2019

Secondary 4 Physics

1.	Assumption English	SA2
2.	Bartley Secondary	SA2
3.	Bedok South Secondary	SA2
4.	Broadrick Secondary	SA2
5.	Changkat Changi Secondary	SA2
6.	Damai Secondary	SA2
7.	Gan Eng Seng School	SA2
8.	Jurongville Secondary	SA2
9.	Northland Secondary	SA2
10.	Unity Secondary	SA2
11.	Yuhua Secondary	SA2

Name: ………………………………………………………… (   )   Class: ……………

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2019

SCIENCE (PHYSICS)
5076 / 01
5077 / 01

LEVEL: 4 Express / 5 Normal (Academic)

DATE: 29 August 2019

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.**

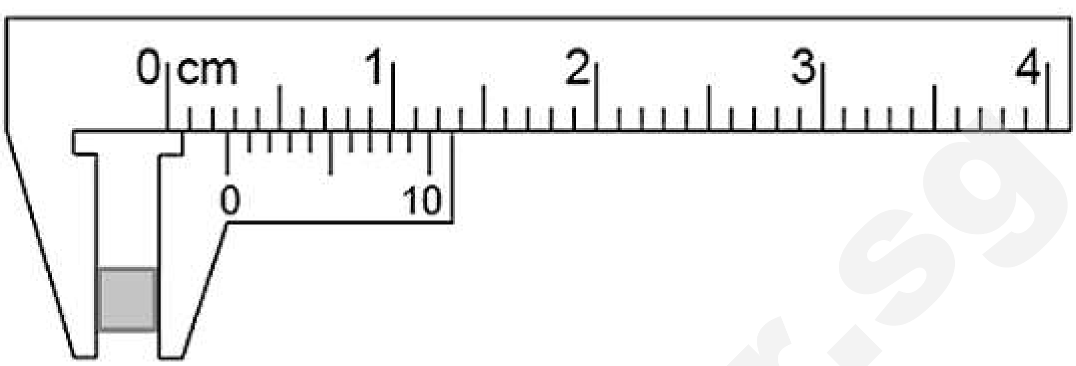
For Examiner's use:	
Paper 1	/ 20
Paper 2	/ 65
Paper 5	/ 15
Total	/ **100**

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

This Question paper consists of 10 printed pages including this page.
[Turn Over

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

1 What is the reading shown by the vernier calipers below?



A 0.07 cm **B** 0.27 cm

C 0.29 cm **D** 0.37 cm

2 Which scenario can cause a change in the acceleration of an object?

A The object continues to move in a straight line at constant speed.

B The object experiences a constant net force to keep it moving.

C The object remains moving in constant velocity.

D The object slides from a rough surface to a smooth surface.

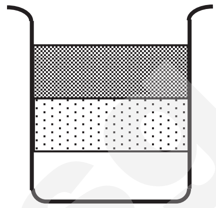
3 An elephant of mass 6000 kg stands on four legs, each having an area of contact of 0.15 m^2 with the ground. What is the pressure exerted by the elephant on the ground?
Take g to be 10 N/kg.

A 10 kPa **B** 40 kPa

C 100 kPa **D** 400 kPa

4 Three immiscible liquids are poured into a beaker. The masses and the corresponding volumes of three liquids **X**, **Y** and **Z** are recorded below.

liquid	mass / g	volume / cm^3
X	270	40
Y	400	70
Z	559	50



What is the order of the liquids in the beaker starting from the top?

A **X**, **Y**, **Z**

B **Y**, **X**, **Z**

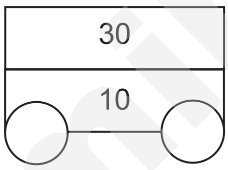
C **Z**, **Y**, **X**

D **Z**, **X**, **Y**

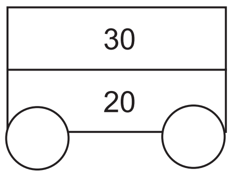
5 Some passengers are travelling on four double-decker buses along a horizontal highway. The numbers of passengers in each deck are as indicated.

Which distribution of passengers on the double-decker bus is the most stable?

A



B



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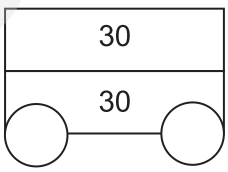
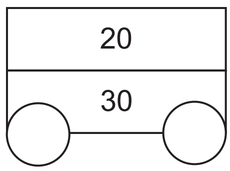


D



6 An experiment is carried out to measure the power of a student running up a flight of stairs. Which quantity is **not** required for this experiment?

A the time taken to run up the stairs

B the total horizontal distance of the stairs

C the total vertical height of the stairs

D the weight of the student

7 Which statement(s) about kinetic model of matter is / are true?

I. Particles in a gas repel each other.
II. Particles in a liquid are constantly in motion.
III. Particles in a solid expand when heated.

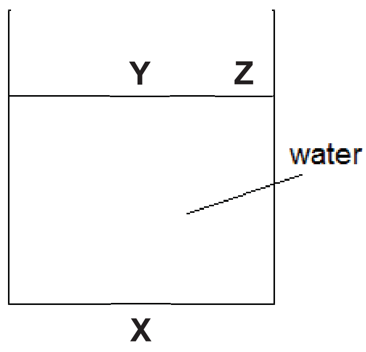
A **II** only

B **I** and **II** only

C **II** and **III** only

D **I**, **II** and **III**

8 The diagram shows a large tank of water.



Which arrangement will set up convection currents in the tank?

A cooling at **X**

B cooling at **Y**

C heating at **Y**

D heating at **Z**

9 Particles in a solid absorb thermal energy and vibrate about their fixed positions more vigorously.

Which process is being described?

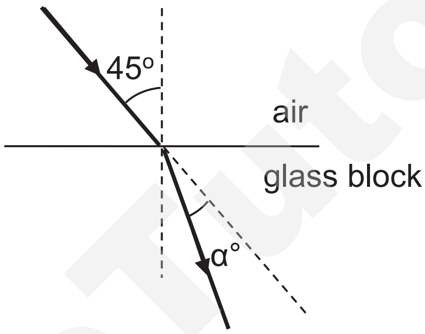
A boiling

B evaporation

C heating

D melting

10 A light ray enters a glass block at an angle of incidence of 45°.



If the glass has a refractive index of 1.41, what is the value of angle α° (not drawn to scale)?

A 14.9 **B** 30.1

C 40.1 **D** 45.0

11 Electromagnetic waves of wavelength **λ** and frequency **f** travel at speed **c** in a vacuum.

Which row correctly describes the wavelength and speed of electromagnetic waves of frequency **f**/2?

	wavelength	speed in a vacuum
A	**λ**/2	**c**/2
B	**λ**/2	**c**
C	2**λ**	**c**
D	2**λ**	2**c**

12 Which application uses ultraviolet rays?

A forgery detector

B imagery of body

C remote controller

D satellite television

13 Which statement about sound is correct?

A Sound waves are transverse waves.

B Sound waves can undergo reflection.

C Sound waves travel slower in steel than in air.

D The speed of sound waves in air is 3×10^8 m/s.

14 The diagram shows a freely suspended positively charged acetate strip and a negatively charged polythene strip.

acetate strip polythene strip

Two rods **X** and **Y** are brought near to the two strips. Rod **X** repels the acetate strip but attracts the polythene strip. Rod **Y** attracts both strips.

Which type of charge is on each rod?

	rod **X**	rod **Y**
A	postive	neutral
B	positive	postive
C	negative	positive
D	neutral	negative

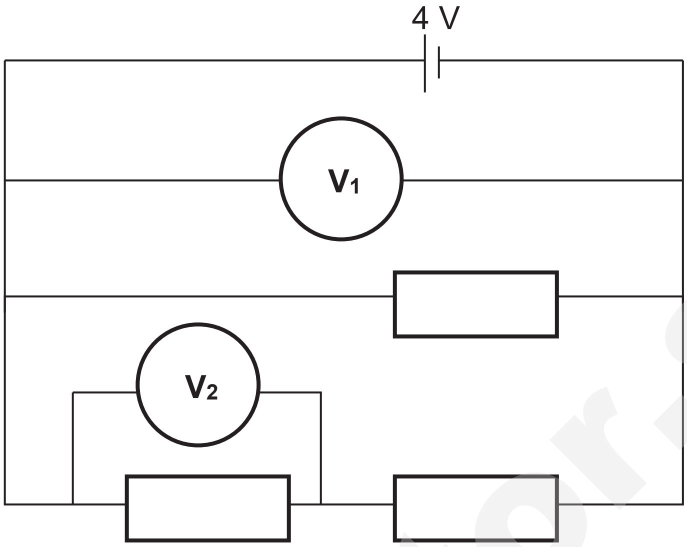
15 The current in an electric heater is 6 A. It is switched on for 5 minutes.

How much charge flows through the heater?

A 20 mC **B** 30 C

C 50 C **D** 1800 C

16 The diagram shows three identical resistors connected to a 4 V cell.

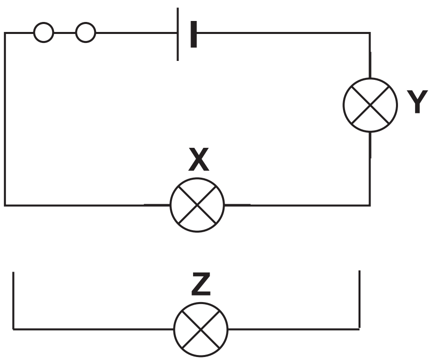


What is the correct relationship between the readings on voltmeters $\mathbf{V_1}$ and $\mathbf{V_2}$?

A $V_1 = V_2$ **B** $V_1 = 2V_2$

C $V_2 = 2V_1$ **D** $V_2 > V_1$

17 The diagram shows identical lamps **X** and **Y** connected in series with a dry cell. Both lamps are equally bright when the circuit is closed.

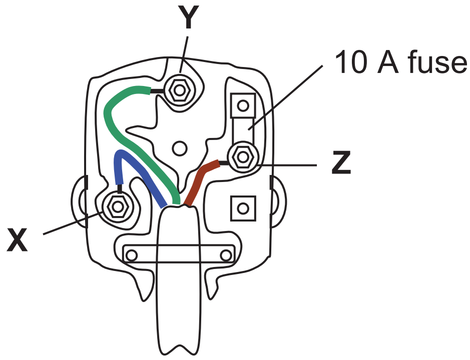


A third identical lamp **Z** is connected in parallel with lamp **X**. How does the magnitude of current in lamp **Y** change compared to the initial arrangement?

A higher **B** lower

C no change **D** no current

18 The diagram shows a three-pin plug used with a 10 A fuse.



Which row shows the possible values of the current flowing through the terminals **X**, **Y** and **Z** when there is **no** fault?

	current at **X** / A	current at **Y** / A	current at **Z** / A
A	0	9	9
B	9	0	9
C	9	0	10
D	9	9	9

19 Which method **cannot** demagnetise a steel bar?

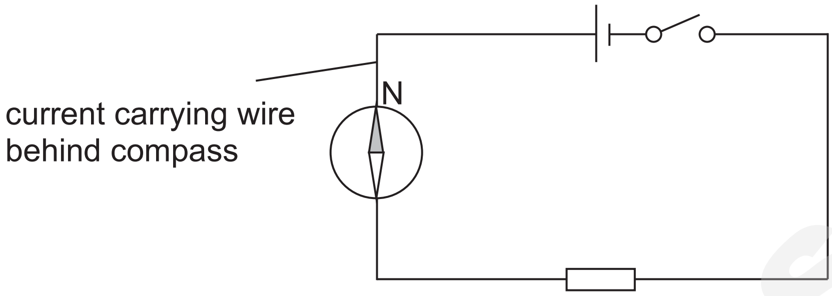
A hammering it repeatedly

B heating over a flame for a period of time

C placing it in a solenoid under an alternating current

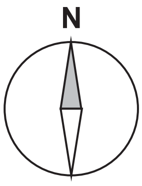
D stroking it with a bar magnet repeatedly

20 A plotting compass is placed above a current-carrying wire. Before the circuit is closed, the direction of compass is shown in the diagram.

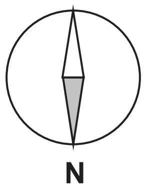


In which direction will the compass needle be pointing when the switch is closed?

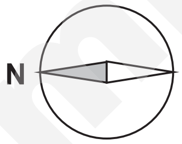
A



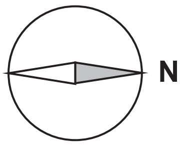
B



C



D



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Name: …………………………………………………… (   )   Class: ……………

ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2019

SCIENCE (PHYSICS)
5076 / 02
5077 / 02

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ASSUMPTION ENGLISH SCHOOL ASSUMPTION ENGLISH SCHOOL ASSUMPTION ENGLISH SCHOOL ASSUMPTION ENGLISH SCHOOL

LEVEL: 4 Express / 5 Normal (Academic) **DATE:** 30 August 2019

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 18 printed pages including this page.

[Turn Over

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

1 Fig 1.1 below shows a bob of weight 50 N hanging in equilibrium from a string that is pulled to one side by a horizontal force **F** of magnitude 60 N.

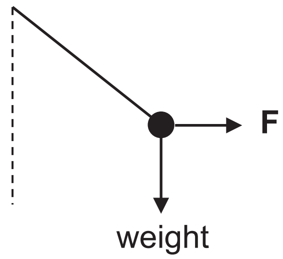


Fig. 1.1

(a) In the space below, draw a scale diagram to determine the resultant force of **F** and the weight of the bob.

resultant force = ...N [3]

(b) Hence, determine the magnitude of the tension in the string.

tension = ...N [1]

2 A car was travelling along Upper Changi Road and was about to pass a traffic crossing when a boy suddenly jay-walked across the road. The graph in Fig. 2.1 shows how the speed of the car changed from the moment the driver saw the boy until the car stopped.

Fig. 2.1

(a) Suggest why the car continued at constant speed for the first 1.5 s, even though the driver had seen the boy.

....

.... [1]

(b) From the moment the driver saw the boy, determine how far the car travelled before the car started to decelerate.

distance = ...m [1]

(c) Calculate the deceleration of the car.

deceleration = ...m/s^2 [2]

(d) A boy is standing 50 m away from the car. Determine if the boy will be knocked down by the car.

....

....

.... [2]

3 An uniform wooden plank **AB**, 2 m long, weighing 54 N, rests on a knife edge 0.50 m from **B**. The end **A** is supported by a vertical string represented by tension **T** in Fig. 3.1, so that **AB** is horizontal.

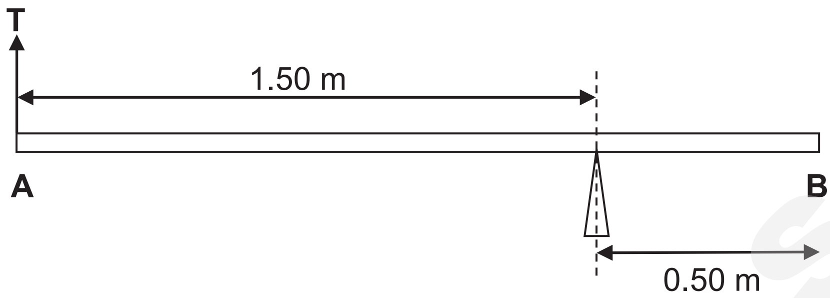


Fig. 3.1

(a) Draw and label the weight **W** of the plank on **Fig. 3.1**, indicating the distance between **A** and **W**.

distance between **A** and **W** = …………………m [1]

(b) Hence, find the tension **T** in the string.

tension = ...N [2]

(c) Without any calculations, state what will happen to tension **T** as the knife edge is shifted towards **B**.

……………………………………………………………………………………………

…………………………………………………………………………………………… [1]

4 Fig. 4.1 shows a metal pan containing water on a cooker. The hotplate heats the water.

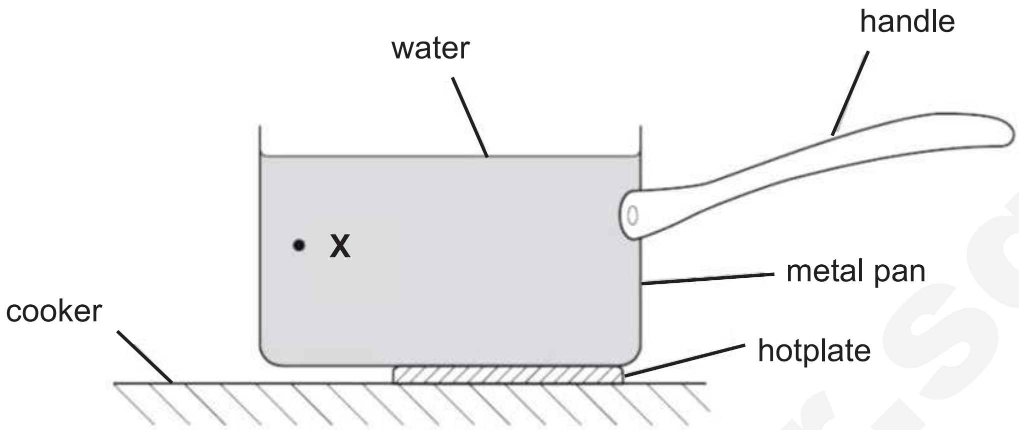


Fig. 4.1

(a) Describe how the heat is transferred through the base of the metal pan.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

(b) **(i)** On Fig. 4.1, draw an arrow to show the direction of movement of the water at point **X**. [1]

(ii) Explain why the water moves in this direction.

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

(c) The pan has a polished and silvery metallic surface. Explain how that feature minimises heat loss from the metal pan.

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [1]

5 Fig. 5.1 shows an arrow shaped object placed in front of a thin converging lens. Two rays from the top of the object are shown passing through the lens.

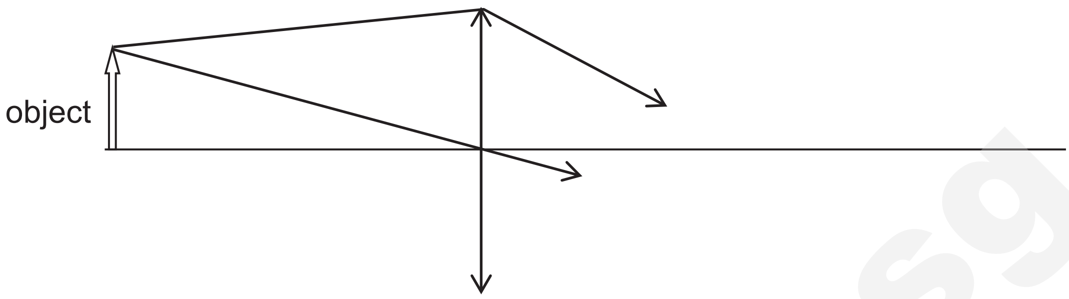


Fig. 5.1

(a) **(i)** On Fig. 5.1, complete the paths of the two rays and mark the image formed with **I**. [2]

(ii) If the top half of the lens is covered by an opaque sticker, state any change to the full image drawn in **(a)(i)**.

....

.... [1]

(b) Table 5.1 shows the speed of light in different materials.

material	air or vacuum	glass block
speed of light / ms^{-1}	3.0×10^8	1.9×10^8

Table 5.1

(i) Calculate the refractive index of glass block.

refractive index = ... [2]

(b) **(ii)** Determine the critical angle of the glass block.

critical angle = ...° [1]

6 Fig 6.1 shows a battery connected to a lamp.

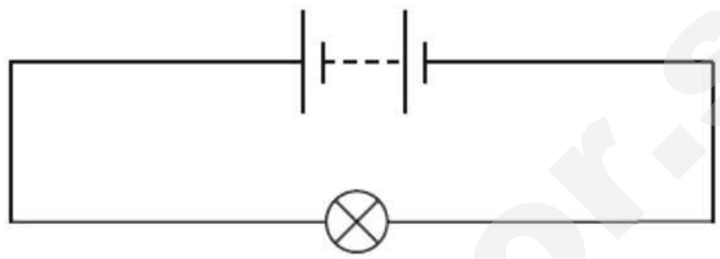


Fig. 6.1

A charge of 150 C flows through the lamp in 100 s.

The energy transferred is 900 J.

(a) Calculate the potential difference across the lamp.

potential difference = ...V [2]

(b) Calculate the current in the lamp.

current = ...A [2]

(c) Calculate the power of the lamp.

power = ...W [2]

7 Fig. 7.1 shows a circuit in which all the switches are opened.

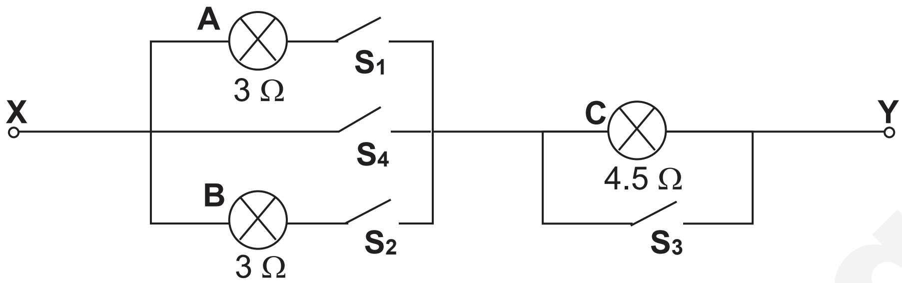


Fig. 7.1

(a) Calculate the effective resistance between **X** and **Y** when **S1** and **S2** are closed.

effective resistance = ... Ω [3]

(b) State the effective resistance between **X** and **Y** when all switches are closed.

.... [1]

(c) State the switches that have to be closed in order to light up bulbs **A** and **B** only.

.... [1]

8 The table lamp shown in Fig 8.1 is made from plastic and has double insulation. It has only two wires in the cable. The lamp has a power rating of 100 W and is used on a 230 V supply.

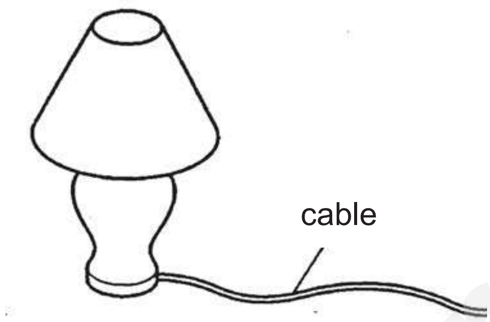


Fig. 8.1

(a) **(i)** State the name and colour of the two wires that are found in the cable.

	name of wire	colour
first wire		
second wire		

[2]

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

....

....

....

