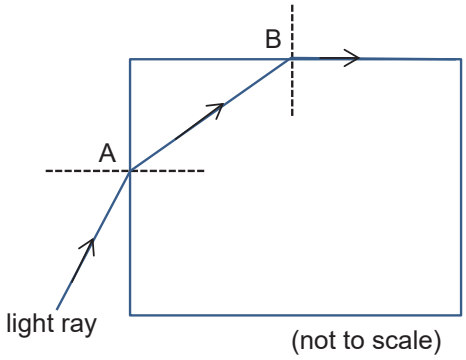

Fig. 5.1

A light ray enters the block at A and is refracted towards B. At B, the light is refracted along the surface of the block. The refractive index of the block is 1.55.

(a) On Fig. 5.1, label

(i) at A, the angle of incidence i and the angle of refraction r, [1]

(ii) at B, the critical angle c. [1]

(b) Calculate the critical angle c.

c = ... ° [2]

(c) The block is replaced by another block which has a higher refractive index.

State one change, if any, to the light ray at the top surface.

..... [1]

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6 Ultrasound is used to find the distance from the ship to the seabed as shown in Fig. 6.1.

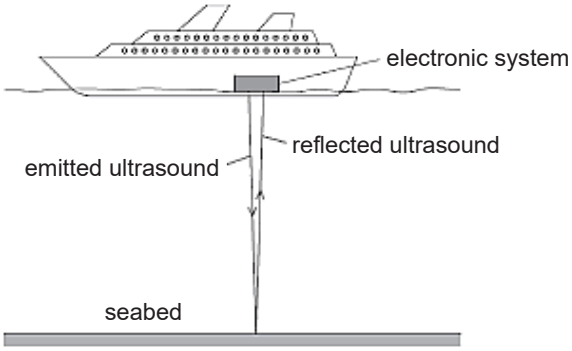

Fig. 6.1

Ultrasound waves are similar to sound waves but have a frequency that is too high to be heard by humans.

(a) State what is meant by *frequency*.

…….. [1]

(b) State the highest frequency of sound that can be heard by humans.

…….. [1]

(c) The speed of ultrasound in water is 1500m/s. The time taken for the ultrasound to be emitted and reflected back to the electronic system is 0.80s.

Calculate the distance between the ship and the seabed.

distance = …….. m [2]

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7 An electric fence is used to keep the cow in one part of a field as shown in Fig. 7.1.

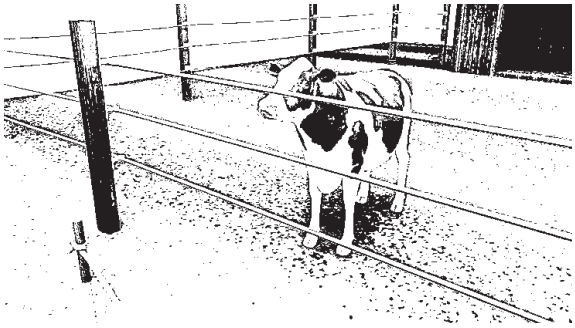

Fig. 7.1

The wire of the fence gives out short high-voltage pulses that each last for 0.10s.

When the cow touches the wire of the fence, a current of 0.015A passes through its body into the ground. This current is not enough to harm the cow but gives it an electric shock.

(a) Calculate the charge that passes through the cow when it gets an electric shock.

charge = ... [3]

(b) The potential difference between the wire of the fence and the ground is 3000V.

Calculate the energy contained in the high-voltage pulse.

energy = ... J [2]

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8 A rigid wire is held between the poles of a magnet as shown in Fig 8.1.

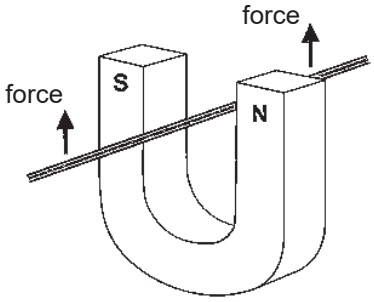

Fig. 8.1

There is a force on the wire in an upward direction when the current flows in the wire.

(a) On Fig. 8.1, draw an arrow to show the direction of the current in the wire. [1]

(b) State two ways to increase the magnitude of the force on this wire.

1 ……..

2 …… [2]

(c) State one change that can be made to cause a downward force on the wire.

…… [1]

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Section B (20 marks)

Answer **any two** questions in the spaces provided.

9 **(a)** Thermal flasks are used to store hot liquids and keep them warm for a period of time. There are two types of thermal flasks. One makes use of foam as the insulating material and the other one, vacuum as shown in Fig. 9.1 and Fig. 9.2 respectively.

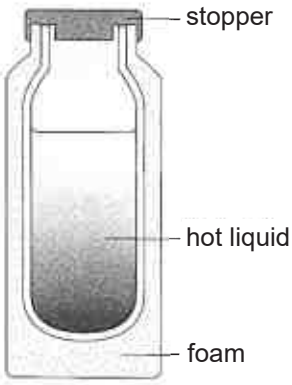

Fig. 9.1

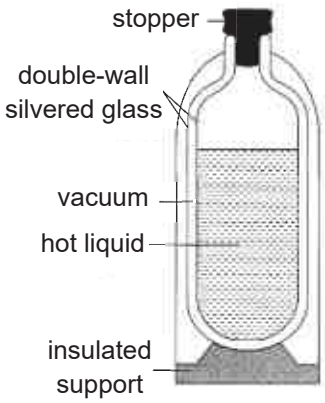

Fig. 9.2

The foam traps small pockets of air between them.

(i) Explain why the foam in Fig. 9.1 reduces loss of thermal energy by conduction.

……..

…… [1]

(ii) Explain why the vacuum between the double glass walls in Fig. 9.2 provides a better heat insulation than foam.

……..

……..

…… [2]

(iii) Explain why the silvered glass in Fig. 9.2 helps to keep the liquid hot for a longer period of time.

……..

……..

…… [2]

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(b) A staff in a restaurant puts water at room temperature T_1 into the freezer of a refrigerator to make ice cubes. The cooling curve of the water is shown in Fig. 9.3.

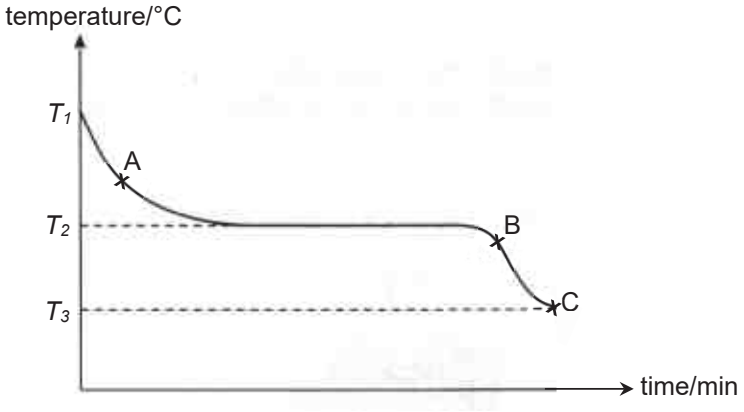

Fig. 9.3

(i) State the physical meaning of temperature T_2.

…… [1]

(ii) Describe the arrangement of the molecules of the substance at point A.

……..

…… [1]

(iii) Describe the changes, if any, that occur to the motion of the molecules of the substance as it cools from B to C.

……..

…… [1]

(c) Explain, in terms of the kinetic theory, why a cooling effect occurs when water evaporates from the surface of the skin.

.....

.....

.....

..... [2]

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10 A thermistor is a resistor that changes its resistance with temperature. Component T is a thermistor connected in series with a resistor U of resistance 500Ω and a 9.0V battery as shown in Fig. 10.1.

Fig. 10.1

Fig. 10.2 shows the variation with temperature of the resistance of T.

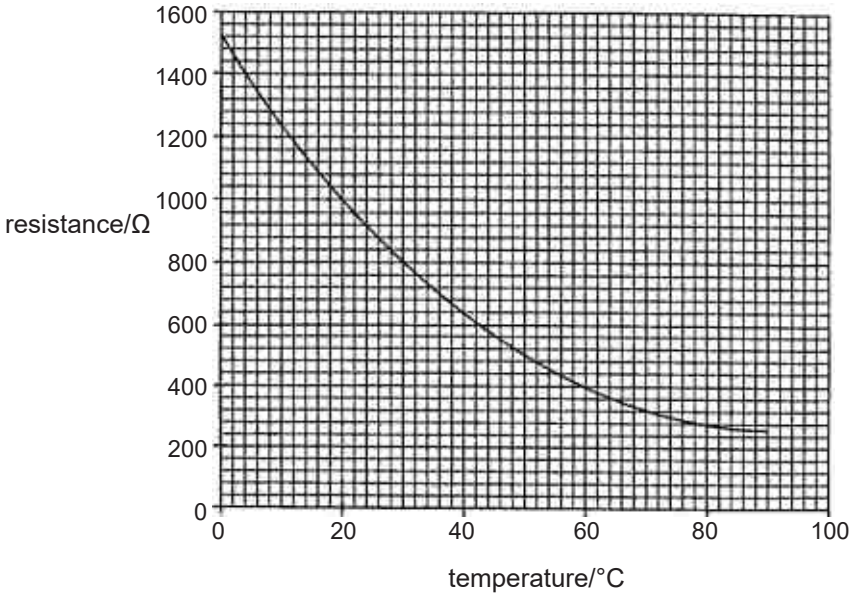

Fig. 10.2

(a) When the temperature is 60°C,

(i) use Fig.10.2 to determine the resistance of T,

resistance = ... Ω [1]

(ii) calculate the current in the circuit,

current = ... A [2]

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(iii) calculate the potential difference across resistor U.

potential difference = …… V [1]

(b) The temperature drops from 60°C to 30°C.

State and explain what happens to

(i) the current in the circuit,

……..

…… [2]

(ii) the potential difference across resistor U,

……..

…… [1]

(iii) the potential difference across thermistor T.

……..

…… [1]

(c) When the circuit in Fig. 10.1 is in use, a fuse is connected to the circuit.

State the function of a fuse and describe how it works.

.....

.....

.....

..... [2]

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11 An air-conditioner with a remote controller is shown in Fig. 11.1.

Fig. 11.1

The air-conditioner is installed at the top of the wall near the ceiling and is operated using the remote controller.

(a) Describe and explain why the air-conditioner is installed at the top of the wall.

……..

……..

……..

…… [2]

(b) State the component of the electromagnetic spectrum used by the remote controller to operate the air-conditioner.

…… [1]

(c) The air-conditioner was switched on for 8 hours and used 4.0kWh of electrical energy.

(i) If the cost per kWh is $0.30, calculate the cost of using the air-conditioner.

cost = $ …… [1]

(ii) Calculate the power consumption of the air-conditioner.

power = ……..W [2]

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(d) The air-conditioner is connected to the main supply by a circuit breaker, as shown in Fig. 11.2.

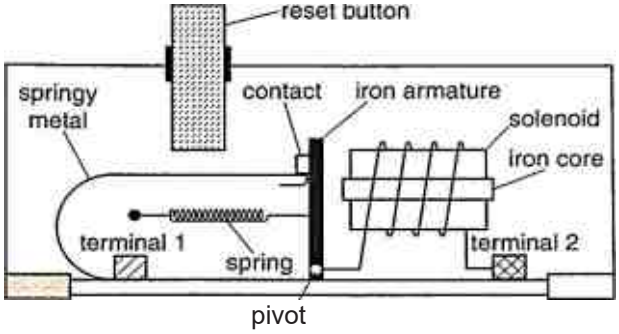

Fig. 11.2

When a fault develops, the circuit breaker switches off the current. The circuit breaker with the current switched off is shown in Fig. 11.3.

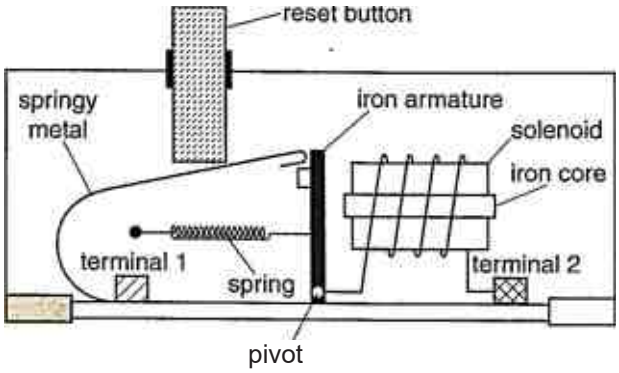

Fig. 11.3

(i) State the type of fault that could cause the circuit breaker to operate.

…… [1]

(ii) Describe how the circuit breaker switches off the current.

……..

……..

……..

……..

……..

…… [3]

End of Paper

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Explanations

No.	Reasoning
1	D X → Z → X is one complete oscillation. Period is time for one complete oscillation.
2	B Main scale = 5.30cm, Vernier scale = 0.03cm Observed reading = 5.33cm
3	C at P, the motorcycle is ~~decelerating~~ accelerating at Q, the motorcycle has ~~constant acceleration~~ constant speed at R, the motorcycle is slowing down at S, the motorcycle ~~has constant speed~~ is at rest
4	D Wheel rotates clockwise. Thus friction acts against the motion.
5	A Mass remains unchanged on the Earth and on the Mars. W = mg = 15 × 3.7 = 56N
6	A P = F/A = 50 / (0.002 × 4) = 6250Pa
7	A Work done = F × d = 200 × 2 = 400J There is no work done by the 400N force as the distance travelled is perpendicular to the force. Power = work done / time = 400 / 20 = 20W
8	D Smallest base area & high centre of gravity
9	B Heating at X, hot water is less dense and remains at the top. No convection current.
10	C Molecules cannot expand!
11	D f = 1/T = 1/0.20 =5.0Hz $v = f\lambda = 5 \times 4 = 20cm/s$
12	B Characteristic of image formed by a plane mirror apply

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13	A Image formed is larger, it is real and inverted as it can be projected onto a screen.
14	C Gamma rays, x-rays and UV rays have higher frequencies and short wavelengths compared to visible light
15	D Softer sound produced lower amplitude
16	A Electric field flow from positive to negative
17	D Ratio of length and area is 2
18	A Thicker wire has lower resistance thus producing less heat
19	C Using right hand grip rule
20	C Like poles repels and magnetic field go into the S-pole

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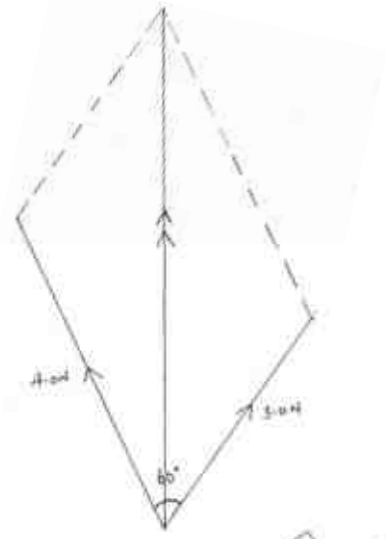
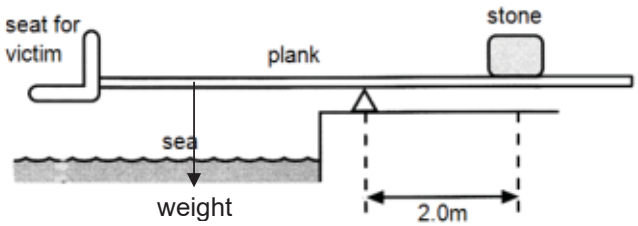
Marking Scheme

No.	Solutions	Marks
1a	Scale 1cm : 0.5N OR 2cm : 1N OR 3cm : 1N  Correct resultant force with double arrowheads Forces labelled (with arrowhead) and correct angle Resultant force = 12.1cm × 0.5 = 6.05N (5.9N to 6.2N) Direction of resultant force = 25° from 4.0N OR 35° from 3.0N (±2°)	1 mark 1 mark 1 mark 1 mark 1 mark
1b	Weight of stone = 6.05N (same as 1a)	1 mark (Allow ECF)
2a	There will be a <u>resultant force</u> acting to the right on the crate.	1 mark
2b	When P = 6.0N, a = 1.25m/s^2 F_{net} = ma 6.0 - 1.0 = m × 1.25 m = 4.0kg	 1 mark (F_{net}) 1 mark (mass)
2c	The crate continues to move forward at a <u>constant speed</u>. / travel at zero acceleration. <u>P is equal and opposite to frictional force</u> and there is <u>no resultant force</u> acting on the crate.	1 mark 1 mark (either 1)
3a	A point where the whole weight of the object seems / appears to act.	1 mark
3bi		1 mark Weight is acting to the left of the pivot

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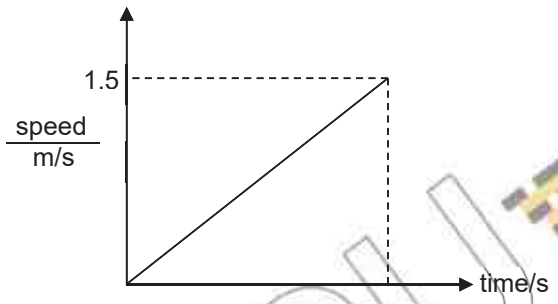
3bii	Take moment about pivot, Anticlockwise moment = Clockwise moment 1200 × d = 1000 × 2 d = 1.67m	 1 mark 1 mark
3c	Shift the stone to the end of the plank to increase the perpendicular distance. OR Replace the stone with a larger mass / Add more stones to increase the force applied on the plank. The clockwise moment produced by the weight of the stone from the pivot increases.	1 mark 1 mark
4ai		1 mark (did not penalize for missing 1.5m/s)
4aii	Distance = Area under graph 10 = $\frac{1}{2} \times t \times 1.5$ t = 13s (Shown)	1 mark 1 mark
4aiii	$a = \frac{v-u}{t} = \frac{1.5-0}{13}$ = 0.115 m/s^2	1 mark 1 mark
4bi	Work done against friction = f × d = 350 × 180 = 63000 J	1 mark 1 mark
4bii	Total energy at starting point = Total energy at A GPE + KE = GPE + KE + WD against friction (2000×10×130) + ($\frac{1}{2} \times 2000 \times 1.5^2$) = (2000×10×60) + KE + 63000 KE = 1340000J	LHS 1mark, RHS 1 mark 1 mark

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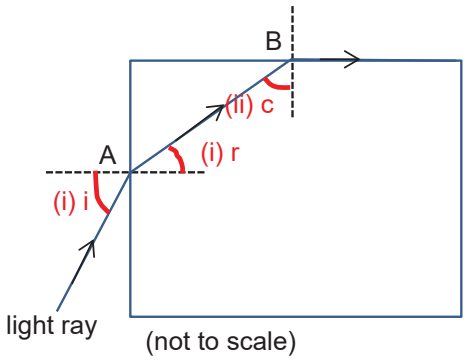
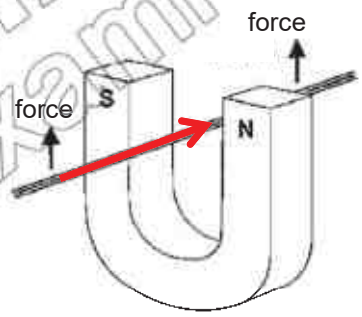
5a		Part (i) 1 mark Part (ii) 1mark
5b	$c = sin^{-1}\left(\frac{1}{1.55}\right) = 40.177 = 40.2°$	1 mark working 1 mark answer
5c	Total internal reflection occurs. / the light ray will be internally reflected. / reflect back into the block	1 mark
6a	The number of complete waves/oscillation in one second.	1 mark
6b	20000Hz or 20kHz	1 mark
6c	$distance\ travelled\ by\ the\ wave = speed \times time$ $= 1500 \times 0.8 = 1200m$ $distance\ from\ ship\ to\ seabed = \frac{1200}{2} = 600m$	1 mark 1 mark
7a	$Q = It = 0.015 \times 0.1$ $= 0.0015C$	1 mark working 1 mark answer 1 mark unit
7b	$E = VQ = 3000 \times 0.0015 = 4.5J$	1 mark working 1 mark answer
8a		1 mark
8b	<u>Increase the current in the wire</u> by increasing the emf of the source <u>using a stronger magnet</u> to Increase the strength of the magnetic field	1 mark 1mark
8c	Reverse the direction of the current flow Swop the poles of the magnet to reverse the magnetic field	1 mark for any correct answer

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9ai	The foam traps air and air is a poor conductor of thermal energy.	1 mark
9aii	There is no heat transfer by conduction and convection in vacuum. Conduction and convection requires a medium for energy transfer. However, there is no medium in a vacuum.	1 mark 1 mark
9aiii	Silvered surfaces are poor emitters / good reflector of thermal energy. The rate of heat lost from the hot liquid to the surrounding by radiation is smaller. / The thermal energy is reflected back into the liquid.	1 mark 1 mark
9bi	Freezing point of water OR melting point of ice	1 mark
9bii	Molecules are packed relatively close together in a random arrangement.	1 mark
9biii	The solid molecules vibrate about their fixed position slower.	1 mark
9c	During evaporation, the water molecules absorb heat from the skin. The more energetic water molecules leave the surface of the skin and the average kinetic energy of the remaining molecules decreases.	1 mark 1 mark
10ai	400Ω	1 mark
10aii	Total R = 400+500 = 900Ω $I = \frac{V}{R} = \frac{9.0}{900} = 0.010A$	1 mark 1 mark
10aiii	$V = IR = 0.010 \times 500 = 5.0V$	1 mark
10bi	The current in the circuit decreases, when temperature decreases, the resistance of thermistor T increases causing the effective resistance to increase and since $= \frac{V}{R}$, current decreases when R increases.	1 mark 1 mark
10bii	since $V = IR$,the current decreases and resistance of U remains the same, the p.d. across resistor U decreases.	1 mark
10biii	Since the p.d. across T and U is equal to the emf / 9.0V, the p.d. across T will increase when the p.d. across resistor U decreases.	1 mark
10c	A fuse prevents excessive current and hence damages to appliances. / protect appliances from overheating	1 mark

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	The fuse is connected to the live wire and when current exceed its rating, the fuse becomes hot and melts. This cuts off the current flow from the live wire to the appliance.	1 mark
11a	Cooler air from the air-con being denser will sink, warmer air at the bottom being less dense will rise, convection current is setup to cool the room effectively.	1 mark 1 mark
11b	The data is transmitted using infrared radiation.	1 mark
11ci	$Cost = kWh \times cost\ per\ unit$ $= 4 \times 0.30 = \$1.20$	1 mark
11cii	$power = \frac{E}{t} = \frac{4}{8} = 0.5kW$ $= 500W$	1 mark 1 mark
11di	Short circuit / when large current passes through	1 mark
11dii	When the current is large enough, the strength of the electromagnet increases until it is strong enough to attract the iron armature. This pulls the iron armature away from the spring and release the contact. This causes an open circuit and switch off the current.	1 mark 1 mark 1 mark

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Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS, ~~CHEMISTRY~~) **5076/01**

PAPER 1 Multiple Choice **12 September 2018**

Wednesday 0800 – 0900 **1 hour**

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid or tape.
Write your name, class and register number on the Answer Sheet in the spaces provided and at the top of this page.

There are **forty** questions in this section. 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.
A copy of the Data Sheet is printed on page 18.
A copy of the Periodic Table is printed on page 19.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **19** printed pages including the cover page.

[Turn over

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1 The diagram shows a vernier scale.

What is the reading on the vernier scale?

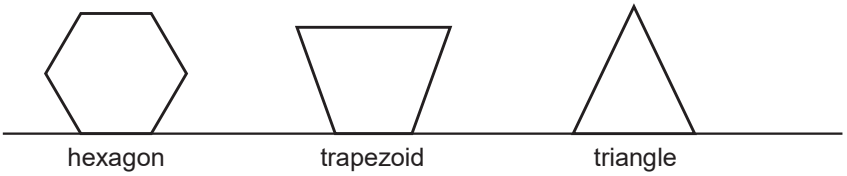
A 6.50 cm **B** 6.55 cm **C** 7.00 cm **D** 7.05 cm

2 A moon rover of mass 15 kg on the Earth is taken to the Moon to collect data. The gravitational field strength on the Earth is 10 N/kg and on the Moon is 1.6 N/kg.

What are the mass and weight of the moon rover on the Moon?

	mass / kg	weight / N
A	15	24
B	15	150
C	24	15
D	24	150

3 Three objects are cut from the same sheet of metal. They are different in shapes but they all have the same mass.



Which object has the greatest density?

A the hexagon **B** the trapezoid
C the triangle **D** all have the same density

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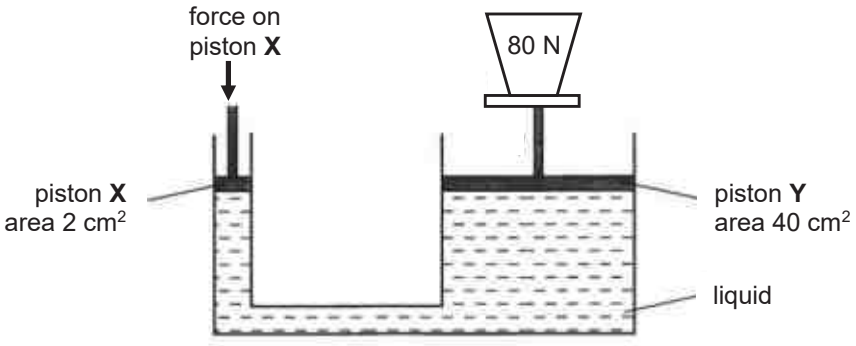
4 A measuring cylinder has a mass of 120 g when empty. When 50 cm^3 of liquid is added, the total mass of the liquid and the measuring cylinder is 160 g. What is the density of the liquid?

A 0.80 g/cm^3 **B** 1.25 g/cm^3 **C** 2.40 g/cm^3 **D** 3.20 g/cm^3

5 A hydraulic system is used to lift a load of 80 N.



When piston **X** is pushed down, pressure is applied on the liquid. The same pressure is applied throughout the entire liquid. What is the minimum downward force that needs to be applied at piston **X** to lift the 80 N load on piston **Y**?

A 1 N **B** 4 N **C** 80 N **D** 1600 N

6 Visible light and radio waves are different types of waves. How may these waves be correctly described?

	visible light	radio waves
A	longitudinal	longitudinal
B	longitudinal	transverse
C	transverse	longitudinal
D	transverse	transverse

7 Which electromagnetic wave travels at the highest speed through a vacuum?

A gamma rays
B microwaves
C ultraviolet rays
D All electromagnetic waves travel at the same speed through a vacuum.

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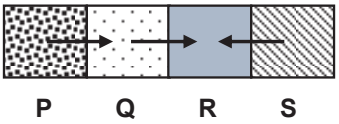
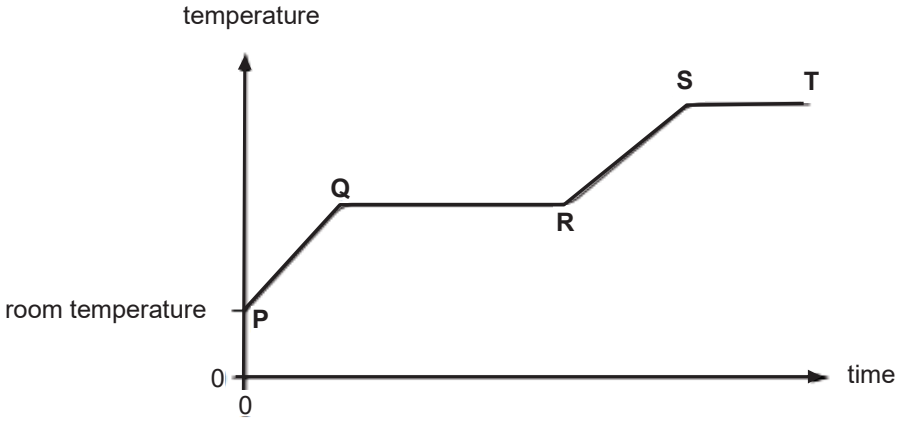
8 Four objects, **P**, **Q**, **R** and **S** are arranged in a line and in contact with each other as shown. The arrows show the directions in which thermal energy travels between the objects.



Which statement about the temperatures of the objects is correct?

A **P** is colder than **Q** and **R**.
B **Q** is hotter than **R** but colder than **P**.
C **R** is the hottest object.
D **S** and **R** have the same temperature.

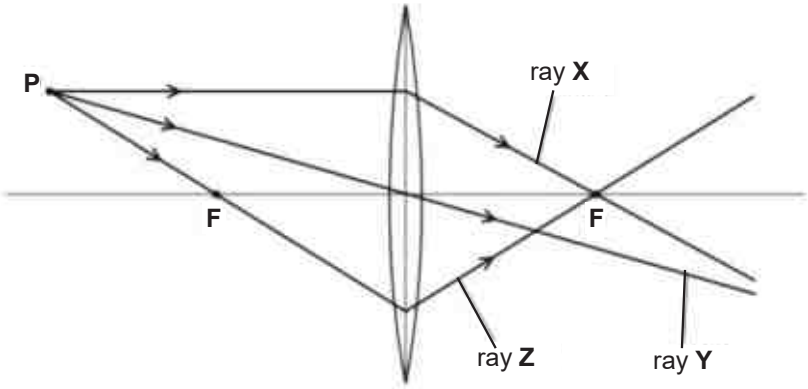
9 A solid is heated from room temperature. The graph shows how its temperature changes with time as it is heated constantly.



Which section of the graph will the substance be in the liquid state?

A **PQ** **B** **QR** **C** **RS** **D** **ST**

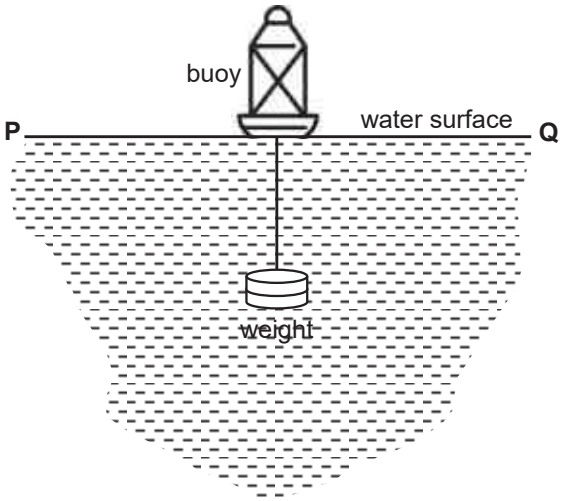
10 Megan draws three rays of light from point **P** through a converging lens. Each point labelled **F** is the principal focus of the lens.



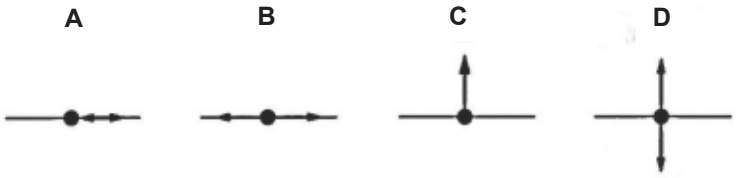
Which of the rays are drawn correctly?

A ray **Y** only **B** ray **Z** only **C** rays **X** and **Y** **D** rays **X** and **Z**

11 The diagram shows a buoy floating in water with a weight attached so that the buoy floats upright.



Transverse waves travel across the water from **P** to **Q**. Which diagram shows the movement of the buoy as the wave passes?



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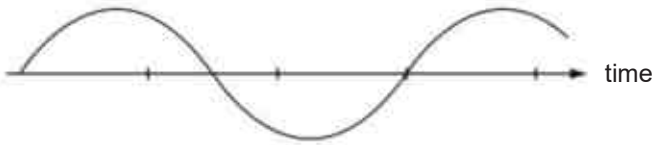
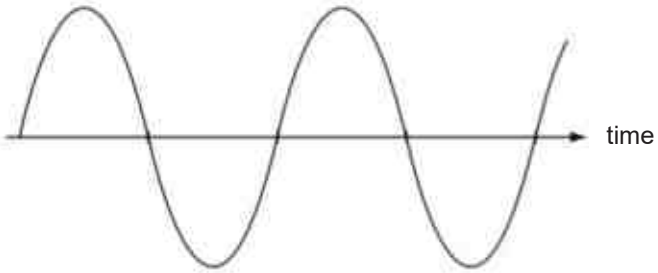
12 The diagrams represent the waves produced by four sources of sound. The scales are the same for all the diagrams. Which sound has the highest frequency?

A

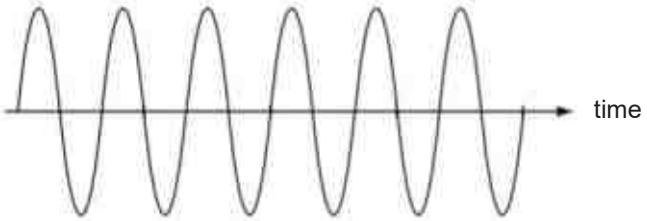


B



C

D



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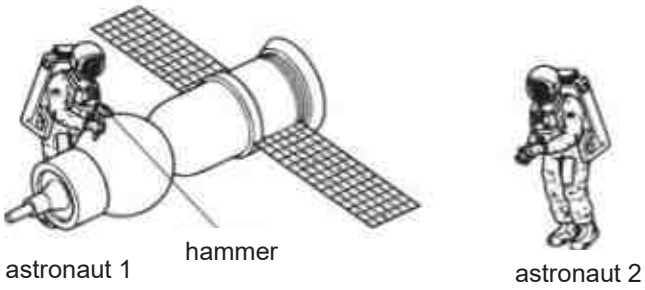
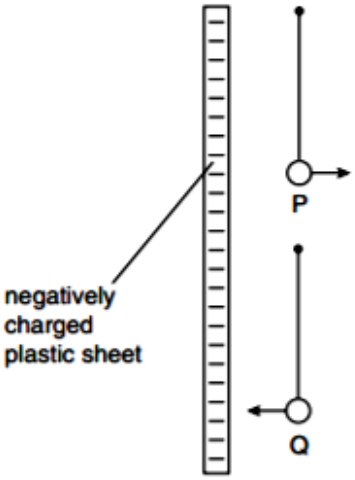
13 Two astronauts are assigned to conduct repair works on a damaged satellite in space. Astronaut 1 uses a hammer to knock out a dent on the satellite. Astronaut 2 is nearby.



Compared with the sound heard if they are working on the Earth, what does astronaut 2 hear?

A a quieter sound
B a louder sound
C a sound of the same loudness
D no sound at all

14 Two very light, charged balls **P** and **Q** are hung, one above the other, from nylon threads. When a negatively charged plastic sheet is placed alongside them, **P** is repelled and **Q** is attracted.



What are the original charges on **P** and **Q**?

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

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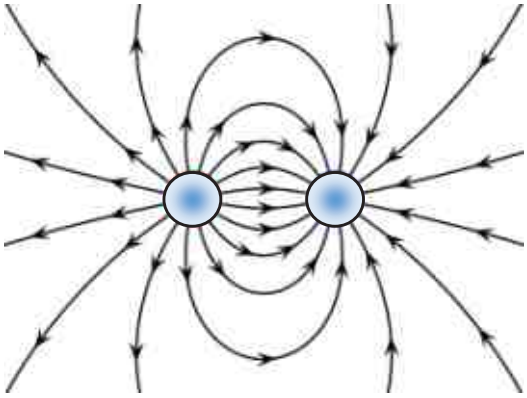
15 The diagram shows the electric field pattern between two isolated point charges.



Which two point charges produce this pattern?

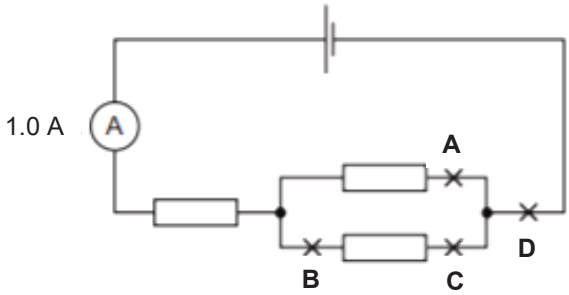
A (+) (+)

B (+) (-)

C (-) (-)

D (-) (+)

16 The reading of the ammeter in the circuit is 1.0 A. When a second ammeter is connected to the circuit, it also reads 1.0 A.



At which point, **A**, **B**, **C** or **D** is the second ammeter connected?

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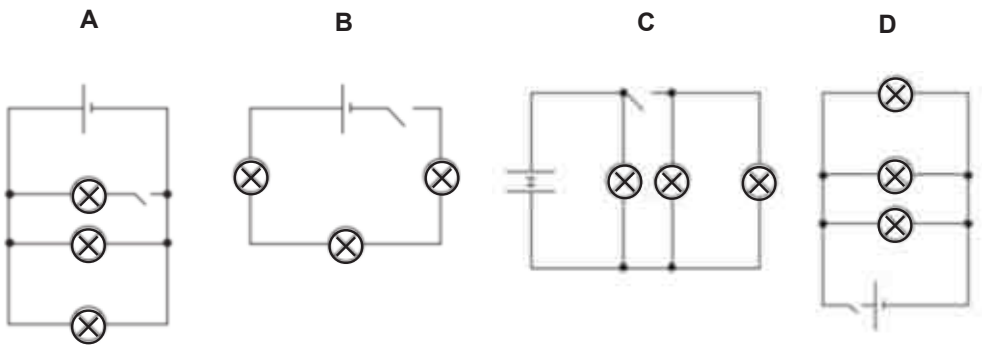
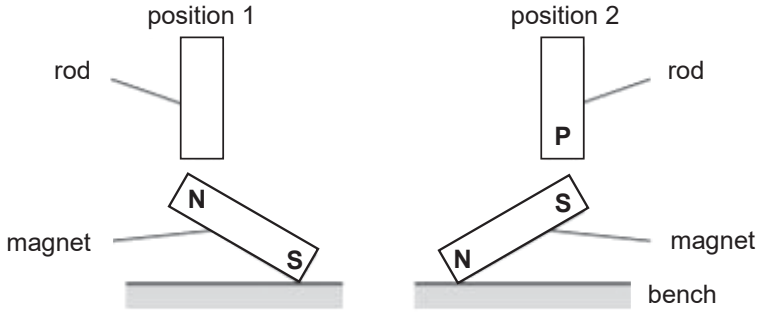
17 Four students, **A**, **B**, **C** and **D**, are asked to draw a circuit showing three lamps connected in parallel. The circuit also requires a switch that controls all three lamps.



Which student has drawn the circuit correctly?

18 One end of a rod picks up the N-pole of a bar magnet when in position 1. The same end of the rod is then brought to position 2. The rod picks up the S-pole of the bar magnet when in position 2.



Which material is the rod made from and what is the pole at end **P** of the rod when in position 2?

	material	pole at **P**
A	iron	N - pole
B	iron	S - pole
C	steel	N - pole
D	steel	S - pole

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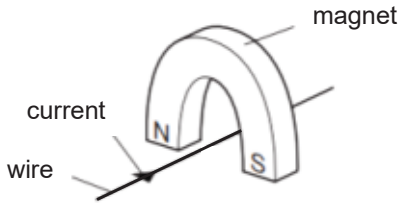
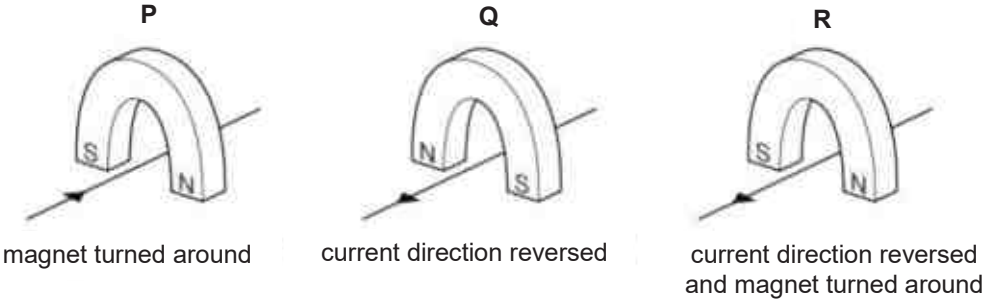
19 A current-carrying wire passes between the poles of a horse-shoe magnet causing a force to act on the wire.



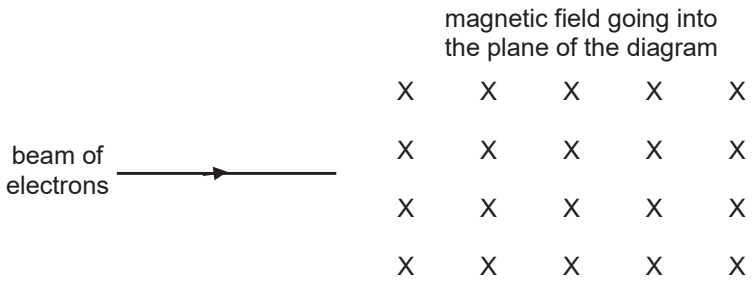
Three other arrangements, **P**, **Q** and **R**, of the wire and magnet are set up as shown.



Which arrangement(s) will produce a force in the same direction as the original arrangement?

A **P** only
B **R** only
C **P** and **Q** only
D **P, Q** and **R**

20 The diagram shows a beam of electrons entering a magnetic field.



What is the effect of the magnetic field on the beam of electrons?

A They are deflected into the plane of the diagram.
B They are deflected out of the plane of the diagram.
C They are deflected towards the bottom of the diagram.
D They are deflected towards the top of the diagram.

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Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS, CHEMISTRY) **5076/02**

Paper 2 Physics **11 September 2018**

Tuesday 0800 – 0915 **1 hour 15 minutes**

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
You may use a pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid or tape.

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A [45 marks]
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B [20 marks]
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total mark for this paper is 65.

For Examiner's Use	
Section A	
Section B	
Qn :	
Qn :	
Total	/ **65**

This document consists of **15** printed pages, including the cover page.

[Turn over

Section A (45 marks)

Answer **all** questions. Write your answers in the spaces provided.

1 Para-sailing is a leisure sport where a person is attached to a parachute and towed over the sea by a tow-rope. The tow-rope is attached to a motor-boat as shown in Fig. 1.1.

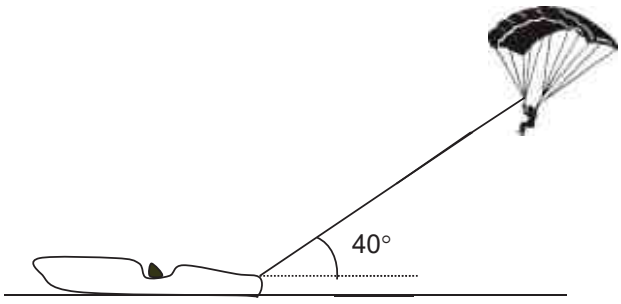

Fig. 1.1

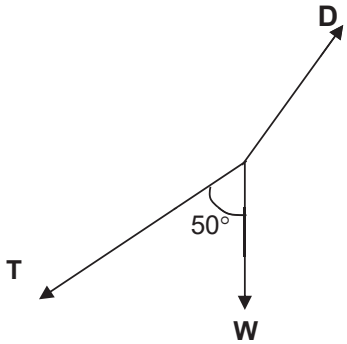

Fig. 1.2

Fig. 1.2 shows the directions of the forces acting on a person who has a weight, **W**, of 800 N. The tension **T** in the tow-rope is 1600 N and **D** is the drag force. The person is being towed horizontally at a constant speed of 8.5 ms^{-1}.

(a) Using a vector diagram and a scale of 1.0 cm to represent 200 N, determine the magnitude and direction of the resultant force of **T** and **W**. [4]

magnitude :……..

direction :……..

(b) State the magnitude of the drag force **D**. [1]

magnitude of the drag force **D** : ……

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2 Fig. 2.1 shows two **horizontal** forces acting on a cyclist and his bicycle as he moves forward.

Fig. 2.1

The cyclist produces a driving force that acts on the back wheel. (You may ignore any frictional force acting on the front wheel.)

(a) The cyclist accelerates until a constant speed is reached. State how the size of the air resistance changes, if any, when the cyclist is accelerating. [1]

.....

(b) Compare the sizes of the two horizontal forces acting on the cyclist and his bicycle when he is moving at a constant speed. [1]

.....

(c) The total mass of the cyclist and his bicycle is 75 kg. When the speed of the bicycle is 4.0 ms^{-1}, the driving force is 30 N and air resistance is 20 N. Calculate the total kinetic energy of the cyclist and his bicycle at this speed. [2]

(d) On Fig. 2.1, draw and label three **vertical** forces acting on the bicycle. [2]

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3 Fig. 3.1 shows a tractor. The bucket in front of the tractor is used to push the fence post into the ground. The bucket pushes the fence post down with a force of 6500 N. The area of the post in contact with the ground is 100 cm^2.

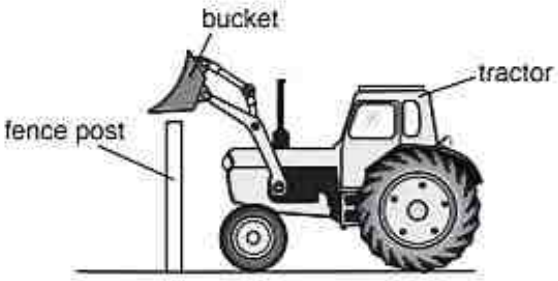

Fig. 3.1

(a) Calculate the pressure that the fence post exerts on the ground. [2]

(b) A farmer cuts the bottom of the post to make it more pointed. He then uses the same force to push the post into the ground.

Explain why he makes the post more pointed. [2]

……

……

……

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4 Fig. 4.1 shows a marathon runner sweating profusely during a race.

Fig. 4.1

At the end of the race, evaporation and convection help to cool the runner.

(a) **(i)** Describe how evaporation helps the runner to cool down. Use ideas about molecules in your answer. [1]

.....

.....

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(ii) Explain how convection currents are set up around the runner at the end of the race. [2]

.....

.....

.....

(b) Fig. 4.2 shows the runner wearing a shiny foil blanket to stop him from cooling down too quickly.

Fig. 4.2

Explain how the shiny foil blanket is able to stop him from cooling down too quickly. [2]

.....

.....

.....

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5 Fig. 5.1 shows a ray of light from the tip of the flame of a burning candle incident on a mirror.

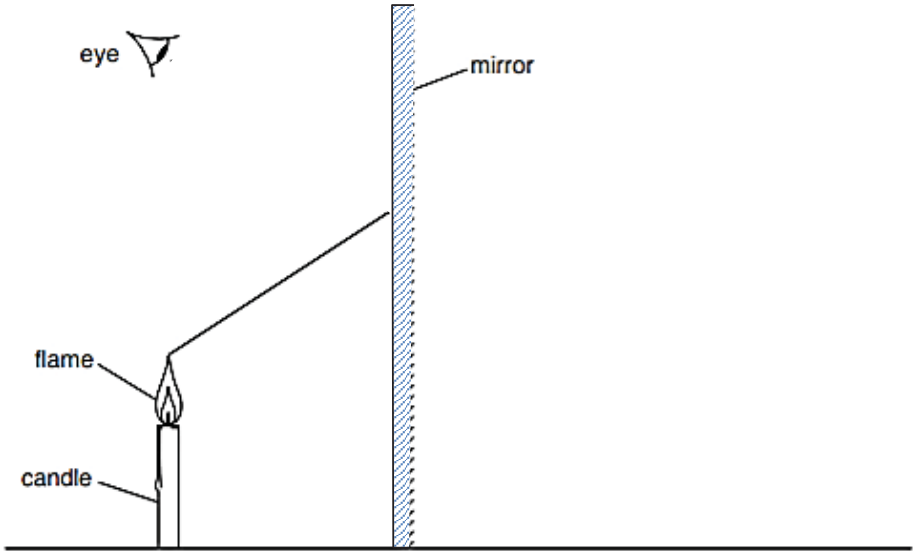

Fig. 5.1

(a) On Fig. 5.1, mark out the position of the image of the tip of the flame. Label the image I. [1]

(b) Complete the ray diagram to show how the eye sees the image of the tip of the flame. [2]

(c) The image of the candle produced by the mirror is a *virtual image*. Explain what is meant by *virtual image*. [1]

.....

6 Fig. 6.1 shows a ray of light **PQR** passing along a simple optical fibre to its end at **R**.

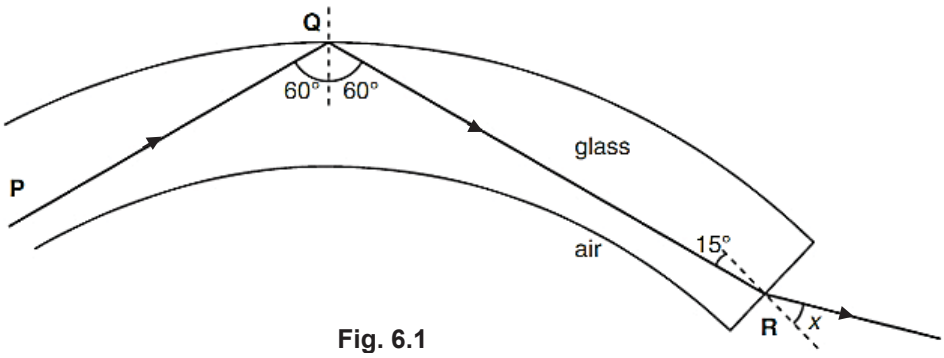

Fig. 6.1

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(a) **(i)** Explain why the ray **PQ** does not leave the optical fibre at **Q**. [3]

.....

.....

.....

.....

(ii) Explain what causes the ray **QR** to change direction at **R**. [2]

.....

.....

.....

(b) The refractive index of glass is 1.5. Calculate the angle, *x*, as shown in Fig. 6.1. [2]

7 Fig. 7.1 and Fig. 7.2 show a thumbprint and its virtual image as seen through a converging lens respectively.

Fig. 7.1

Fig. 7.2

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On Fig. 7.3, sketch a ray diagram to show how the image in Fig. 7.2 is formed by the lens. You may use an arrow to represent the thumbprint. [3]

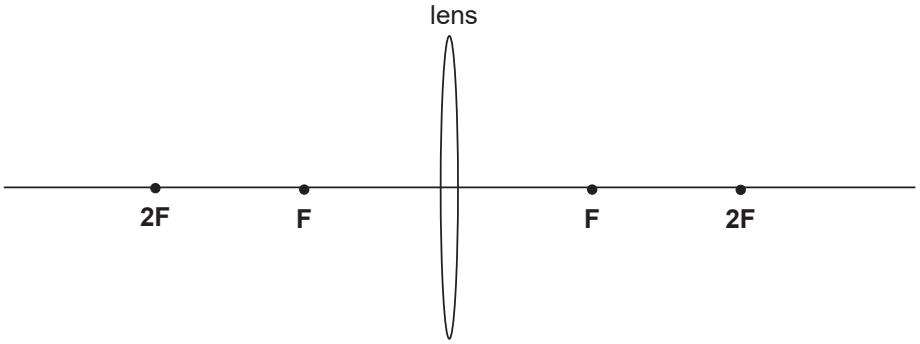

Fig. 7.3

8 Fig. 8.1 shows an electric kettle connected to a 240 V mains supply by a flexible cable. The kettle has a power rating of 2500 W.

Fig. 8.1

Fig. 8.2 shows the maximum current that may be carried safely by wires of various diameters.

wire diameter / mm	maximum current / A
0.50	3
0.75	6
1.00	10
1.25	13
1.50	15

Fig. 8.2

(a) Show that the current in the cable when the kettle is in use is 10.4 A. State clearly any equation that you use. [1]

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(b) **(i)** From Fig. 8.2, select the smallest diameter of wire that can be safely used for this kettle. [1]

……

(ii) Explain why it is dangerous to use a wire thinner than that in **(b)(i)**. [2]

……

……

(c) Describe one fault that may occur in the flexible cable that will cause the fuse in the plug to melt. [2]

……

……

9 Fig. 9.1 shows an electromagnetic relay being used to operate an electric motor.

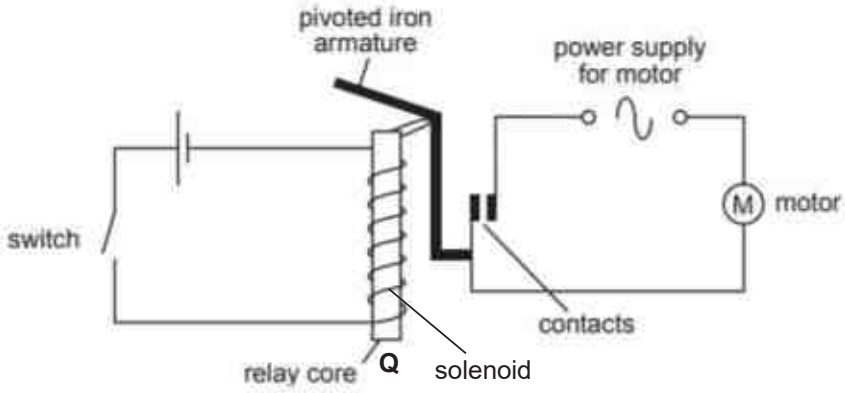

Fig. 9.1

(a) Below are sentences that describe stages of the process by which the circuit works.

A The armature pivots and the contacts close.
B The relay core is magnetised.
C The switch is closed and the current flows through the solenoid.
D A current flows through the motor, making it work.
E The core attracts the top part of the armature.

Put the sentences so that the stages are in the correct order by filling in the appropriate letters in the boxes below. One box has been filled in as an example.

C → ☐ → ☐ → ☐ → ☐ [2]

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(b) What is the polarity of the relay core at point **Q** when it is magnetised? [1]

polarity at point **Q** : …….

(c) The solenoid in Fig. 9.1 creates a magnetic field as shown in Fig. 9.2.

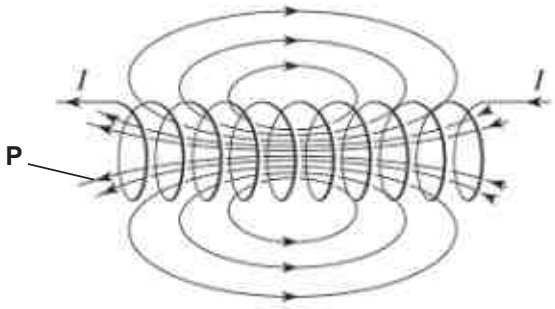

Fig. 9.2

What is the effect on the strength and direction of the magnetic field at point **P** if a larger current is passed through the solenoid in the opposite direction? [2]

……

……

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Section B (20 marks)

Answer any **two** questions. Write your answers in the spaces provided.

10 Fig. 10.1 shows the variation with time of the speed of a car as it travels along a level road. The car brakes when time t = 20 s, and comes to rest when t = 24 s.

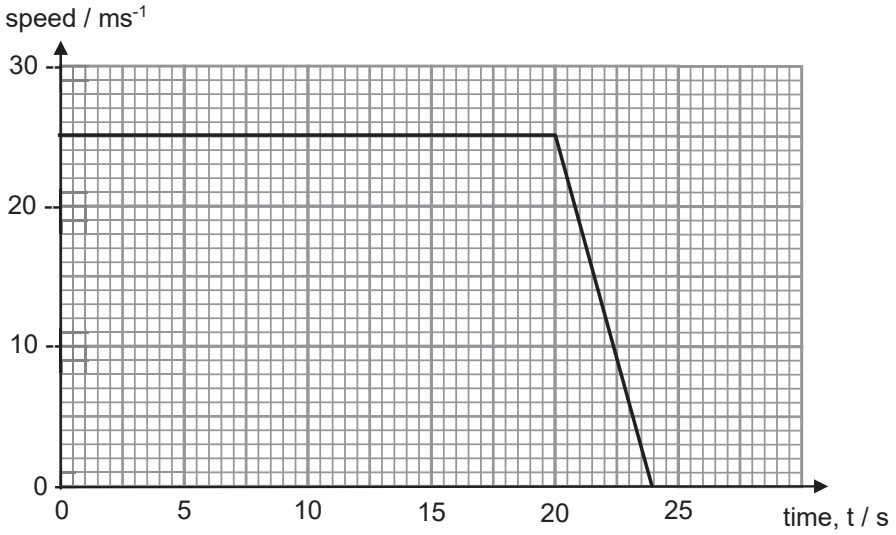

Fig. 10.1

The car has a mass of 800 kg and the forward driving force on the wheels is 1200 N.

(a) For the first 20 s of the motion shown in Fig. 10.1, calculate

(i) the distance travelled, [1]

(ii) the work done by the driving force, [2]

(iii) the power supplied by the driving force. [2]

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(b) During braking, the speed of the car decreases uniformly. The engine no longer provides a driving force.

(i) Calculate the deceleration of the car between t = 20 s and t = 24 s. [1]

(ii) Calculate the total braking force acting on the car during this period. [2]

(iii) Explain why the power dissipated in the brakes to slow down the car is greater at the beginning of the braking period than at the end. [2]

……..……

……..……

……..

11 **(a)** Fig. 11.1 shows an object of weight 2.5 N tilted about point **P** by a force **F**. The point **G** is the centre of gravity of the object.