.... [2]

(b) **(i)** Calculate the rating of the fuse that should be used for this lamp.

rating = ...A [2]

(ii) Singapore Power charges 26.70 cents for each kWh of electrical energy used. Calculate the cost of using the lamp in 30 minutes.

cost = ...cents [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 A car accelerates from rest to reach a constant velocity during a 24 seconds journey. The car experiences friction while it is moving as shown in Fig. 9.1.

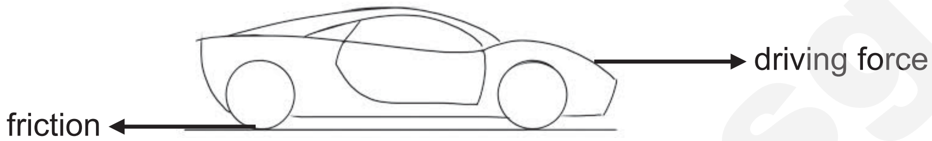


Fig. 9.1

Fig. 9.2 shows how the friction changes with time, **t**, over a period of 24 seconds.

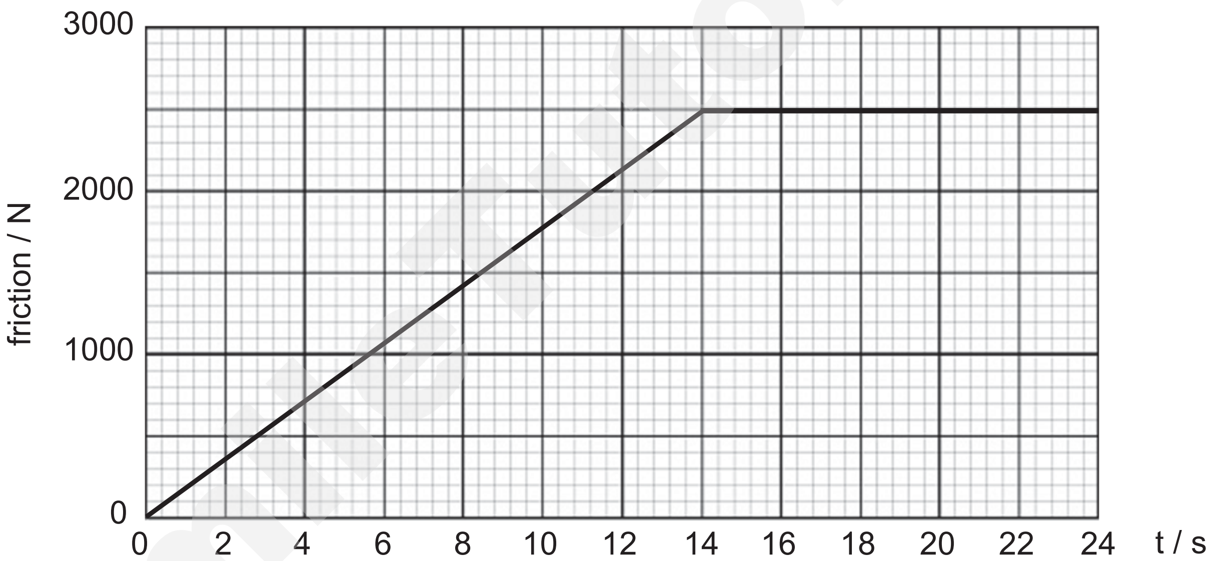


Fig. 9.2

The car has a mass of 850 kg and moves under a constant driving force of 2500 N for the entire journey.

(a) At t = 8 seconds, determine the

(i) friction experienced by the car,

friction = ...N [1]

(ii) resultant force of the car,

resultant force = ...N [1]

(iii) acceleration of the car.

acceleration = ...m/s^2 [2]

(b) The car travels at a constant velocity of 20 m/s between 14 seconds and 24 seconds.

(i) Using Fig 9.2, explain how the graph can be used to show the car is travelling at constant velocity in the last 10 seconds of the journey.

....

....

.... [2]

(ii) Calculate the distance covered when the car is travelling at a constant velocity.

distance = ...m [1]

(iii) Calculate the work done by the car's engine during this period.

work = ...J [2]

(iv) If the kinetic energy of the car is 170 kJ, explain why it is less than the work done by the car's engine.

....

.... [1]

10 Fig 10.1 shows the cross section of a swimming pool. A wave machine at one end creates waves that travel across the pool. The diagram shows the surface of the water 1.5 seconds after the wave machine began making waves.

Fig. 10.1

(a) Estimate the number of wavelengths between points **X** and **Y** in Fig. 10.1.

number of wavelengths = ... [1]

(b) Calculate the frequency of the waves.

frequency = ...Hz [2]

(c) Fig 10.2 shows the surface of the pool several minutes after the wave machine has begun working. Three toy ducks are placed at different positions in the pool as shown below. The line **LL** represents the original water level before the wave machine began working

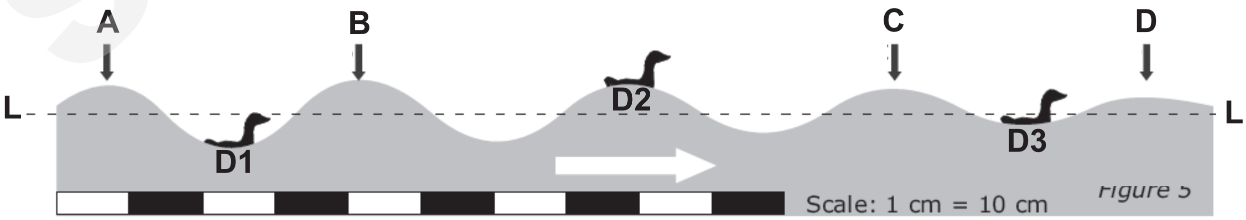


Fig. 10.2

(i) Use Fig. 10.2 to state what happens to the amplitude as the wave travels across the pool from **A** to **D**. Explain why this happens.

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………… [2]

(ii) If the wavelength of the wave is 35 cm, calculate the speed of the wave in section **AB**. Explain whether this speed would change when the wave reaches section **CD**. Show your working below.

speed = ……………..m/s

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………… [3]

(iii) The three ducks are set in motion as the wave travels across the water. Explain whether duck at **D1** would hit the other two ducks after some time.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………… [2]

11 A lift in a tall building needs a very powerful electric motor to move it. Fig. 11.1 shows an arrangement which uses a relay circuit on the left to switch the electric motor on and off.

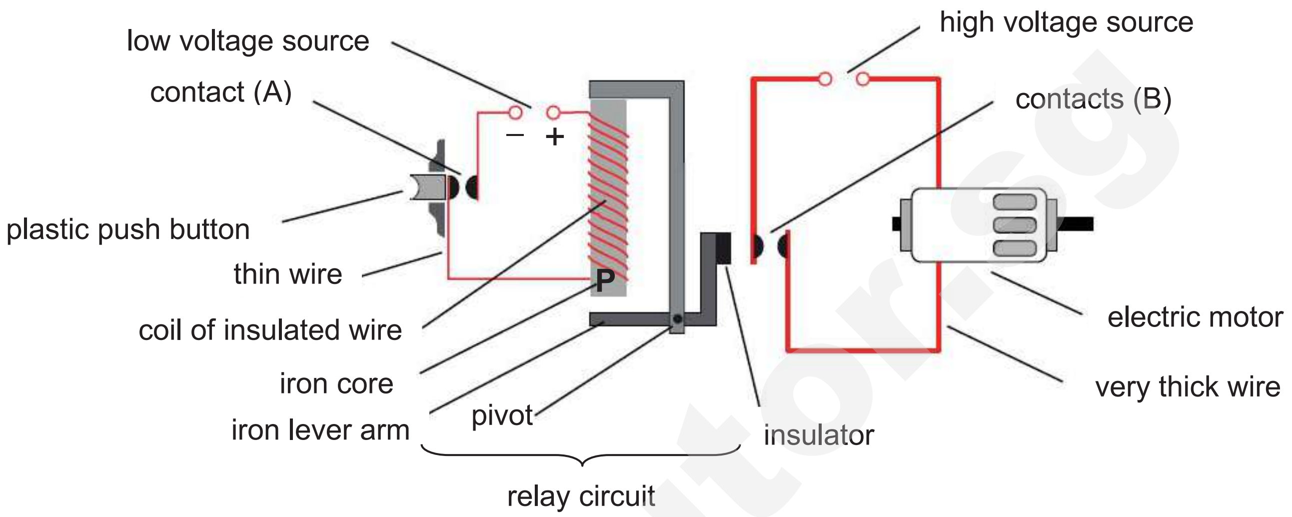


Fig. 11.1

(a) The electric motor circuit uses thicker wire than the one in the relay circuit. Explain why a thicker wire is used in the electric motor circuit.

....

.... [1]

(b) A user on the left pushes the plastic push button in the relay circuit to start the motor running.

(i) State the polarity at the end of the iron core indicated by **P**, when the relay circuit is turned on.

.... [1]

(ii) Explain why it is suitable to use an iron core in the relay circuit.

....

....

……………………………………………………………………………………… [2]

(ii) Describe the sequence of events that take place from the moment the button is pushed to the time when the motor starts.

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

……………………………………………………………………………………… [4]

(c) The low voltage source in the relay circuit is a battery which has to be replaced once its energy runs low. State whether the motor can still be switched on if a battery low on energy is not replaced. Explain your answer.

………………………………………………………………………………………

………………………………………………………………………………………

……………………………………………………………………………………… [2]

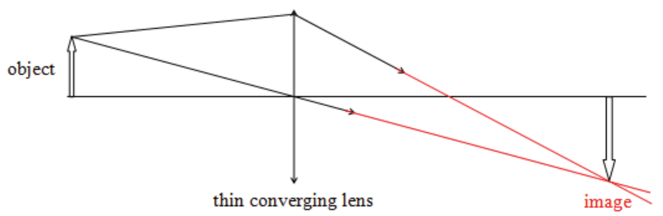
- END OF PAPER -

4E5N Sc(Physics) Prelim Marking Scheme 2019

Paper 1: MCQ [20]

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

Section a: Short Structured Questions [45]

Qn	Ans	Marks
1a	use of appropriate scale (1 cm : 10 N or 1 cm : 5 N) parallelogram method resultant force = 78 N (accept answers between 70 N to 86 N)	C1 C1 A1
b	tension = 78 N (same ans as 1a)	B1 ECF
2a	The driver took 1.5 s to react.	B1
b	distance = 25 x 1.5 = 37.5 m	B1
c	deceleration = 25/(5-1.5) = 7.14 m/s^2	C1 A1
d	braking distance = 0.5(25)(3.5) = 47.25 m Total distance = 37.5 + 47.25 m = 81.25 m Car did not manage to stop in time, pedestrian will be knocked down by the car..	C1 A1
3a	Draw an arrow from the 1 m mark of the plank and label it W. Distance between A and W is 1.0m	B1
b	T x 1.5 = 54 x 0.5 T = 18 N	C1 A1
c	T increases.	B1
4a	When the metal pan is heated, the molecules at the base gained kinetic energy, collided with the neighbouring molecules and transferred energy in the process. This process is called conduction.	B1 B1
bi	arrow pointing downwards.	B1
bii	water above the hotplate gets heated and expands, resulting in a lower density and hence rises. the cooler water at X hence sinks to replace the water above the hotplate.	B1 B1
c	Polished and shiny surface is a poor radiator/emitter of heat, hence heat loss is minimised.	B1
5ai		B1

	B1-complete the paths of the two rays correctly. B1- The image I is marked correctly.	B1
aii	The **full image** would still be seen but appear **dimmer**	B1
bi	$n = \frac{c}{v}$ $= \frac{3.0 \times 10^8 \text{ m s}^{-1}}{1.9 \times 10^8 \text{ m s}^{-1}}$ = 1.58	C1 A1
bii	sin c = 1 / n sin c = 1/ 1.58 c = 39.3 ° ECF	B1
6a	p.d. = E/Q = 900/150 = 6 V.	C1 A1
b	I = Q/t = 150/100 = 1.5 A	C1 A1
c	P = VI = 6 x 1.5 = 9 W ECF OR P = E/t = 900/100 = 9 W	C1 A1 or C1 A1
7a	effective resistance of A and B in parallel $= (1/3 + 1/3)^{-1}$ $= 1.5\ \Omega$ effective resistance of A, B and C = 1.5 + 4.5 $= 6\ \Omega$	C1 C1 A1
b	zero.	B1
c	S_1, S_2 and S_3.	B1
8ai	Live (brown) and neutral (blue)	B1 B1
aii	Lamp is made of plastic which is an electrical insulator, lamp casing would never become 'live' OR current cannot flow to the user through the casing.	B1 B1
bi	current in cable, I = P/V = 100/230 = 0.435 A 1A fuse rating (accept 0.5 A, 1.0 A)	C1 A1

bii	Electrical energy = 0.1kW x 0.5h = 0.05 kWh Cost = 0.05 x 26.70 = 1.34 cents	C1 A1
9ai	1400 N or 1450 N	B1
aii	2500 – 1400 = 1100 N ECF	B1
aiii	a = 1100 / 850 1.29 m/s^2	C1 A1
bi	Friction at this time is <u>equal</u> to the driving force and so the <u>acceleration becomes zero</u>	B1 B1
bii	200 m	B1
biii	W = 2500 * 200 500 kJ ECF	C1 A1
biv	Remaining energy has been converted into <u>sound and heat energy</u>	B1
10a	3 (accept range between 2.75 to 3.25)	B1
b	T = 0.5 s OR f = 3 / 1.5 2 Hz (accept range between 1.83 Hz to 2.17 Hz)	C1 A1
ci	Amplitude decreases. As the wave propagates from A to D, energy is lost to the surroundings, hence the amplitude decreases.	B1 B1
cii	2 Hz x 0.35 m = 0.70 m/s ECF but accept values between 0.63 m/s and 0.77 m/s The speed of the wave <u>would not change</u> because <u>both frequency and wavelength of the wave do not change</u>	C1 A1 B1
ciii	Duck at D1 would <u>never hit</u> the other two ducks because All three ducks would only <u>move vertically at the same position</u>	B1 B1
11a	Thicker wire is used because it has lower resistance and it <u>carries a larger current</u>.	B1
bi	South pole	B1
bii	Iron core is a soft magnetic material that can be <u>demagnetized easily</u> When the push button is pushed, the iron core has to be demagnetized so as to <u>allow the iron lever arm to return to original position</u> to switch off the motor	B1 B1
biii	Current flows in the relay circuit to <u>magnetise the iron core</u> <u>Iron lever arm is induced</u> to be a magnet to be attracted to the iron core <u>Contacts in the motor circuit closes</u> as iron lever arm swings clockwise <u>Current flows in the motor circuit</u> to run the motor	B1 B1 B1 B1
c	The motor can <u>no longer be switched on</u> because Current in the relay circuit would be reduced which <u>lowers the magnetic strength</u> of the iron core and <u>unable to cause the iron lever to turn clockwise</u> OR iron core <u>may not be magnetized</u> to attract the iron lever	B1 B1

Class	Register Number	Name

BARTLEY SECONDARY SCHOOL

GCE O-LEVEL PRELIMINARY EXAMINATIONS

SCIENCE (PHYSICS, CHEMISTRY) 5076/01

Sec 4 Express / 5 Normal (Academic)

Paper 1 Multiple Choice

23 September 2019

1 hour

Candidates answer on the Multiple Choice Answer Sheet.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on all the work you hand in.
Do not use staples, paper clips, 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 correct and record your choice in **soft pencil** on the separate Multiple Choice 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.
The use of an approved scientific calculator is expected, where appropriate.

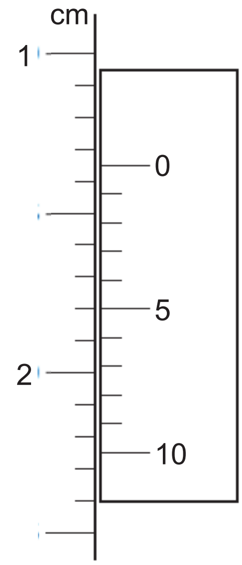
At the end of the examination, submit the Multiple Choice Answer Sheet.

This document consists of **9** printed pages and **1** blank page.

Set by: OGK

[Turn over

1 The diagram shows part of a vernier scale.



What is the correct reading of the vernier scale?

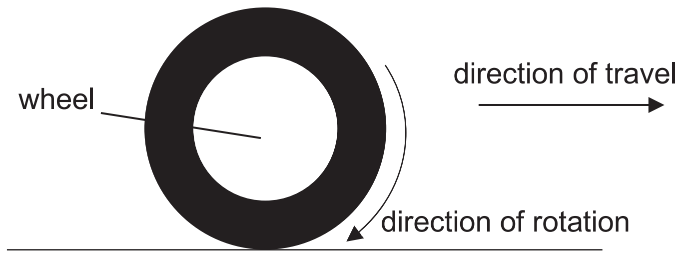
A 1.05 cm **B** 1.35 cm **C** 1.85 cm **D** 2.65 cm

2 An object falls through a vacuum.

Which row describes the acceleration and the velocity of the object?

	acceleration	velocity
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

3 A car is accelerating along a road in the direction shown. The wheel shown is connected to the engine.



Which row shows the correct directions of air resistance on the car and friction acting on the wheel?

	air resistance	friction
A	←	←
B	←	→
C	→	←
D	→	→

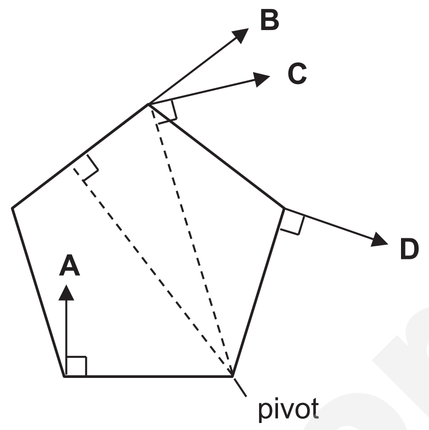
4 The weight and density of a gold bar are measured on Earth. The weight and density of the same gold bar are now measured on the Moon.

Which row describes how the density and weight of the gold bar change as the gold bar is brought to the Moon?

	density of gold bar on the Moon	weight of gold bar on the Moon
A	decrease	decrease
B	decrease	unchanged
C	unchanged	decrease
D	unchanged	unchanged

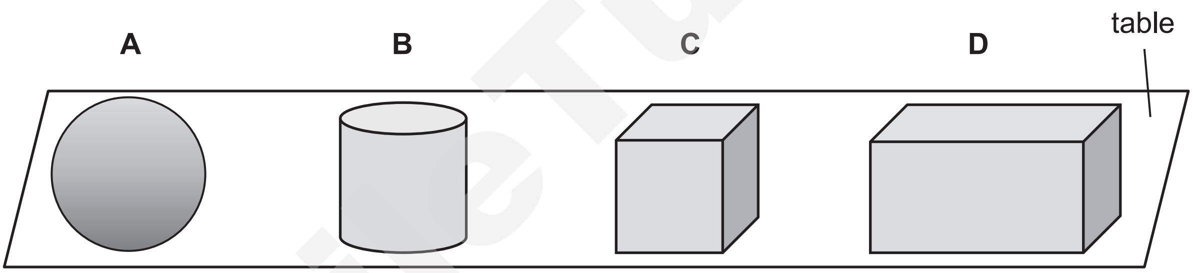
5 The diagram shows four forces acting on a pentagon-shaped object.
The four forces shown have the same magnitude.

Which force will give the greatest turning effect about the pivot?

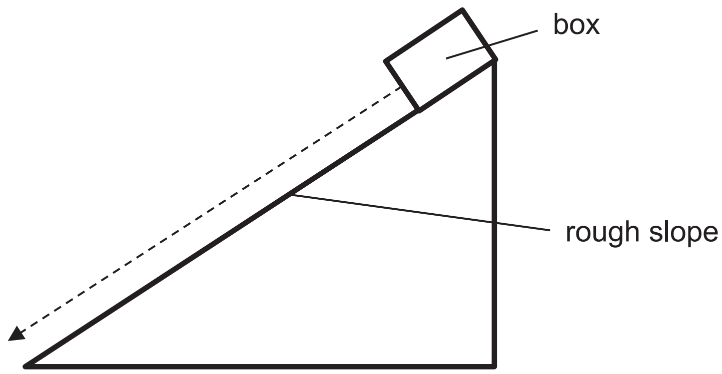


6 Four objects, each of the same weight, are placed on a table as shown.

Which object exerts the **least** pressure on the table?



7 A box at the top of a rough slope has an initial kinetic energy of 60 J and gravitational potential energy of 40 J. It then moves from the top to the bottom of the slope.



Given that the work done against friction is 10 J, what is the kinetic energy of the box at the bottom of the ramp?

A 0 J **B** 30 J **C** 90 J **D** 110 J

8 A substance consists of particles that are close together and slide past one another. The average speed of the particles is gradually **decreasing**.

Which statement best describes the substance?

A a liquid being cooled

B a liquid being heated

C a solid being cooled

D a solid being heated

9 Four metal cans are identical except for the colour and texture on their outer surfaces. The same volume of tap water at room temperature is poured into each can.

Which can will give the **lowest** temperature reading after being put in the sun for a period of time?

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

black, rough surface	black, shiny surface	white, rough surface	white, smooth surface

10 An ice cube at 0 °C is heated.

What is the immediate change to the internal energy of the ice cube?

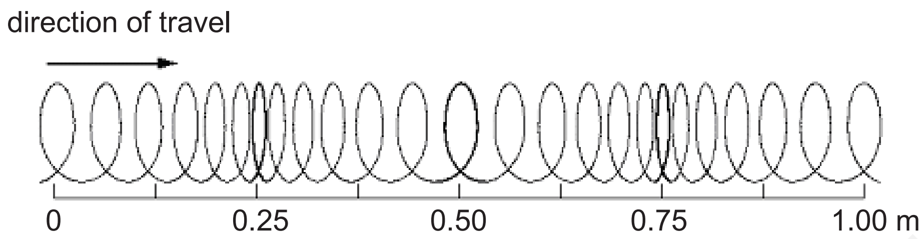
A The internal kinetic energy decreases.

B The internal kinetic energy increases.

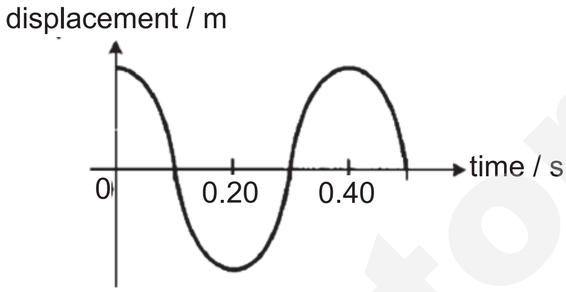
C The internal potential energy decreases.

D The internal potential energy increases.