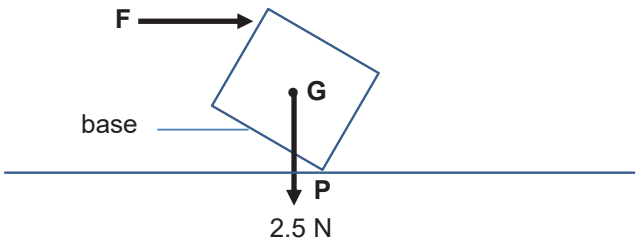

Fig. 11.1

(i) Explain what is meant by *centre of gravity*. [1]

……..

……..

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(ii) Describe and explain what will happen to the object when force **F** is removed. [2]

.....

.....

.....

(b) The object is then placed on a uniform beam as shown in Fig. 11.2. The beam is pivoted at its centre and balanced by a 1.5 N load suspended from a string.

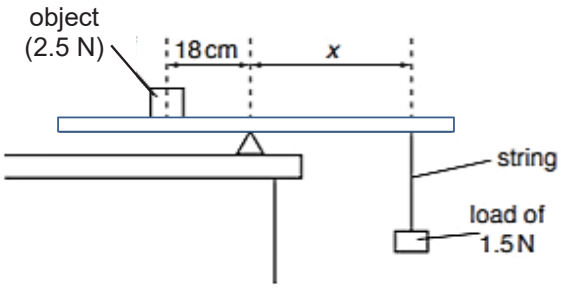

Fig. 11.2

(i) State the *principle of moments*. [2]

.....

.....

.....

(ii) On Fig. 11.2, indicate and label the centre of gravity, **Q**, of the beam. [1]

(iii) Explain if the weight of the beam produce any moment about the pivot. [1]

.....

.....

(iv) Calculate the distance *x*. [2]

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(iv) The pivot is shifted to the edge of the table. Without changing the weight of the object and the load, suggest one possible way to balance the beam again. [1]

……

……

12 Fig. 12.1 shows a variable resistor **R** connected to a light bulb **Q** and a 10 V battery of negligible resistance. Resistor **R** is adjusted until the voltmeter reading is 2.5 V and the ammeter reading is 0.5 A.

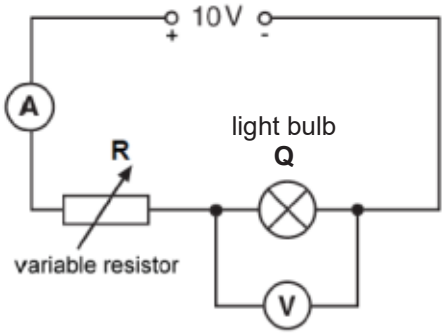

Fig. 12.1

(a) Calculate

(i) the resistance of light bulb **Q**, [2]

(ii) the resistance of variable resistor **R**. [2]

(b) The resistance of the variable resistor **R** is now increased to 30 Ω. Assuming that the resistance of light bulb **Q** remains unchanged, state and explain what happens to the brightness of light bulb **Q**. [2]

……

……

……

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(c) Light bulb **Q** is then used in a different circuit. It is connected to 2 other light bulbs **A** and **B** as shown in Fig. 12.2.

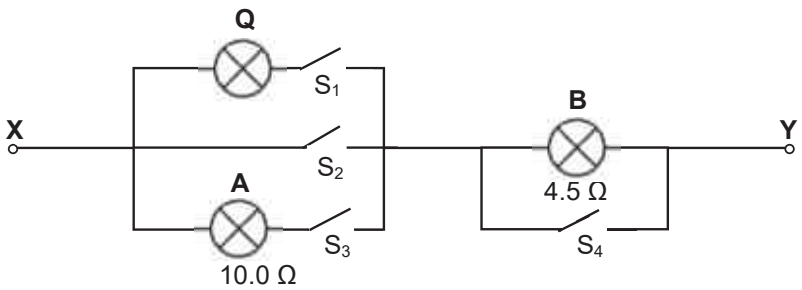


Fig. 12.2

(i) Calculate the effective resistance between **X** and **Y** when S_1 and S_3 are closed. [2]

(ii) Suggest which light bulb(s) will light up when switches S_1, S_3, and S_4 are closed. Explain your answer. [2]

……..

……..

……..

END OF PAPER

Sec 4E5N SCIENCE (PHYSICS) 5076/2
PRELIMINARY EXAMINATION 2018
Suggested Answers

Paper 1 (Multiple Choice Questions)

Qn	Ans
1	**B**
2	**A**
3	**D**
4	**A**
5	**B**
6	**D**
7	**D**
8	**B**
9	**C**
10	**C**

Qn	Ans
11	**D**
12	**D**
13	**D**
14	**B**
15	**B**
16	**D**
17	**D**
18	**A**
19	**B**
20	**C**

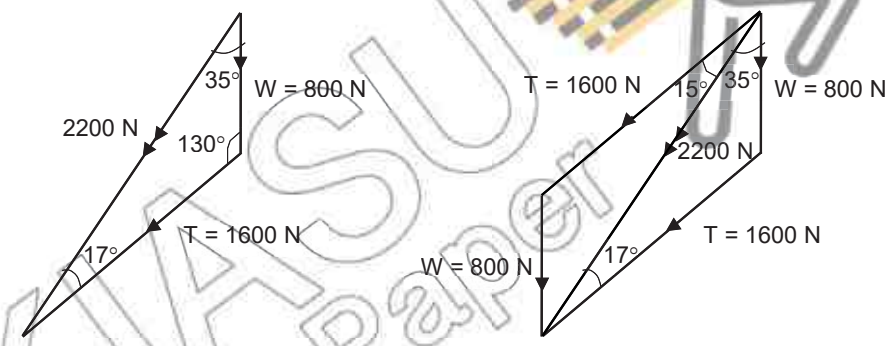
SECTION A [45 marks]

1 **(a)** component vectors correctly drawn according to scale with correct direction and angle [1]

resultant drawn correctly with correct direction ecf [1]

resultant force = <u>2200 N (Accept 2160 N ≤ F ≤ 2240N)</u> [1]

direction = <u>17° from T (1600 N) or 35° from W (800 N) ± 2°</u> [1]



(b) Drag force = resultant force ecf [1]

2 **(a)** Air resistance <u>increases</u>. [1]

(b) Air resistance is <u>equal</u> to the driving force. [1]

(c) Kinetic energy = ½ mv^2

= ½ x 75 x 16 [1]

= <u>600 J</u> [1]

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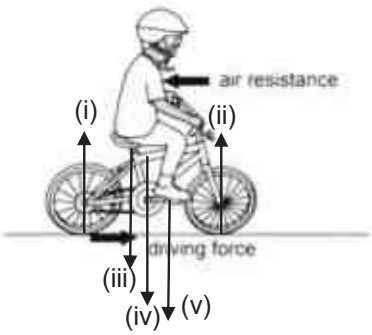
(d) [2] - for any 3 vertical forces correctly drawn and labelled

[1] - for 2 forces vertical forces correctly drawn and labelled.



(i) normal contact force from road on bicycle
(ii) normal contact force from road on bicycle
(iii) normal contact force from cyclist on bicycle seat
(iv) weight of bicycle
(v) normal contact force from cyclist on bicycle pedal

3 **(a)** Pressure = F/A
= 6500 / 100 [1]
= 65 N /cm^2 or 650 kPa [1]

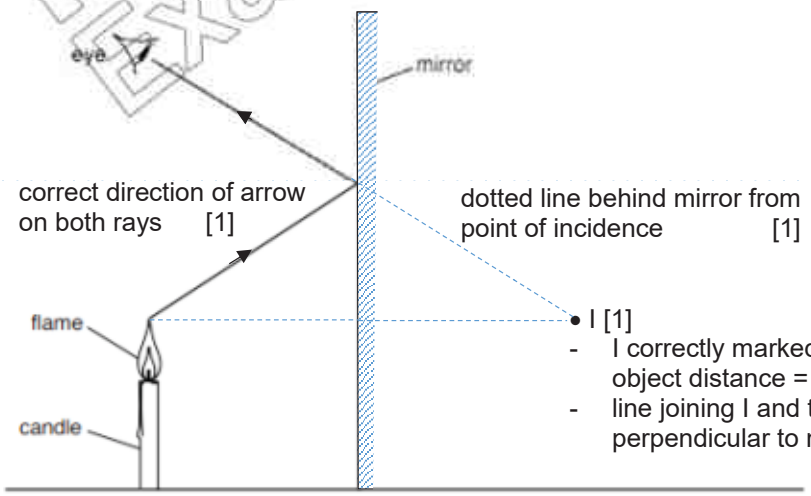
(b) This is to reduce the area of contact of the post with the ground. [1/2]
Pressure is now greater [1]
to enable the post to be pushed more easily into the ground. [1/2]

4 **(a)** **(i)** The water molecules in the perspiration absorb thermal energy from the body to evaporate. [1]

(ii) The air molecules surrounding the runner get heated up by conduction. [1/2]
The heated air expands, become less dense and then rises. [1/2]
The cooler air, being more dense, sinks (to replace the heated air). [1/2]
The cooler air is then heated and the process repeats. [1/2]
Convection currents are set up.

(b) Shiny surface is a good reflector /poor emitter of infrared radiation. [1]
Heat loss from the body to the surroundings is minimized. [1]

5 **(a)**



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(b) A virtual image is an image that cannot be captured on a screen. [1]

6 **(a)** **(i)** Ray **PQ** is travelling from a more optically dense medium to an optically less dense medium. [1]
It is incident at point Q at an angle greater than the critical angle. [1]
Total internal reflection takes place reflecting the ray back into the optical fibre. [1]

(ii) The ray **QR** is incident at an angle that is smaller than the critical angle. [1/2]
The ray exits the optical fibre, which is an optically denser medium [1/2]
and changes direction as the speed of light in air is greater. [1]

(b) n = sin x / sin 15
1.5 = sin x / sin 15 [1]
x = $\sin^{-1}$ (1.5 x sin 15)
= 22.8° [1]

7

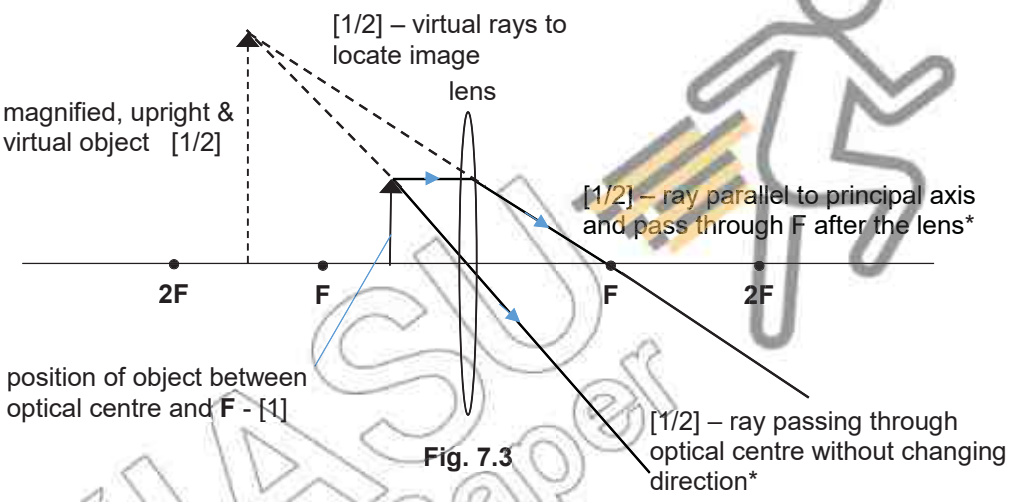

Fig. 7.3

*Maximum of [1] only if object is placed beyond F provided the rays are drawn correctly.

8 **(a)** P = VI
I = 2500 / 240 No mark if P = VI is not stated. [1]
= 10.4 A

(b) **(i)** 1.25 mm [1]

(ii) Thinner wire has a higher resistance. [1]
This will cause the wire to overheat and result in an [1/2]
electric fire. [1/2]

(c) Damaged insulation in the flexible cable can cause [1]
the live wire to come into contact with the neutral wire / earth wire resulting in a [1/2]
short circuit. [1/2]

9 **(a)**

[1/2] for each correctly labelled box

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(b) polarity at point **Q** : South [1]

(c) The strength of the magnetic field increases. [1]
The direction of the magnetic field reverses. [1]

SECTION B [20 marks]

10 (a) (i) Distance travelled = area under graph
= 25 x 20
= 500 m [1]

(ii) Work done = force x distance
= 1200 x 500 [1]
= 600 000 J [1]

(iii) Power = work done / time
= 600 000 / 20 [1]
= 30 000 W [1]

(b) (i) a = (v-u) / t
= (0 – 25) / 4
= - 6.25 ms^{-2} [1/2]

Deceleration = 6.25 ms^{-2} [1/2]

(ii) driving force – braking force = resultant force
0 - braking force = mass x acceleration
- braking force = 800 x (- 6.25) [1]
braking force = 5000 N [1]

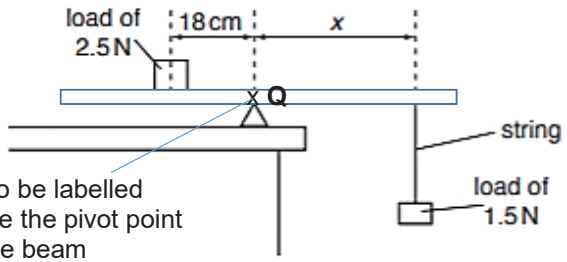
Award only 1 mark if student uses braking force = mass x deceleration.

(iii) Speed is higher at the beginning of the braking period [1/2]
so kinetic energy is higher. [1/2]
The brakes have to do more work [1/2]
per unit time to slow down the car. [1/2]

11 (a) (i) Centre of gravity is the point on an object where the (entire) weight of the object appears to act on. [1]

(ii) The object will turn anticlockwise / fall to the left and come to rest on its base. [1/2]
Line of action of the weight lies within the base area. [1/2]
The weight produces an anticlockwise moment about **P**. [1]

(b) (i)



[1] CG to be labelled above the pivot point on the beam

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(ii) When an object is in equilibrium, [1/2]
the sum of clockwise moment about a point is equal to the sum of anticlockwise moment [1]
about the same point. [1/2]

(iii) No, because perpendicular distance from the weight to the pivot is zero. [1]

(iii) Sum of clockwise moment about pivot = sum of anticlockwise moment about pivot
1.5 x ***x*** = 2.5 x 18 [1]
x = 30 cm [1]

(iv) Shift the 2.5 N load closer to the pivot or [1]
Shift the 1.5 N further away from the pivot.

12 (a) (i) R_Q = V/ I
= 2.5 / 0.5 [1]
= 5 Ω [1]

(ii) RR = V/ I
= (10 – 2.5) / 0.5 [1]
= 7.5 / 0.5
= 15 Ω [1]

(b) The effective resistance of the circuit increases. [1/2]
The current in the circuit decreases. [1/2]
Potential difference across the bulb also decreases. [1/2]
Brightness of bulb Q decreases. [1/2]

(c) (i) Effective resistance in parallel = $(1/5 + 1/10)^{-1}$
= 3.33 Ω ecf from **(a)(i)** [1]

Effective resistance between X and Y = (3.33 + 4.5)Ω
= 7.83 Ω ecf [1]

(ii) Bulbs **A** and **Q** will light up. [1]
Current will flow through the short circuit path below bulb **B** when switch S_4 is closed. [1/2]
There is no current flowing through **B**. [1/2]

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NAME:	CLASS:	INDEX NO:

QUEENSWAY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

SECONDARY 4 EXPRESS/5 NORMAL (ACADEMIC)

Parent's Signature:

SCIENCE (PHYSICS, CHEMISTRY) **5076/01**

Paper 1 Multiple Choice **14 Sep 2018**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name and index number on the Answer Sheet in the spaces provided.

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.

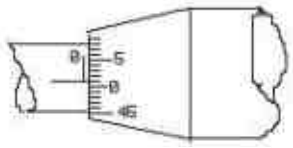
Read the instructions on the Answer Sheet very carefully.

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.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

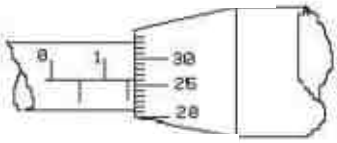
This document consists of **10** printed pages.

Setters: Mr Jimmy Ong, Mr Enrico Tan (Phy) **[Turn over**

1 A micrometer screw gauge is used to measure the diameter of a pearl



without pearl



with pearl

What is the diameter of the pearl?

A 1.25 mm **B** 1.75 mm

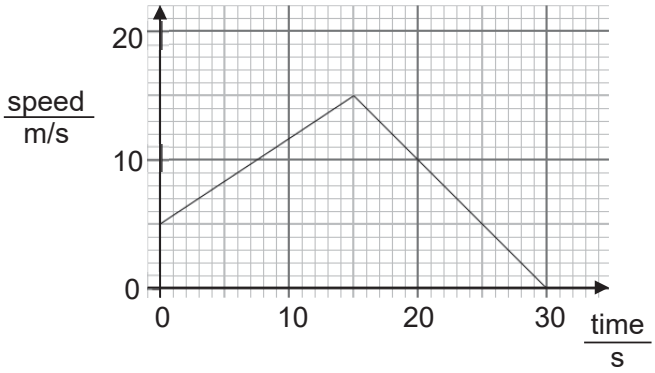
C 1.76 mm **D** 2.25 mm

2 Which of the following shows the closest estimate for the height of a 25-storey HDB flat?

A 0.1 dm **B** 10 km

C 100 Gm **D** 10 000 cm

3 The graph shows the movement of a bicycle over a period of 30 s.

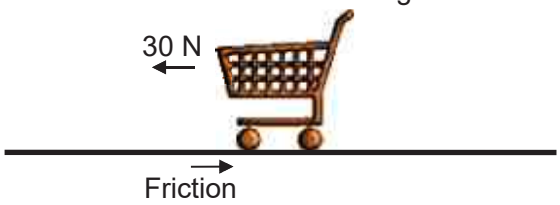


What is the average speed of the bicycle for the first 15 s?

A 0.5 m/s **B** 3.75 m/s

C 7.5 m/s **D** 10 m/s

4 A trolley of mass 10 kg was pushed with a force of 30 N. If it moves with a constant speed of 0.5 m/s, what is the force of friction acting on the trolley?



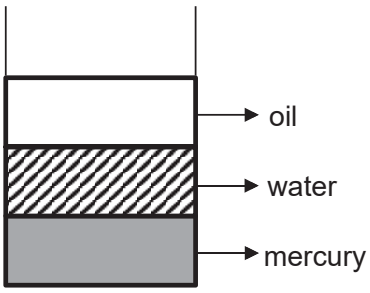
A 0 N

B 15 N

C 25 N

D 30 N

5 The following diagram shows the position of mercury, oil and water in a clear glass container.



Which of the following lists is arranged in ascending order of density?

A water, mercury, oil

B mercury, water, oil

C oil, water, mercury

D oil, mercury, water

6 Which of the following are typical characteristics of an unstable object?

	base	**center of gravity**
A	narrow	high
B	narrow	low
C	wide	high
D	wide	low

7 Gavin is attempting to cross a frozen lake which is covered with only a very thin layer of ice on the surface. Which of the following is the **best** method to cross the lake without cracking the ice?

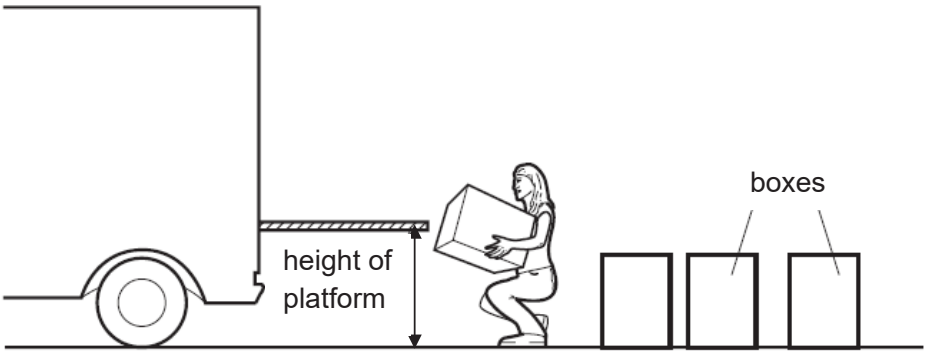
A tip-toe lightly and slowly across the surface

B run as fast as he can across the surface before it cracks

C lie flat on the thin ice and push himself across the surface

D remove all unnecessary heavy objects and walk normally across the surface

8 A person lifts boxes of equal weight onto a platform.



Which quantity will not affect the total work done by the person?

A the weight of the boxes

B the number of boxes lifted

C the time taken to lift the boxes

D the height of the platform above the ground

9 Substance X has a melting point of −98 °C and a boiling point of 65 °C.

Which statement best describes the motion and arrangement of the particles of substance X at a temperature of 0 °C

A They vibrate about their fixed positions.

B They slide past one another at high speeds.

C They move freely and randomly at high speeds.

D They slide pass one another and have no fixed positions.

10 A piece of ice cube feels cool to the skin when touched.

Which of the following best explains why?

A Heat is transferred from the skin to the ice cube.

B Heat is transferred from the ice cube to the skin.

C Coldness is transferred from the ice cube to the skin.

D Coldness is transferred from the skin to the ice cube.

11 Boiling and evaporation are different processes.

Which of the following shows their differences accurately?

	Boiling	Evaporation
A	No bubbles are formed	Bubbles are formed
B	Occurs throughout the liquid	Only occurs at the surface
C	Occurs at 100 °C	Occurs at any temperature
D	Requires energy source	Requires heat source

12 What is meant by the term *wavefront*?

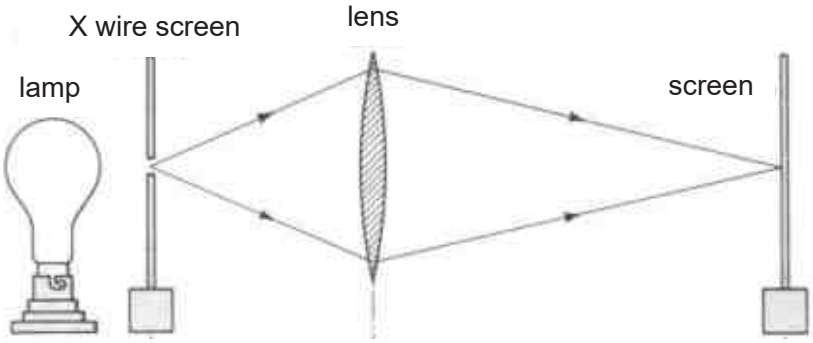
A half the distance between crest and the trough

B a line joining the points of the same phase on a wave

C the distance between two successive crests of a wave

D the time taken to complete a full oscillation of the wave

13 A lamp produces a sharp image of an X wire on a screen through a thin converging lens



.

How does the image change as the lens is moved closer to the lamp?

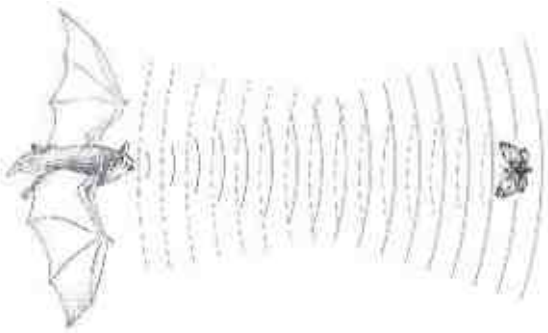
A The image becomes virtual.

B The image becomes brighter.

C The image on the screen becomes blurred.

D The image on the screen becomes more focussed.

14 Bats use echolocation to locate their prey. A bat hears the echo that bounced off the moth 2.2 ms after it emits its call.



Assuming the speed of sound is 330 m/s, what is the distance between the bat and the moth?

A 75 mm

B 150 mm

C 363 mm

D 726 mm

15 Which of the following is the SI units for charge?

A Ampere

B Coulomb

C Joules

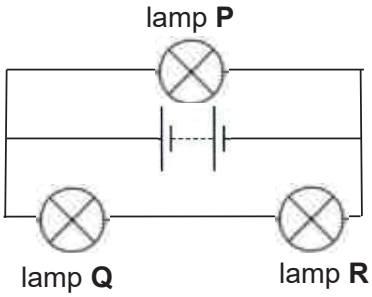
D Watts

16 The potential difference across a bulb is 12 V and 100 C of charge flows through it.

Calculate the amount of light and thermal energy dissipated by the bulb.

A 0.12 J
B 8.33 J
C 120 J
D 1200 J

17 The diagram shows three identical lamps **P**, **Q** and **R** connected in a circuit.



Which row shows how the brightness of lamp **P** and **Q** will change if lamp **R** is removed?

	brightness in lamp P	brightness in lamp Q
A	no change	dimmer
B	no change	brighter
C	dimmer	brighter
D	brighter	dimmer

18 The switch of a fan is connected incorrectly along the neutral wire.

Which of the following statements about the operation of the fan is/are correct?

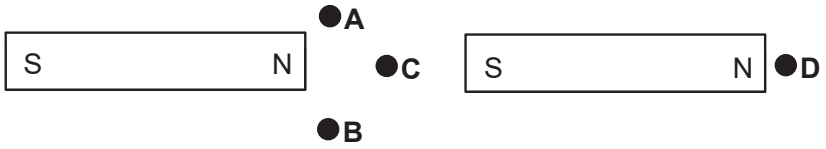
I. The fan would still operate when the switch is closed.
II. The fuse of the fan would melt under normal working condition when the switch is closed.
III. The fan would still be connected to the high voltage source when the switch is opened.

A I only
B III only
C I and II only
D I and III only

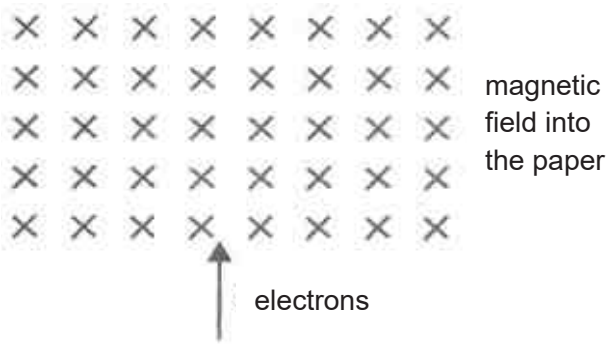
19 Two bar magnets are placed near each other with their poles as shown.

A student plots the resultant field lines with a compass.
The Earth's magnetic field can be ignored.

At which point does the compass point towards the top of the page?



20 An electron beam is directed into a uniform magnetic field. The magnetic field lines are flowing into the paper.



How would the electron beam be affected?

A It will deflect out of the paper.

B It will deflect to the left.

C It will deflect to the right.

D It will slow down but will not change direction.

END OF PAPER

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key

a X b	a = relative atomic mass X = atomic symbol b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

NAME:	CLASS:	INDEX NO:

QUEENSWAY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

Parent's Signature:

SCIENCE (PHYSICS, CHEMISTRY) **5076/02**

Paper 2 Physics **11 Sep 2018**

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A:
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B:
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

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	
Section A	/45
Q	/10
Q	/10
TOTAL	/65

This document consists of **16** printed pages.

Setters: Mr Jimmy Ong, Mr Enrico Tan (Phy) **[Turn over**

SECTION A

Answer **all** the questions in the spaces provided.
The total mark for this section is 45.

A1 Fig. 1 shows how the speed of a bicycle changes with time.

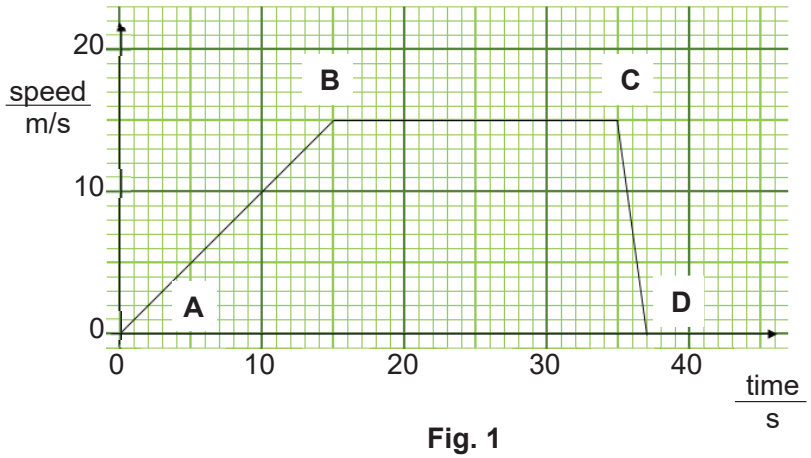


Fig. 1

(a) State the magnitude of the acceleration of the object between points **B** and **C**.

acceleration = ... m/s^2 [1]

(b) Use your answer to **(a)** to describe the motion of the bicycle between points **B** and **C**.

.....[1]

(c) Calculate, showing your working, the distance travelled by the bicycle between points **A** and **B**.

distance travelled = ... m [1]

(d) Is it possible to tell the direction of the bicycle using the Fig. 1? If so, state the time period at which the bicycle is travelling in the reverse direction. If not, state the reason why it is not possible.

.....

.....[2]

A2 Fig. 2.1 shows a ball falling a distance of 1.1 m when David drops it. The mass of the ball is 0.50 kg.
Ignore air resistance. The gravitational field strength is 10 N/kg.

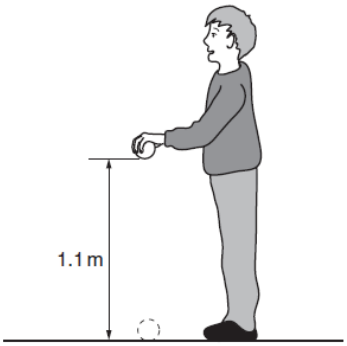


Fig. 2.1

(a) Calculate the decrease in gravitational potential energy of the ball as it falls through the 1.1 m.

decrease in potential energy = ... J [1]

(b) The ball bounces and only rises to a height of 0.80 m.

(i) Calculate the energy lost during the bounce.

energy lost = ... J [2]

(ii) Suggest one reason why energy is lost during the bounce.

.....[1]

(c) After retrieving the ball, David throws the ball down from a height of 1.1 m with an initial kinetic energy of 9.0 J.
Calculate the speed of the ball when it hits the ground.

speed = ... m/s [2]

A3 Fig. 3.1 shows a pressure cooker with a safety valve.

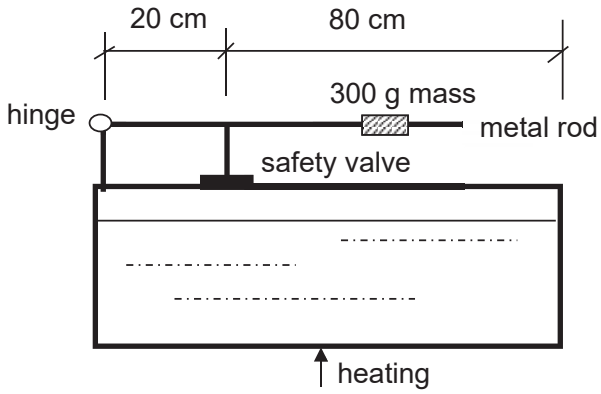


Fig. 3.1

(a) Calculate the weight of the mass. Take g = 10 N/kg.

weight = ... N [1]

(b) The safety valve is designed to open when the pressure in the cooker is 2500 Pa. The area of the valve is 0.003 m^2.

(i) Calculate the force applied on the safety valve due to the pressure in the cooker.

force = ... N [2]

(ii) Taking moments about the hinge of the pressure cooker, determine the shortest distance the weight should be positioned from the hinge such that the safety valve remains closed.

distance = ... cm [2]

A4 Two cars are parked next to each other in a hot, sunny afternoon as shown in Fig. 4.1.

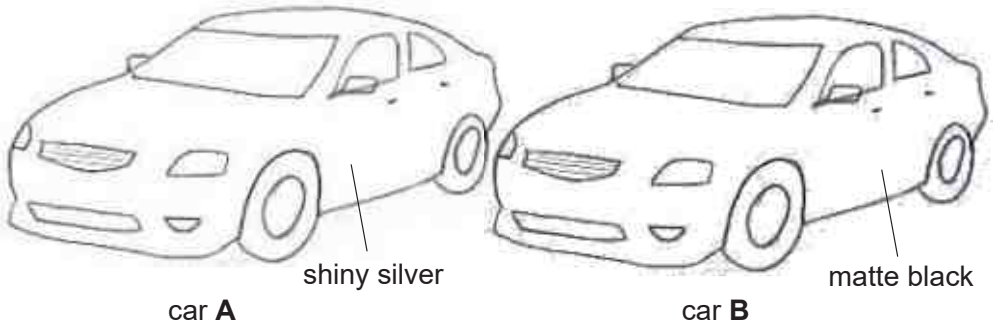


Fig. 4.1

The cars are identical except that car **A** has a polished silver surface and car **B** has a matte (dull) black surface.

The rise in temperature of car **B** over time is shown in Fig. 4.2.

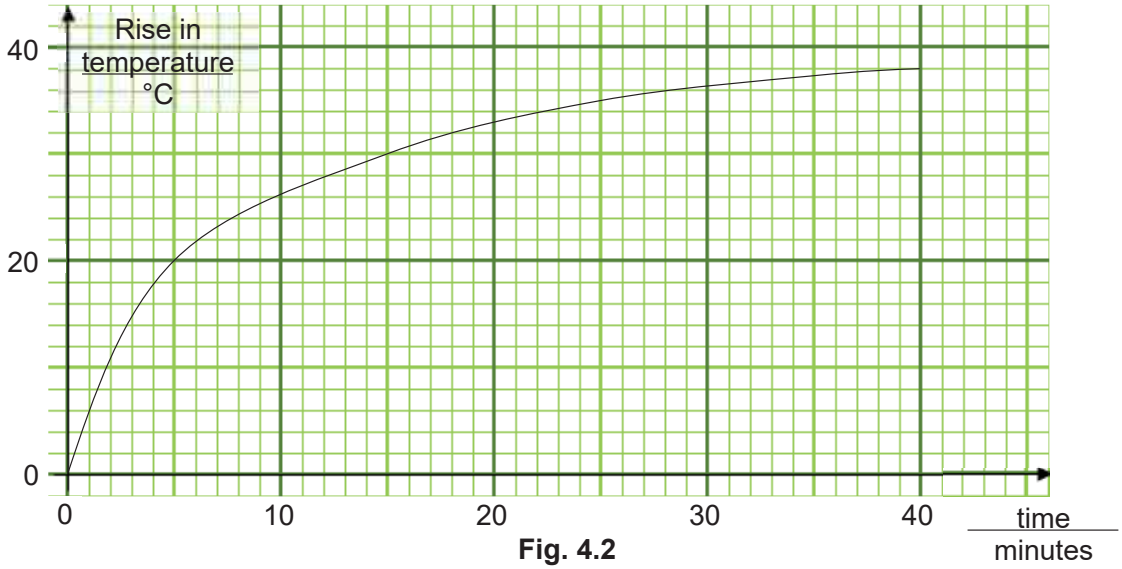


Fig. 4.2

(a) On Fig. 4.2, sketch the variation with time of the rise in temperature of car **A** for time between 0 and 20 minutes. [2]

(b) The two words "shiny" and "silver" describe car **A**'s reflectiveness of light and colour respectively. State one more property that affects absorption and emission of radiant heat.

..... [1]

A5 Fig. 5.1 shows how the pressure changes with time, at a sound receiver, for a sound wave. Point A is at an instant where the pressure is the highest. Fig. 5.2 shows position of air particles in the sound wave as it passes through.

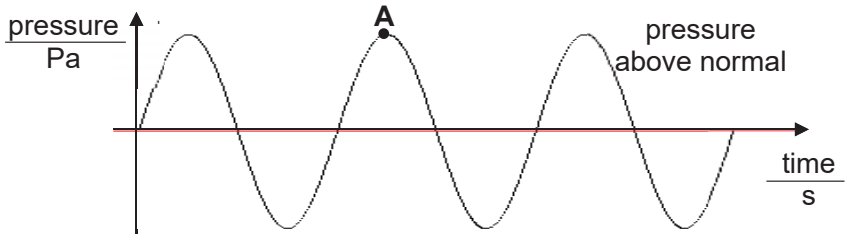


Fig. 5.1

Fig. 5.2

(a) Sound is type of wave.
Describe the behaviour of sound waves that make it a "wave" making reference to its energy transfer and particles.

……..…….

……..... [2]

(b) The sound wave has a frequency of 432 Hz.

State the meaning of "frequency of 432 Hz" in the context of a sound wave.

...……..……..……..... [1]

(c) Calculate the speed of this sound wave.

speed = ... m/s [2]

(d) On Fig. 5.2, circle a region on the wave where it corresponds to the pressure at point **A**. [1]

(e) A sound wave with a high maximum pressure corresponds to a high amplitude in the sound wave.

State how a sound with high amplitude affects the type of sound heard.

...……..……..……..... [1]

A6 A parallel beam of light shines on the surface of a glass block.

(a) Glass has a higher refractive index than air.

State the effect on the speed of light as light travels from a medium of lower refractive index to a medium of higher refractive index.

.....[1]

(b) The beam of light hits the surface of the glass at an angle of 35° to the surface of the glass as shown in Fig. 6.1.

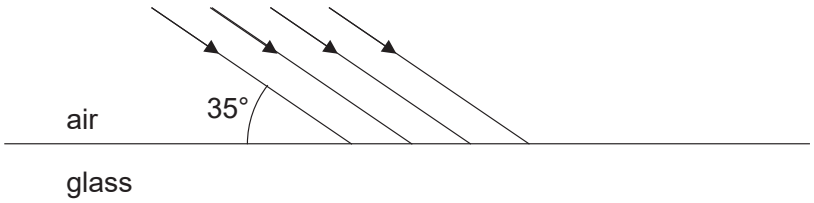


Fig. 6.1

Parallel rays of light strike the surface of the glass block from directly above it.

(i) Calculate the angle of refraction, given that the refractive index of glass is 1.5. Round your answer to the nearest 1°.

angle of refraction = ... °[3]

(ii) Hence, complete the diagram on Fig. 6.1 to show the path of the light in the glass. [1]

A7 Fig. 7 shows regions of the electromagnetic spectrum in order of decreasing frequency. Some regions are identified by letters.

high frequency → low frequency

A	**B**	ultraviolet	visible light	infrared	microwave	**C**

Fig. 7

(a) **(i)** State one property of waves in regions **A** and **C** that is common among waves in both regions.

.....[1]

(ii) State how waves in region **A** are different from that of waves in region **C** (other than having higher frequencies).

.....[1]

(b) For each device, state which component of the electromagnetic spectrum is used.

sunbed .....

cooking .....[2]

A8 Fig. 8 shows the electric field pattern between two isolated point charges. The direction of the field and the polarity of the charges are unknown.

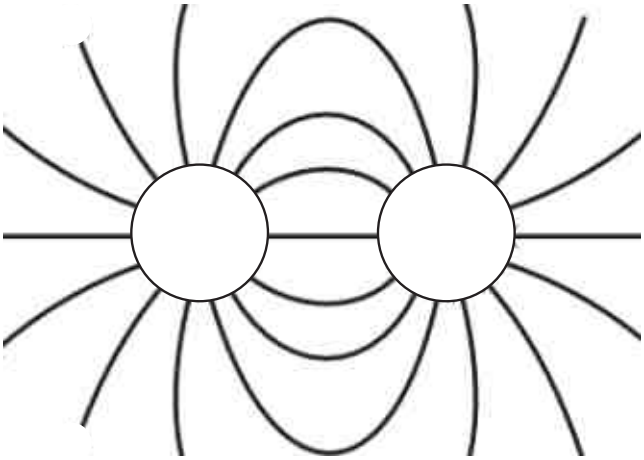


Fig. 8

(a) On Fig. 8,

(i) Label the possible polarities for both charges with a "+" and/or a "–" in the point charges. [1]

(ii) Using your answer to **(a)(i)**, draw the directions of the electric field lines. [1]

(b) The magnitude of the electrical charge for both point charges increases.

State two ways in which the electric field pattern would change.

……

……. [2]

A9 Fig. 9.1 shows how the current in the filament of a lamp depends on the potential difference across it.

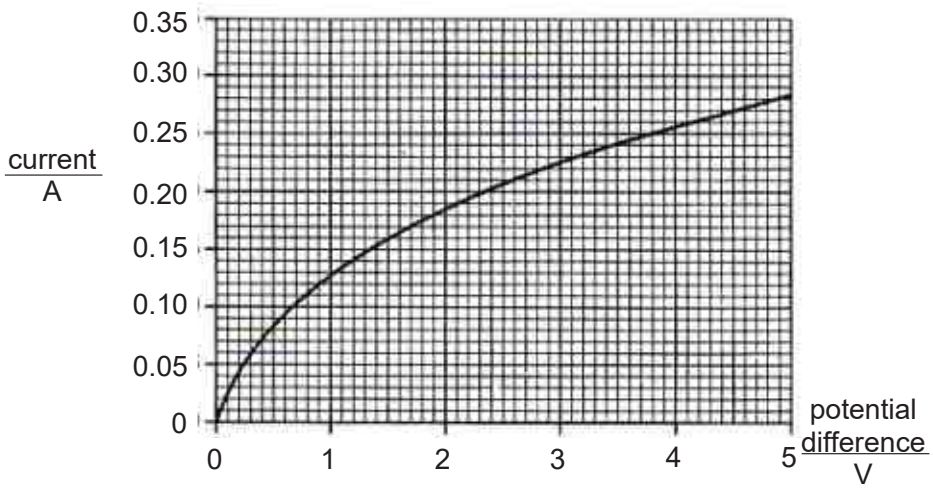


Fig. 9.1

(a) Calculate the resistance of the filament when the current is 0.25 A.

resistance = ... Ω [2]

(b) Explain how Fig. 9.1 shows that the resistance of the filament increases with temperature rise.

……...…....

……..... [1]

The lamp in Fig. 9.1 is connected in a circuit shown in Fig. 9.2.

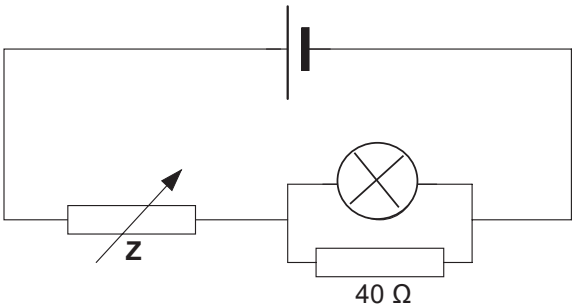


Fig. 9.2

The current in the lamp is maintained at 0.25 A. Determine

(i) the potential difference across the 40 Ω resistor,

potential difference = ...V [1]

(ii) the current in the 40 Ω resistor,

current = ... A [2]

SECTION B

Answer any **two** questions in this section.
Write your answers in the spaces provided.

B10 Fig 10.1 shows a Bunsen burner. Three spots are marked showing possible spots to place a spoon to be heated by the flame. An ice cube is placed on the spoon.

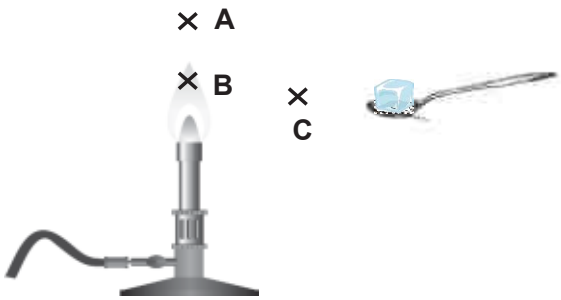


Fig. 10.1

(a) State the **main** process of transfer of thermal energy from the fire to the spoon when placed at :

point **A** : …….....……

point **B** : …….....……

point **C** : …….....…[3]

(b) Fig. 10.2 shows the heating curve of the ice cube when placed at point **B**.

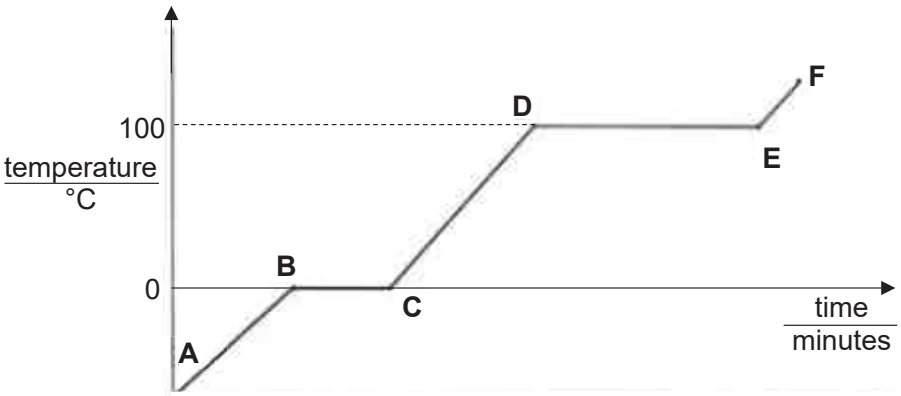


Fig. 10.2

(i) Explain, in detail, why the temperature of the ice cube remains constant between points **B** and **C** even though thermal energy is still being supplied to the ice cube.

……

……

……..……..... [3]

(ii) Describe the changes, if any, to the arrangement and to the motion of the molecules of water as it heats up from point **C** to point **D**.

……

……..……..... [2]

(c) **(i)** The water loses some mass even before it reaches 100°C. Assuming there was no spillage, state a reason for this loss.

……..……..... [1]

(ii) Explain why the reason you have mentioned in **(c)(i)** can happen before the water reaches boiling point.

……...……

……...…[1]

A11 **(a)** Two cylindrical iron rods, **A** and **B** are placed inside a solenoid that has a cross section in the shape of a circle as shown in Fig. 11.1. The solenoid is connected to a battery and a switch (not shown).

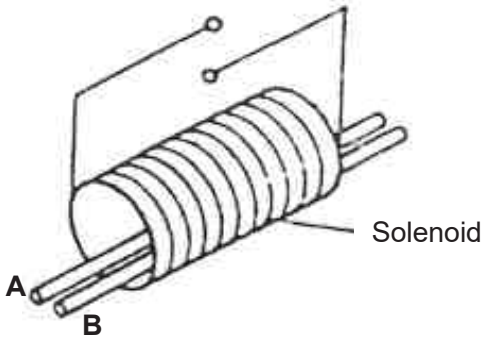


Fig. 11.1

(i) Describe and explain the observations on the iron rods when the switch is closed.

……

……

…… [2]

(ii) Describe and explain the observations on the iron rods when the switch is opened.

……

……

…… [2]

(b) Fig. 12.2 shows a rectangular metallic coil **ABCD** carrying a current that is placed in a magnetic field. BC is 2 cm long.

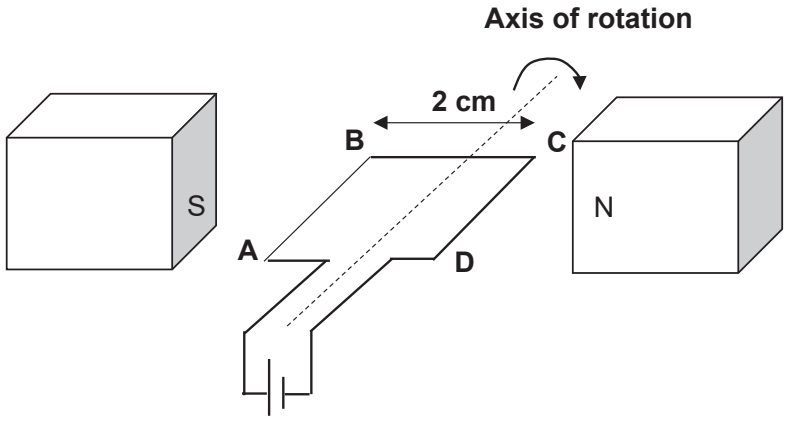


Fig. 12.2

(i) Describe and explain the observations on the iron rods when the switch is closed.

……..……

……..……

…..…….. [2]

(ii) On Fig. 12.2, draw the force that is acting on

1. Section **AB**;
2. Section **CD**. [1]

(iii) Assuming the force acting on each section is 2 N, calculate the total moment generated on the coil ABCD.

Moment = ... Ncm [2]

(iv) The north and south pole positions are swapped. Describe how the forces acting on section **AB** and **CD** respectively will change, if any.

……..…….. [1]

(v) State one way to increase the magnitude of the force acting on section **AB** of the coil.

……..... [1]

A12 An electric kettle with power rating of 2.5 kW is connected to a 240 V mains supply by a flexible cable to a 3-pin plug.

State the names of the 3 wires found in the 3-pin plug and their respective colours in Table 12.1 [3]

Name of wire	Colour

Table 12.1

(a) Calculate the current flowing in the circuit when the electric kettle is operating under normal condition.

current = ... A [2]

(b) Suggest a suitable fuse rating for this circuit. Explain your answer.

……

…….. [2]

(c) If the cost of electricity is $0.23 per kWh, calculate the total cost of using the electric kettle for 1 hour every day for 1 week.

cost = $..... [2]

(d) Suggest where a heating element should be placed in the electric kettle so that the water can be heated efficiently.

……...

…….. [1]

END OF PAPER

QUEENSWAY SECONDARY SCHOOL
Sec 4E5N Prelim Answers 2018

MCQ

1	B
2	D
3	D
4	D
5	C
6	A
7	D
8	C
9	D
10	A
11	B
12	B
13	C
14	C
15	D
16	D
17	B
18	D
19	A
20	B

Section A

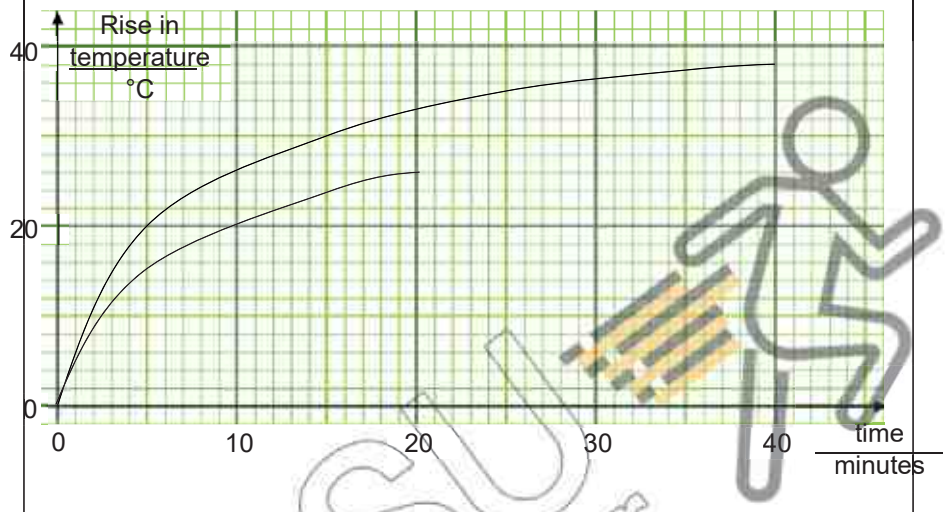
1a	The bicycle is travelling at constant speed from B to C then decelerates constantly to rest from C to D.	1 1
1b	Distance travelled $= \frac{1}{2} \times ((35 - 15) + 37) \times 15$ $= 427.5$ m $= 428$ m (3 s.f.)	1 1
1c	Average speed $= \frac{427.5m}{37s}$ $= 11.6$ m/s (3 s.f.)	1

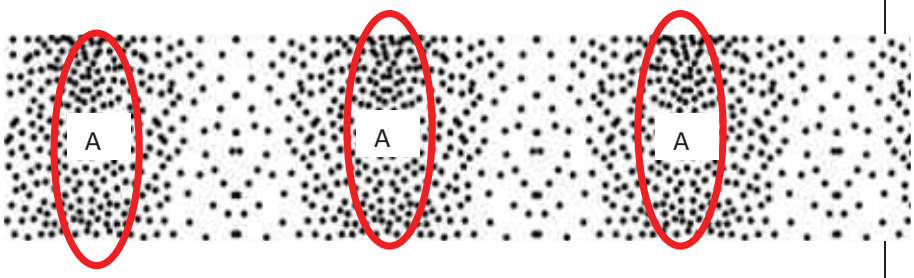
2a	loss in p.e. = 0.5 × 10 × 1.1 = 5.5 J	1
2bi	5.5 – (0.5 x 10 x 0.8) = 1.5 J	1 1
2bii	energy lost as thermal/sound	1
2c	5.5 + 9 = ½(0.5)v^2 v = 7.62 m/s	1 1

3a	Weight = 0.3 x 10 = 3 N	1

www.KiasuExamPaper.com

3bi	F = 2 500 x 0.003 = 7.5 N	1 1
3bii	ACWM = CWM 7.5 x 20 = 3 x d d = 50 cm from hinge	1
3biii	Force applied at safety valve will be higher. The weight should be moved further/ to the right.	1

4a	 Drawn graph must be below the given graph Drawn graph must have a similar shape to the given graph.	 1 1
4b	Surface temperature or surface area.	1

5a	Sound energy is transferred from particle to particle as the particles vibrate to and fro. They collide against each other, transferring the energy from one particle to the next.	1 1
5b	It means 432 oscillations of the sound wave is produced in one second.	1
5c	v=fλ v=432 × 0.76 =328.32 m/s =328 m/s (3 s.f.)	 1 1
5d	 Any one correct region circled	 1

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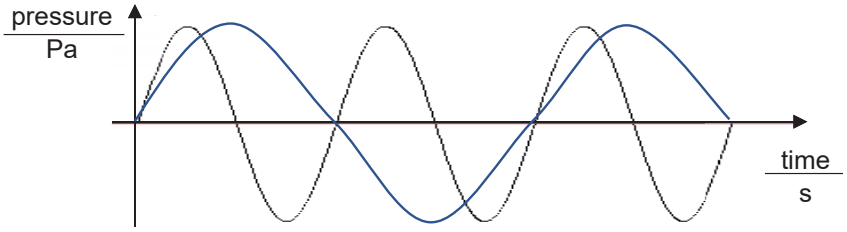
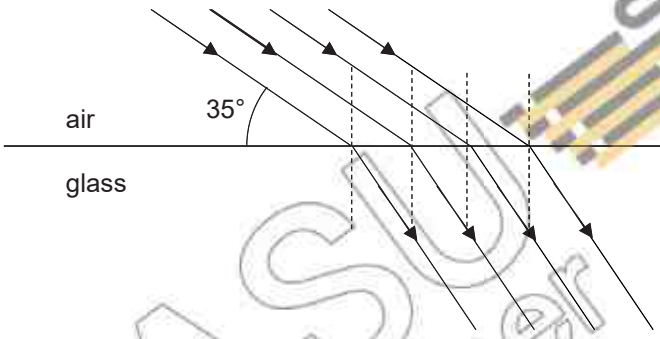
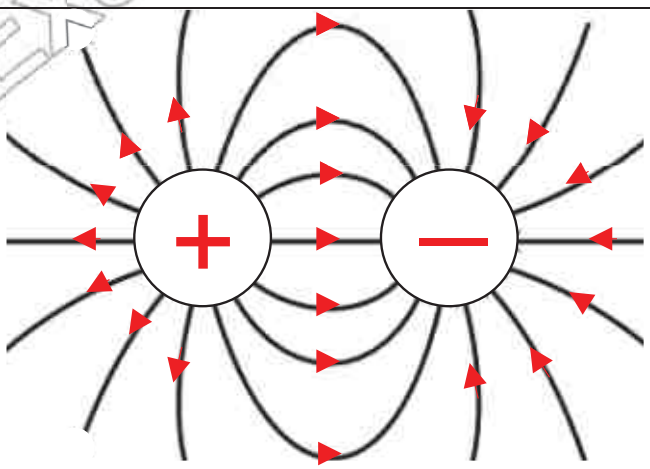
5e	 Same amplitude but twice the period.	1
6a	Speed of light decreases.	1
6b	$1.5 = \frac{\sin(90°-35°)}{\sin r}$ $r = sin^{-1}(\frac{\sin(55°)}{1.5})$ $r = 33°$ (nearest degree)	1 1 1
6c	 All lines drawn correctly at 33° ±1°	1

7ai	Waves in both regions have a speed of 3.0×10^8 m/s.	1
7aii	Waves in region A have a shorter wavelength.	1
7b	sun tanning : ultraviolet barbecue : infra-red	1 1

8ai **8aii**		

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	Both charges have opposite charges (position does not matter) All arrows come out of positive charge and go into negative charge	1 1
8bi	There will be an increase in magnetic field lines. The magnetic field lines will get closer together.	 1
8bii	The two charges will have a stronger attraction to each other.	1

9a	When current, I = 0.25 A, V = 3.75, 3.8 V (from the graph) Therefore, Resistance, R = V / I = 3.7 / 0.25 = 14.8 Ω	1 1
9b	There is an increase in the ratio of potential difference to current, which is equivalent to resistance.	1
9ci	Potential difference across 40 Ω resistor = potential difference across the lamp = 3.75-3.8 V (parallel connection)	 1
9cii	Current, I = V/R = 3.7 / 40 = 0.0925 A or 0.093 A	 1 1

Section B

10a	Point P : convection Point Q : conduction Point R : radiation	1 1 1
10bi	The thermal energy gained is only **converted to potential energy** between points B and C. This energy is used to **break the intermolecular bonds**. Temperature is a measure of kinetic energy. Since there is **no gain in kinetic energy, temperature remains constant.**	1 1 1
10bii	The water molecules vibrate **more vigorously** and randomly around each other. They **remain closely packed** in random arrangement.	1 1
10ci	Evaporation.	1
10cii	Evaporation can occur at all temperatures.	1

11ai	When the switch is closed, the solenoid will become a temporary magnet. The iron rods will also become temporary magnets and attain the same polarity at the same ends. Since like poles repel, the two iron rods will repel from each other.	 1 1
11aii	When the switch is opened, the current will stop flowing through the solenoid and the solenoid will cease to be a temporary magnet. The iron rods, being made of iron will also lose magnetism as iron is a soft magnet and does not retain magnetism.	 1 1

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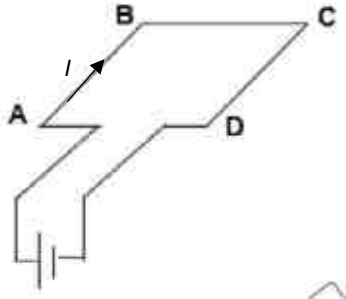
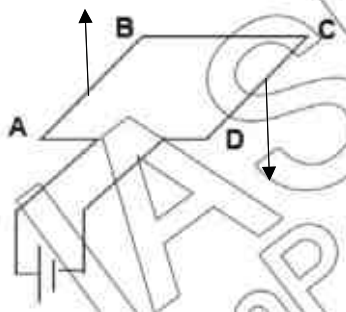
	Hence the two iron rods will not repel and will instead come close to each other at the bottom of the solenoid since the solenoid is cylindrically shaped.	
11bi		1
11bii		1
11biii	2 x 2 = 4 Ncm	1 1
11biv	The direction of the force will be reversed. The force at section **AB** will point downwards while the force at section **CD** will point upwards.	1
11bv	Increase the current or use a stronger North and South poles.	1

12a	<table><tr><th>Name of wire</th><th>Colour</th></tr><tr><td>Live wire</td><td>Brown</td></tr><tr><td>Neutral wire</td><td>Blue</td></tr><tr><td>Earth wire</td><td>Green and Yellow</td></tr></table>	3
12b	I = 2500/240 = 10.4 A	1 1
12c	Suitable fuse rating = 13 A The fuse rating should be slightly higher than the current flowing in the circuit for the fuse to work under normal working conditions of the electric kettle.	1 1
12d	Total cost = $(0.23 x 2.5 x 7) = $4.03	1 1
12e	The additional earth wire in the 3-pin plug helps to redirect current away from the user and prevent an electric shock.	1

The End

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West Spring Secondary School

PRELIMINARY EXAMINATION 2018

SCIENCE (PHYSICS, CHEMISTRY) **5076/01**

Paper 1 Multiple Choice

SECONDARY 4/5 EXPRESS/ NORMAL ACADEMIC

Name _____ ( ) **Date** **17 September 2018**

Class _____ **Duration** **1 hour**

Additional Materials: Optical Mark Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the Multiple Choice Answer Sheet provided.
Write in dark blue or black pen.