11 A longitudinal wave is generated along a slinky coil as shown in the diagram.



The graph below shows the variation of the displacement of a particle in the wave with time.



What is the speed of the wave?

A 0.20 m/s **B** 0.625 m/s **C** 1.25 m/s **D** 2.5 m/s

12 The image of an object O formed using a converging lens has the following properties: same size as the object, real and inverted.

Which are the positions of the focal point, image and lens?

	position of focal point	position of image	position of lens
A	X	Y	W
B	X	Z	W
C	Y	W	X
D	Y	Z	X

13 The diagram shows the main components of the electromagnetic spectrum in order of increasing frequency. Some of the components are labelled.

radio waves		T	light			gamma rays

increasing frequency →

What is an application of the electromagnetic waves in component T?

A intruder alarm

B kill cancerous cells

C satellite television

D sterilisation of medical equipment

14 The speed of a sound wave is doubled when it passes from medium X to medium Y.

Which statement describes the change in the sound wave correctly?

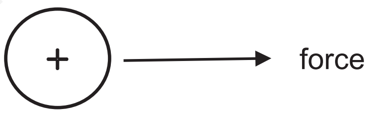
A The frequency is doubled.

B The frequency is halved.

C The wavelength is doubled.

D The wavelength is halved.

15 A positive test charge in an electric field experiences a force in the direction shown.



Ignoring the effects of gravity, what is the direction of the electric field lines?

A horizontally to the left

B horizontally to the right

C vertically downwards

D vertically upwards

16 A resistor with resistance R is made from a resistance wire with a cross-sectional area A and length L.

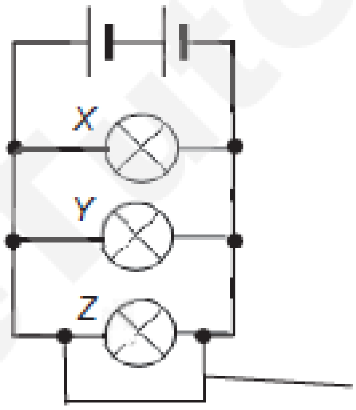
A second resistor made from the wire of the same material has a cross-sectional area of $\frac{A}{4}$ and a length of $\frac{L}{2}$.

What is the resistance of the second resistor?

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

17 Three lamps X, Y and Z are initially of the same brightness in a circuit.

If a piece of copper wire is connected across Z as shown, what effect does it have on the lamps?



A Lamps X, Y and Z will all go off.

B Lamps X and Y become brighter and lamp Z will go off.

C Lamps X and Y become dimmer and lamp Z will go off.

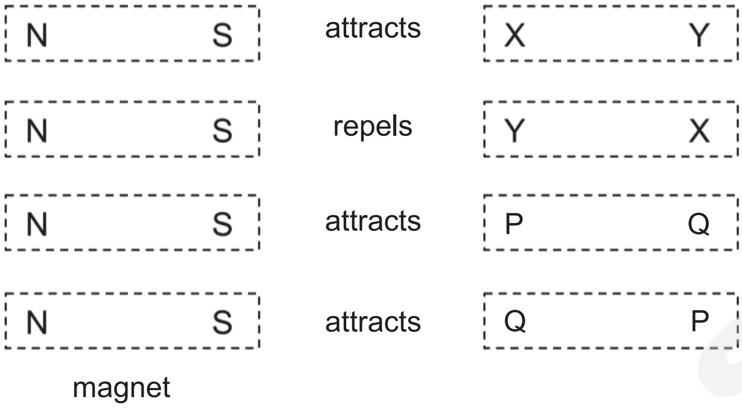
D Lamps X and Y have the same brightness as before and lamp Z will go off.

18 An electric kettle with the rating "240 V, 1.5 kW" is fitted with a 7.0 A fuse.

When the kettle is operating normally, which row shows the currents flowing in the respective wires?

	earth wire	live wire	neutral wire
A	0 A	6.25 A	0 A
B	0 A	6.25 A	6.25 A
C	0 A	7.0 A	7.0 A
D	6.25 A	6.25 A	6.25 A

19 The diagram shows the interaction between two specimens XY and PQ with a magnet.



Which position(s) is/are the north pole of a magnet?

A X only

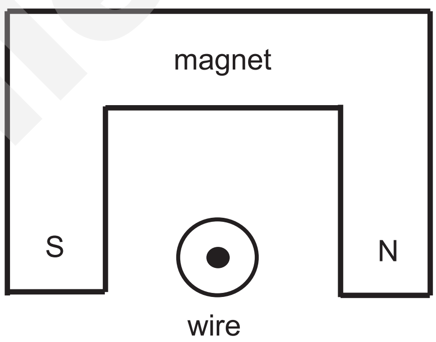
B Y only

C P and Q

D P, Q and X

20 The diagram shows a wire that is placed within the magnetic field of a U-shaped magnet.

An electric current passes through the wire and the direction of the current is out of the page.



What is the direction of the force acting on the wire?

A downwards

B towards the N pole

C towards the S pole

D upwards

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Class	Register Number	Name

BARTLEY SECONDARY SCHOOL

GCE O – LEVEL PRELIMINARY EXAMINATIONS

SCIENCE (PHYSICS, CHEMISTRY) **5076/02**

Sec 4 Express / 5 Normal (Academic)

Paper 2 Physics

18 September 2019

1 hour 15 minutes

Candidates answer on the Question Paper.
Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, 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	
Section B	
Total	

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Section A

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

1 Fig. 1.1 below shows a hydraulic system that consists of two pistons and a flexible pipe. The cross-sectional area of the smaller piston is 500 cm^2 and cross-sectional area of the larger piston is 1440 cm^2.

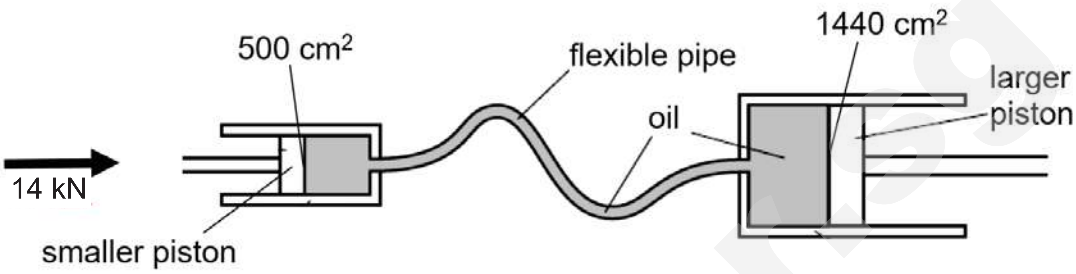

Fig. 1.1

A force of 14 kN is exerted by the smaller piston on the oil

(a) Calculate the pressure on the oil exerted by the small piston.

pressure = …………………………………N/cm^2 [2]

(b) The pressure on the oil by the smaller piston is the same as the pressure of the oil on the larger piston.

Show that the force on the larger piston is greater than the force by the smaller piston.

[2]

2 An archer shoots an arrow vertically upward into the air as shown in Fig. 2.1.

Fig. 2.1

The archer uses an average force of 85 N to pull the bowstring back by a distance of 42 cm. The arrow has a mass of 0.16 kg. Assume that the energy transferred to the arrow when the string is released is 100% of the energy stored in the stretched bow.

Take gravitational field strength, g = 10 N/kg and ignore any effects of friction.

(a) State the energy conversion when the arrow is released from the stretched bowstring.

…………………………………………………………………………………………………... [1]

(b) Calculate

(i) the work done in pulling back the bowstring,

work done = ……………………………...…. J [2]

(ii) the maximum height reached by the arrow.

maximum height = …………………………...... m [2]

(c) In practice, the maximum height reached will be lower than the actual value calculated in **(b)(ii)**. Explain why this is so.

……………………………………………………………………………………………………..

…………………………………………………………………………………………………... [1]

3 Fig. 3.1 shows a metal plate-warmer. The plate-warmer contains two small candle heaters. Plates of food are placed on top of the warming-tray.

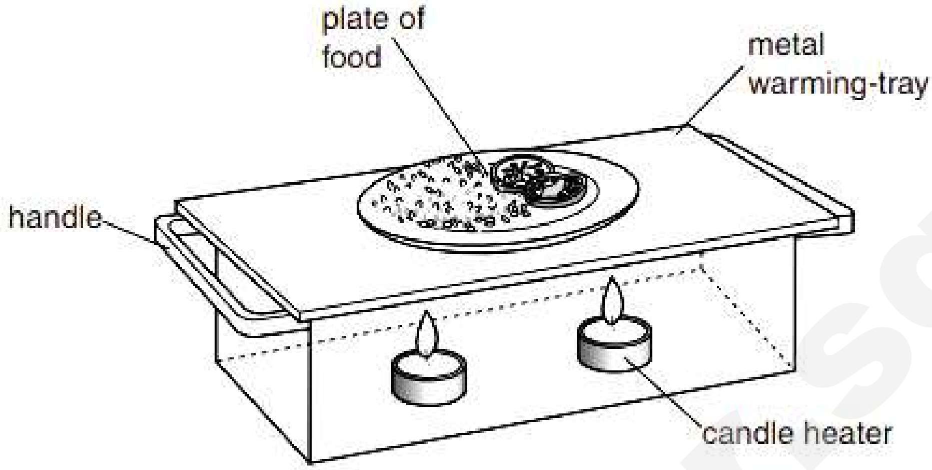

Fig. 3.1

(a) Describe how the metal warming-tray is heated by the candle heaters through convection.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

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……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………... [2]

(b) The handles of the plate-warmer are made of metal. Describe the potential hazard.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………... [2]

4 Fig. 4.1 shows the temperature of a solid substance when it absorbs heat from a 600 W heater over a period of 40 minutes.

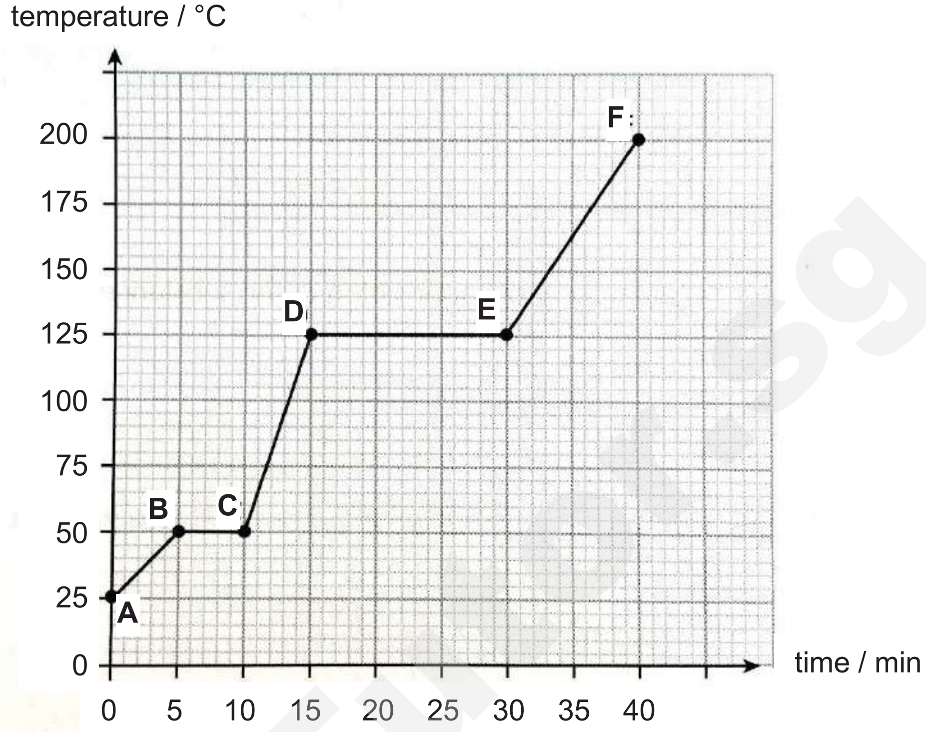

Fig. 4.1

(a) Calculate the amount of energy supplied by the heater for region **DE** to boil.

energy = ……………………………... J [2]

(b) Explain why the temperature remains constant throughout region **BC**.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

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…………………………………………………………………………………………………... [3]

(c) Describe how the kinetic energy and spacing of the molecules change in region **CD**.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………... [2]

5 Fig. 5.1 shows a ray of light incident on a triangular glass prism **ABC**.
The critical angle of light in the glass prism is 43°.

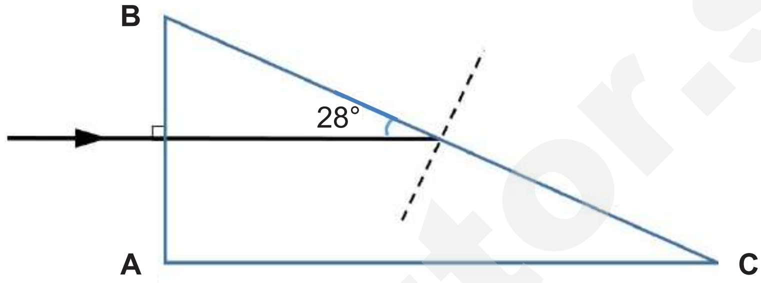

Fig. 5.1 (not drawn to scale)

(a) State whether the light ray will emerge from the face **BC**. Explain your answer.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………... [2]

(b) Calculate the refractive index of the glass.

refractive index = ………..…………………...….. [2]

6 Sound travels from a loudspeaker to a microphone 10 m away as shown in Fig. 6.1.

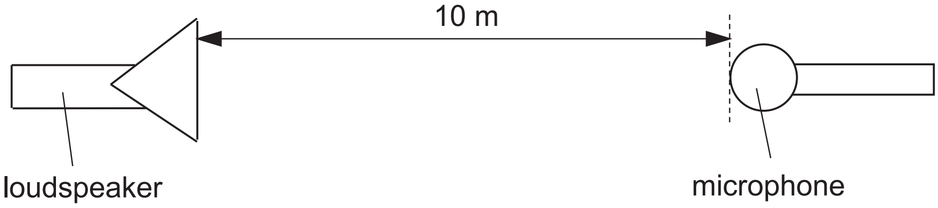

Fig. 6.1 (not to scale)

The microphone is connected to a cathode-ray oscilloscope (c.r.o.). The trace on the screen of the c.r.o. is shown in Fig. 6.2.

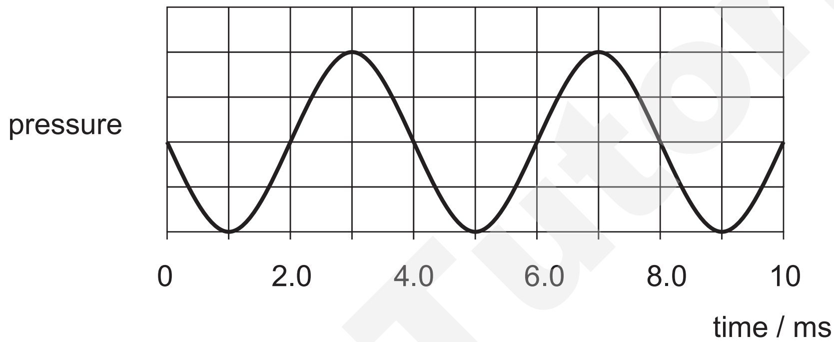

Fig. 6.2

(a) Explain how sound energy is transferred from the loudspeaker to the microphone.

……………………………………………………………………………………………………….

……………………………………………………………………………………………………….

……………………………………………………………………………………………………….

……………………………………………………………………………………………………….

…………………………………………………………………………………………………... [2]

(b) Using Fig. 6.2, calculate the frequency of the sound.

frequency = …………………………... Hz [2]

(c) The speed of sound in air is 330 m/s.

Hence, calculate the wavelength of the sound.

wavelength = ……………………………….. m [2]

7 Thunderclouds contain charges. Water drops are carried up by air currents and become charged. Fig. 7.1 shows a positively-charged cloud, a negatively-charged ground and a negatively-charged water drop.

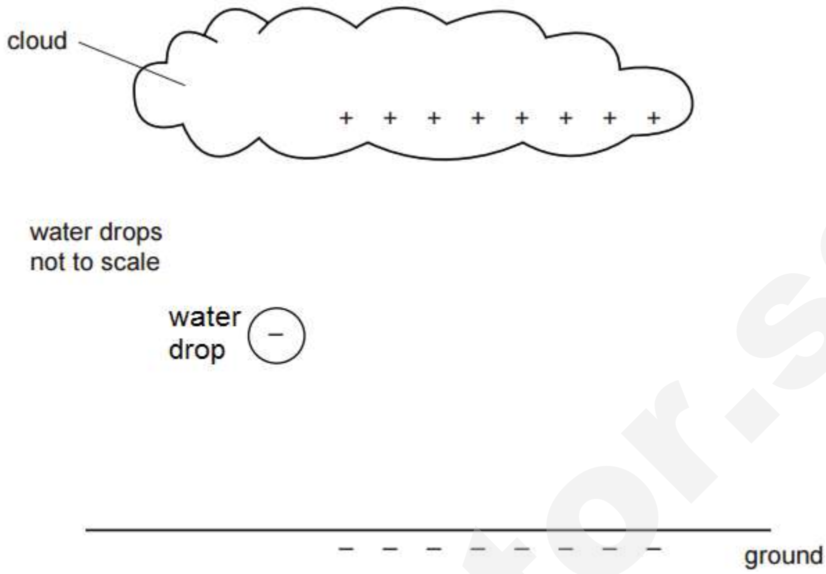

Fig. 7.1

(a) On Fig. 7.2, draw the electric field pattern due to the negatively-charged water drop. Show the direction of the field.

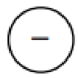

Fig. 7.2

[1]

(b) Describe and explain the movement of the water drop as it passes under the thundercloud.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………... [2]

8 Fig. 8.1 shows a part of the wiring circuit that connects a 240 V, 1 500 W metallic electric kettle to the household mains.

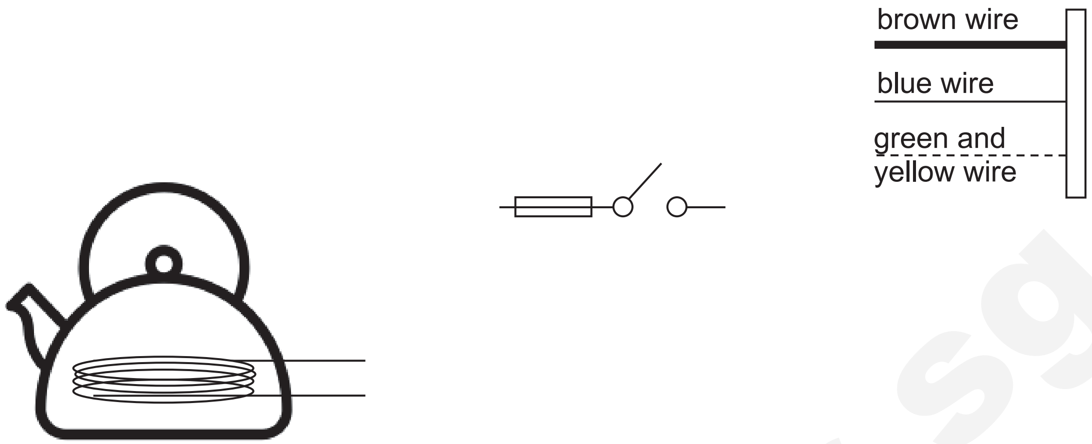

Fig. 8.1

(a) On Fig. 8.1, connect all the wires to complete the connections so that the kettle can operate normally. [3]

(b) The fuses that are available are rated 1 A, 2 A, 5 A and 8 A.

Determine which is the most suitable fuse for the kettle.

fuse rating = …………………………….. A [2]

(c) The cost of 1 kWh of electricity is 20 cents. The kettle is used to boil water for 30 minutes daily. Calculate the cost of using the kettle for 30 days.

cost = $ ………………………………. [3]

9 Fig. 9.1 shows a nail, a magnet and two compasses.

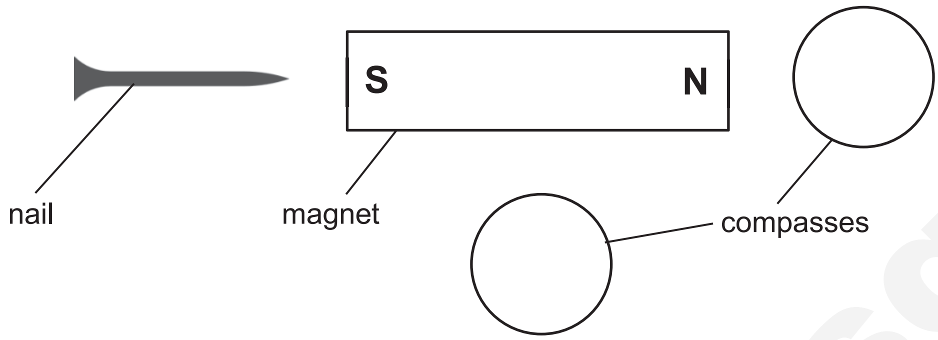

Fig. 9.1

(a) On Fig 9.1, draw an arrow in each compass to show the direction of the magnetic field of the magnet at the two positions. [2]

(b) The magnet causes the nail to become magnetised by induction.
When the magnet is removed, the nail are still magnetised.

Identify the material that the nail is made of.

………………………………………………………………………………………………….... [1]

Section B

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

Write your answers in the spaces provided.

10 An object falls through the air from rest until it hits the ground.

Fig. 10.1 shows how the speed of the object changes with time.

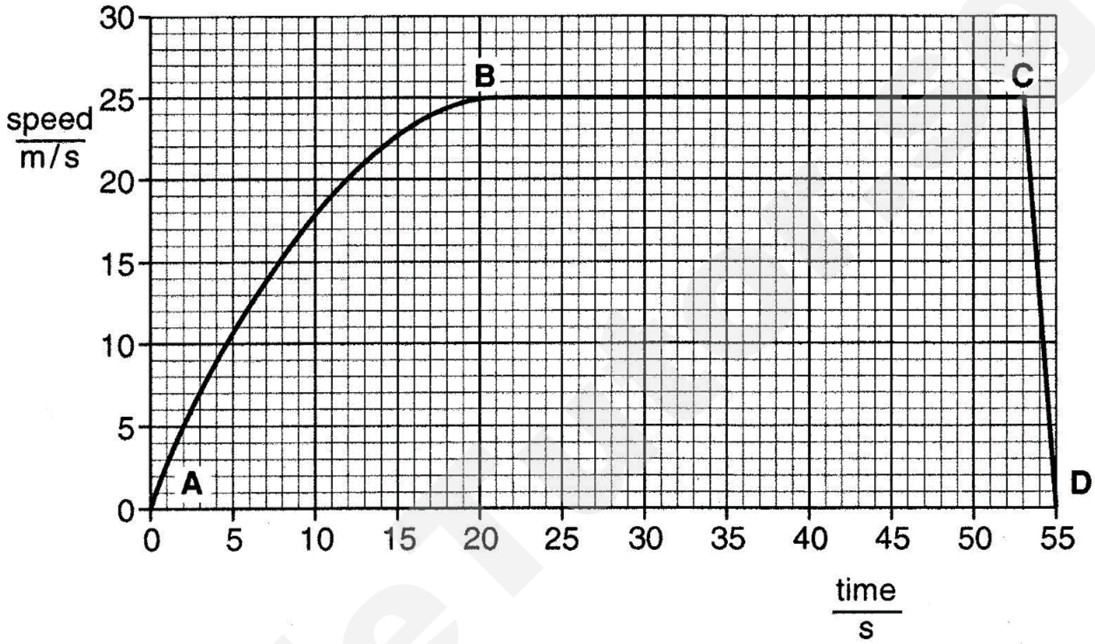

Fig. 10.1

(a) State the magnitude of the acceleration of the object between points **B** and **C**.

acceleration = ……………………………….….. [1]

(b) Describe the motion of the object between points **A** and **B**.