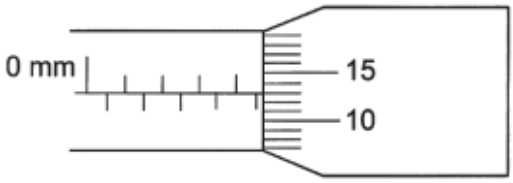
There are **forty** questions in this paper. Answer **all** questions.
For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in the Multiple Choice Answer Sheet provided.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
A copy of the periodic table is provided.
The use of an appropriate scientific calculator is expected, where appropriate.

This document consists of **17** printed pages including this cover page.

Setter: Mr Mok KF and Ms Priscilla Yu **[Turn over]**

1 In the diagram below, a micrometer screw guage is used to measure the diameter of a ball bearing.



The actual diameter of the ball bearing is 4.65 mm.

What is the zero error of this micrometer?

A -0.52 mm

B -0.02 mm

C +0.02 mm

D +0.52 mm

2 The diameter of four spherical objects W, X, Y and Z are tabulated below.

Object	Diameter
W	17 μm
X	4.88×10^{3} km
Y	3.74 nm
Z	6.7×10^{-2} m

Which of the following correctly lists the objects in **ascending** order of diameter?

A X, W, Z, Y

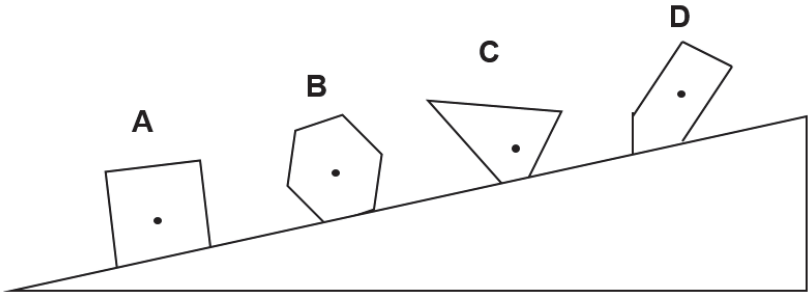
B Y, W, Z, X

C Y, Z, W, X

D Z, Y, X, W

3 The diagram below shows four objects placed on a slope. The dot in each object indicates its centre of gravity.

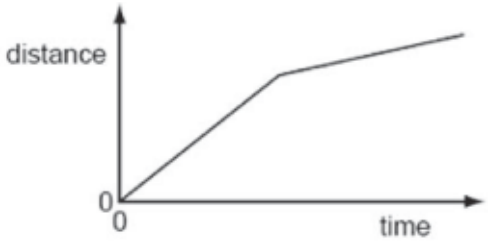
Which object is the most unstable?



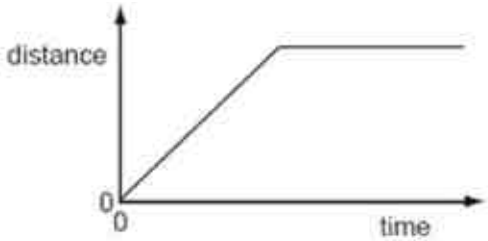
4 Elfie is jogging initially at constant speed around a track. He gets distracted by a friend at the grandstand and then jogs at a lower constant speed.

Which of the following shows the distance-time graph of Elfie's jog?

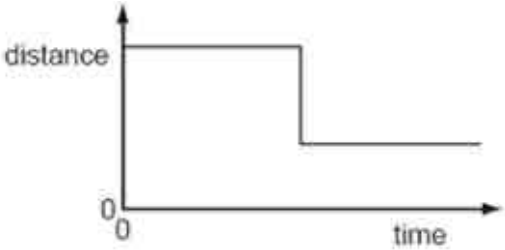
A



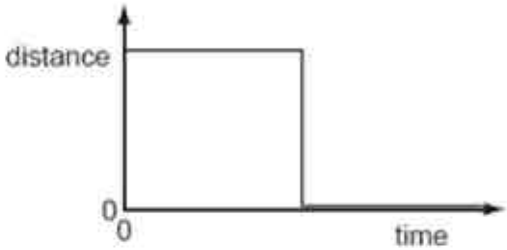
B



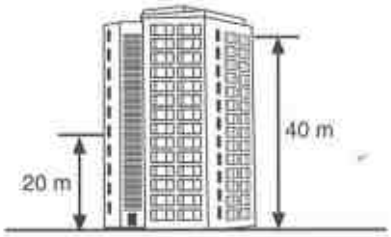
C



D



5 Two similar balls are dropped from a building at the same time. One falls from 40 m from the ground while the other from 20 m.



Assuming that air resistance is negligible, which physical quantity is the same for both balls just before they reach the ground?

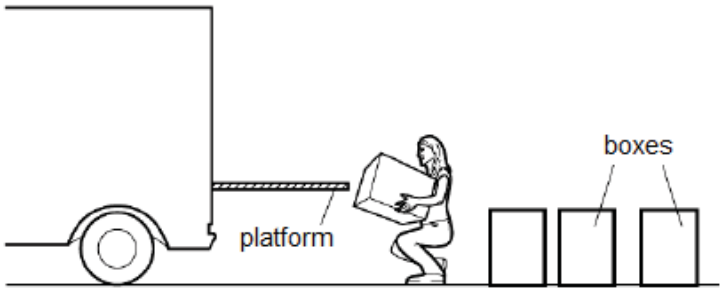
A acceleration

B final velocity

C displacement

D kinetic energy

6 A person lifts boxes of equal weight onto a platform.



Which quantity would **not** affect the total work done by the person?

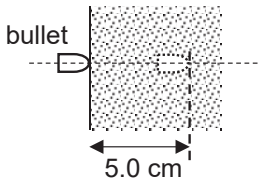
A the mass of the boxes

B the number of boxes lifted

C the time taken to lift the box

D the height of the platform above the ground

7 A bullet of mass 0.040 kg enters a wooden target horizontally. Its speed of entry is 300 m/s and it comes to rest 5.0 cm into the target, at the same height as the point of entry, as shown.



What is the frictional force exerted on the bullet by the wooden target? Assume the frictional force is constant.

A 120 N

B 360 N

C 1800 N

D 36000 N

8 The diagram shows a tractor on muddy ground.

Why does the tractor need to have big and wide tires?

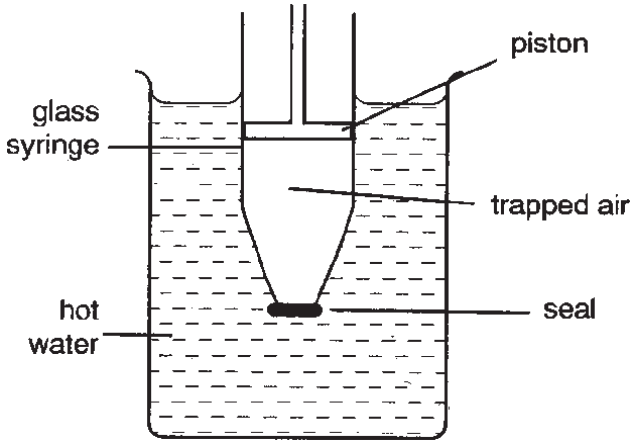
A to travel a further distance

B to avoid skidding on the ground

C to support the weight of the tractor

D to reduce the pressure on the ground

9 The outlet of a glass syringe is sealed so that air is trapped below the piston as shown in the diagram below.



Which of the following explains why the piston begins to rise when the syringe is placed in hot water?

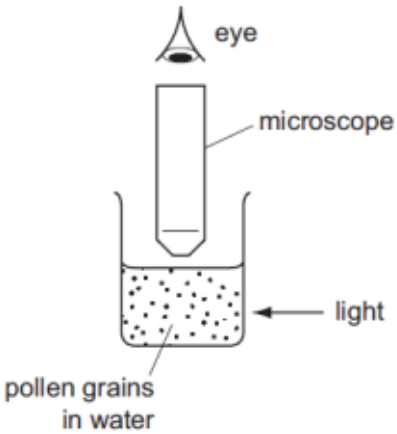
A Convection is occurring inside the syringe.

B The glass is expanding.

C The molecules of trapped air become bigger.

D The trapped air molecules are hitting the piston more often with greater force.

10 The diagram below shows very small pollen grains suspended in a beaker of water. A bright light shines from the side of the beaker. Small, bright dots of light are seen through a microscope. The dots move in rapidly changing and random directions.



Which of the following statements explains the observation?

A Convection current due to energy from the light source causing the pollen grains to collide with water molecules.

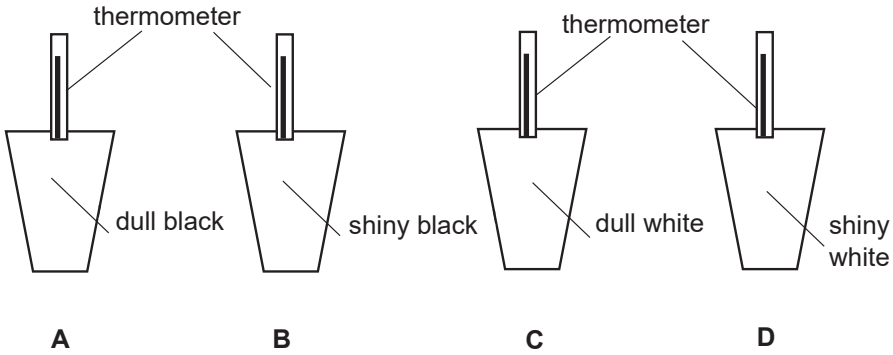
B Convection current due to energy from the light source causing the water molecules to collide with the pollen grains.

C Random collision between pollen grains.

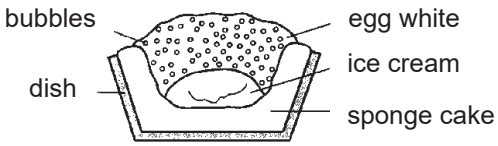
D Random collision between water molecules and pollen grains.

11 Hot water of the same temperature are poured simultaneously into four similar cups with different type of surfaces.

Which of the cups will register the fastest fall in temperature?



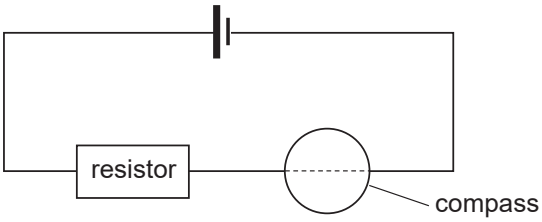
12 A cook makes the pudding 'baked Alaska'. The pudding is placed in a very hot oven until the top of the egg white turns brown. It is then removed from the oven.



Why does the ice cream stay cold?

A Air is a good conductor of heat and conducts the heat away from the ice cream.
B Air is a poor conductor of heat and reduces the heat transfer to the ice cream.
C The metal dish is a good conductor of heat and conducts the heat away from the ice cream.
D The metal dish is a poor conductor of heat and reduces the heat transfer to the ice cream.

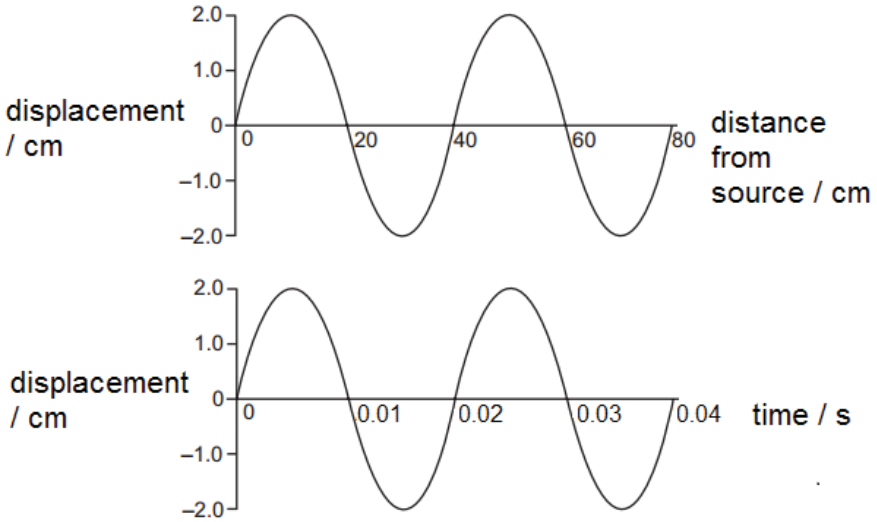
13 The diagram below shows a plotting compass placed **above** a current carrying wire.



Ignoring effects of the Earth's magnetic field, which of the following shows the direction which the compass needle will point towards?

A
B
C
D

14 The displacement-distance and displacement-time graphs are shown below for a water wave in an ocean.



What is the frequency of the water wave?

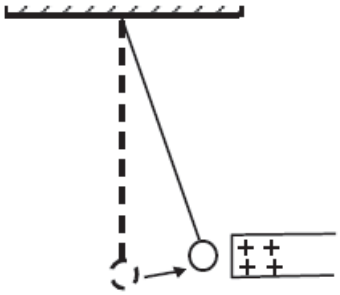
A 0.025 Hz

B 0.05 Hz

C 50 Hz

D 100 Hz

15 A small conducting sphere is suspended by an insulated thread. When a positively charged rod is brought near the sphere, the sphere is attracted as shown in the diagram below.



Which of the following is/are reasonable deduction(s)?

I The sphere may carry a positive charge.
II The sphere may carry a negative charge.
III The sphere may be neutral.

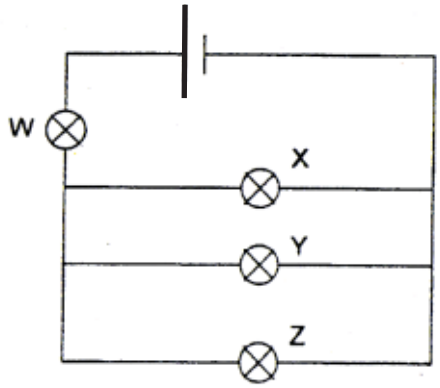
A I and II only

B I and III only

C II and III only

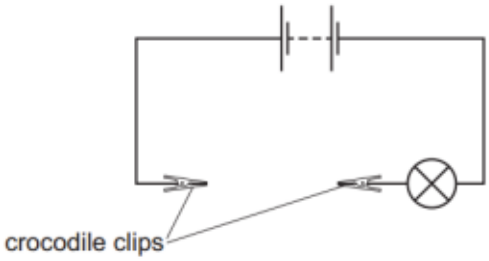
D III only

16 The diagram shows four similar light bulbs connected to a battery. Each bulb operates at normal brightness. If bulb X breaks, what happens to the brightness of the remaining bulbs?

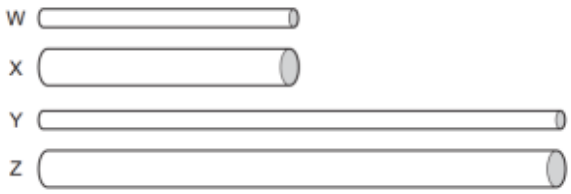


	Bulb W	Bulb Y	Bulb Z
A	decreases	decreases	decreases
B	decreases	increases	increases
C	increase	unchanged	unchanged
D	increase	increases	increases

17 A battery is connected to two crocodile clips and a lamp. There is a gap between the crocodile clips.



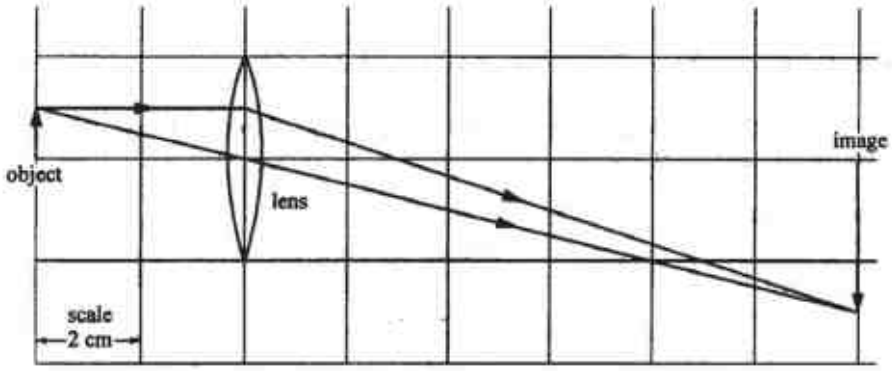
Four wires W, X, Y and Z, made of the same material but have different lengths and thicknesses, are connected in turn between the crocodile clips.



Which wire will make the lamp glow the most brightly and which wire will make the lamp glow the least brightly?

	most brightly	least brightly
A	X	Y
B	Y	Z
C	W	Y
D	W	Z

18 The ray diagram below shows the formation of a real image by a converging lens.



What is the focal length of the lens?

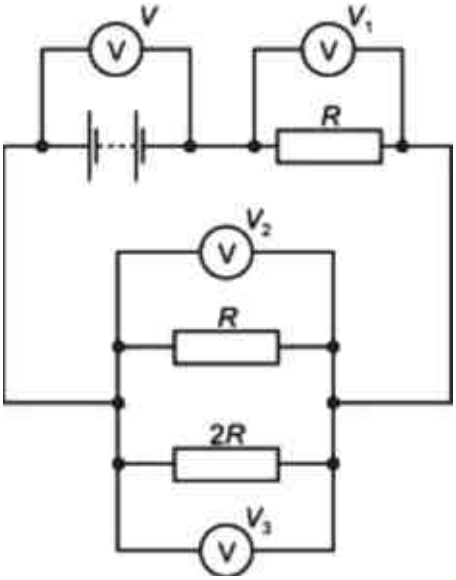
A 1.5 cm

B 3 cm

C 4 cm

D 12 cm

19 The diagram below shows a circuit with four voltmeter readings V_1, V_2, V_3 *and* V.



Which equation relating the voltmeter readings must be true?

A $V = V_1 + V_2 + V_3$

B $V + V_1 = V_2 + V_3$

C $V = V_1 + V_3$

D $V_2 = 2V_3$

20 An electric cooker is connected to the power supply by a 3 core cable. When the cooker is working correctly, which wires, if any, carry the same current?

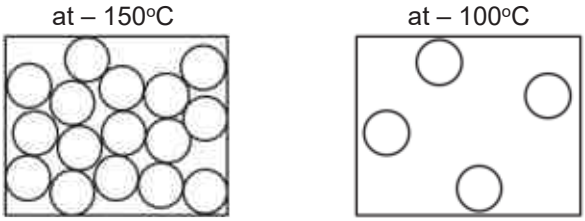
A the live and the earth wires

B the live and the neutral wires

C the live, the neutral and the earth wires

D none of the three wires carry the same current

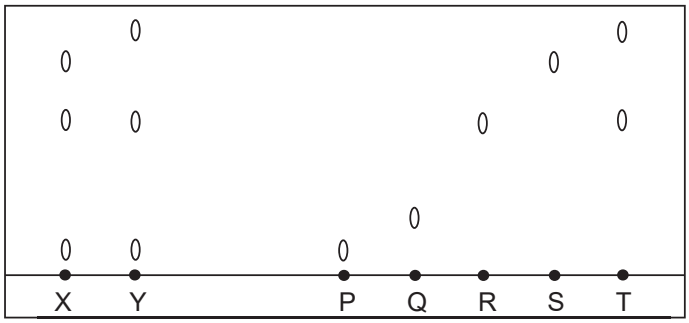
21 The diagrams show the arrangement of molecules in a substance at a pressure of 1 atm and at two different temperatures.



Which substance could the diagrams represent?

substance	melting point/ °C	boiling point/ °C
A	–183	–89
B	–169	–112
C	–155	–93
D	–114	–85

22 The following diagram shows the result of a chromatogram obtained from two mixtures, X and Y.



Which substance(s) is/are present in mixture X but not mixture Y?

A Q and S only

B R and T only

C S only

D T only

23 A pale green solution of compound E reacts with aqueous sodium hydroxide to form a blue precipitate. When acidified silver nitrate is added to the solution of compound E, a white precipitate is observed. What is E?

A copper(II) chloride

B copper(II) sulfate

C iron(II) chloride

D iron(II) sulfate

24 An element, F, has p protons and n neutrons in its nucleus.

Which row gives a possible correct number of protons, neutrons and electrons in a positive ion of an isotope of F?

	protons	neutrons	electrons
A	p	n + 1	p + 1
B	p	n + 1	p – 1
C	p + 1	n	p + 1
D	p + 1	n	p – 1

25 How many electrons are shared in a molecule of methane?

A 2 **B** 4 **C** 6 **D** 8

26 The table shows some properties of sodium chloride and ethane. Which properties are in the wrong column?

	sodium chloride	ethane
A	ionically bonded	covalently bonded
B	solid at room temperature	gas at room temperature
C	soluble in water	soluble in water
D	has strong forces between its ions	has weak forces between its molecules

27 Element L is in Group I, while element M has an electronic configuration of 2,6. The two elements react to form a chemical compound.

What is the correct chemical equation for the reaction between element L and element M?

A $L + 2M \rightarrow LM_2$

B $2L + M \rightarrow L_2M$

C $2L + M_2 \rightarrow 2LM$

D $4L + M_2 \rightarrow 2\ L_2M$

28 4.0 g of calcium are completely burnt in oxygen.

$$2Ca + O_2 \rightarrow 2CaO$$

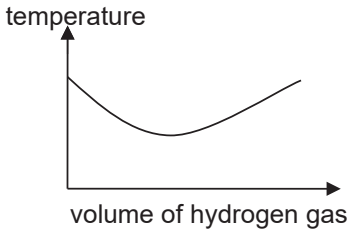
Which volume of oxygen is used in this reaction at room temperature and pressure?

A 0.05 dm^3 **B** 0.10 dm^3 **C** 1.20 dm^3 **D** 2.40 dm^3

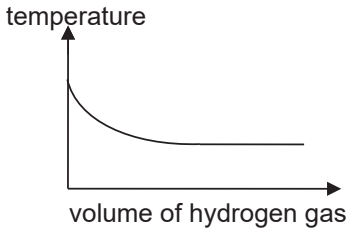
29 The formation of hydrogen chloride gas from hydrogen and chlorine gas is exothermic.

Which graph shows the change in temperature when hydrogen gas is reacted with excess chlorine gas?

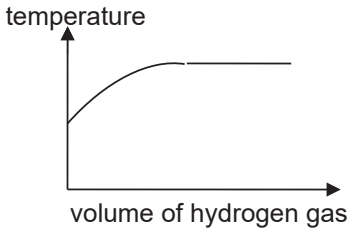
A



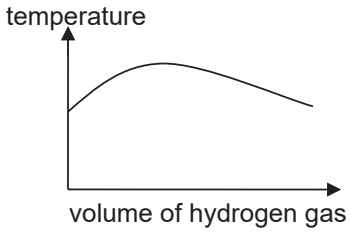
B



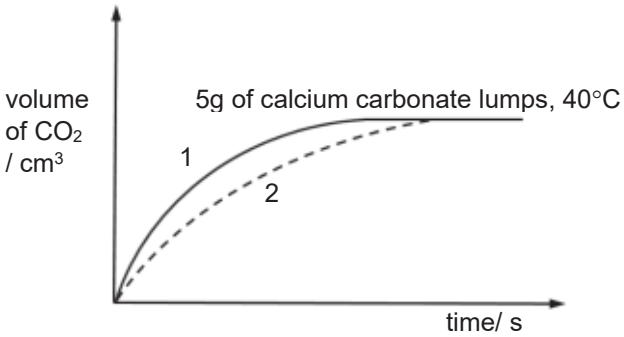
C



D



30 Curve 1 shows the volume of carbon dioxide given off when 5 g of calcium carbonate lumps react completely with an excess of hydrochloric acid at 40°C.



What change could result in curve 2?

A Using a lower temperature.

B Using a more concentrated solution of the acid.

C Using 3 g of calcium carbonate lumps.

D Using 5 g of calcium carbonate powder.

31 Part of some chemical reactions are shown.

In which reaction is the underlined substance oxidised?

A $\underline{Br_2}$ (l) + $2e^-$ → $2Br^-$ (aq)

B $\underline{Cu^{2+}}$ (s) + $2e^-$ → Cu (s)

C $\underline{Fe^{3+}}$ (aq) + e^- → Fe^{2+} (aq)

D $\underline{Mg}$ (s) → Mg^{2+} (aq) + $2e^-$

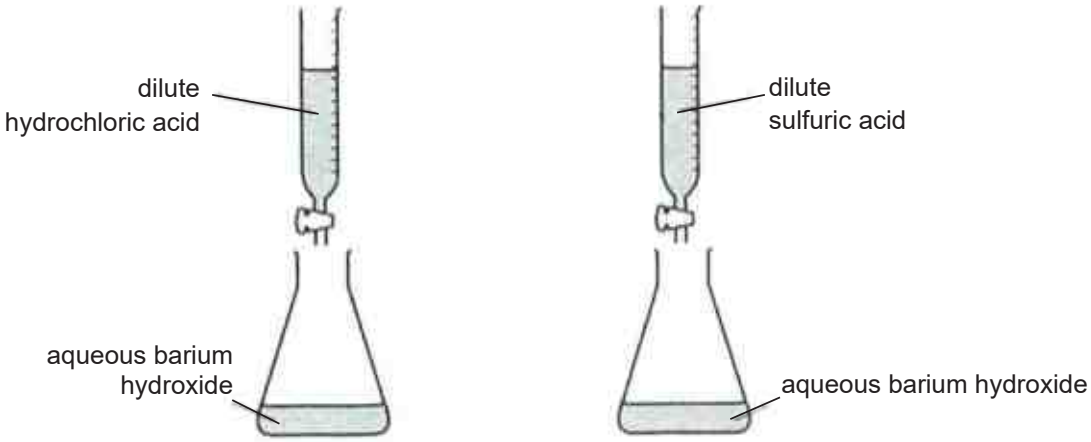
32 The table gives information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
thymol blue	red	3	yellow
congo red	blue	5	red
phenolphthalein	colourless	10	red

Which colour would be obtained when each indicator is added separately to pure water?

	thymol	congo red	phenolphthalein
A	red	blue	colourless
B	red	blue	red
C	yellow	blue	red
D	yellow	red	colourless

33 The diagrams show two experiments, one to make barium chloride and the other to make barium sulfate.



In each experiment, the acid is run into the conical flask until the pH is 7.

Which are the next steps needed to obtain solid samples of each salt?

	barium chloride	barium sulfate
A	crystallisation	crystallisation
B	crystallisation	filtration
C	filtration	crystallisation
D	filtration	filtration

34 Which statement about Groups in the Periodic Table is correct?

A All elements in the Periodic Table are not coloured.

B All Groups contain both metallic and non-metallic atoms.

C Elements become more metallic across the Periodic Table from left to right.

D Atoms of elements in the same Group have the same number of valence electrons.

35 Lithium, sodium, potassium and rubidium are elements in Group I in the Periodic Table.

Which of the following shows the correct trends down the Group for the melting point and density for the four elements?

	melting point	density
A	decreases	increases
B	decreases	decreases
C	increases	increases
D	increases	decreases

36 Metals P and Q display the chemical behaviours as shown below when added to the various solutions.

aqueous solution	metal P added	metal Q added
magnesium nitrate	no reaction	no reaction
zinc nitrate	zinc displaced	no reaction
iron(ii) nitrate	iron displaced	no reaction
copper(ii) nitrate	copper displaced	copper displaced

Which of the following is the correct arrangement of metals in order of decreasing reactivity?

A magnesium, P, zinc, iron, Q, copper
B magnesium, zinc, iron, P, Q, copper
C P, magnesium, zinc, iron, Q, copper
D magnesium, P, zinc, iron, copper, Q

37 Many countries have taken measures to ensure that the amount of sulfur in unleaded petrol and diesel fuels are kept low. Which of the following could be the reason for such measures?

A To cut down the amount of fuel used in vehicles.
B To reduce the acidity of the rain.
C To reduce the greenhouse effect.
D To protect the ozone layer.

38 Bitumen is made from crude oil. It is used _____.

A as an aircraft fuel
B for making polishes
C for making roads
D in oil stoves

39 The table shows the observations made when an organic compound R undergoes certain processes.

process	observation
combustion	white precipitate produced in limewater
bromination	reddish-brown solution decolourises
hydrogenation	margarine is produced

Which homologous series does compound R belong to?

A alcohols
B alkanes
C alkenes
D carboxylic acids

40 Alcohols S and T have the molecular formulae C_xH_7OH and $C_yH_{11}OH$ respectively. What are the relative molecular masses of S and T?

	relative molecular mass of S	relative molecular mass of T
A	59	88
B	60	88
C	60	90
D	62	90

END OF PAPER

West Spring Secondary School

PRELIMINARY EXAMINATION 2018

SCIENCE **5076 /02**
Physics

SECONDARY **4** **Express/ 5 Normal (Academic)**

Name _____ ( ) **Date** 11 Sep 2018

Class _____ **Duration** 1 h 15 min

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Section A (45 Marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
Show **all** relevant working.

Section B (20 Marks)
Answer **TWO out of THREE** questions.
Write your answers in the spaces provided on the question paper.
Show **all** relevant working.

Information for Candidates
The number of marks is given in [ ] at the end of each question or part question.

The use of an approved scientific calculator is expected, where appropriate.
In calculations, you should show all the steps in your working, giving your answer at each stage.

FOR EXAMINER'S USE	
Section A	/45
Section B	/20
Total	/65

This document consists of **18** printed pages including the cover page.

Setter(s) **Mr Mok Kai Fore** **[Turn over**

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Section A

Answer **all** questions in the spaces provided.

1 Fig. 1.1 shows the total forces acting forward and backward on a car at different times **X** and **Y** during a journey. In each case, the car is moving forward.

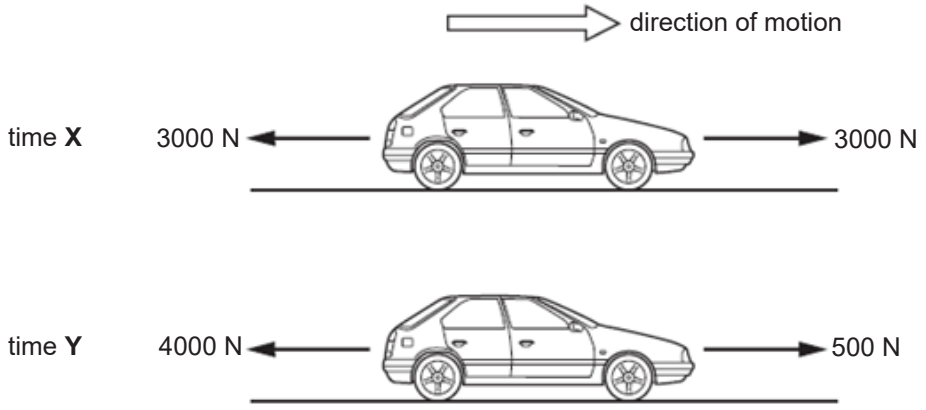


Fig. 1.1

(a) State the name of **one** of the forces that is acting in the opposite direction to the motion of the car.

..... [1]

(b) State whether the speed of the car is changing at time **X**.

..... [1]

(c) State whether the speed of the car at time **Y** is increasing, decreasing or constant.

..... [1]

2 Fig. 2.1 shows a cylinder filled with air. It is fitted with a freely moving piston.

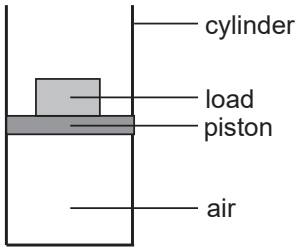


Fig. 2.1

The area of the piston is 0.10 m^2 and the area of the load is 0.05 m^2. Calculate the mass of the load needed to balance the piston when the pressure exerted by the air is 15 Pa.

mass = ... kg [2]

3 A student slowly heats a sample of solid wax in a test tube. Fig. 3.1 shows how the temperature of the wax varies with time *t*.

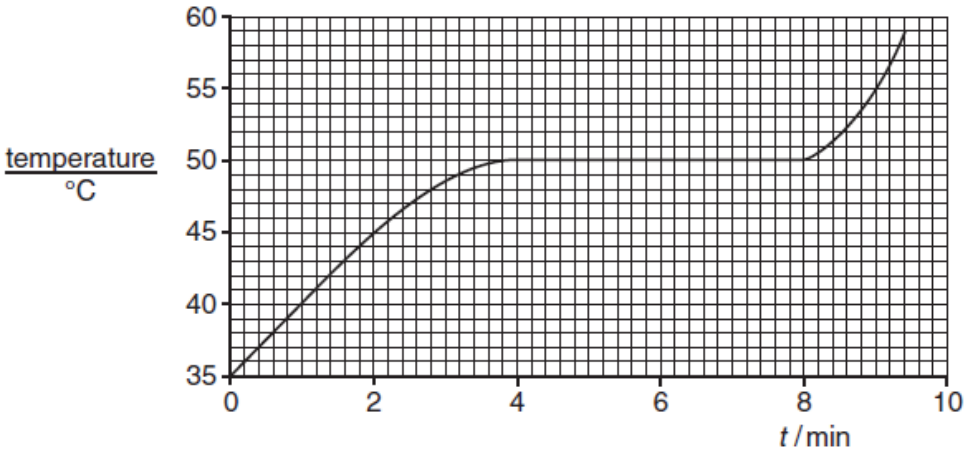


Fig. 3.1

(a) State the melting point of wax.

Melting point = ...…… °C [1]

(b) Thermal energy passes into the wax throughout the experiment.

(i) Describe what effect this energy has on the wax particles between *t* = 0 min and *t* = 4 min in terms of motion and spacing.

……

……

…….....…..... [2]

(ii) Describe what effect this energy has on the wax particles between t = 4 min and t = 8 min in terms of motion and arrangement.

……

……

…….....…..... [2]

(c) The wax expands as the temperature rises. It expands more between *t* = 8 min and 9 min than between *t* = 0 and 1 min. Explain why.

……

……

……

…….....…..[2]

4 Fig. 4.1 shows how the speed of two cars change as they move from rest along a straight road.

car **A**	
time / s	speed / (m/s)
0	0
5.0	20
10.0	40
15.0	60
20.0	60
25.0	60
30.0	60

car **B**	
time / s	speed / (m/s)
0	0
5.0	10
10.0	20
15.0	30
20.0	40
25.0	50
30.0	60

Fig. 4.1

(a) Plot and draw the speed-time graphs in Fig. 4.2 for both cars **A** and **B**. Label your graphs clearly. [2]

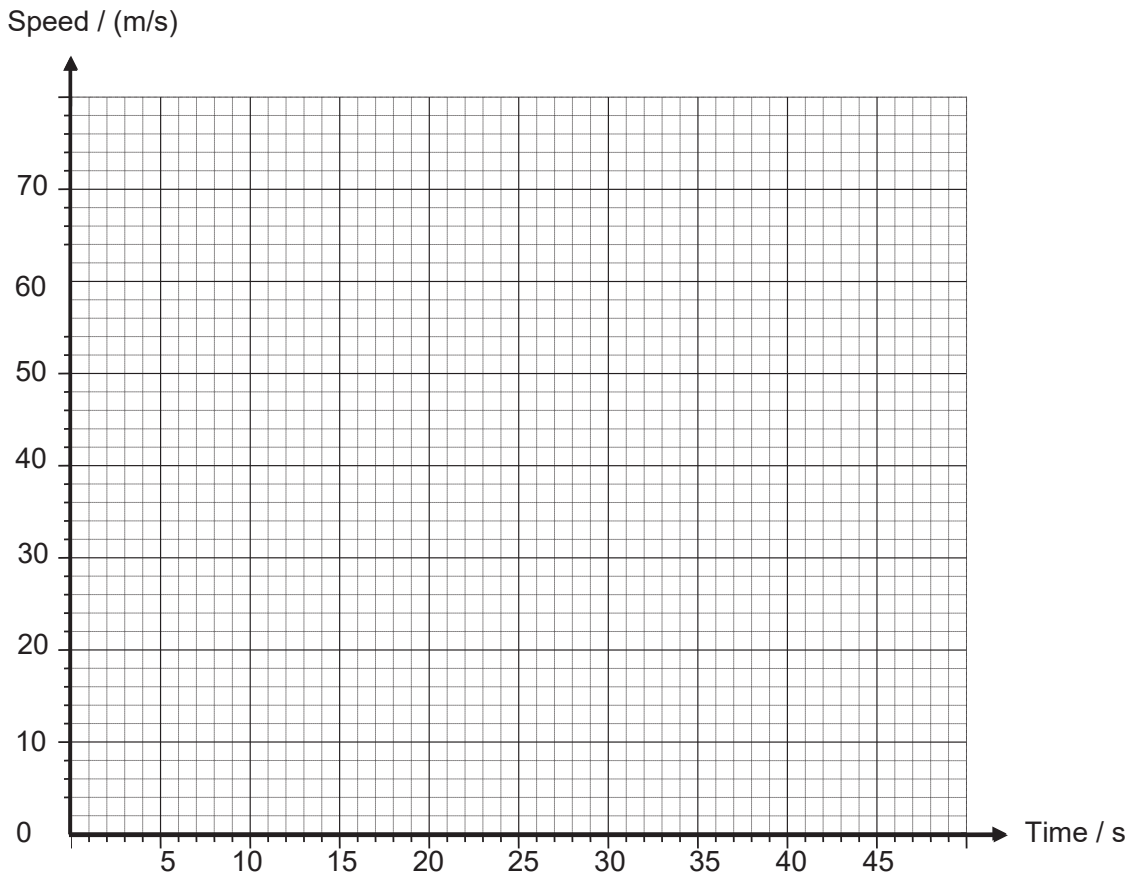


Fig. 4.2

(b) At the end of 30.0 s, calculate the distance between the two cars.

distance = ... m [2]

(c) If the mass of the car **B** is 500 kg, calculate the net force acting on it.

Net force = ... N [2]

5 A student wanted to find the density of an unknown liquid using a bottle and obtained the measurements as shown in Fig. 5.1.

Calculate the density of the unknown liquid, given that the density of coconut oil is 0.924 g/cm^3.

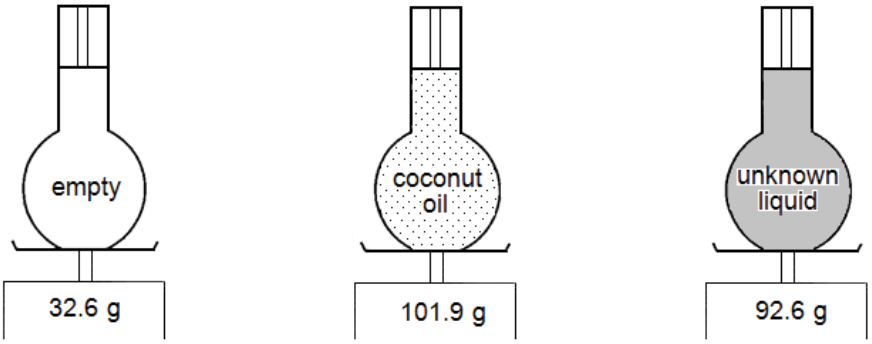


Fig. 5.1

density = ... g/cm^3 [3]

6 An iron block has mass of 10 kg on Earth.

The block is teleported to Krypton, a planet with a gravitational field strength **twice** that of Earth. Given that the gravitational field strength on Earth is 10 N/kg, state and/or calculate the mass and weight of the iron block on Krypton.

Mass of block = ...…… kg [1]

weight of block = ...…… N [1]

7 Bats use echolocation to determine their surroundings in the dark. They send out a pulse of ultrasound, which will be reflected when it hits an object. They listen for the echo of this pulse, and are able to deduce the distance of the object from where they are located.

Fig. 7.1 shows a bat in a cave. It lets out a pulse of ultrasound of 5 kHz towards the back of the cave.

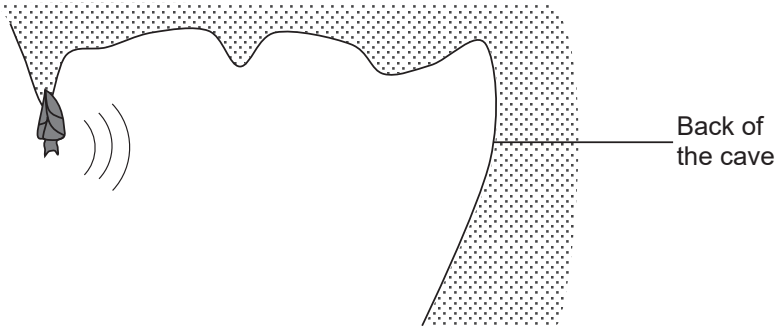


Fig. 7.1

(a) Calculate the wavelength of the ultrasound pulse if the ultrasound travels at 330 m/s.

wavelength = ...…… m [2]

(b) The pulse that the bat sends out is reflected back 12 s after the pulse was sent out. Calculate the distance from the bat to the back of the cave.

distance = ...…… m [2]

8 Fig. 8.1 shows the path of a light ray passing through a rectangular block.

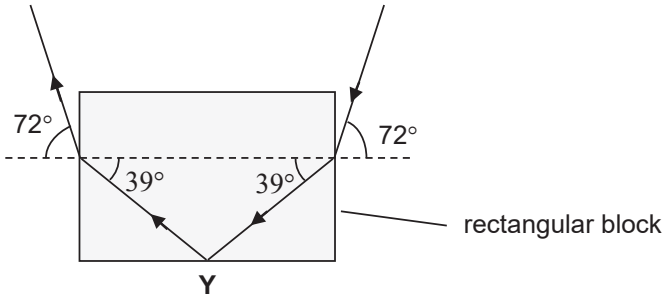


Fig. 8.1

(a) Calculate the refractive index of the rectangular block.

refractive index = ...…… [2]

(b) Calculate the critical angle of the rectangular block.

critical angle = ...…… ° [1]

(c) Explain why the light ray does not exit the rectangular block at **Y**.

.....……...

.....……..... [1]

9 **(a)** The list below shows three components of the electromagnetic spectrum.

infra-red **gamma rays** **visible light**

Arrange the components in order of **increasing** wavelength.

..... [1]

(b) Satellites are used in the transmission of some television signals.

Fig. 9.1 shows a satellite above the television station where a television signal is generated. The satellite is orbiting at a distance of 36 000 km from the television station.

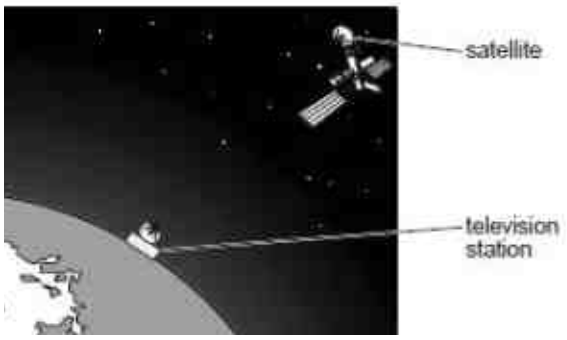


Fig. 9.1

(i) State which component of the electromagnetic spectrum is used to transmit the television signal to the satellite.

..... [1]

(ii) Given that the component in **b(i)** travels at a speed of 3.00×10^8 m/s, calculate the time the television station takes to send a signal to the satellite.

time = ... s [2]

10 Fig. 10.1 shows the circuit diagram of a metal filament lamp which is connected to a power supply. The electromotive force (e.m.f.) produced by the power supply can be varied.

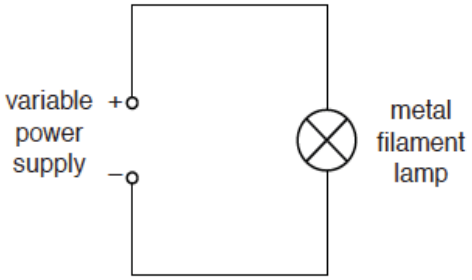


Fig. 10.1

(a) State what is meant by electromotive force (e.m.f.).

.....

..... [1]

(b) In the space below, **redraw and add** appropriate circuit symbols to the circuit diagram in Fig. 10.1 to show the positions of

(i) an ammeter that measures the current in the circuit, and [1]

(ii) a voltmeter that measures the voltage across the lamp. [1]

11 Fig. 11.1 shows a rigid wire being held between the poles of a U-shaped magnet. When the switch is closed, there is an upward force on the wire as indicated.

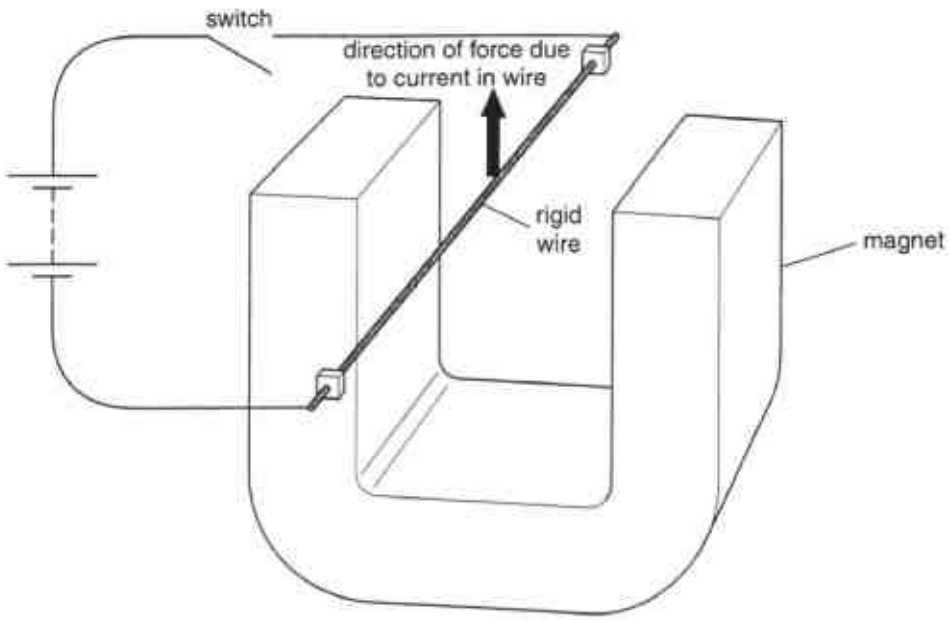


Fig. 11.1

(a) On Fig. 11.1, draw an arrow in the rigid wire to show the direction of conventional current. [1]

(b) On Fig. 11.1, label the north pole of the U-shaped magnet. [1]

(c) State **one** change that can be made to the set-up to cause a downward force on the wire.

.....

..... [1]

(d) Explain why the magnet is made of steel instead of iron if the above setup is to be used as part of a fan motor which can operate continuously.

.....

..... [1]

12 Fig. 12.1 shows a manual car park barrier.

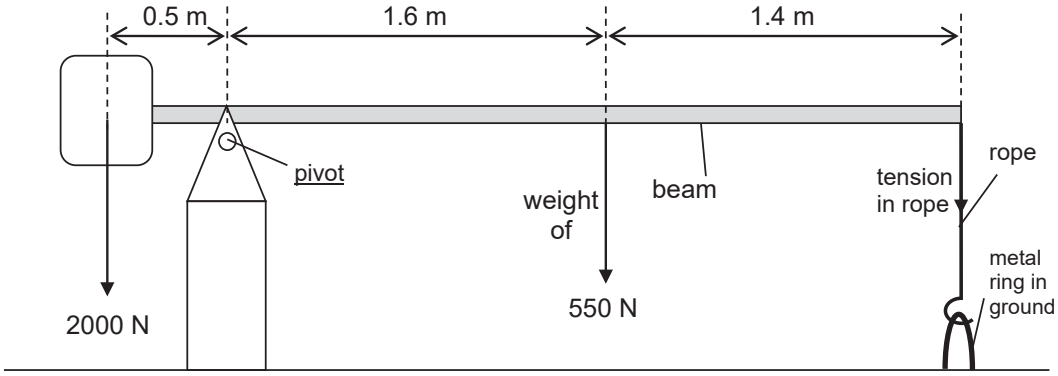


Fig. 12.1

The weight of the barrier beam is 550 N and acts at 1.6 m to the right of the pivot. Calculate the tension needed in the rope in order to keep the beam horizontal.

tension = ...…… N [3]

Section B

Answer any **two** questions from this section in the spaces provided.

13 **(a)** Fig. 13.1 shows the structure of a 240 V electric hair dryer with a plastic case. It mainly consists of a fan and two heating coils of same power rating. The manufacturer claims that it is double insulated.

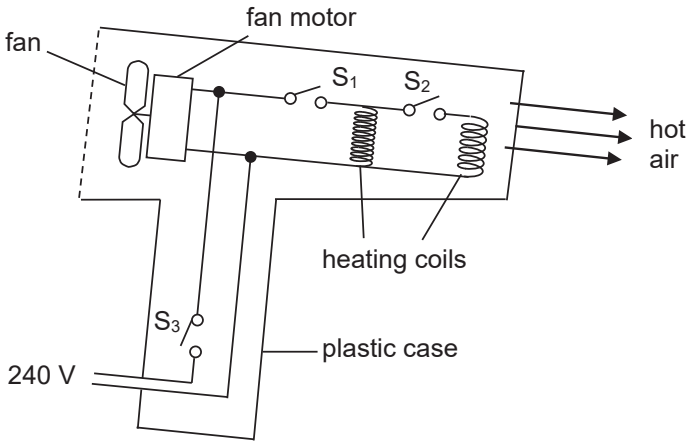


Fig. 13.1

The hair dryer has three settings that can be controlled by switches S_1, S_2 and S_3. Fig. 13.2 shows the total power consumed at each setting.

Setting	Function	Power / W
1	Cold (fan only)	140
2	Hot (half heating power)	640
3	Hot (full heating power)	1140

Fig. 13.2

(i) State the switch or switches that should be closed for the hair dryer to operate at the power of

140 W, ... [1]

640 W. ..... [1]

(ii) Suggest why the earth wire is not required for this hair dryer.

.....

.....

..... [1]

(iii) Calculate the current flowing in the hair dryer when it is operating at full heating power.

current = …… A [1]

(iv) Suggest a suitable fuse rating for the hair dryer.

fuse rating = …….. [1]

(b) Another hair dryer is designed with a different arrangement of the two heating coils as shown in Fig. 13.3.

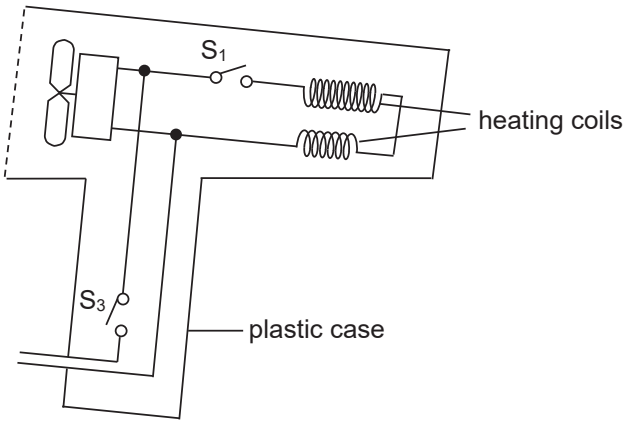


Fig. 13.3

State **one** way in which such an arrangement will not be as advantageous as that in Fig. 13.1.

……..

…….....….. [1]

(c) Fig. 13.4 shows a circuit with a lamp and resistor connected in parallel to each other.

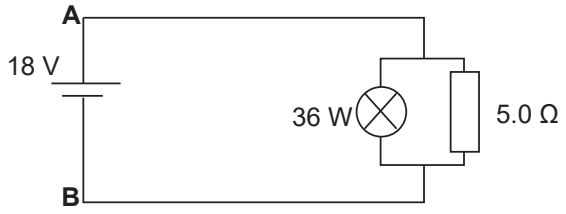


Fig. 13.4

(i) Calculate the amount of charge that passes through the resistor in 1 minute.

charge = …….. [2]

(ii) The input energy to the lamp is 72 000 J. How long has the lamp been operating?

operation time = …….. [2]

14 A pendulum consists of a pendulum bob attached to a thin thread, as shown in Fig. 14.1.

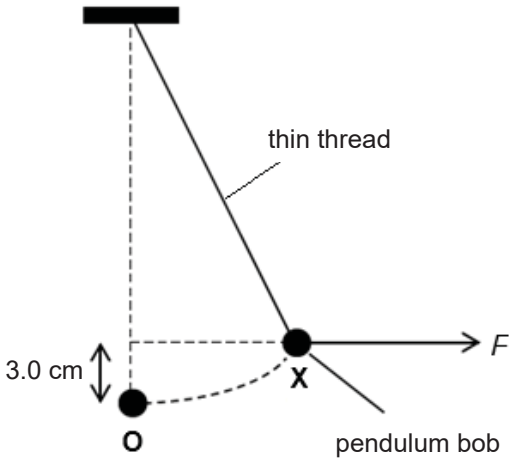


Fig. 14.1

When the thread is vertical, the metal sphere is at **O**. The metal sphere is moved from **O** to **X** and held in position **X** by a horizontal force *F*.

(a) Draw a free-body diagram to show the forces acting on the metal sphere when it is at **X**. [2]

(b) The pendulum bob is now released so that the pendulum is free to swing. Explain why the pendulum bob begins to move and why it continues to move past **O**.

.....

.....

.....

..... [2]

(c) The mass of the pendulum bob is 200 g. When the bob is moved from **O** to **X**, it is raised through a vertical height of 3.0 cm. The gravitational field strength is 10 N/kg.

(i) Calculate the work done to raise the sphere.

work done = …….. [2]

(ii) Calculate the maximum speed of the sphere after it has been released, assuming air resistance is negligible.

maximum speed = …….. [2]

(iii) A student determines the time taken for one complete swing of the pendulum. She uses two methods.
In the first method, she measures the time for one complete swing.
In the second method, she measures the time for 20 complete swings and divides the total time by 20.

Explain why the second method gives a more accurate result than the first method.

……

……

…… [2]

15 **(a)** Fig. 15.1 shows the boiler of a coal-fired power station. Hot gases rise and thermal energy from the hot gases heats the cold water inside the metal pipes, forming steam.