…………………………………………………………………………………………………

…………………………………………………………………………………………………[1]

(c) Explain, in terms of the weight of the object and air resistance, why the acceleration changes between points **A** and **B**.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………… [3]

(d) Calculate the distance moved by the object between points **B** and **D**.

distance moved = ……………………………………… [2]

(e) The mass of the object is 5.0 kg.

Calculate the resultant force on the object between points **C** and **D**.

resultant force = ……………………………………… [3]

11 A 50 kg woman is doing push-ups and is in the position shown in Fig. 11.1.

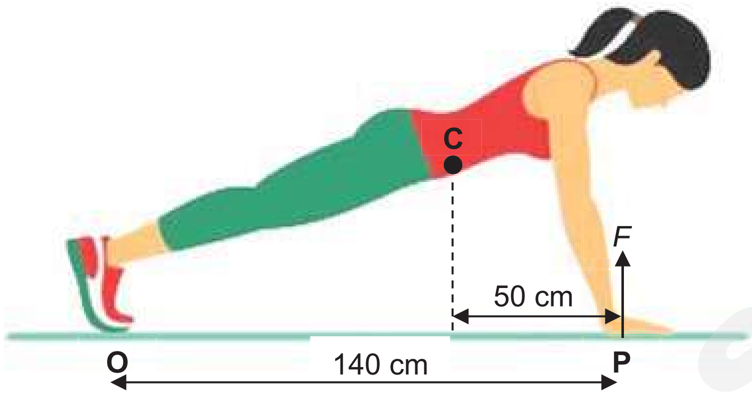

Fig. 11.1

C is the centre of gravity of the woman, **P** is the position of her hands on the ground, and **O** is the position of her feet. A combined vertical force *F*, acts on her hand by the ground.

Gravitational field strength g = 10 N/kg.

(a) Define *centre of gravity*.

………

………[1]

(b) Calculate the weight of the woman.

weight = ……………………………… [1]

(c) Calculate the clockwise moment about the point **O**.

clockwise moment = ……………………………… [2]

(d) Calculate the combined vertical force *F* exerted on the woman's hands by the ground.

vertical force *F* = ……………………………….….. [2]

(e) The woman decides to make the exercise more challenging by strapping weights above her shoulders, as shown in Fig. 11.2.

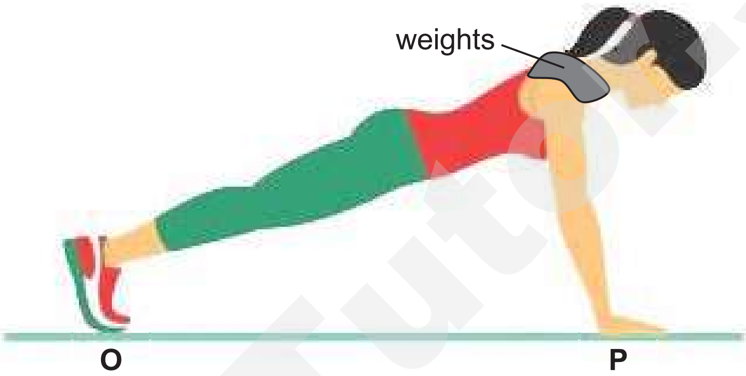

Fig. 11.2

(i) State how the clockwise moments about point **O** change, if at all, when the weights are strapped above the woman's shoulders. Explain your answer.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………………….[2]

(ii) State how the combined vertical force *F* changes, if at all, when the weights are strapped above the woman's shoulders. Explain your answer.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………………….[2]

12 Fig. 12.1 shows a circuit containing a switch, a 120 Ω resistor, a 90 Ω resistor, two ammeters, A_1 and A_2, and a lamp connected to a dry cell with an electromotive force of 24 V.

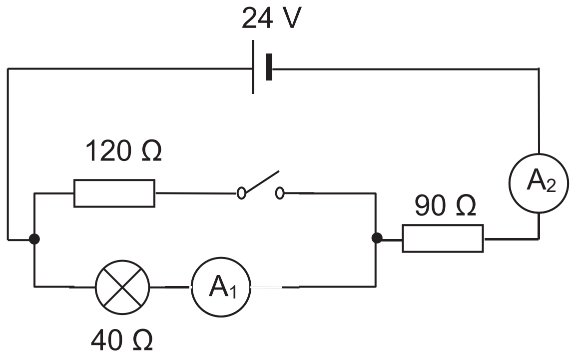

Fig. 12.1

(a) Define *electromotive force*.

………………………………………………………………………………………………………

……………………………………………………………………………………………………[1]

(b) Without any calculations, explain why the brightness of the lamp decreases when another resistor is connected in series with the 90 Ω resistor.

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

……………………………………………………………………………………………………[2]

(c) The switch is now closed.

(i) Explain why the current through ammeter A_2 increases.

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

……………………………………………………………………………………………………[2]

(ii) Calculate the effective resistance of the circuit.

effective resistance = ……….……………………...….. [2]

(iii) Calculate the reading on ammeter A_2.

reading on ammeter A_2 = ……….……………………...….. [1]

(iv) Calculate the reading on ammeter A_1.

reading on ammeter A_1 = ……….……………………...….. [2]

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4E5N Sci(Physics) Preliminary Examinations (2019) suggested answers

Paper 1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	**B**	**B**	**C**	**C**	**D**	**C**	**A**	**D**	**D**
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	**D**	**A**	**C**	**B**	**C**	**A**	**B**	**A**	**A**

4E5N Sci(Physics) Preliminary Examinations (2019) suggested answers

Paper 2

Section A

1 (a) $P = \dfrac{F}{A}$

$= \dfrac{14\ 000\ \text{N}}{500\ \text{cm}^2}$ [C1]

$=$ **$\underline{28\ \text{N/cm}^2}$** [A1]

(b) $P_{larger} = P_{smaller}$

$\dfrac{F_{larger}}{A_{larger}} = \dfrac{F_{smaller}}{A_{smaller}}$ [B1]

$\dfrac{F_{larger}}{F_{smaller}} = \dfrac{A_{larger}}{A_{smaller}}$

$= \dfrac{1440\ \text{cm}^2}{500\ \text{cm}^2} > 1$ [B1]

Therefore $F_{larger} > F_{smaller}$.

OR

$F_{larger} = 28\ \text{N/cm}^2 \times 1440\ \text{cm}^2$

$= 40\ 230\ \text{N}$ [B1]

Since $F_{smaller} = 14\ 000\ \text{N}$, $F_{larger} > F_{smaller}$ [B1]

2 (a) elastic potential energy to kinetic energy and gravitational potential energy [B1]

(b) (i) $W = F \times d$

$= 85\ \text{N} \times 0.42\ \text{m}$ [C1]

$=$ **$\underline{35.7\ \text{J}}$** [A1]

(ii) G.P.E gained = work done

$0.16\ \text{kg} \times 10\ \text{N/kg} \times h = 35.7\ \text{J}$ [allow e.c.f. from **(b)(i)**] [C1]

$h =$ **$\underline{22.3\ \text{m}}$** (3 s.f.) [A1]

(c) Some of the **energy is converted to thermal energy** due to work done against air resistance. [B1]

3 **(a)** The **air above the candles is heated** and **becomes less dense** so **it rises to** the **warming tray**. [B1]
The **cooler air below the warming tray is denser** and **sinks to takes its place**. [B1]
The whole process is repeated and forms a convection current to heat the warming tray.

(b) As the **handles are made of metal** and **metal is a good conductor of thermal energy/ heat**, [B1]
the **handles** may **become hot** and **injure the user**. [B1]

4 **(a)** t = 15 min = 15 × 60 = 900 s

E = Pt
= 600 W × 900 s [C1]
= **540 000 J** [A1]

(b) At BC, **thermal energy is absorbed to break the intermolecular bonds**. [B1]
The **kinetic energy of the molecules remains constant** [B1]
but the **potential energy of the molecules increases.** [B1]

(c) The **kinetic energy increases** and [B1]
the **spacing between the molecules remains constant / increases slightly**. [B1]

5 **(a)** The **light ray** will not emerge from BC as it **undergoes total internal reflection at face BC**. [B1]
The **angle of incidence** (62°) **is larger than the critical angle** (43°), and the light ray is going from a optically denser medium to a optically less dense medium. [B1]

(b) $n = \dfrac{1}{\sin 43}$ [B1]
= **1.47** (3 s.f.) [A1]

6 **(a)** The **air particles travel** through a **series of compressions and rarefactions parallel to the direction that the sound wave travels**. [B1]
The sound energy is transferred as the **air particles collide with each other**. [B1]

(b) T = 4 ms

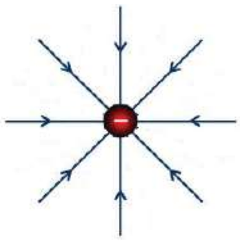
$f = \dfrac{1}{4\times10^{-3}}$ [C1]
= **250 Hz** [A1]

(c) $v = f\lambda$

$\lambda = \dfrac{330\ \text{m/s}}{250\ \text{Hz}}$ [allow e.c.f. from **(b)**] [C1]

$= \underline{\mathbf{1.32\ m}}$ [A1]

7 **(a)**



[A1]

(b) The **water drop will move upwards** as it is **attracted to the positively-charged cloud** [B1]
since **unlike charges attract** [B1]

8 **(a)** Join brown wire to fuse to heating coil [B1]
Join heating coil to blue wire [B1]
Join green wire to metallic casing [B1]

(b) $I = \dfrac{P}{V} = \dfrac{1\ 500\ \text{W}}{240\ \text{V}}$ [C1]

$= 6.25\ \text{A}$

Fuse = $\underline{\mathbf{8\ A}}$ [A1]

(c) $E = Pt$

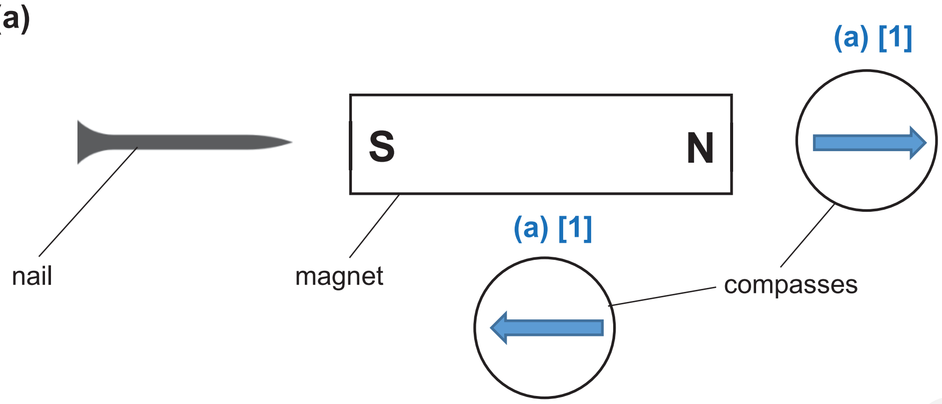
$= 1.5\ \text{kW} \times \dfrac{30}{60}\ \text{hour}$

$= 0.75\ \text{kWh}$ [C1]

Cost per day = 0.75 kWh × \$0.20
= \$0.15 [C1]

Cost for 30 days = \$0.15 × 30 days
= **<u>\$4.50</u>** [A1]

9 (a)



(b) Steel [B1]

Section B

10 (a) 0 m/s^2 [A1]

(b) The object falls at **decreasing acceleration**. / increasing speed at decreasing rate.
[A1]

(c) As the **object falls**, **air resistance increases**. [B1]
The **weight remains unchanged**, hence the **resultant force of the object decreases**
[B1]

From F = ma, the **acceleration of the object decreases**. [B1]

(d) distance = area under the graph
= ½ × (35 + 33) × 25 [C1]
= **<u>850 m</u>** [A1]

(e) $a = \dfrac{v - u}{t}$

$= \dfrac{0 - 25}{2}$ [C1]

$= -12.5 \text{ m/s}^2$ [C1]

F = ma
= 5.0 kg × (-12.5 m/s^2)
= **<u>- 62.5 N</u>** (accept 62.5 N) [A1]

11 (a) Centre of gravity is a point on an object where the entire weight appears to act on
. [B1]

(b) W = mg
= 50 kg × 10 N/kg
= **<u>500 N</u>** [A1]

(c) clockwise moment = 500 N × 0.90 m [allow e.c.f. from **(b)**] [C1]
= **<u>450 Nm</u>** [A1]

(d) F × 1.4 m = 450 Nm [allow e.c.f. from **(c)**] [C1]
F = **<u>321 N</u>** [A1]

(e) (i) The **total clockwise moments about O increases**. [B1]
The **additional weights provide an additional clockwise moment about O**. [B1]

(ii) Since **the total clockwise moments is increased, the total anti-clockwise moments increased too**. [B1]
Hence **F increases**. [B1]

12 (a) Electromotive force is the work done required to move a unit charge around the complete circuit. [B1]

(b) The **total resistance of the circuit increases** [B1]
and the **current through the circuit and lamp decreases**. [B1]
The brightness of the lamp will decrease.

(c) (i) When switch is closed, the **total resistance of the circuit decreases**, [B1]
hence **current in the circuit and through the lamp increases**. [B1]
The ammeter A_2 reading will increase.

(ii) $R = \left(\frac{1}{120} + \frac{1}{40}\right)^{-1} + 90$ [C1]
$= \underline{\mathbf{120\ \Omega}}$ [A1]

(iii) $I = \frac{24\text{ V}}{120\ \Omega}$ [allow e.c.f. from **(c)(ii)**]
$= \underline{\mathbf{0.20\ A}}$ [A1]

(iv) $V_{lamp} = 24\text{ V} - (0.20\text{ A} \times 90\ \Omega)$
$= 6.0\text{ V}$ [C1]

$I = \frac{6.0\text{ V}}{40\ \Omega}$
$= \underline{\mathbf{0.15\ A}}$ [A1]

or

$I = \frac{120\ \Omega}{160\ \Omega} \times 0.20\text{ A}$ [C1]
$= \underline{\mathbf{0.15\ A}}$ [A1]

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019

4E5N

CANDIDATE NAME

CLASS

REGISTER NUMBER

Science (Physics/ Chemistry)
Paper 1

5076
03 Sep 2019

1 hour

Additional Material: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

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 to be 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 question paper.

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

Setter: Mr Sean Goh and Ms Corinna Teo

This document consists of ___ printed pages including the cover page

1 Which of the following consist of only vector quantities?

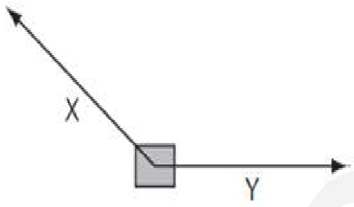
A mass, distance, time

B friction, velocity, electromotive force

C tension, speed, energy

D weight, displacement, electrostatic force

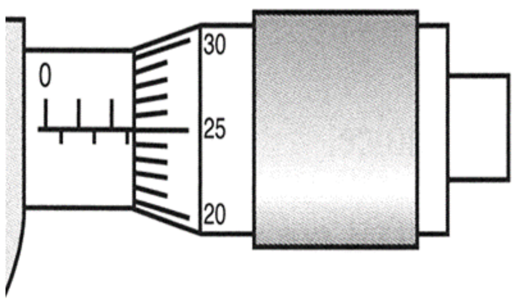
2 The diagram shows two forces X and Y act on an object.



Which arrow below shows the possible direction of the resultant force?

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

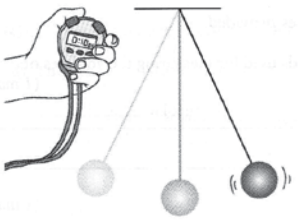
3 The diagram shows a ball bearing being measured using a micrometer screw gauge.



What is the diameter of the ball bearing?

A 2.25 mm **B** 2.52 mm **C** 2.75 mm **D** 3.25 mm

4 A digital stopwatch to time the period of a simple pendulum.

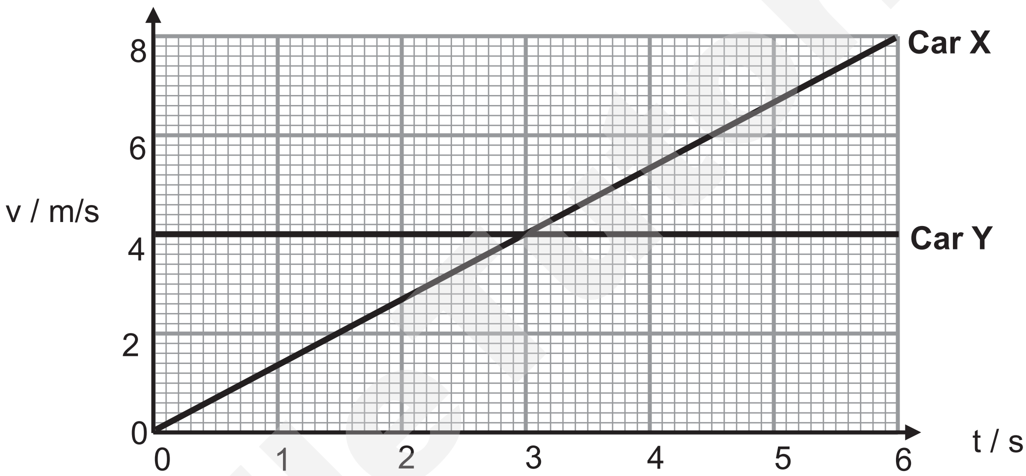


Two readings for 20 oscillations are as follows: 34.98 s and 35.70 s.

What is the average period of the pendulum?

A 0.28 s **B** 1.77 s **C** 3.53 s **D** 35.34 s

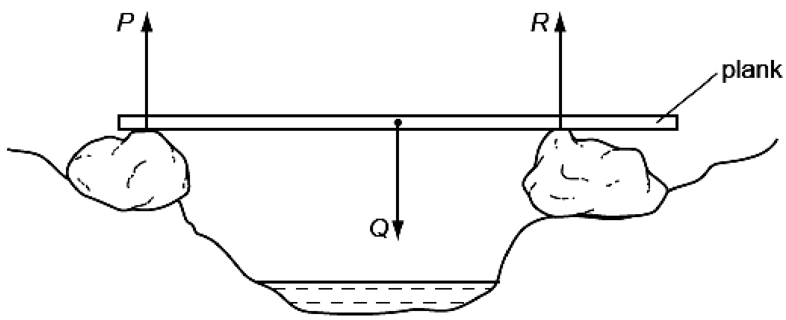
5 The speed-time graphs of car X and car Y are shown below.



When will the two cars meet each other?

A 3 s **B** 4 s **C** 5 s **D** 6 s

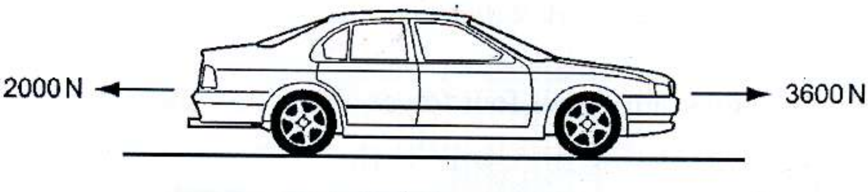
6 A wooden plank rests in equilibrium on two boulders on opposite sides of a narrow stream. Three forces of size *P*, *Q* and *R* act on the plank.



Which shows the correct relationship for the three forces?

A $P + Q = R$
B $P + R = Q$
C $P = Q = R$
D $P = Q + R$

7 A car of mass 800 kg is being driven along a level road.
The engine supplies a forward force of 3600 N and the total resistive force is 2000 N. What is the acceleration of the car?

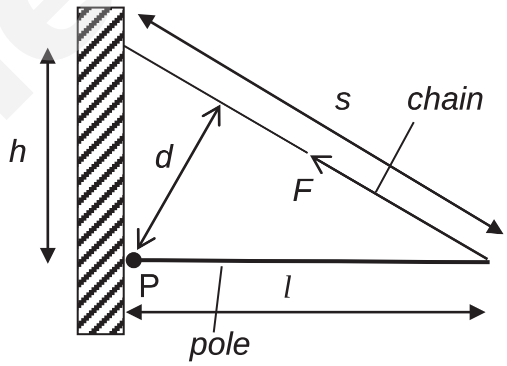


A 2.0 m/s^2 **B** 2.5 m/s^2 **C** 4.5 m/s^2 **D** 7.0 m/s^2

8 Which of the following objects has the greatest inertia?

A a stationary car of mass 800 kg
B a 2 kg trolley traveling at 0.5 ms^{-1}
C a ball of mass 200 g traveling at 4.0 ms^{-1}
D a 50 kg athlete running the 100 m race in 10 s

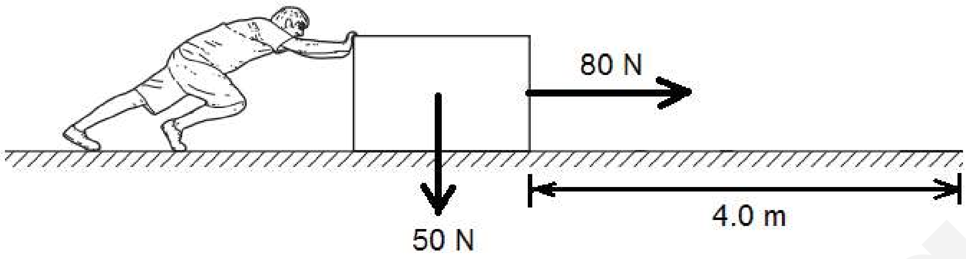
9 A horizontal pole is attached to the side of a building as shown. There is a pivot P at the wall and a chain is connected from the end of the pole higher up the wall. There is a tension F in the chain.