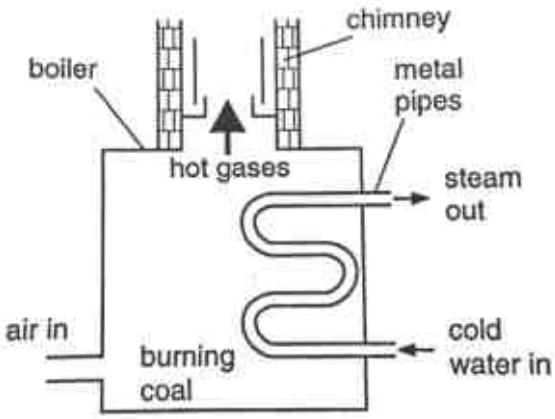


Fig. 15.1

(i) Explain, in terms of particle movement and density change, why the hot gases rise.

.....

.....

..... [2]

(ii) Using ideas about particles, explain how energy passes through the metal pipes by conduction.

.....

.....

..... [2]

(iii) Suggest what might happen if cold water is piped in from the top of the metal pipes instead of the bottom.
Give a reason for your answer.

.....

.....

..... [2]

(b) Fig. 15.2 shows an electrostatic precipitator that prevents dust and ash from emerging from the chimney.

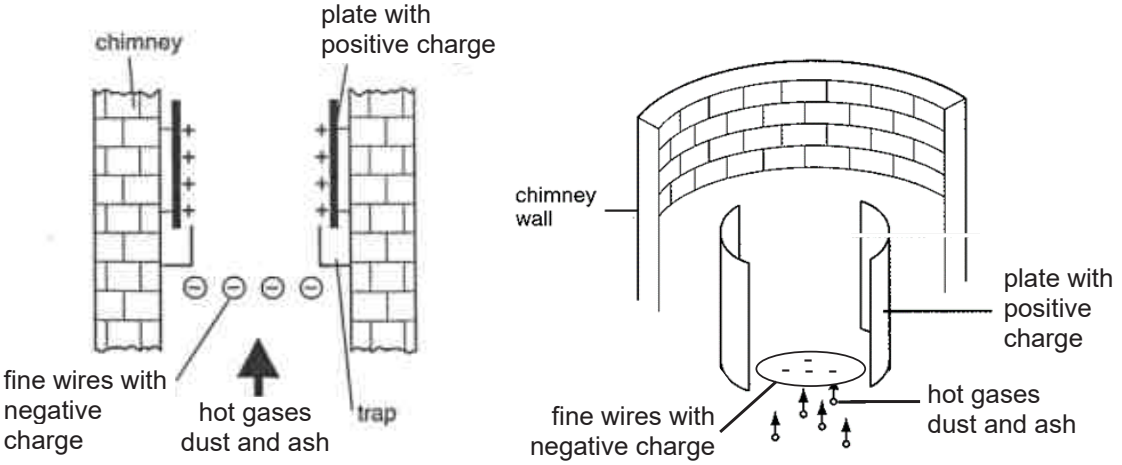


Fig. 15.2

(i) Describe what happens to the dust and ash particles in the hot gas after they pass through the fine wires with negative charges.

.....

.....

..... [1]

(ii) Provide an explanation for your answer in **(b)(i)**.

.....

.....

..... [2]

(iii) Suggest a reason why it is important for the power station to prevent dust and ash from emerging from their chimneys.

.....

.....

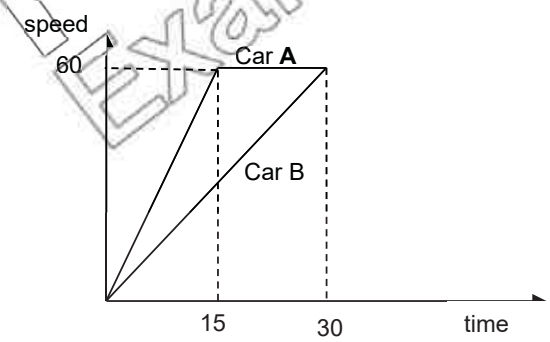
..... [1]

End of paper ☺

Answers to MCQ

1	2	3	4	5	6	7	8	9	10
B	B	D	A	A	C	D	D	D	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	B	D	C	C	B	A	B	C	B

Answers for Section A and B

Qn	Answers	Marks awarded
	Section A	
1a	Air resistance/Air friction/brake friction	B1 (anyone)
1b	Not changing	B1
1c	decreasing	B1
2	Mass = (0.10 m^2 x 15 Pa) / 10 N/kg = 0.15 kg	M1 A1
3a	50 °C	B1
3bi	The energy will cause the wax particles to vibrate more/with increasing speed about its fixed positions The spacing between the wax particles will increase slightly.	B1 B1
3bii	~~The energy will cause the wax particles to break their forces of attraction/bonds between particles.~~ 1.Some particle are able to slide past each other. 2.The wax particles will change from fixed arrangement to random arrangement.	 B1 B1
3c	As the forces of attraction between liquid particles are weaker than the forces of attraction between solid particles, the more energetic/faster moving liquid particles will move further apart from each other compared to the solid particles. Hence it expands more between 8-9 min than between 0-1 min.	B1 B1
4a	 Penalise max 1m for graph extension beyond 30 min, missing any label	B1,B1 (1m for each graph)
4b	Distance between the cars = (½ x 15 x 60 + 15 x 60) – (½ x 30 x 60) = 1350 900 = 450 m	M1 A1

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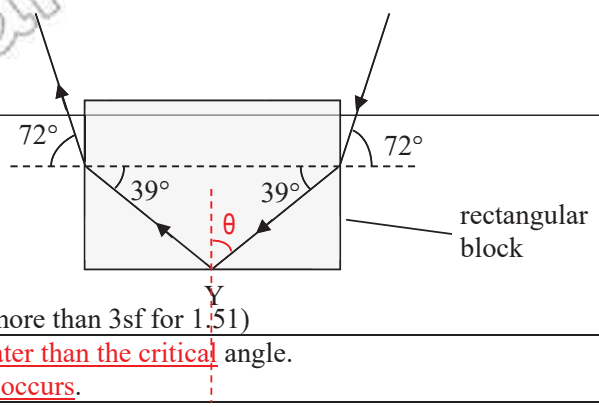
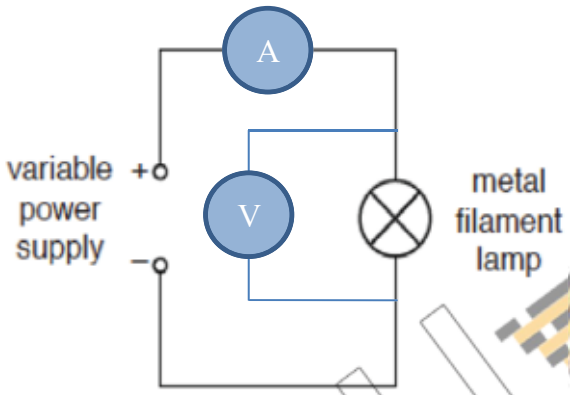
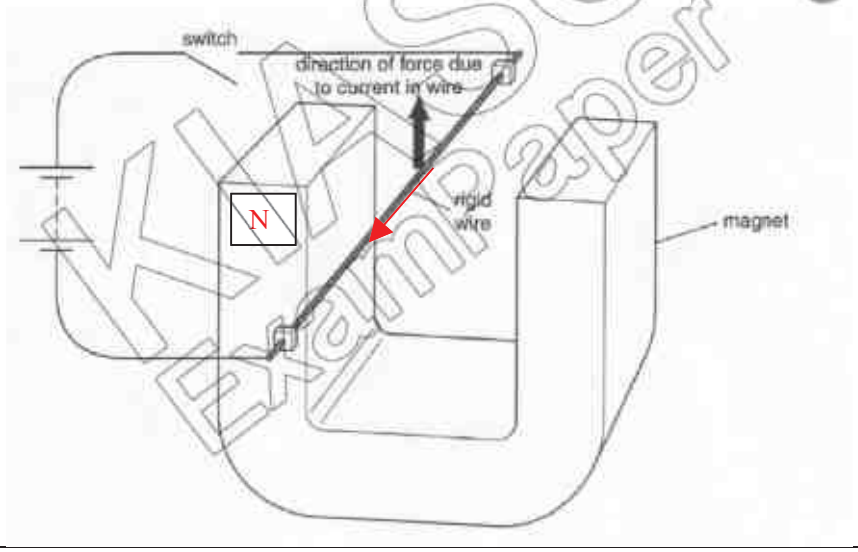
Qn	Answers	Marks awarded
4c	$Acceleration = \frac{60-0}{30}$ $= 2.0\ m/s^2$ Net force = 500 x 2.0 = 1000 N	M1 A1
5	Mass of coconut oil = 101.9 – 32.6 = 69.3 g Mass of the unknown liquid = 92.6 – 32.6 = 60 g Volume of unknown liquid = volume of coconut oil = Mass / Density = 69.3 / 0.924 = 75 cm^3 Density of unknown liquid = Mass / Volume = 60 / 75 = 0.80 g/cm^3	 M1 M1 A1
6	Mass = 10 kg Weight = 10 kg x 10 N/kg x 2 =200 N	B1 B1
7a	$\lambda = \frac{330}{5000}$ $= 0.066\ m$	M1 A1
7b	$v = \frac{2d}{t}$ where distance between bat and back of cave $d = (v \times t)/2$ = 330 x 6(1 mark if workings reflect the correct relationship between v,distance, t) = 1980 m	 M1 A1
8a	Refractive index $= \frac{\sin i}{\sin r}$ $= \frac{\sin 72^0}{\sin 39^0}$ $= 1.51$	 M1 A1
8b	$\sin c = \frac{1}{n}$ $\sin c = \frac{1}{1.51}$ $c = 41.4^0$ or $c = 41.5^0$ (use more than 3sf for 1.51)	 B1
8c	The angle of incidence is greater than the critical angle. Thus, total internal reflection occurs.	B1



KIASU ExamPaper

Qn	Answers	Marks awarded
9a	gamma rays, visible light, infra-red	B1
9bi	microwave	B1
9bii	d = v x t 36000000 m = 300000000 m/s x t {1m for correct relationship between s,d,t, ignore prefixes} t = 0.120 s	M1 A1
10a	the work done by the source in driving a unit charge/1 coulomb around a complete circuit.	B1
10b		B1 any series connection with poer supply B1 any parallel connection with lamp
11ab		B1 B1
11c	Turn the magnet so that the poles exchange places with each other. or Turn the cells so that the terminals are switched over.	B1 either one
11d	Steel retains magnetism/is a permanent magnet while iron is not.	B1
12	Anticlockwise moments = clockwise moments (2000)(0.5) = T(3.0) + (550)(1.6) applies prin. of moment 1000 = 3.0 T + 880 correct distance T = 40 N	M1 M1 A1

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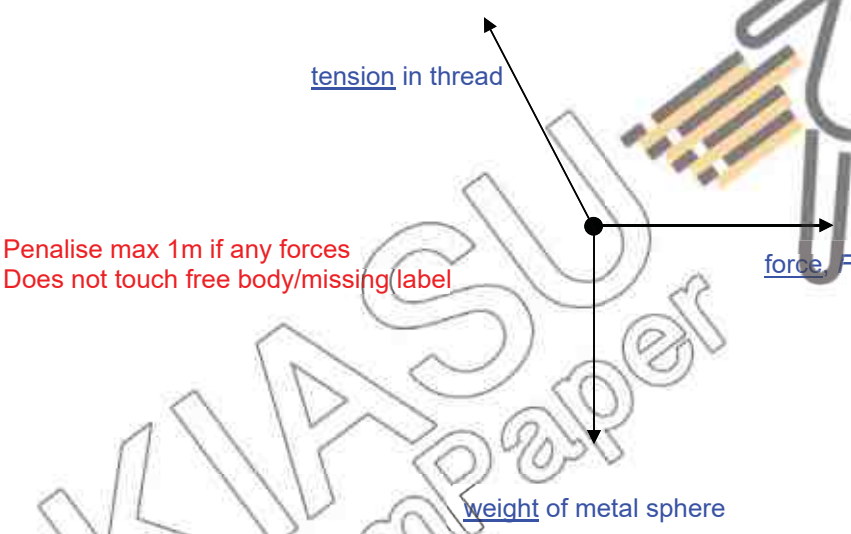
Qn	Answers	Marks awarded
	Section B	
13ai	S_3 S_3, S_1	B1 B1
13aii	the hair dryer has a plastic case which is an insulator so any current leakage from the wires will not be conducted outwards/double insulations	B1
13aiii	P = IV I = 1140/240 = 4.75 A	 B1
13aiv	5 A (no marks for no units)	B1
13b	if one heating coil is faulty, the whole dryer cannot work OR the power of the hot air cannot be changed	B1 either one
13c	Q = It = (V/R)t = (18/5)*60 = 216 C (no marks for no units)	M1 A1
	Using E = Pt, t = E / P =72 000 / 36 = 2000 s (no marks for no units)	M1 A1
14a	 Penalise max 1m if any forces Does not touch free body/missing label	B2 if all 3 forces general direction correct with correct label (1 mark if 2 forces are correct 0 mark if only 1 force is correct)
14b	At X, all three forces are balanced and the metal sphere does not move. When F is removed, a resultant force (due to weight of metal sphere and tension in thread) acts on the metal sphere, causing the metal sphere to move. At O, all GPE is converted to kinetic energy and the metal sphere continue to move pass O due to inertia /acquired/possession of KE. [Do not give marks, if candidate only gave descriptions of energy changes without linking KE to motion]	B1 B1
14ci	Work done = gain in GPE = mgh $= \frac{200}{1000}(10)\frac{3}{100}$ [convert mass and height correctly] = 0.06 J [include correct unit]	 M1 A1
14cii	GPE at X = KE at O 0.06 = ½ (0.2) v^2 v^2 = 0.6 v = $\sqrt{0.6}$ = **0.775 m/s** (3 sf) [also accept 0.78 m/s minus 1 mark for wrong or missing unit]	 M1 A1
14ciii	The main source of error is the reaction time of the student. By taking average of 20 complete swings, the error is divided between/spread over the 20 swings. [Do not award marks, if students just mention as obtaining more	B1 B1

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Qn	Answers	Marks awarded
	accurate timing without explaining why.]	
15ai	The particles in hot gases becomes further apart than surround cold air. The hot gases hence becomes less dense and rises.	B1 B1
15aii	The particles in the metal pipe gains kinetic energy from the energetic gas particles and vibrate more vigorously. They collide with the neighboring metal particles and passes kinetic energy to them.	B1 B1
15aiii	The cold water when heated becomes steam which is less dense. The steam rises up the metal pipes. If the cold water is piped in from the top, it will flow against the rising steam and heat transfer to outside the boiler will be inefficient/blocked/disrupted. ~~If cold water is piped in from the bottom, water is heated, become less dense and rises up the pipe creating a convection current which transfer heat away from the boiler.~~ ~~If cold water is piped in from the top, it will goes against the natural convection current leading to inefficient/blocked/disrupted heat transfer~~	B1 B1
15bi	The particles will be attracted to the positively charged plates	B1
15bii	The dust and ash particles will gain electrons from the fine wires and become negatively charged. As opposite charges attract, the particles will be attracted to the plates with positive charge.	B1 B1
15biii	To prevent air pollution, bad for the environment etc (any reasons pertaining to damage to environment)	B1
	~END~	

KIASU ExamPaper

Name:	Class:	Index No:

Yuan Ching Secondary School

End-of-year Examination 2018

Secondary Three Express

SCIENCE (PHYSICS) **5076/01**

Paper 1 Multiple Choice **12 Oct 2018**

Papers 1: 1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

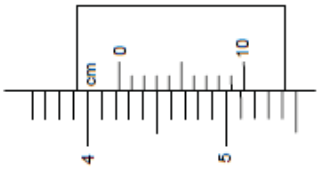
There are **twenty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Answers to Paper 1 and Paper 2 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
You are advised to spend no more than **30 minutes** on **Paper 1**.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **6** printed pages.

1 The diagram shows a vernier scale placed against a ruler.



What is the vernier reading?

A 3.90 cm **B** 3.93 cm **C** 4.23 cm **D** 4.25 cm

2 A sea breeze happens in the day. An explanation of the sea breeze contains only five statements.

1 Density of the air decreases
2 Less dense air rises
3 The air above the land is heated and expand
4 Land mass warms up faster than the sea in the day
5 Cooler air from the sea moves in to form sea breeze

What is the correct order of these statements?

A 1 → 2 → 3 → 4 → 5
B 1 → 2 → 5 → 3 → 4
C 4 → 3 → 1 → 2 → 5
D 4 → 3 → 5 → 1 → 2

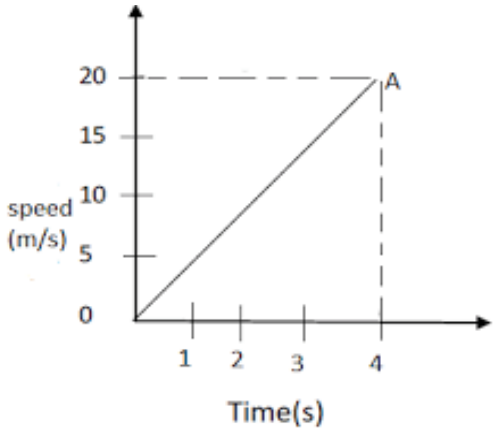
3 What is the name of the property of a body that resists a change in its state of rest or motion?

A Mass
B Speed
C Density
D Acceleration

4 A portable generator can supply 69 120 000 J of electrical energy in 24 hours. What is the average power output of the generator?

A 27 W **B** 800 W **C** 19 200 W **D** 2 880 000 W

5 The speed-time graph for a cyclist is shown below.



The mass of the cyclist with the bike is 70 kg.

What is the resultant force on the cyclist with bike?

A 140 N **B** 350 N **C** 3500 N **D** 14000 N

6 A uniform plank is balanced at the centre by a pivot. John placed block P on the plank as shown in the diagram below. Block Q is made of the same material as P but is smaller in volume.

Where should John place block Q to keep the plank in equilibrium?

7 A small table weighing 80 N stands on four legs, each having an area of contact of 0.001 m^2. What is the pressure of the table on the floor?

A 20 kPa **B** 80 kPa **C** 20 000 kPa **D** 80 000 kPa

8 A nylon jacket is filled with feather and down. Down is the fur found at the chest area of birds.

Which of the following best explain how the jacket keeps the user warm in winter?

A Nylon is shiny and is a poor absorber of cold.
B Feather is a poor conductor of heat.
C Down is very fine and stops convection current from getting set up.
D Feather and down is able to trap air, and air is a poor conductor of heat.

9 Which form of energy, that molecules have, is related to temperature?

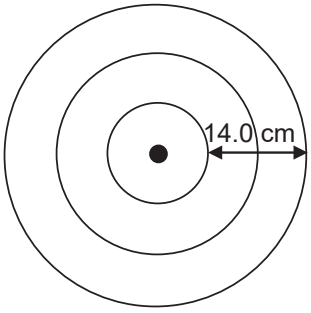
A nuclear energy
B kinetic energy
C potential energy
D thermal energy

10 Molten glass are poured onto a stick to be moulded into glass ball. The glass cools to its freezing point and begins to solidify.

As the glass solidifies, its temperature

A decreases and energy is lost from the glass.
B remains the same and energy is lost from the glass.
C decreases and no energy is lost from the glass.
D remains the same and no energy is lost from the glass.

11 John threw a pebble into the pond and created a ripple as shown below.



In two seconds, three complete waves are produced on the surface of the water. The distance between three crests is 14.0 cm.

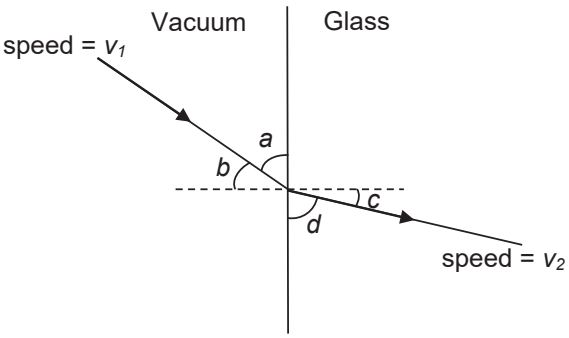
What is the speed of the wave?

A 3.11 cm/s **B** 4.67 cm/s **C** 7.00 cm/s **D** 10.5 cm/s

12 Which of the following statements about transverse waves is true?

A All transverse waves travels at the speed of 3.0×10^8 m/s in vacuum.
B Transverse waves are waves that travels parallel to the direction of its vibration.
C All transverse waves require a medium to travel.
D All transverse waves can be reflected or refracted.

13 A ray of light travels from vacuum into glass.



What is the refractive index of the glass?

A sin *a* / sin *d*
B sin *c* / sin *b*
C v_1 / v_2
D v_2 / v_1

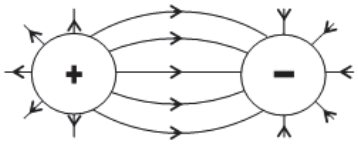
14 The diagram shows a patient having his eyes tested. A chart with letters on it is placed behind him and he sees the chart reflected in a plane mirror.

How far away from the patient is the image of the chart?

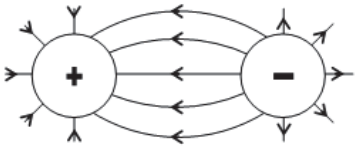
A 2 m **B** 5 m **C** 7 m **D** 10 m

15 Which diagram correctly shows the electric field pattern between two isolated point charges?

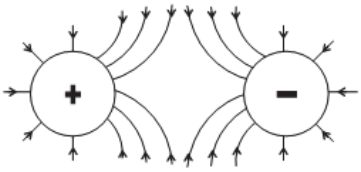
A



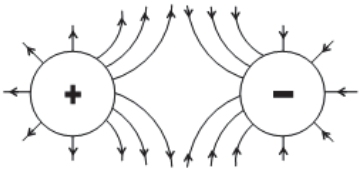
B



C



D

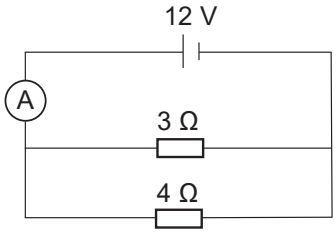


16 A wire has a resistance of 12 Ω. A second wire, made of the same material, has half the length and half the cross-sectional area.

What is the resistance of the second wire?

A 3.0 Ω **B** 6.0 Ω **C** 12 Ω **D** 48 Ω

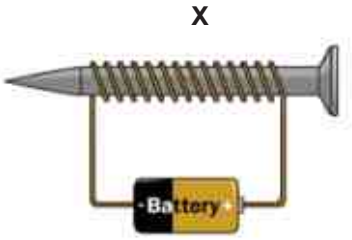
17 A 12 V battery is connected across a parallel arrangement of two resistors.



What is the reading on the ammeter?

A 1.7 A **B** 3.0 A **C** 4.0 A **D** 7.0 A

18 A compass is placed at **X** beside an electromagnet as shown in the diagram below.



Which of the drawings shows the correct direction of the compass needle?

A

B

C

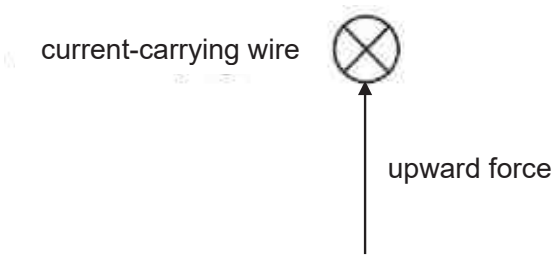
D

19 A combined Audio-Visual unit of a speaker and a television is controlled by one switch. The unit contains a 1.2 kW speaker and a 800 W television.
In one week, the television used 4.0 kWh of electrical energy.

How much electrical energy is used by the Audio-Visual unit in that one week?

A 2.0 kWh **B** 4.0 kWh **C** 6.0 kWh **D** 10 kWh

20 The diagram below shows an upwards force acting on a current-carrying wire in a magnetic field. What is the direction of the magnetic field?



A to the left
B to the right
C downward
D out of the paper

----- End of Paper -----
Efforts Today Rewards Tomorrow

YUAN CHING SECONDARY SCHOOL
Secondary Four Express / Five Normal (Academic) Course
Preliminary Examination 2018

CANDIDATE NAME	

CLASS		INDEX NUMBER	

SCIENCE (PHYSICS) 5076/02

Paper 2 **14 September 2018**

Candidates answer on the Question Paper. **1 hour 15 minutes**
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work that you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (45 marks)
Answer **all** questions.

Section B (20 marks)
Answer **any two** questions.

Candidates are reminded that **all** quantitative answers should include appropriate units.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

At the end of the examination, fasten all work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 65.

For Examiner's Use	
Section A	
Section B	
Total	/ 65

This paper consists of **15** printed pages.

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Section A: [45 marks]
Answer **all** the questions in the spaces provided.

1 Fig. 1.1 shows the diagram of a speaker.

Fig. 1.1

(a) Sound is being produced and can be heard by everyone in the room. Describe how the sound from the loudspeaker reaches all parts of the room.

…….
…….
…….
…… [2]

(b) The lowest frequency that a human with normal hearing can hear is 20 Hz and the highest frequency is 20 kHz.

(i) Explain what is meant by *frequency is 20 kHz*.

……...
……... [1]

(ii) Given that the speed of sound in air is 340 m/s, calculate the **longest** wavelength of sound that a human can hear.

wavelength =……..……. m [2]

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2 A 1200 kg sports car travels at 20 m/s for 3.0 minutes.
It then accelerates uniformly to a speed of 45 m/s in 1.0 minute.
It travels at a uniform speed of 45 m/s for a further 5.0 minutes before decelerating non-uniformly to rest in 3.0 minutes.

(a) Plot a graph on Fig 2.1 to show how the speed of the sports car varies with time.

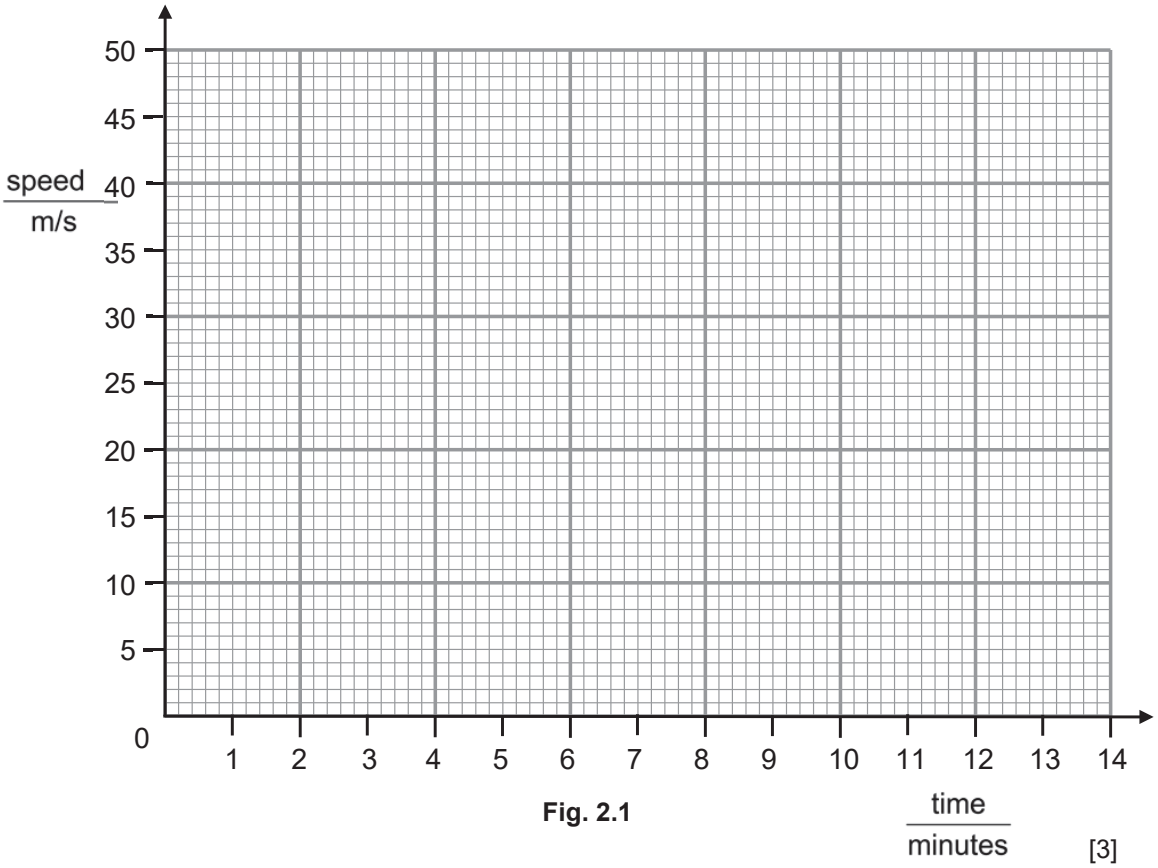

Fig. 2.1

[3]

(b) Calculate the acceleration of the sports car from 3.0 to 4.0 minute.

acceleration = …….. m/s^2 [3]

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(c) Calculate the resultant force needed to result in this acceleration.

force = ……. N [2]

3 A beaker can hold 250 cm^3 of liquid.
When it is completely filled with methanol (density 0.80 g/cm^3), the total weight is 2.6 N.
Take the gravitational field strength as 10 N/kg.

(a) Calculate the mass of the filled beaker.

mass = …… kg [1]

(b) Calculate the mass of methanol in the beaker. State clearly the formula used.

mass = …….. kg [2]

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4 The diagram below shows a computer monitor resting on a uniform tabletop **AB** of weight 70 N that is hinged to the wall at **A**. The computer monitor has a weight of 50 N acting through a point 0.20 m from **A**. The tabletop is supported by a vertical force, **F** acting at **B** to keep it horizontal. The length of the tabletop is 0.80 m.

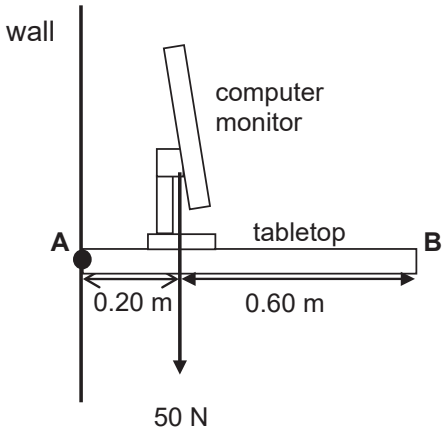

Fig. 4.1

(a) On **the diagram**, draw an arrow to represent the **weight** of the **tabletop**. Label it **W**. [1]

(b) Calculate the total moments due to the weight of the computer monitor and the tabletop.

total moment = ……Nm [2]

(c) Hence, by means of the principle of moments, calculate the vertical force, **F** applied at **B** that is required to keep the tabletop horizontal.

vertical force, F = …… N [2]

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5 Fig. 5.1 shows an object **A** of mass 1.6 kg resting on top of a smooth plank which is 2.0 metres long.

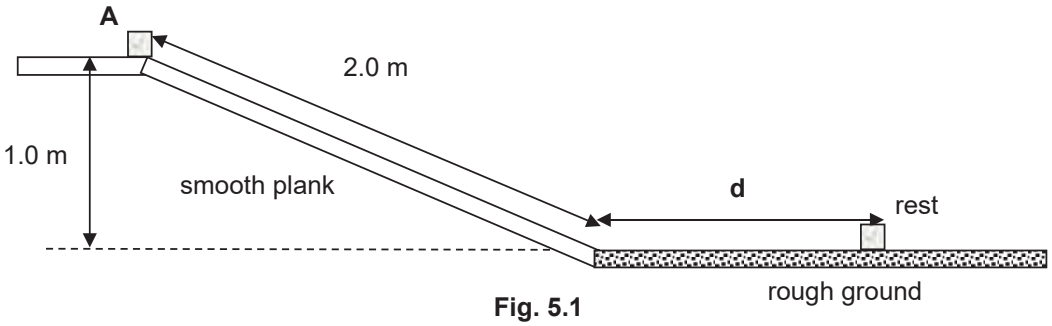

Fig. 5.1

When object **A** is released, it slides down the smooth plank and stops after travelling a distance **d** along the rough ground.

(a) Using the Principle of Conservation of Energy, calculate the speed of object **A** at the bottom end of the plank.

speed = …….. m/s [2]

(b) If the friction along the rough ground is 2.5 N, calculate the distance **d**.

distance **d** = ……. m [2]

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6 Ultraviolet radiation and microwave are different types of radiation in the electromagnetic spectrum.

(a) State one use of ultraviolet radiation and of microwave.

(i) Ultraviolet radiation:

…… [1]

(ii) Microwave:

…… [1]

(b) State one property that both types of radiation have in common and one property that makes them different.

Common property:

…….....

…….....

[1]

Different property:

…….....

…….....

[1]

7 Fig. 7.1 shows a computer chip fitted with a heat sink with black metal fins.

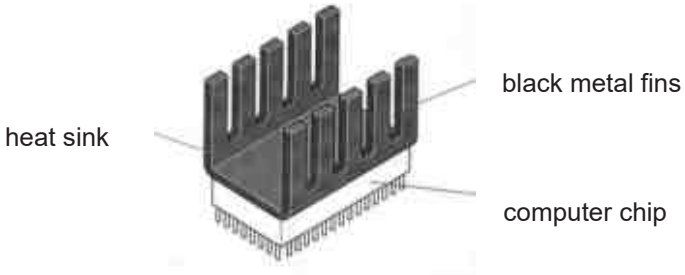

Fig. 7.1

The main function of the heat sink is to keep the computer chip cool.

(a) Explain any **two** features of the heat sink that allow thermal energy to be transferred easily away from the chip.

…….....

…….....

……

…… [4]

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(b) Describe what happens to the motion of the molecules and their arrangement in the heat sink as it gains heat.

.....

.....

.....

..... [2]

8 Fig. 8.1 shows an iron rod resting on two brass strips between the poles of a magnet. When the switch is closed, a current passes through the iron rod from the two brass strips connected to a power supply.

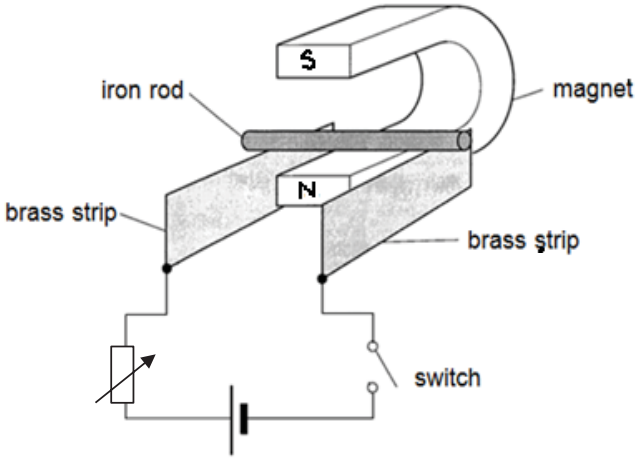

Fig. 8.1

(a) **(i)** Draw an arrow to indicate the direction of current in the iron rod. [1]

(ii) State the direction in which the rod would move.

.....

..... [1]

(b) State the effect on the movement of the iron rod when

(i) the resistance of the rheostat is increased,

.....

..... [1]

(ii) the current is reversed.

.....

..... [1]

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9 Fig. 9.1 shows three resistors **X**, **Y** and **Z** connected in a circuit. The current flowing through **X** is 1.5 A and **X** has a resistance of 3.0 Ω.

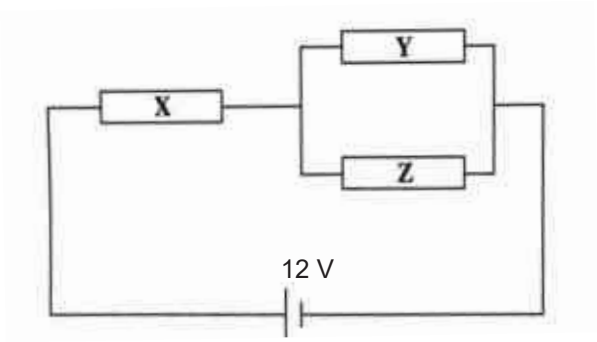

Fig. 9.1

(a) Calculate the potential difference across **X**.

potential difference = ... V [2]

(b) The resistance of **Z** is 6.0 Ω. Calculate the current flowing through **Z**.

current = ... A [2]

(c) Calculate the resistance of **Y**.

resistance = ... Ω [2]

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Section B [20 marks]

Answer any **two** questions in this section.
Write your answers in the spaces provided.

10 Fig. 10.1 shows a hand-operated hydraulic press.

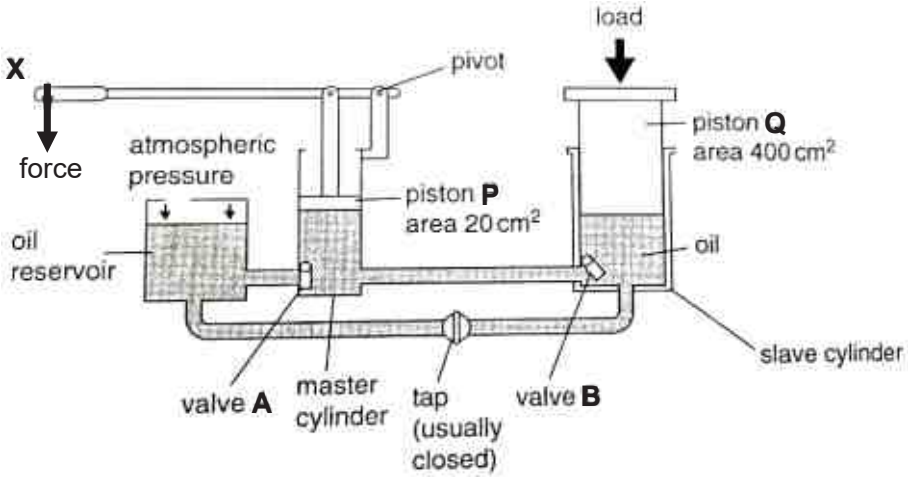

Fig. 10.1

A force is applied downwards at **X** as shown. When piston **P** moves downwards, valve **A** closes, valve **B** opens and oil is forced through to raise piston **Q** in the slave cylinder.

(a) The cross-sectional area of the piston **P** is 20 cm^2 and the cross-sectional area of piston **Q** is 400 cm^2. Piston **P** exerts a downward force of 300 N on the oil.

(i) Calculate the pressure, in N/cm^2, exerted by piston **P** on the oil.

pressure = …….. [2]

(ii) State the value of the pressure in the slave cylinder.

pressure = …….. [1]

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(iii) Hence, calculate the force exerted by the oil on piston **Q**.

force = …….. [1]

(b) Piston **P** moves down 5.0 cm.

(i) Calculate the volume of oil that moves out of the master cylinder.

volume = …….. [1]

(ii) Hence, calculate the distance moved by piston **Q**.

distance = …….. [1]

(c) After **X** is pushed down, it is lifted up again.
State what happens to valve **A**, valve **B** and piston **Q** when **X** is lifted up.

…….....
…….....
……. [2]

(d) Using kinetic theory of matter, explain why oil rather than air is used in the hydraulic press.

…….....
……..... [2]
……

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11 Fig. 11.1 shows an object placed in front of a converging lens. $\mathbf{F_1}$ and $\mathbf{F_2}$ are the focal points of the lens.

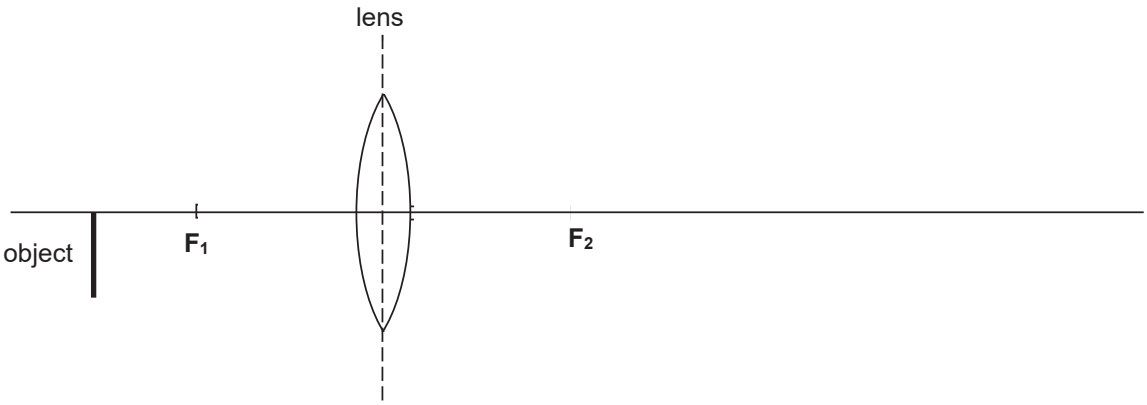

Fig. 11.1

(a) Draw the ray diagram on Fig 11.1 to locate the image of the object. [2]

(b) State two characteristics of the image formed.

…….....

……..... [1]

(c) State one use of the above converging lens when the object is placed as in the diagram.

……..... [1]

(d) Explain the change in the focused image, if any, when the top half of the lens is blocked by a piece of cardboard.

…….....

…….....

…… [2]

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(e) Fig. 11.2 shows a rectangular glass block, **PQRS**, with a refractive index of 1.54. A light ray is incident on the side **PS** of the glass block as shown.

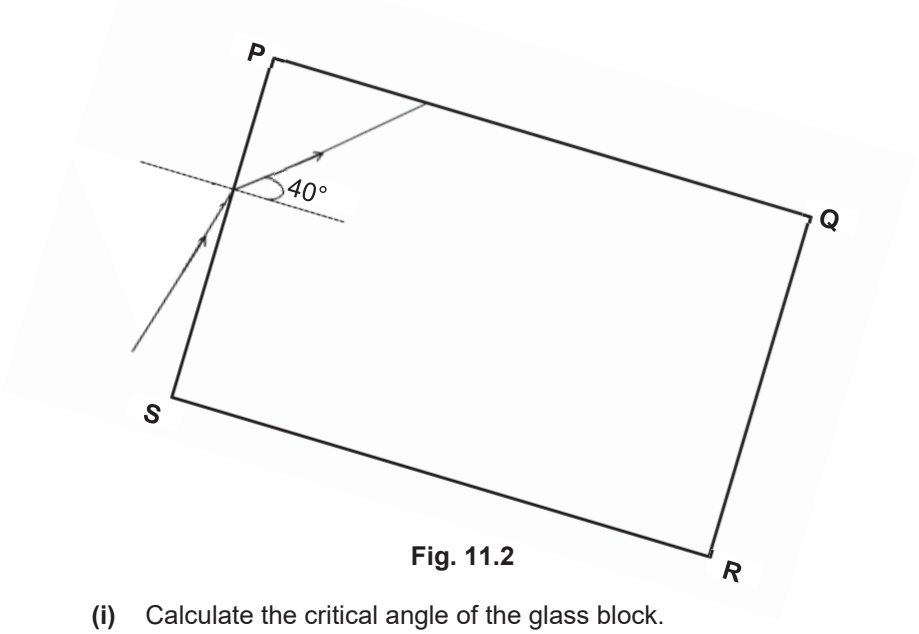

Fig. 11.2

(i) Calculate the critical angle of the glass block.

critical angle = ……..

[2]

(ii) Continue the path of the light ray in Fig. 11.2 at side **PQ** and explain the path you have drawn.

…….....

…….....

……..

[2]

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12 Fig. 12.1 shows the electrical wiring in a table lamp.

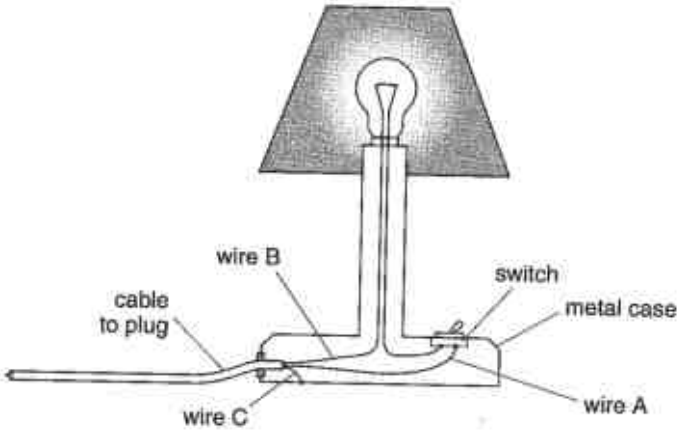

Fig. 12.1

(a) The lamp is marked "240 V, 100 W".

(i) Calculate the resistance of the lamp.

resistance = …….. [2]

(ii) The lamp is switched on for 5 hours daily. Calculate the cost of using the lamp for 1 day, given that the electrical consumption rate is $0.24 per kWh.

cost = …….. [2]

(b) Explain why wire **A** rather than wire **B** is connected to the live terminal in the plug.

…….....

……..... [2]

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(c) State which wire carries no current when the table lamp is working normally.

.....

..... [1]

(d) Fig 12.2 shows a circuit breaker that is connected to the table lamp.

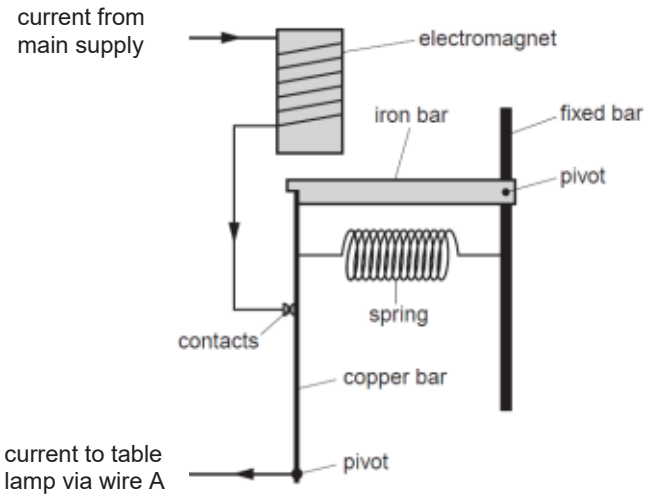

Fig. 12.2

Wire **A** in the table lamp becomes loose and touches the metal case. When this electrical fault occurs, explain how the circuit breaker in Fig 12.2 switches off the main current.

.....

.....

.....

.....

..... [3]

End of Paper

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Answers:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
C	C	A	B	B	D	A	B	B	C
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
D	B	C	C	A	C	D	B	D	A
21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
A	D	B	D	C	B	D	D	B	A
31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
D	B	C	D	D	A	D	D	D	C

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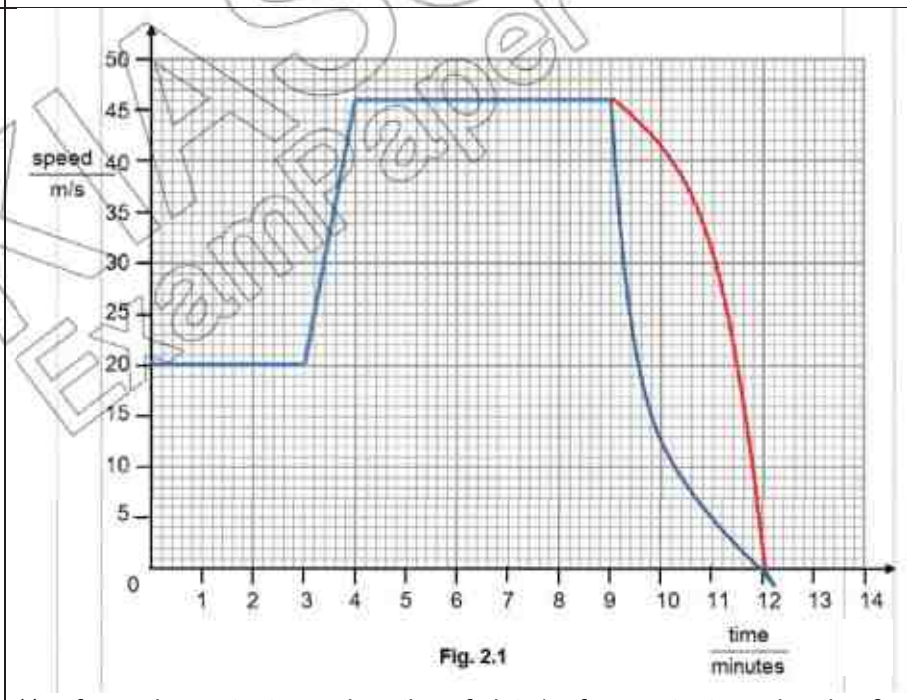
Marking Scheme 4E/5NA

Section A: [20]

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
11.	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**

Section B: [45]

1	**(a)**	• The vibrating speaker pushes and pulls the surrounding air particles causing it to vibrate in the same direction as the wave motion. • This first layer of air will in turn pushes and pulls the next layer of air, • This process continues. • Producing a series of compression and rarefaction in the air.	[1/2] [1/2] [1/2] [1/2]
	(b)(i)	20000 waves are produced in 1 second.	[1]
	(ii)	$v = f\lambda$ $\lambda = v / f$ For longest wavelength, use f = 20 Hz $\lambda = 340\ ms^{-1} / 20\ Hz$ $= 17.0\ m$	 [1] [1]
2	**(a)**	 Fig. 2.1 ½ m for each constant speed section of plot. 1m for constant acceleration & 1m for non-uniform deceleration If time duration is wrong, 0 m for each section.	[3]

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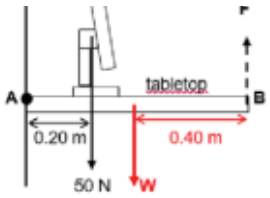
	(b)	$a = \frac{v-u}{t} = \frac{45-20}{4-3} = 25/60$ $= 0.417$ m/s² changing 1 min to 60 s (1m)	[M1] [A1]
	(c)	Force = 1200 X 0.417 = 500 N	[1] [1]
3	**(a)**	mass = w/g = 2.6/10 = 0.26 kg	[1]
	(b)	mass = density x volume = 0.80 x 250 = 200 g = 0.2 kg	[1] [1]
4	**(a)**	 give 1m so long w is vertical downward arrow near or at the centre of the tabletop.	[1]
	(b)	(1m) (1m) Resultant moment = (W x $D_{monitor}$) + (W x $D_{tabletop}$) = (50 N x 0.20 m) + (70 N + 0.40 m) = 10 Nm + 28 Nm = 38 Nm	[2]
	(c)	Sum of Anti-Clockwise moment = Sum of Clockwise moment F x 0.8 m = 38 Nm F = 38 / 0.8 F = 47.5 N	[1] [1]
5	**(a)**	KE = mgh (0.5)(1.6)(v^2) = (1.6)(10)(1) = 16 v = 4.47 m/s	[1] [1]
	(b)	work done = KE (2.5)d = 16 d = 6.4 m	[1] [1]
6	**(a)(i)**	Ultraviolet radiation is used in sun beds / sterilisation of equipment.	[1]
	(ii)	Microwave is used for microwave oven / satellite communication	[1]

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	(b)	Common: They are all transverse waves or They can travel through vacuum. Or They travel at a speed of 3.0×10^8 m/s in vacuum Difference: They have different wavelength / frequency (accept any other plausible answers)	[1] [1]
7	**(a)**	• Heat sink is made of metal, which is a good conductor of thermal energy allows thermal energy to be conducted quickly away from the chip. or • The heat sink/metal fins are painted black which is a good emitter / radiator of heat, which allow heat to be radiated more quickly. or • The metal fins have a large combined surface area , that allows radiant heat to be radiated more quickly through convection current. *(either two)*	[2] [2]
	(b)	As the temperature rises, the molecules in the heat sink vibrate more rigorously. The average spacing between the molecules increases.	[1] [1]
8	**(a)(i)** **(ii)**	Current in the rod from left to right The rod moves outward	[1] [1]
	(b)	(i) The rod moves with **slower speed** **outward**. [½ , ½] (ii) The rod moves in **the opposite direction** to its initial direction / inwards **in the same speed**. [½ , ½] **Must have both direction and speed to gain 1 mark*	[1] [1]
9	**(a)**	V = 1.5 x 3 = 4.5 V	[1] [1]
	(b)	V = 12 –4.5 = 7.5 V (allow ecf) I = 7.5 / 6 = 1.25 A or 1.3 A	[1] [1]
	(c)	V = 7.5V I = 1.5 – 1.25 = 0.25 A R = 7.5 / 0.25 = 30 Ω	 [1] [1]

Section B

10	**(a)(i)**	P = force / area = 300 N / 20 cm^2 = 15 N/cm^2	 [1] [1]
	(ii)	15 N/cm^2	[1]
	(iii)	Force = 15 N/cm^2 X 400 cm^2 = 6000 N	[1]
	(b) (i)	Volume = area x length = 20 cm^2 x 5 cm = 100 cm^3	 [1]

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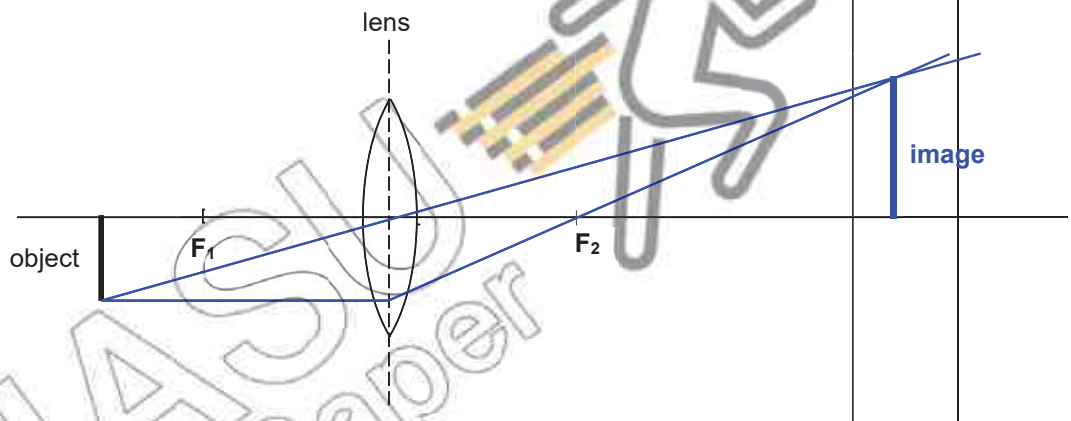
	(ii)	Length = Volume / area = 100 cm^3 / 400 cm^2 = 0.25 cm	[1]
	(c)	Valve A open and oil flows from the reservoir into piston P; valve B closes; pistonQ remains where it is. *(missing/wrong 1 deduct 1 mark)	[2]
	(d)	Oil, being a liquid, has molecules closely packed. As such it is not compressible. Air has molecules which are far apart. As such it is compressible.	[1] [1]
11	**(a)**	 At least 2 light rays coming from the top of the object to the opposite side of lens. Light rays must include arrow. Image drawn correctly without arrow head.	[1] [1]
	(b)	Real, inverted and enlarged – any two (missing/wrong 1 deduct 1 mark)	[1]
	(c)	projector	[1]
	(d)	The image becomes dimmer/less bright. With half the lens covered, less light passes through the remaining half of the lens to form the image.	[1] [1]
	(e)(i)	n = 1/sin c 1.54 = 1/sin C c = 40.5°	[1] [1]

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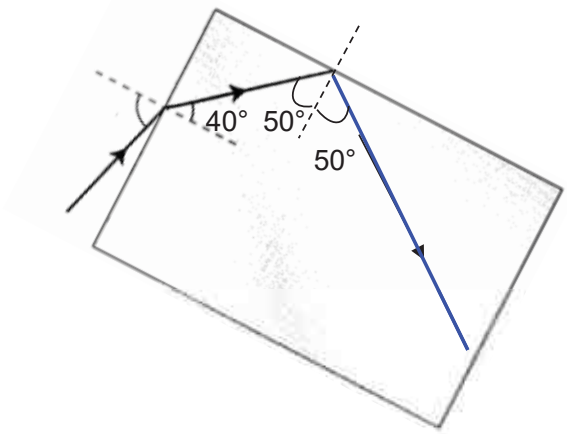
	(ii)	 Correct ray direction [1/2] Correct angle given [1/2] Missing arrows/ incorrect arrows minus 1/2 mark Explain: With the <u>incident angle at side PQ greater than the critical angle</u> while going from denser medium to a less dense medium, <u>Total Internal Reflection occurs at side PQ</u>.	[1] for drawing [1/2] [1/2]
12	(a) (i)	P = VI 100 = 240 I I = 0.417 A R = V/I = 240 ÷ 0.417 = 576 Ω **OR** P = V^2 / R 100 = 240^2 / R R = 240^2 / 100 = 576 Ω	 [1] [1] [1] [1]
	(ii)	E = Pt = 0.1 x 5 = 0.5 kWh Cost = 0.5 x 0.24 = $0.12	 [1] [1]
	(b)	This is because wire A has a **switch** connected to it. So when the switch is open, the appliance will be **disconnected from the high voltage live wire**. Thus preventing the possibility of electric shock to the user.	[1] [1]
	(c)	Wire C	[1]

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	(d)	When the fault occurs, large current flows into the circuit breaker the electromagnet is magnetised strong enough to attract the iron bar. The copper bar is pulled away from the contact by the spring. The contact is broken.	[1] [½, ½] [1]

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