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

A $F \times d$ **B** $F \times h$ **C** $F \times l$ **D** $F \times s$

10 A man pushes a box weighing 50 N across a floor. He exerts a force of 80 N and the box moves 4.0 m in 5.0 seconds.



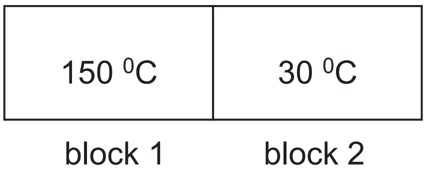
What is the average power developed by the man?

A 40 W **B** 64 W **C** 1 000 W **D** 1 600 W

11 In which states of matter is the force of attraction between the molecules the greatest and in which state is the speed of the molecules the greatest?

	greatest force of attraction	greatest speed
A	liquid	solid
B	liquid	gas
C	solid	solid
D	solid	gas

12 Two metal blocks of the same mass and size, one at temperatures 150 ^{0}C and the other at temperature 30 ^{0}C, are in good thermal contact. The two blocks are well insulated and there is no loss of thermal energy to the surrounding.



Which of the following correctly describes the transfer of thermal energy between the blocks?

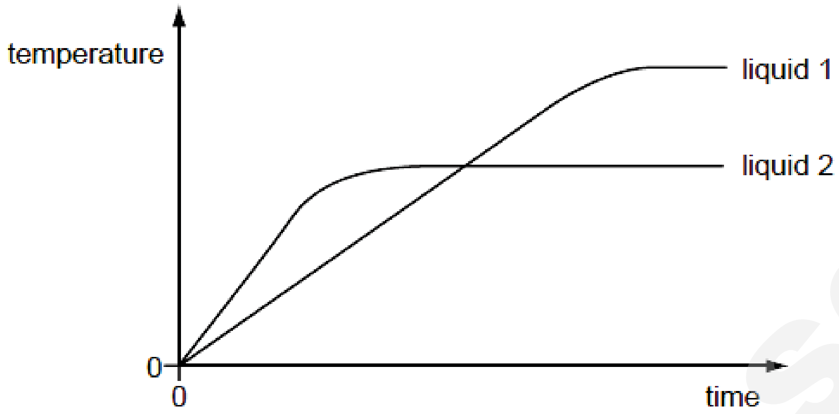
A Thermal energy will be transferred from block 1 to block 2 until they both reach thermal equilibrium at 90 ^{0}C.

B Thermal energy will be transferred from block 1 to block 2 until they both reach thermal equilibrium at 30 ^{0}C.

C Thermal energy will be transferred from block 2 to block 1 until they both reach thermal equilibrium at 90 ^{0}C.

D Thermal energy will be transferred from block 2 to block 1 until they both reach thermal equilibrium at 150 ^{0}C.

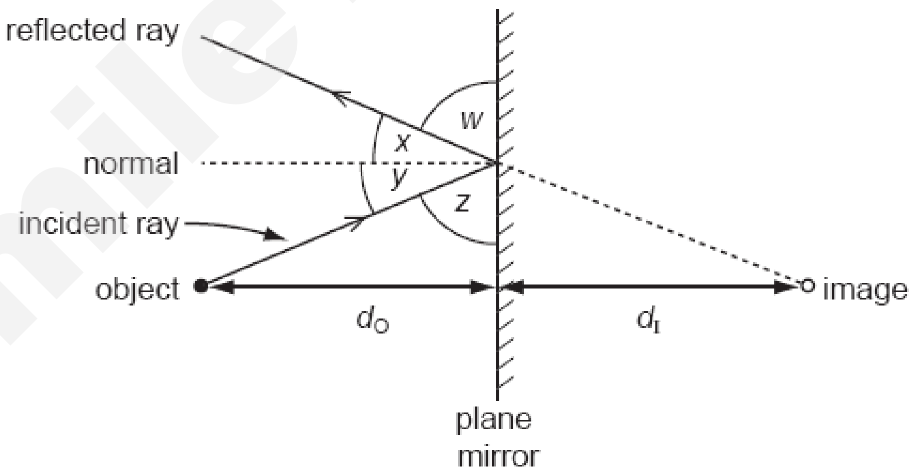
13 Equal masses of two different liquids are heated using the same heater. The graph shows how the temperature of each liquid changes with time.



What does the graph tell us about the liquids?

A Liquid 1 starts to boil sooner than liquid 2.
B Liquid 1 starts to melt sooner than liquid 2.
C Liquid 1 has a higher boiling point than liquid 2.
D Liquid 1 has a higher melting point than liquid 2.

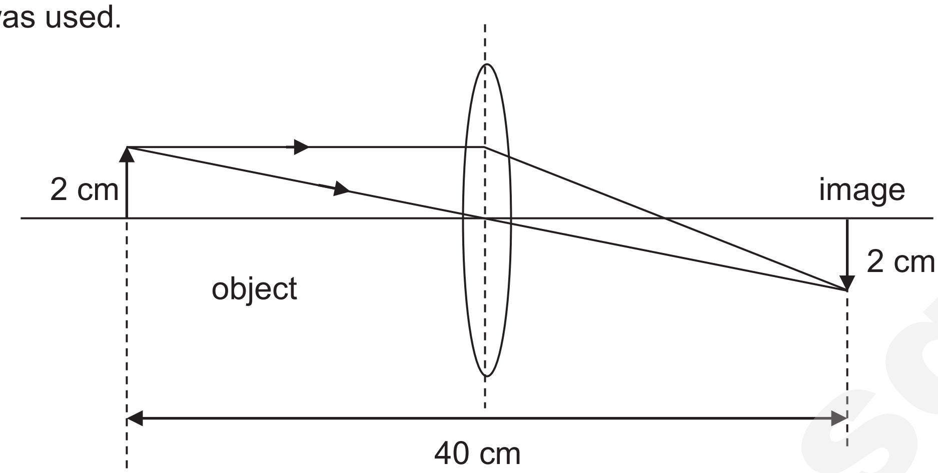
14 An image is formed in a plane mirror.



Which of the following is correct?

	angles	distances
A	$w = y$	$d_O = d_1$
B	$w = z$	$d_O = d_1$
C	$x = y$	d_O is greater than d_1
D	$x = z$	d_O is greater than d_1

15 The ray diagram below shows the formation of an image when a thin converging lens was used.



If both the object and the image are 2 cm in height, what is the focal length of the lens?

A 1 cm **B** 2 cm **C** 10 cm **D** 20 cm

16 A VHF radio station broadcasts at a frequency of 90 MHz (9.0×10^7 Hz). The speed of radio waves is 3.0×10^8 m/s. What is the wavelength of the waves broadcast by the station?

A 0.30 m **B** 3.3 m **C** 27 m **D** 2.7×10^{16} m

17 Which of the following correctly describes the properties exhibited by infrared, visible, ultraviolet and X-rays?

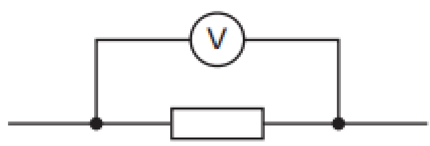
A They are all transverse waves.

B They are all visible to the naked eye.

C They all travel at the same speed of 3.0×10^8 m/s in glass.

D Their frequency change when they travel from one medium to another.

18 A voltmeter is connected across a resistor in an electrical circuit.



What does the reading on the voltmeter measure?

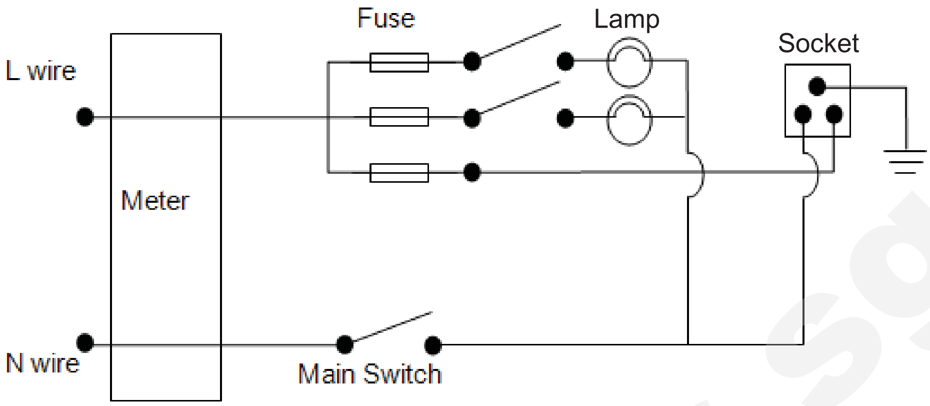
A the work done in driving 1 W of power through the resistor

B the work done in driving 1 J of energy through the resistor

C the work done in driving 1 A of current through the resistor

D the work done in driving 1 C of charge through the resistor

19 What is the mistake in the household circuit shown below?



A The fuses should be placed along the neutral wire.

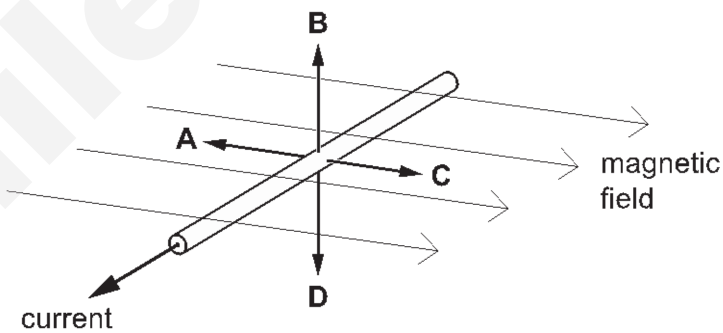
B The position of the earth wire in the socket is wrong.

C The main switch should be installed along the live wire.

D The neutral and the live wire in the socket should be interchanged.

20 The diagram shows a current-carrying wire in a magnetic field.

Which arrow shows the direction of the force experienced by the wire?



BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019

4E5N

CANDIDATE NAME			
CLASS		REGISTER NUMBER	

SCIENCE (PHYSICS, CHEMISTRY)

5076/02

Paper 2 Physics

27 Aug 2019

1 h 15 min

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

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on the cover page.
You may use a soft pencil for any diagrams, graphs or rough working.
Write in dark blue or black ink.
Do not use paper clips, highlighters, 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 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.

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
Section B	20
TOTAL	65

Setter: Mr Sean Goh

This document consists of **16** printed pages including the cover page

Section A (45 Marks)

Answer **all** questions. Write your answer on the spaces provided.

1 Fig. 1.1 shows the speed of the three lorries at several values of time *t*.

	speed at $t = 0$	speed at $t = 5\ s$	speed at $t = 10\ s$	speed at $t = 20\ s$	speed at $t = 40\ s$
lorry X	0	4.0 m/s	8.0 m/s	16 m/s	32 m/s
lorry Y	0	6.0 m/s	12 m/s	18 m/s	24 m/s
lorry Z	0	8.0 m/s	16 m/s	20 m/s	20 m/s

Fig. 1.1

(a) Define acceleration.

....

.... [1]

(b) Which lorry has the greatest initial acceleration?

.... [1]

(c) Which lorry has a uniform acceleration? Explain your answer.

....

....

....[2]

(d) The mass of lorry X is 2 000 kg. Calculate the average forward driving force acting on lorry X during the first 10 s of the journey.

force = …………….. N [2]

2 A vertical uniform cylinder contains a volume of liquid, as shown in Fig 2.1.

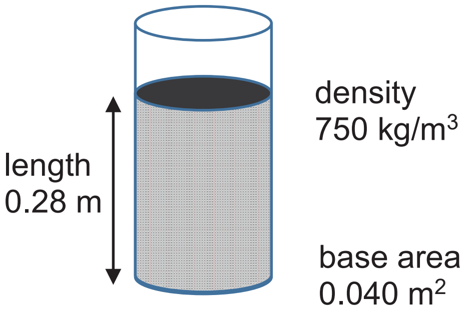


Fig 2.1

The cross-sectional area of the cylinder is 0.040 m^2.
The vertical length of the liquid is 0.28 m.
The density of the liquid is 750 kg/m^3.
The gravitational field strength on earth is 10 N/kg.

Determine
(a) the mass of the liquid in the cylinder, and

mass = ... kg [2]

(b) the weight of the liquid in the cylinder.

weight = ... N [1]

3 Fig. 3.1 shown a device to squeeze the juice out of oranges easily.

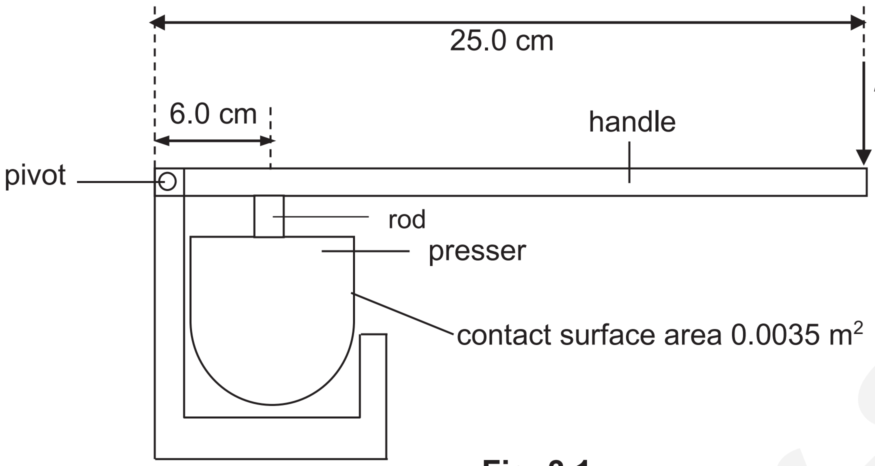


Fig. 3.1

When a force *F* is applied at the end of the handle, the presser squeezes the juice out of the orange.

The area of the presser in contact with the orange is 0.0035 m^2. The perpendicular distance from the pivot to the rod holding the presser is 6.0 cm. A force *F* is applied normal to the handle at a distance 25.0 cm from the pivot. A minimum pressure of 4 000 N/m^2 is needed to squeeze the juice out of the orange.

Calculate

(a) The force that is exerted by the rod to cause a pressure of 4 000 N/m^2 on the orange.

force = …………………. N [2]

(b) the minimum force *F* that is required at the end of the handle to exert a pressure of 4000 N/m^2 on the orange.

force = …………………. N [2]

4 Two identical conical flasks, one empty and the other filled with sand, are both left to stand upside down as shown in the diagram below.

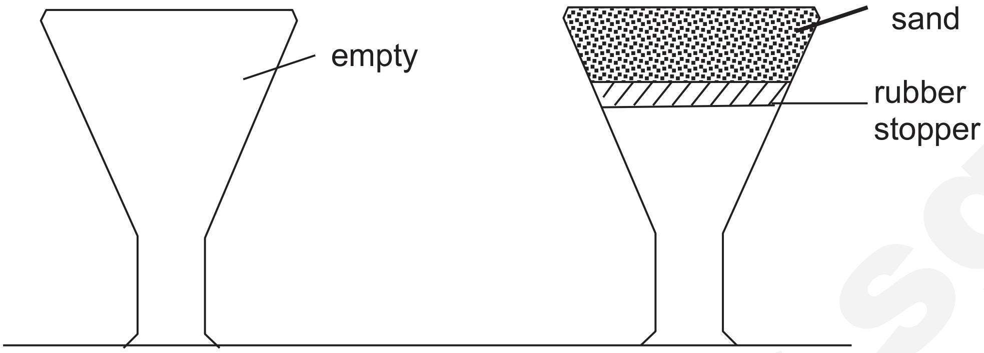


Fig. 4.1 **Fig. 4.2**

(a) Mark, with a cross '**X**' on each diagram, the positions of the centre of gravity for each flask. [2]

(b) Which flask is easier to topple? Explain your answer.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

5 Fig. 5.1 (not drawn to scale) shows an incident ray at point **P** on the surface of a right angled glass prism.

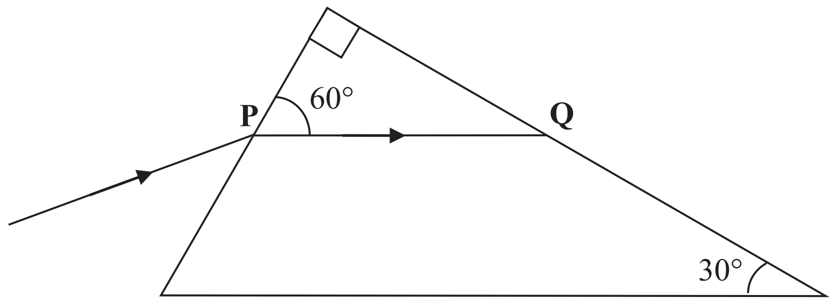


Fig. 5.1

(a) The refractive index of the glass prism is 1.54. Determine the angle of incidence at point P.

angle of incidence =……………………… [2]

(b) Determine the critical angle of glass.

critical angle =……………………….. [2]

(c) On Fig. 5.1, complete the path of the light after it reaches point Q. Explain clearly how you arrive at your answer.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………………… [2]

6 Fig. 6.1 shows sea waves approaching a beach at a speed of 1.5 m/s.

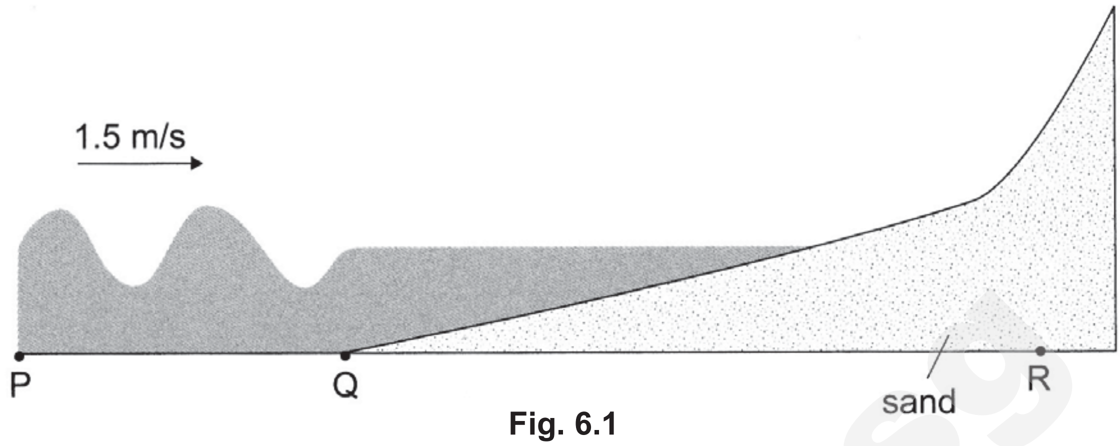


Fig. 6.1

(a) The wave takes 1.2 seconds to travel from **P** to **Q**.

(i) What is the distance between **P** and **Q**?

distance = ………………. m [1]

(ii) What is the wavelength of the wave?

wavelength = ……………….. m [1]

(b) A small floating boat is midway between **Q** and **R**.

(i) Describe the boat's motion as the wave passes.

…………………………………………………………………………………………

…………………………………………………………………………………….. [1]

(ii) What is the frequency of the boat's motion?

frequency = ………………….. Hz [2]

7 Thunderclouds contain charges. Water drops are carried up by air currents and become charged. Fig. 7.1 shows a positively charged cloud and a droplet of water.

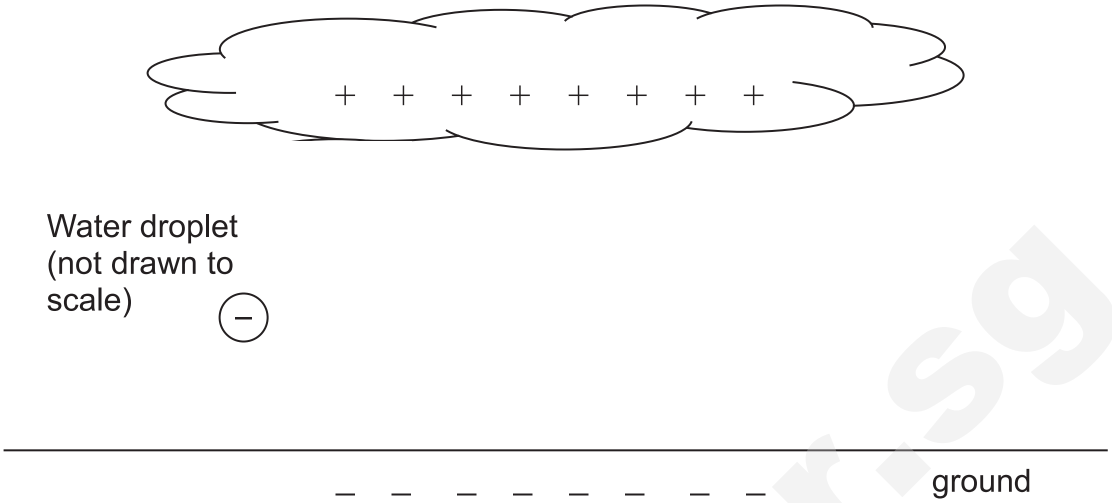


Fig.7.1

(a) Draw in Fig.7.1 the electric field pattern between the cloud and the ground (ignore the droplet). [1]

(b)(i) Fig.7.1 also shows the charge distribution on the droplet of water. Draw in Fig.7.1 the path of the water droplet as it enters the region of electric field. [1]

(ii) Explain your answer to **(b)(i)**.

....

....[1]

8 Fig. 8.1 shows a circuit which contains an 6.0 V battery, an ammeter, a voltmeter and three resistors.

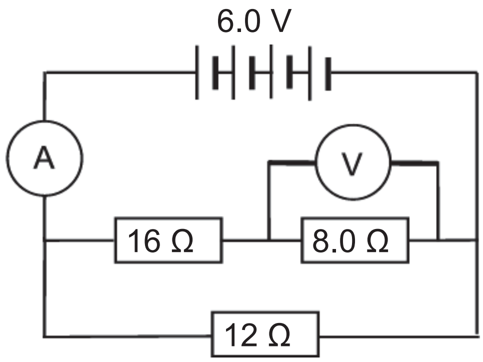


Fig. 8.1

Calculate

(a) the total resistance of the circuit,

total resistance = ………………… Ω [2]

(b) the reading of the ammeter,

reading of ammeter = ………………… A [2]

(c) the current flowing through the 16 Ω resistor,

current = ………………… A [2]

(d) the reading of the voltmeter.

reading of voltmeter = ……………… V [2]

9 Fig. 9.1 shows two coils of wire, **P** and **Q**, through which currents can be passed.

The coils are mounted on free running trolleys. The arrows indicate the direction of the currents in **P** and **Q**.

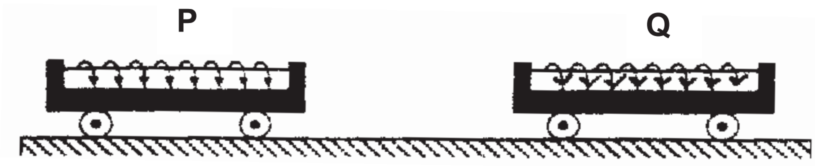


Fig. 9.1

(a) When the currents are switched on, it is observed that the trolleys move towards each other. When the currents are switched off, it is found that the trolleys are easy to separate. Explain these observations.

....

....

....

....

....

.... [3]

(b) The experiment is now repeated, with an iron rod in coil **P** and with a steel rod in coil **Q**. Describe how **different** the behaviour of the trolleys will be from part (a)(i) when the currents is switched on and after which, it is switched off. Explain your observations.

....

....

....

....

....

.... [3]

Section B

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

Write your answers on in the space provided.

10 Fig. 10.1 shows a small sphere of mass 250 g moving through a track represented by **WXYZ**, where **WX** and **YZ** are smooth surfaces and **XY** is a rough surface. The speed of the object along **WX** is 4.2 m/s.

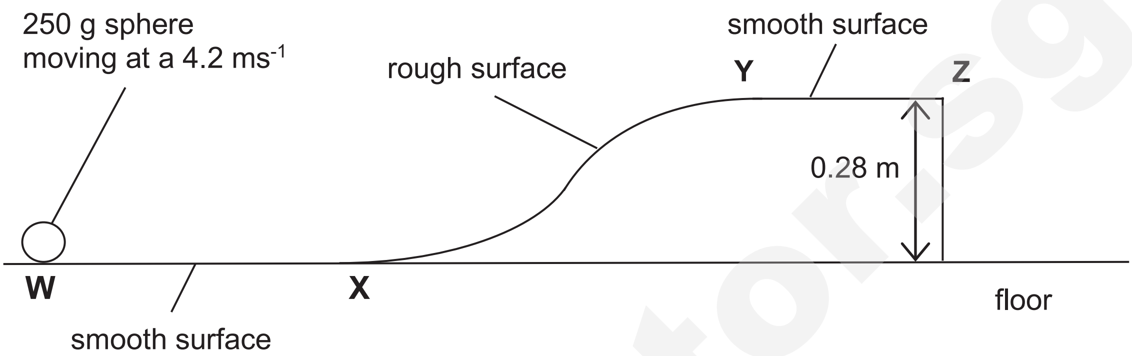


Fig. 10.1

(a) Calculate the kinetic energy of the sphere along **WX**.

kinetic energy = ………………. [2]

(b) If the sphere reaches **Y** with a velocity of 1.4 m/s, calculate

(i) gravitational potential energy of the sphere at **Y**,

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

(ii) the work done against friction along **XY**.

work done = ………………… [2]

(c) If the sphere reaches **Z** with a speed of 1.2 m/s and drops to the floor, calculate the speed of the sphere when it reaches the floor. Assume there are no energy losses at it falls.

speed = ……………….. [2]

(d) When the sphere hits the floor, the ground vibrates and a loud crash is heard.

(i) What type of wave, transverse or longitudinal, is produced by the vibrating floor?

……………………………………………………………………………………… [1]

(ii) When a thick sponge is placed on the floor, the sound made by the sphere on hitting the sponge is much softer. Fig. 10.2 shows the sound wave produced when the sphere hits the floor without the sponge.

On Fig. 10.2, draw the sound wave produced by the wave with the sponge in place. [1]

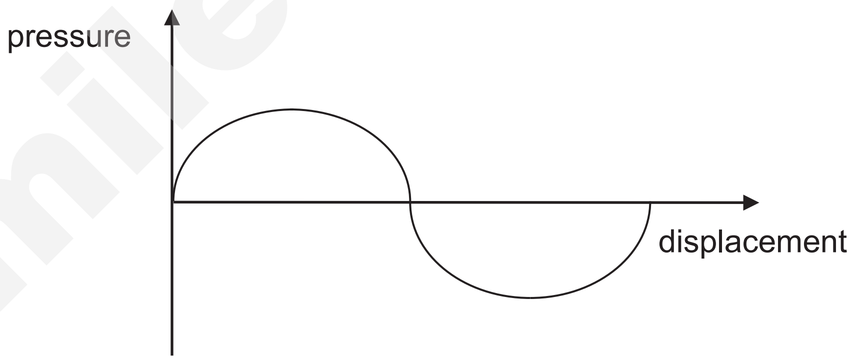


Fig. 10.2

11 Fig. 11.1 shows how a baby's milk bottle can be heated using a bottle warmer. The bottle warmer has foam-filled walls and a shiny outer casing. Heat is provided by a 200 W heating element. The heating element raises the temperature of the liquid in the warmer to 40 ^{0}C.

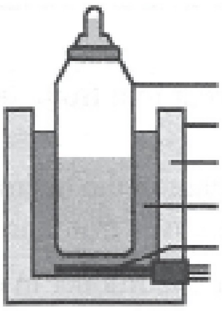


Fig. 11.1

(a) Explain how the foam-filled walls and shiny outer casing reduce heat loss from the bottle warmer to the surroundings.

Foam-filled wall: ....

....

Shiny outer casing: ....

.... [2]

(b) Explain how heat from the heating element is transferred to the entire amount of liquid.

....

....

....

.... [2]

(c) When the temperature of the liquid increases, state what happens to the motion and kinetic energy of the molecules.

....

....

....

.... [2]

(d) When the top part of the bottle is removed, it is noticed that some of the milk evaporates.

Describe and explain, using ideas about molecules, what happens during evaporation and what effect does it have on the temperature of the remaining liquid.

....

....

....

.... [2]

(e) If the heating element is turned on for 5 minutes, calculate the amount of thermal energy dissipated.

energy = ... [2]

12 Fig. 12.1 shows the structure of a 240 V electric hair dryer with a plastic case. It mainly consists of a fan and two heating coils. The manufacturer claims that it is double insulated.

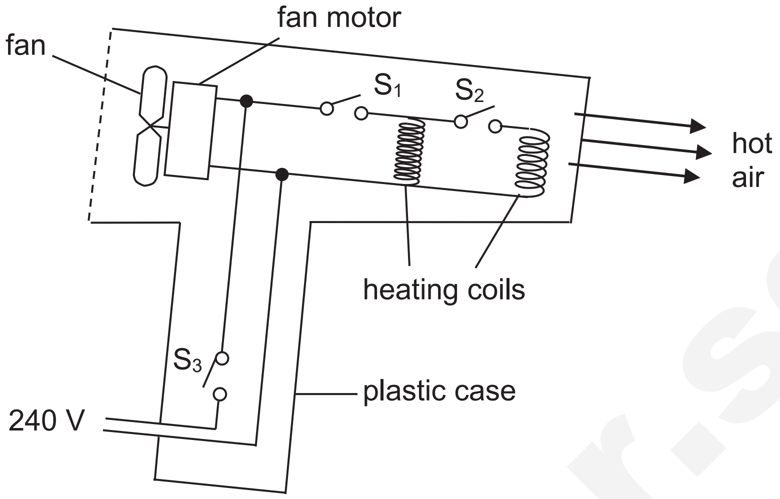


Fig. 12.1

The hair dryer has three settings. The following table shows the power at each setting.

	Setting	**Power / W**
1	Cold (fan only)	120
2	Hot (half power)	630
3	Hot (full power)	1140

(a) State the switch or switches that should be closed for the hair dryer to operate at the power of

(i) 120 W, ………………………………………………………………………... [1]

(ii) 630 W. ………………………………………………………………………... [1]

(b) Suggest why the earth wire is not required for this hair dryer.

……………………………………………………………………………………………

……………………………………………………………………………………...[1]

(c) (i) Calculate the current flowing in the hair dryer when it is at full power.

current = …………………… [2]

(ii) Suggest a suitable fuse rating for the hair dryer.

fuse rating = ………………………...[1]

(d) In a month, the hair dryer is used at full power for 15 hours and at half power for 8 hours. Given that the electrical tariff is \$0.32 per kWh, calculate the cost incurred for the hair dryer in a month.

cost = ……………………… [3]

(e) Another hair dryer is designed with a different arrangement of the two heating coils as shown in Fig. 12.2.

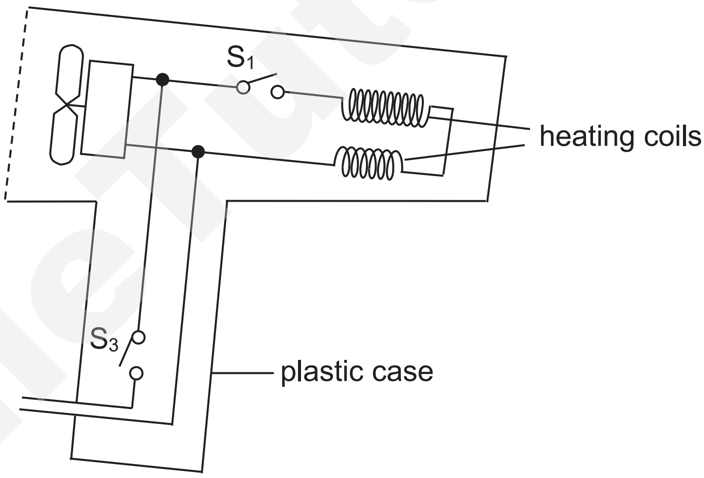


Fig. 12.2

State one way in which such an arrangement will not be as advantageous as that in Fig. 12.1.

………………………………………………………………………………………………

……………………………………………………………………………………………..[1]

End of paper

Bedok South Secondary School
Sec 4Exp/ 5NA Science (Physics) Prelim Exam 2019
Marking scheme

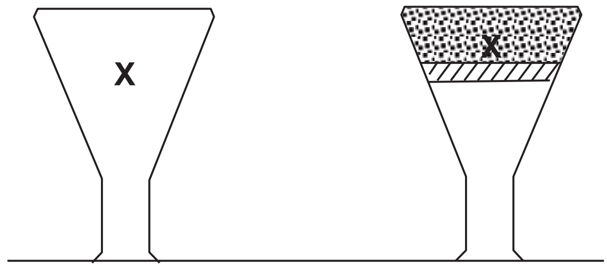
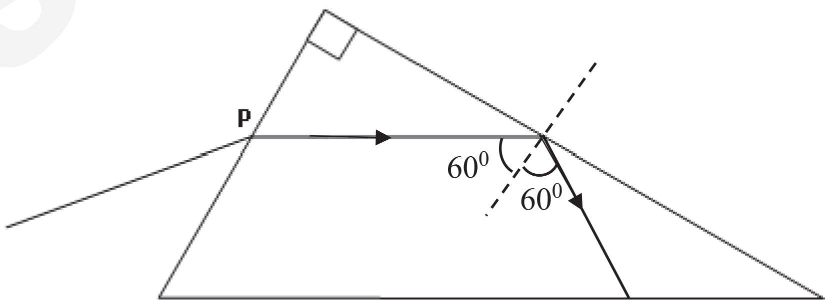
Paper 1

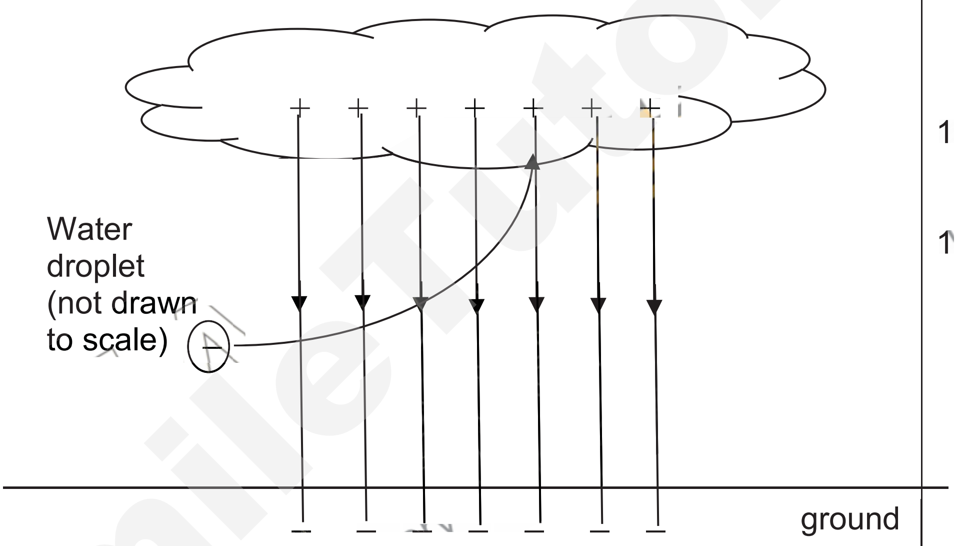
1. D	2. C	3. C	4. B	5. D
6. B	7. A	8. A	9. A	10. B
11. D	12. A	13. C	14. B	15. C
16. B	17. A	18. D	19. C	20. B

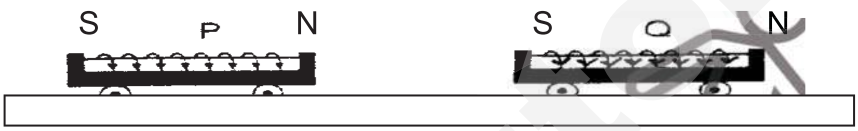
Paper 2

Section A

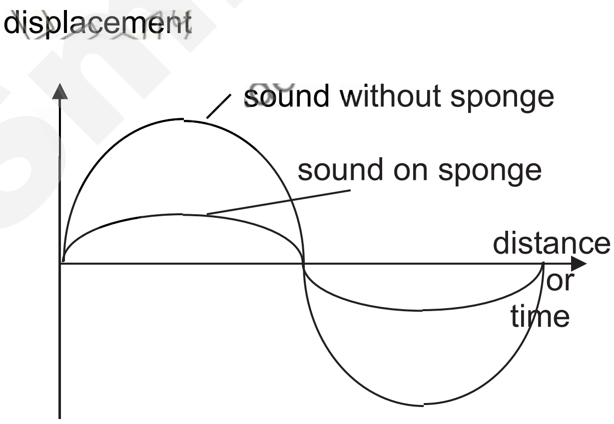
No.	Answers	Marks
1a	Acceleration is the rate of change of velocity or acceleration refers to the change in velocity per unit time.	1
b	Lorry Z	1
c	Lorry X The increase in the value if the speed per unit time is constant.	1 1
d	$a = \Delta v / \Delta t$ $= 8 / 10$ $= 0.80\ m/s^2$ $F = ma$ $= 20000 \times 0.80$ $= 16\ 000\ N$	 1 1
2a	Density = mass / volume Mass = volume x density = (0.04 x 0.28) x 750 = 8.4 kg	1 1
b	Weight, w = mg = 8.4 x 10 = 84 N	 1
3a	Pressure = force / area Force = pressure x area = 4000 x 0.0035 = 14 N	1 1

3b	Apply principle of moment, Sum of Clockwise moments = Sum of anti-clockwise moments F x 0.25 = 14 x 0.06 F = 3.36 N	 1 1
4a		[1] each 2
b	Sand filled flask as its centre of gravity is higher. Easier for the line of action of the weight to cross over the pivot.	1 1
5a	$\frac{\sin i}{\sin r} = n$ $\frac{\sin i}{\sin 30} = 1.54$ i = 50.4^0 or 50^0	1 1
b	sin c = $\frac{1}{n}$ = $\frac{1}{1.54}$ c = 40.5^0 or 40^0	1 1
c	 Total internal reflection occur at point Q as The angle of incidence (60^0) is greater than the critical angle 40^0.	1 1

6a(i)	Distance = speed x time = 1.5 x 1.2 = 1.8 m	1
(ii)	2 λ = 1.8 λ = 0.90 m	1
b(i)	The boat move up and down, perpendicular to the travelling direction of the wave.	1
(ii)	Velocity, v = f λ 1.5 = f x 0.90 f = 1.67 Hz or 1.7 Hz OR $f = \frac{1}{T}$ $= \frac{1}{0.6}$ = 1.67 Hz or 1.7 Hz	1 1
7a, b(i)		1 1
b(ii)	Like charges repel and unlike charges attract.	1
8a	Total resistance = $[\frac{1}{16+8} + \frac{1}{12}]^{-1}$ = 8.0 Ω	1 1
b	Current or ammeter reading, $I = \frac{V}{R}$ $= \frac{6}{8}$ = 0.75 A	1 1

c	Current = $\frac{V}{R}$ $= \frac{6}{16+8}$ = 0.25 A	 1 1
d	Voltmeter reading, V = R I = 8 x 0.25 = 2.0 V	 1 1
13a	When the currents are switched on: Coils **P** and **Q** are induced with the following poles as shown:  Since the two nearer ends has unlike poles which attract, they move towards each other. When the currents are switched off: The two coils lost their magnetic fields, so they are easy to separate.	1 1 1
b	When the currents are switched on: The two nearer ends will still have unlike poles which attract, but they move towards each other with greater speed since the iron core in **P** makes a stronger electromagnet. When the currents are switched off: They remain attracted to each other. The steel core in **Q** retains its magnetism and continues to attract the iron core of coil **P**.	 1 1 1

Section B

No.	Answers	Marks
a	Kinetic energy (KE), $E_k = ½ mv^2$ $= ½ \times 0.25 \times 4.2^2$ $= 2.205$ J $= 2.21$ J or 2.2 J	1 1
b(i)	Gravitational potential energy (GPE), $E_p = mgh$ $= 0.25 \times 10 \times 0.28$ $= 0.70$ J	1 1
b(ii)	Work done against friction = kinetic enegy **X** - (GPE + KE) of sphere at **Y** $= 2.205 – (0.7 + ½ \times 0.25 \times 1.4^2)$ $= 1.26$ J	 1 1
c	KE at floor= KE + GPE at top $= ½ mv^2 + 0.7$ $= ½ \times 0.25 \times 1.2^2 + 0.7$ $= 0.88$ J $½ mv^2 = 0.88$ J $½ \times 0.25 \times v^2 = 0.88$ J $v = 2.65$ or 2.7 m/s	 1 1
d	longitudinal	1
		1
11a	Foam-filled wall: It traps air which is a poor conductor of heat. It reduces heat loss through conduction Shiny outer casing: A shiny surface is a poor emitter of heat. It reduces heat loss by radiation.	1 1

b	The liquid near the heating element gets heated, it becomes less dense and rise. The cooler, denser liquid at the top will sink, and in turns gets heated and rise. This process continues, setting up convection current and heat up the entire liquid.	1 1
c	When temperature increases, the particles in the liquid gain kinetic energy and slide pass one another with greater speed.	1 1
d	During evaporation, the more energetic particles at the surface of the liquid break the forces of attraction and left the liquid. Leaving behind particles with lower kinetic energy and thus, lowering the temperature of the liquid.	1 1
e	Energy = Power x time = 200 W x (5 x 60 s) = 60 000 J or 60 kJ	1 1
12a(i)	S_3	1
a(ii)	S_1 and S_3	1
b	the hair dryer has a plastic case which is an insulator so any current leakage from the wires will not be conducted outwards	1
c(i)	P = VI I = 1140/240 = 4.75 A	1 1
c(ii)	fuse rating = 5 A	1
d	E = Pt = (1.14 × 15) + (0.63 × 8) = 22.14 kWh C1 Cost = $7.08	1 1 1
e	if one heating coil is faulty, the other cannot work OR the power of the hot air cannot be changed	1

Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
PRELIMINARY EXAMINATION 2019

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 Multiple Choice September 2019

Additional Materials: Multiple Choice Answer Sheet 1 hour

READ THESE INSTRUCTIONS FIRST

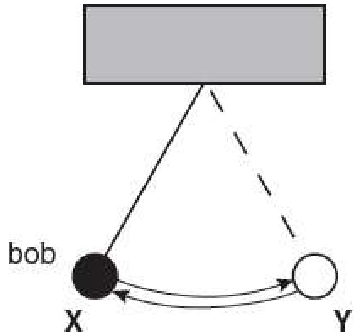
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid
Write your name, index number and class on the OTAS answer sheet.

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 **soft pencil** on the separate OTAS 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.
The use of an approved scientific calculator is expected, where appropriate.

Setter: Mr Foo SK and Mrs Kerensa Chia

1 One oscillation of a swinging pendulum occurs when the bob moves from X to Y and back to X again.



Using a stopwatch, which would be the most accurate way to measure the time for one oscillation of the pendulum?

A Time 20 oscillations and divide by 20.

B Time 20 oscillations and multiply by 20.

C Time one oscillation.

D Time the motion from X to Y, and double it.

2 Which of the following is a vector quantity?

A a mass of 2.0 kg

B a temperature of –10 °C

C a weight of 15 N

D an average speed of 20 m/s

3 The circuit of a motor racing track is 3.0 km in length. In a race, a car goes 25 times round the circuit in 30 minutes.

What is the average speed of the car?

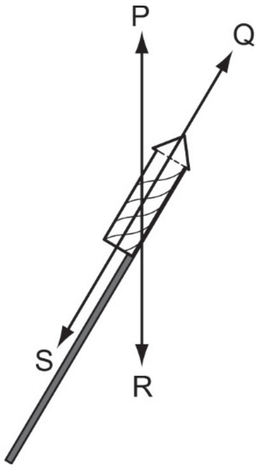
A 75 km / hour

B 90 km / hour

C 150 km / hour

D 750 km / hour

4 The diagram shows a firework rocket.



As the rocket flies through the air, three forces act on it. These forces are weight, thrust and air resistance.

What are the three forces?

	thrust	**air resistance**	**weight**
A	P	R	S
B	P	S	R
C	Q	R	S
D	Q	S	R

5 The mass and the volume of a bar made from metal **X** are measured.
The masses and volumes of four other bars are measured.

Which bar is made from a metal with a density that is double that of **X**?

	mass compared with **X**	volume compared with **X**
A	double	half
B	half	same
C	same	double
D	same	half

6 Which of the following statements about *inertia* is true?

A A body has inertia because of frictional forces acting on it.

B A body will have inertia even if placed in a vacuum.

C Inertia is a force that a body at rest will encounter that prevents it from starting to move.

D The inertia of a body keeps the body moving at constant velocity.

7 A body is suspended freely from a pivot.

Where can the centre of gravity of this body be found?

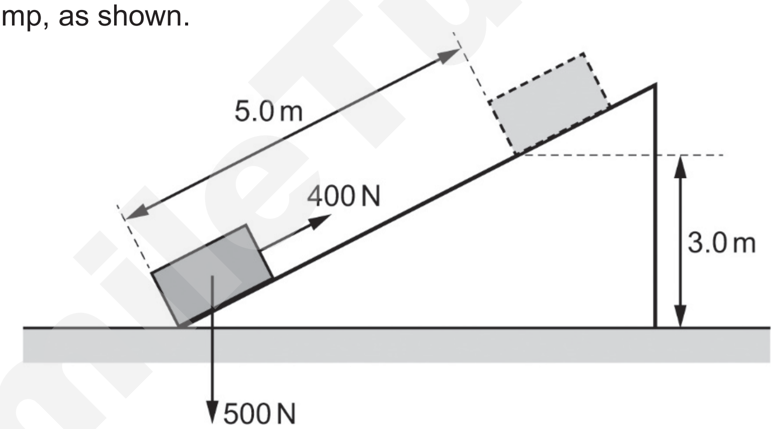
A at the left of pivot

B at the right of pivot

C vertically above the pivot

D vertically below the pivot

8 Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.



Part of the work done increases the gravitational potential energy ***E*** of the crate and the rest is work done ***W*** against friction.

What are the values of ***E*** and ***W***?

	E / J	**W** / J
A	1500	500
B	1500	2000
C	2000	2500
D	3500	500

9 Which of the following statements correctly explain why a balloon becomes smaller when it is kept in a freezer?

A The air molecules in the balloon are moving slower and colliding with each other less frequently.

B The air molecules in the balloon contract.

C The average distance between the air molecules in the balloon decreases.

D The number of air molecules in the balloon decreases.

10 A beaker of water is heated at its base.

Why does the water at the base rise?

A It contracts and becomes less dense.

B It contracts and becomes more dense.

C It expands and becomes less dense.

D It expands and becomes more dense.

11 Four beakers contain equal volumes of water at two different temperatures. The beakers are placed in the open air.

From which beaker does water evaporate the fastest?

	surface area of beaker / cm^2	temperature of water / °C
A	20	20
B	20	40
C	40	20
D	40	40

12 Which of the following statements about waves is true?

A The frequency of the waves always increases as its wavelength decreases.

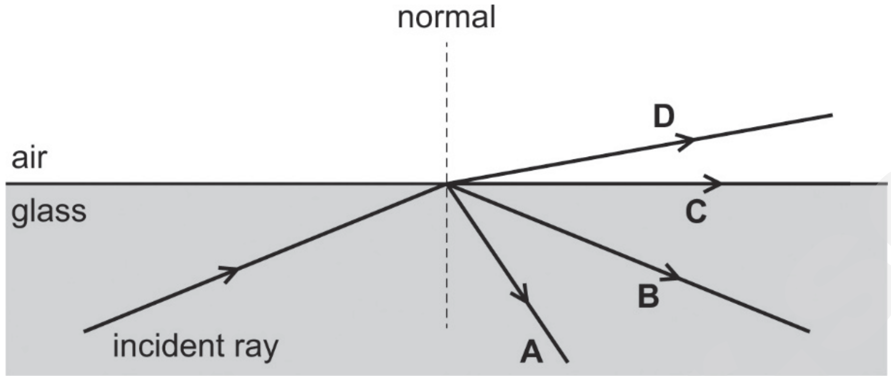
B The period of a wave is the time taken for the particles to travel from the maximum positive displacement to the maximum negative displacement.

C They transfer energy with the transfer of particles of matter.

D None of the above.

13 Light travelling in glass is incident on a glass-air boundary. The angle of incidence of the light is greater than the critical angle.

Which arrow shows the direction of the light after it is incident on the boundary?



14 Which statement about electromagnetic waves is correct?

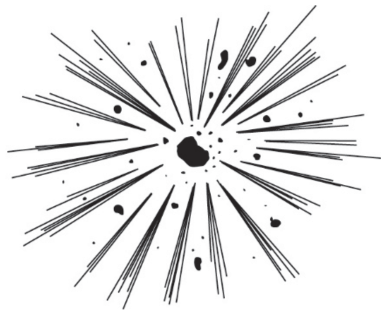
A All electromagnetic waves have speeds in air of approximately 3 x 10^8 m/s.

B In air, some electromagnetic waves travel faster than light.

C The electromagnetic waves with the largest wavelength are in the infra-red region.

D The electromagnetic waves with the smallest wavelength are in the X-ray region.

15 An explosion experiment is carried out on Earth. The experiment is repeated by an astronaut in space where there is no gas or air.



How does the explosion sound to the astronaut in space?

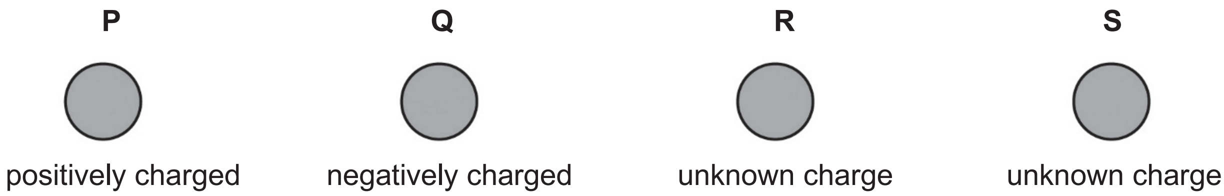
A completely silent

B slightly louder than on Earth

C slightly quieter than on Earth

D the same loudness as on Earth

16 The diagram shows four charged objects, **P**, **Q**, **R** and **S**.



It is found that P attracts R but repels S.

Which statement is correct?

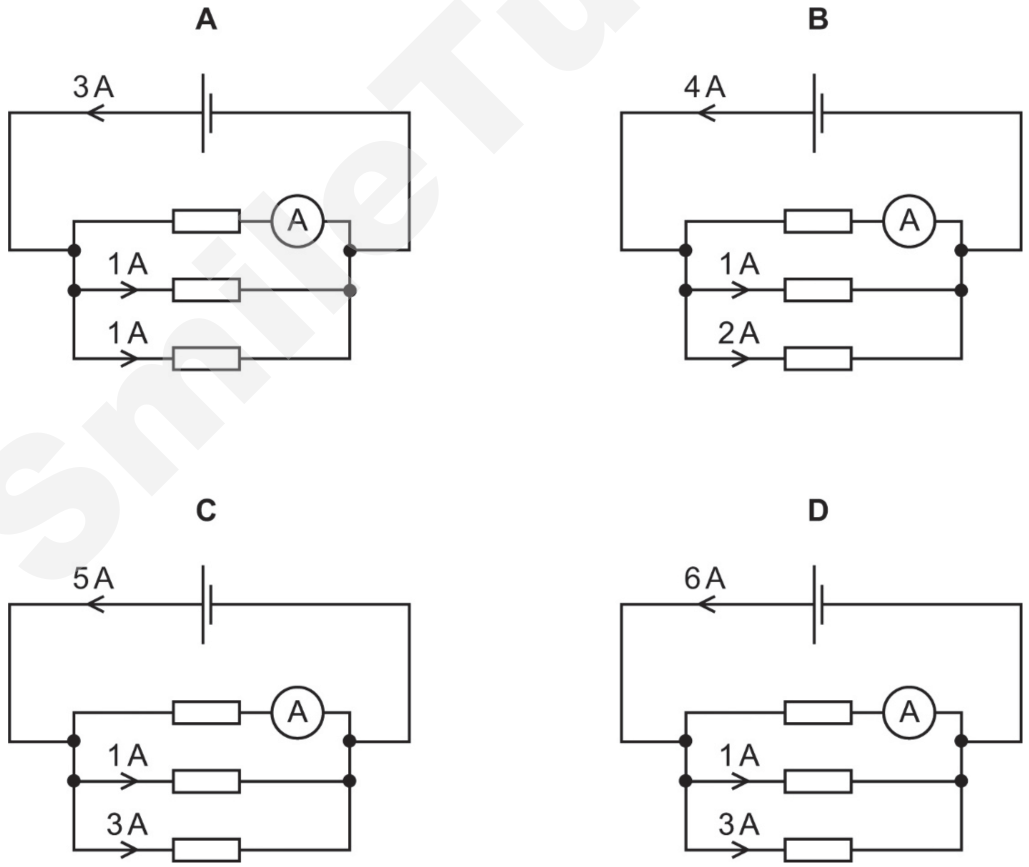
A Q attracts R.

B Q repels S.

C R attracts S.

D R repels S.

17 In which circuit does the ammeter read 2 A?



18 A metal wire has length l and cross-sectional area **A**.

Which of the following is proportional to the resistance?

A l + A

B l / A

C A × l

D A / l

19 The current in a hand dryer is 14 A. It is switched on for two minutes.

How much charge flows through the hand dryer?

A 0.14 C

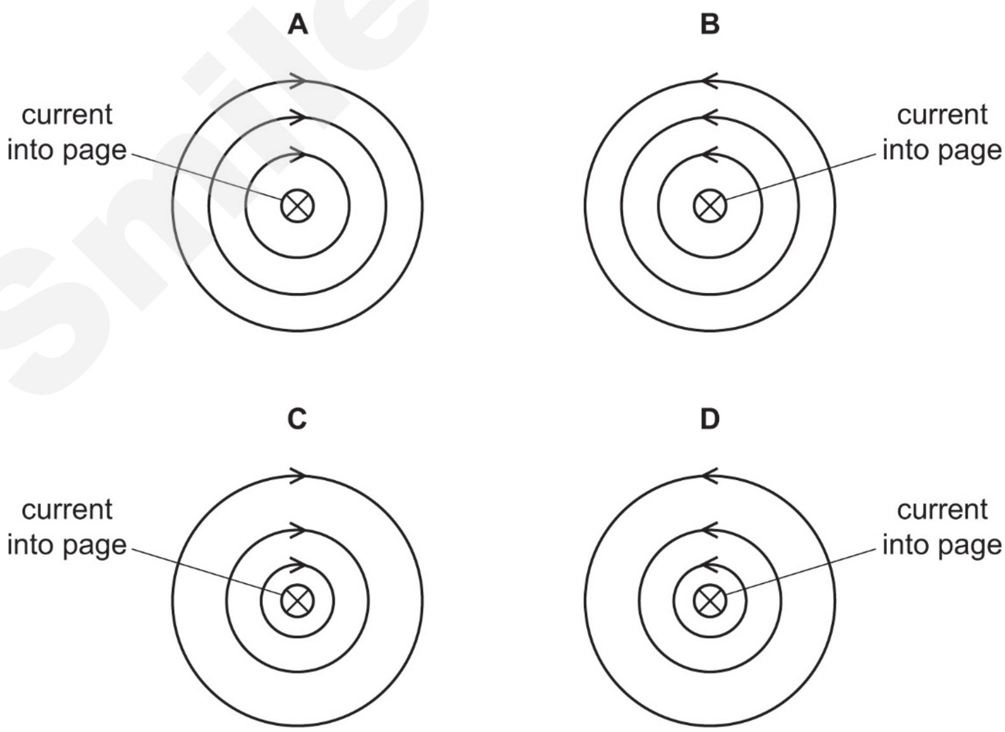
B 7 C

C 28 C

D 1680 C

20 An electric current in a wire is into the page.

Which diagram shows the shape and direction of the magnetic field around the wire?



21 – 40 Sci Chem

Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
PRELIMINARY EXAMINATION 2019

SCIENCE(PHYSICS) **5076/02**

Paper 2 September 2019

Candidates answer on the Question Paper 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST
Write your name, index number and class on all the work 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, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid. If working is needed for any question it must be shown with the answer. Omission of essential working will result in loss of marks. Calculators should be used where appropriate.

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.

The number of marks is given in brackets [ ] at the end of each question or part question.
[Take g to be 10 m/s^2 or the weight of 1 kg to be 10 N]

Target Grade:
Actual Grade:
For Examiner's Use
65

Section A (45 Marks)

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

1 A truck travelling along a road experiences air resistance and friction as shown below in Fig 1.1.

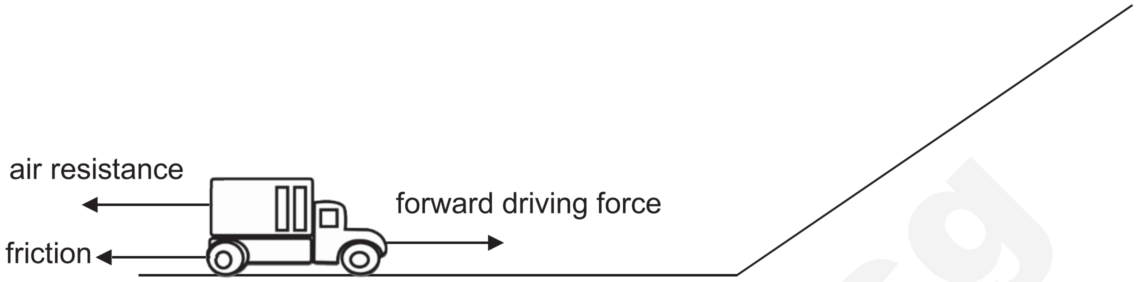
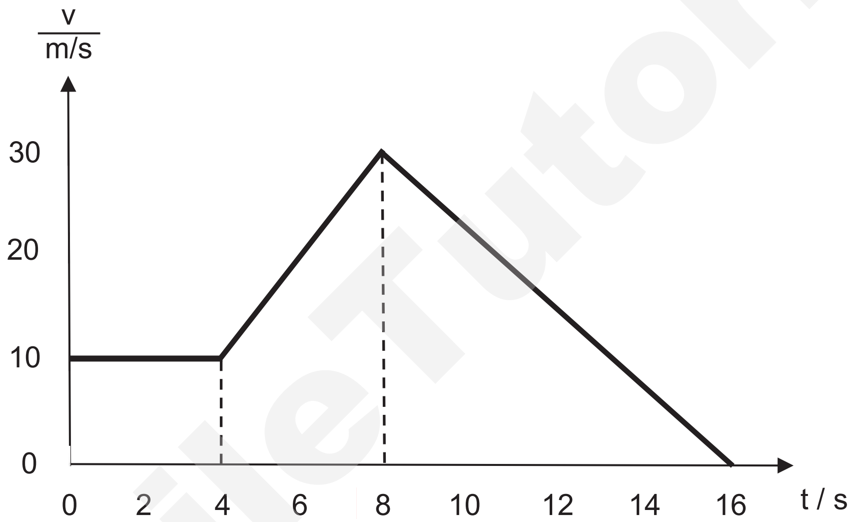


Fig 1.1

The graph below shows how the velocity of the truck varies with time.



The forward driving force by the engine is constant throughout the whole journey of 16 seconds.

(a) During which time interval are the forces on the truck balanced?

.... [1]

(b) The truck has a mass of 1500 kg.
Calculate the net force at t = 6 s.

force = ... N [2]

(c) At what time does the truck start to travel up the slope? Explain your answer.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………… [2]

(d) Hence, or otherwise, calculate the length of the slope.

length = ……………… m [2]

2 **(a)** Define pressure and state its S.I. unit.

……………………………………………………………………………………………………..

…………………………………………………………………………………...………. [2]

(b) Sally weighs 480 N. The area of the heel of her shoes is 1 cm^2.

Calculate the pressure exerted by the heel on the ground.
Give your answer in its S.I. unit.

pressure = ……………… [2]

3 A builder needs to determine the density of a solid cube of wood.
He places the 50 cm mark of a uniform metre rule on a pivot, so that the rule balances.
He then places the cube on the rule with its centre of gravity directly above the 75 cm mark.

A mass of 0.050 kg is moved along the rule until balance is restored.
This is shown in Fig 3.1.

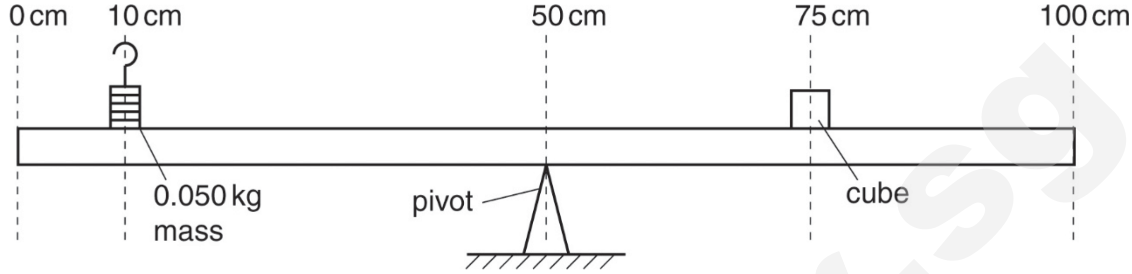


Fig 3.1 (not to scale)

The rule is balanced when the 0.050 kg mass is at the 10 cm mark.

(a) Explain why the rule originally balances when the pivot is placed at the 50 cm mark.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………… [2]

(b) Calculate the mass of the cube.

mass = ……………… kg [3]

(c) The cube has a volume of 1.6×10^{-4} m^3.
Determine the density of the wood.

density = ……………… kg/m^3 [2]

4 **(a)** The time required to bake large potatoes in an oven may be significantly reduced if a long steel spike was placed through the center of each potato before putting them in an oven.

Explain why this process reduces the cooking time.

………………………………………………………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

……………………………………………………………………………………………… [2]

(b) Aluminium foil-coloured blankets can be used to keep mountaineers warm.

Explain this statement.

………………………………………………………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

……………………………………………………………………………………………… [3]

5 A small quantity of crushed substance **X** was allowed to warm up from the temperature of −3°C using a 300 W heater. Fig 5.1 shows how the temperature of the substance varies with time.

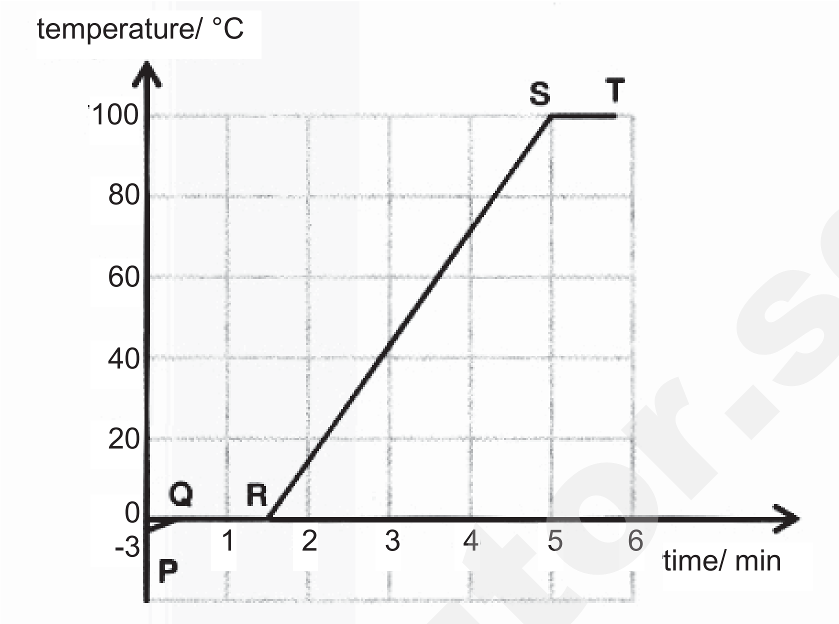


Fig 5.1

(a) What is the melting and boiling point of the substance **X**?

.... [2]

(b) Explain why the temperature remained constant for the period between **Q** and **R**.

....

.... [1]

(c) If the 300 W heater in the above experiment is replaced by a 600 W heater, describe and explain the difference seen on the graph during the sections **QR** and **RS**.

....

....

....

.... [3]

6 **(a)** In the swimming pool at a new leisure centre there is a 'wave machine' as shown in Fig 6.1.

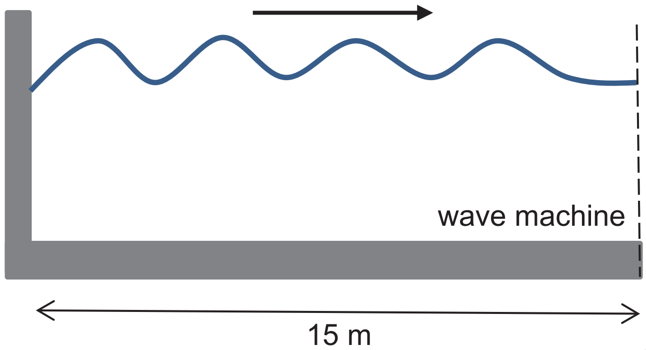


Fig 6.1

This machine makes waves in the water at one end of the pool at a frequency of 0.25 Hz. The waves take 12.0 s to travel 15 m along the pool.

(i) Define *transverse waves.*

……………………………………………………………………………………..

…………………………………………………………………………………... [1]

(ii) Calculate the wavelength of the waves.

wavelength = ……………… m [2]

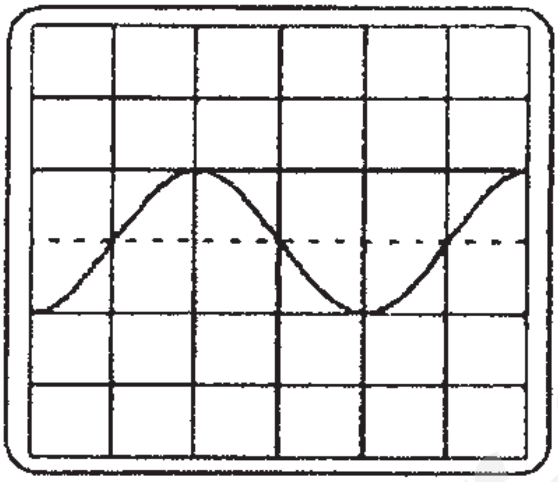
(iii) The swimming pool operator wants to reduce the speed of the waves.
He decided to reduce the frequency of the 'wave machine'.
Explain why he will be unsuccessful in this attempt?

……………………………………………………………………………………..

……………………………………………………………………………………..

…………………………………………………………………………………… [1]

(b) Fig 6.2 shows an oscilloscope trace for a sound with a frequency of 5000 Hz.



5000 Hz

Fig 6.2

On Fig 6.2, draw the trace for a louder sound with a frequency of 10 000 Hz. [2]

7 Fig 7.1 shows Dylan walking on a carpet and approaching a metal door, which is earthed.

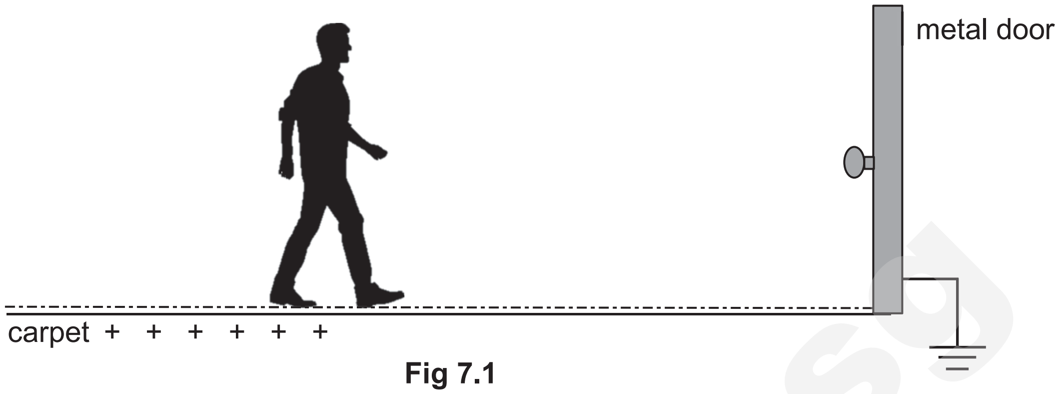


Fig 7.1

(a) It is found that the carpet on which Dylan has walked on carries positive charges. Explain how these charges are formed.

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

…………………………………………………………………………………………… [2]

(b) Explain why Dylan gets a momentary electric shock when he is close to the metal door as shown in Fig 7.2.

Fig 7.2

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

…………………………………………………………………………………………… [2]

8 Fig 8.1 shows an electric circuit containing two identical lamps and a resistor. The lamps can operate at normal brightness when connected to a 6 V cell and resistor R.

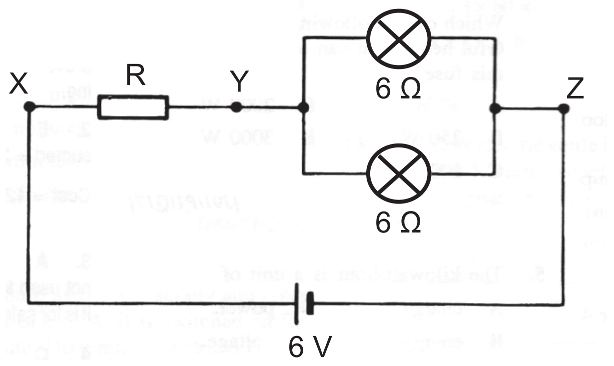


Fig 8.1

(a) Calculate the combined resistance of the two light bulbs.

resistance = ……………… Ω [2]

(b) The current flowing through the battery is 1.0 A.

Find the value of R.

R = ……………… Ω [2]

(c) Comment on the level of brightness of the remaining bulb if one of the light bulbs is removed. Explain your answer.

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

………………………………………………………………………………………………… [2]

Section B (20 Marks)

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

Write your answers in the space provided.

9 Fig 9.1 shows a ray of blue light passing from air into a glass optical fibre and refracting at the surface.

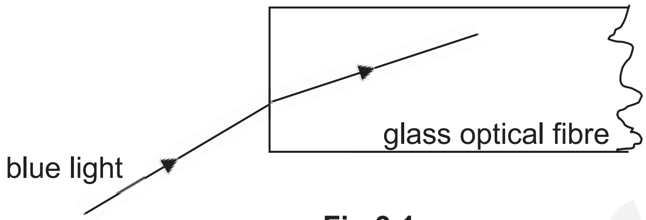


Fig 9.1

(a) Describe how the wavelength and the frequency of the blue light change after it entered the optical fibre.

……………………………………………………………………………………………………...

……………………………………………………………………………………………………...

…………………………………………………………………………………………… [2]

(b) The refractive index of the optical fibre is 1.5.
Calculate the speed of the blue ray in the optical fibre.

speed = ……………… [2]

(c) Fig 9.2 shows the same blue ray travelling in the optical fibre. The ray strikes the wall of the fibre at *Q*. The angle between the ray and the wall of the fibre is 7°.

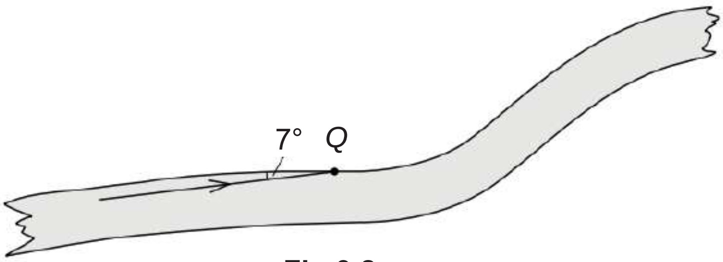


Fig 9.2

(i) Calculate the critical angle of the optical fibre.

critical angle = ……………… [2]

(ii) State and explain how the blue ray travels after hitting *Q*.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………… [2]

(d) Explain why diamond, which has a refractive index higher than glass, is a more suitable material for the optical fibre, in terms of ensuring that light entering the optical fibre at one end will only leave the fibre at the other.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………… [2]

10 An electric kettle has a power rating of 2.4 kW when it is connected to a 240 V power supply. To make a cup of tea the kettle is switched on for three minutes. During a morning it is used five times to make cups of tea.

(a) Sketch a circuit diagram to show how the kettle is connected to the 240 V power supply. In your diagram, show clearly how the live wire, the neutral wire, the earth wire, a switch and a fuse are connected. [3]

(b) If one unit of electricity costs 20 ¢, calculate the total cost of using the kettle in the morning.

cost = ……………… [2]

(c) The kettle is connected to the mains using a standard plug.

(i) Write down the equation which relates current, power and voltage.

……………………………………………………………………………………. [1]

(ii) Calculate the current used by the electric kettle when it is operating. Show clearly how you obtain your answer.

current = ……………… [1]

(iii) Should a 3 A fuse or a 13 A fuse be fitted?

……………………………………………………………………………………… [1]

(d) Explain the function of the earth wire.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

11 Fig 11.1 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.

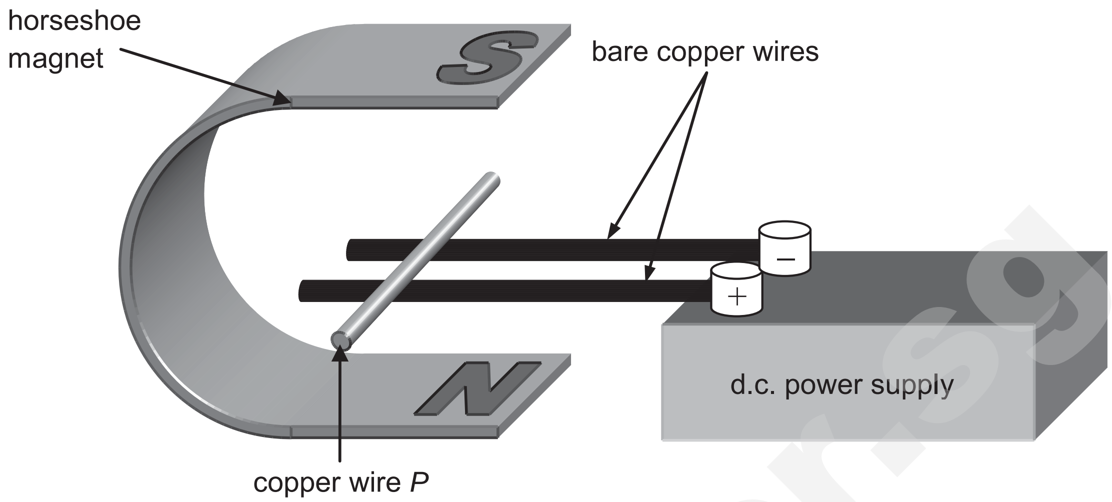


Fig 11.1

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

.... [1]

(b) Explain the observation made in **(a)**.

....

....

.... [2]

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

(i) the current is reversed,

.... [1]

(ii) the current is decreased,

.... [1]

(iii) 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]

(e) Fig 11.2 below shows a positive charge moving into a magnetic field, the direction of which is perpendicular to and into the plane of the paper. Fig 11.3 shows a negative charge moving into a magnetic field, the direction of which is perpendicular to and out of the plane of the paper.

In the two figures below, draw the paths of the two charges in the respective magnetic fields. [2]

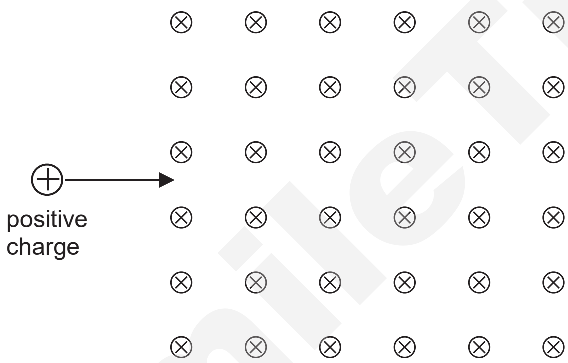


Fig 11.2

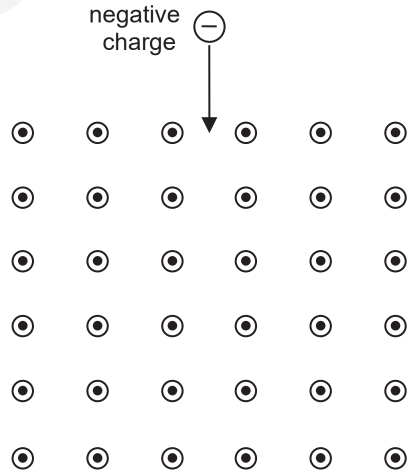


Fig 11.3

End of Paper

Paper 1 (20 Marks)

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

Paper 2 Section A (45 Marks)

1 **(a)** t = 0 s to t = 4 s. [1]

(b) gradient at t = 6 s = 5 m/s^2 [1]
F = m a = 1500 x 5 = 7500 N [1]

(c) The truck is traveling up the slope from t = 8.0 s. [1]
Part of the weight is acting against the motion thus deceleration will occur. [1]

(d) Distance travelled = area under graph from t = 8 s to 16 s [1]
= ½ x (16 – 8) (30) = 120 m [1]

2 **(a)** Pressure is force per unit area. [1]
SI unit is Pa (or N/m^2) [1]

(b) area = 1 cm^2 = 0.0001 m^2 [1]
P = F / A
= 480 / 0.0001 = 480 000 Pa [1]

3 **(a)** Uniform metre. CG in the middle (ie at the 50 cm mark), [1]
weight of rule through CG, no turning effect (moment) [1]
due to the weight of the rule. Thus the rule balances.

(b) sum of clockwise moments = sum of anticlockwise moments [1]
0.050 × (10) × 40 = m2 × (10) × 25 [1]
0.080 kg [1]

(c) ρ = m / V
0.08 / 1.6 × 10^{-4} [1]
= 500 kg/m^3 [1]

4	**(a)**	Steel is a good conductor of heat. It conducts heat quickly from the oven to the inside of the potatoes, reducing cooking time.	[1] [1]
	(b)	Aluminium is a shiny metal. thus it is a poor emitter of heat able to reduce the body heat from being lost.	[1] [1] [1]
5	**(a)**	The **melting point** of X is **0°C** and the **boiling point** of X is **100°C**.	[2]
	(b)	During the period between Q and R, the **heat energy is absorbed to weaken the intermolecular forces**.	[1]
	(c)	Since **thermal energy is supplied at a higher rate,** the length of **QR will be shorter** as the time taken for melting to complete will be lesser. The slope of **RS will be steeper as the liquid will reach the boiling point faster**.	[1] [1] [1]
6	**(a)**	**(i)** Transverse waves are waves that **travel in a direction perpendicular to the direction of vibration.**	[1]
		(ii) $v = 15 / 12$ $= 1.25$ m/s $\lambda = v / f = 1.25 / 0.25$ $= 5.00$ m	 [1] [1]
		(iii) Since the **depth/medium of the pool remains unchanged**, the speed of the waves will not change.	[1]
	(b)	Amplitude increased. Period halved. (showing 3 waves)	[1] [1]
7	**(a)**	Electrons are transferred from the carpet to Dylan due to charging by friction. Since carpet has more positive charges than negative charges, carpet becomes positively charged.	[1] [1]
	(b)	Dylan accumulates negative charges and induces positive charges on the surface of the door knob/ door knob is positively charged. Since unlike charges attract, negative charges from his body flows from his body to the metal door causing him to feel an electric shock.	[1] [1]
8	**(a)**	$1/R_t = 1/6 + 1/6 = 1/3$ $R_t = 3\Omega$	[1] [1]
	(b)	$R = (6-3) / 1$ $= 3\ \Omega$	[1] [1]
	(c)	Remaining bulb is brighter. More current flows through this bulb now.	[1] [1]

Paper 2 Section B (20 Marks)

9	(a)	The frequency remained unchanged. The wavelength decreases.		[1] [1]
	(b)	n = c / v v = 3.0 x 10^8 m/s / 1.5 = 2.0 x 10^8 m/s		 [1] [1]
	(c)	(i)	n =1 / sin c c = $\sin^{-1}$ 1 / 1.5 = 42° (41.8°)	 [1] [1]
		(ii)	The blue ray will be totally internally reflected. This is because the angle of incidence at Q is greater than the critical angle.	[1] [1]
	(d)	Diamond will have a smaller critical angle and therefore a higher chance of undergoing total internal reflection.		[1] [1]
10	(a)	Correct labelled diagram		[3]
	(b)	Cost = 2.4 x (15 / 60) x 20 = 12 cents		[1] [1]
	(c)	(i)	power = voltage x current reject answer if students did not state what the letters denote	[1]
		(ii)	10 A	[1]
		(iii)	13 A	[1]
	(d)	When the metal casing becomes 'live' due to a fault, the excessive current will flow to the ground via the earth wire thus preventing anyone getting an electric shock by touching the 'live' metal casing		 [1] [1]

11 **(a)** Roll to the ***right*** (towards the d.c. power supply) [1]

(b) 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]

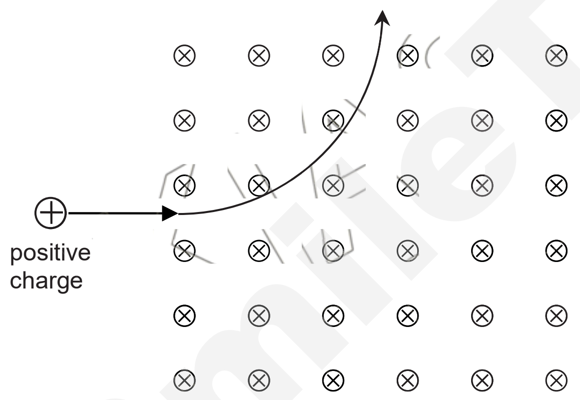
(c) **(i)** P rolls to the **left**. [1]

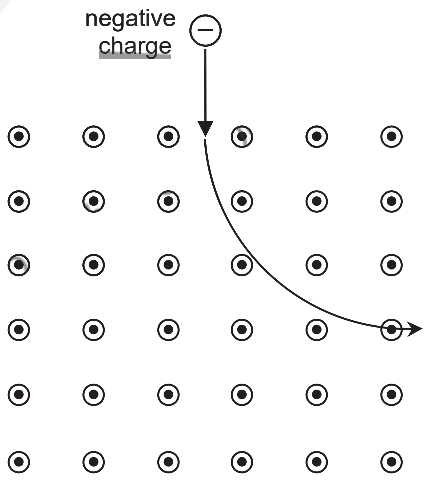
(ii) P rolls **more slowly**. [1]

(iii) 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]

(e) [1] [1]





End of Paper

Candidate Name	Class	Register Number

CHANGKAT CHANGI SECONDARY SCHOOL

Preliminary Examination 2019

Subject	**:**	**Science (Physics / Chemistry)**
Paper No	**:**	**5076/01**
Level	**:**	**Secondary 4 Exp/5 Normal Academic**
Date	**:**	**4th September 2019**
Duration	**:**	**1 Hour**
Setter	**:**	**Mr Hong KK / Ms Ling GK**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, class and register number in the spaces provided at the top of this page.
Do not use staples, paper clips, glue or correction fluid.

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 OTAS sheet.

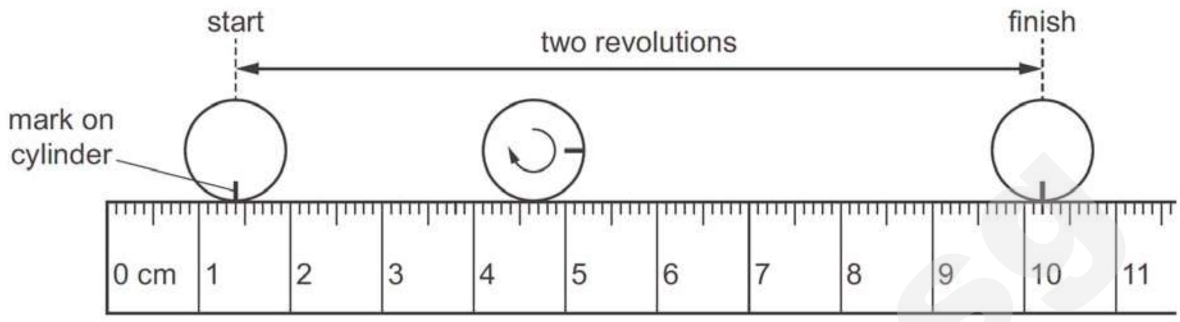
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

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

For Examiners' Use	**Marks**
Paper 1	/ 40
Personal Target	Actual Grade
Parent's / Guardian's Signature	

This Question Paper consists of **9** printed pages.

1 A small cylinder is rolled along a ruler and completes two revolutions.

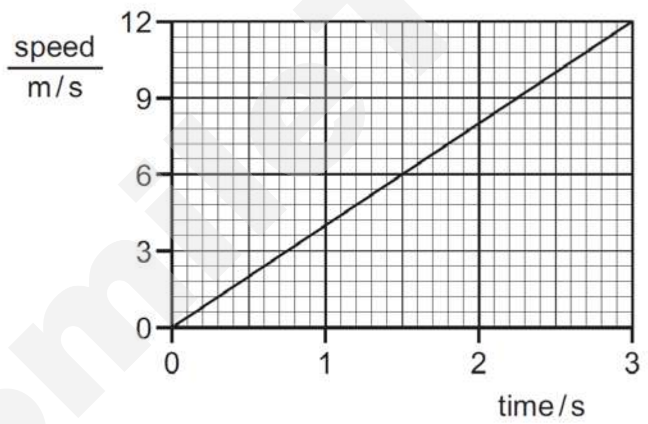


The circumference is the distance around the outside of a circle.

What is the circumference of the cylinder?

A 4.4 cm **B** 5.2 cm **C** 8.8 cm **D** 10.2 cm

2 The graph shows the speed of a car as it moves from rest.



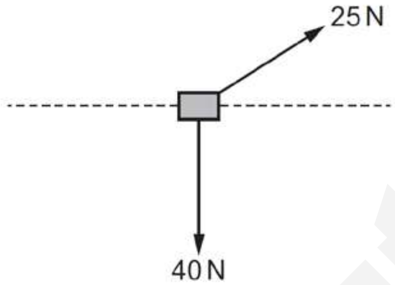
What is the average speed of the car during the first 3 s?

A 4 m/s **B** 6 m/s **C** 18 m/s **D** 36 m/s

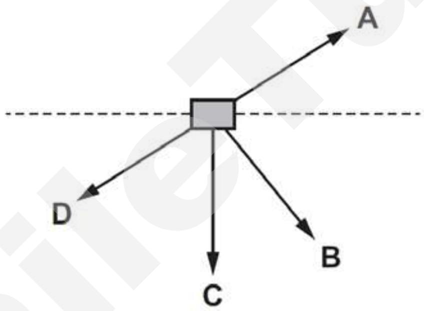
3 When a heavy coin falls a short distance towards the ground it does not reach terminal velocity.
Which of the following explains this observation correctly?

A The coin has not hit the ground.
B The weight of the coin equals the air resistance.
C The weight of the coin increases as air resistance increases.
D The weight of the coin is always more than air resistance.

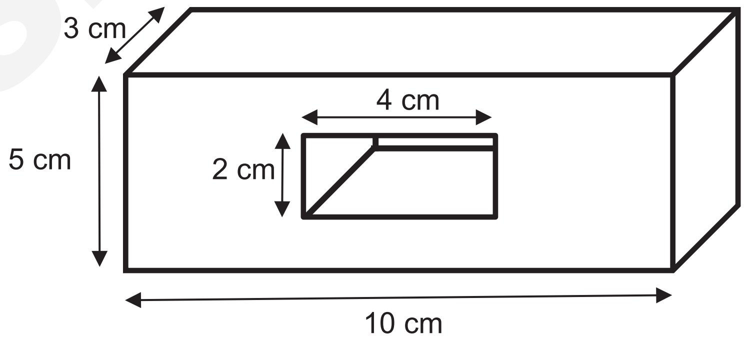
4 Forces of 25 N and 40 N act on an object in the directions shown.



Which arrow shows the direction of the resultant force on the object?



5 A hollow rectangular metal block has the dimensions shown.

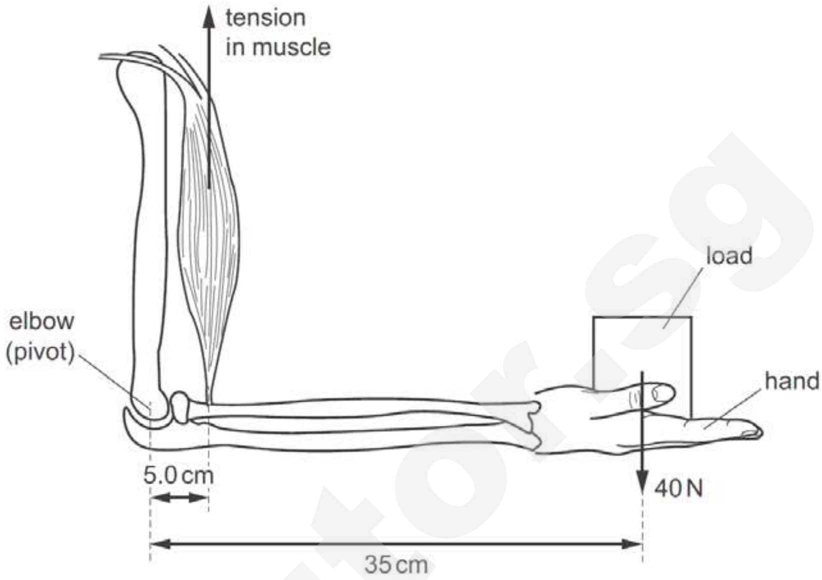


The hole in the middle goes all the way through the block.
The density of the metal is 10 g/cm^3.

What is the mass of the block?

A 12.6 g **B** 540 g **C** 1260 g **D** 1500 g

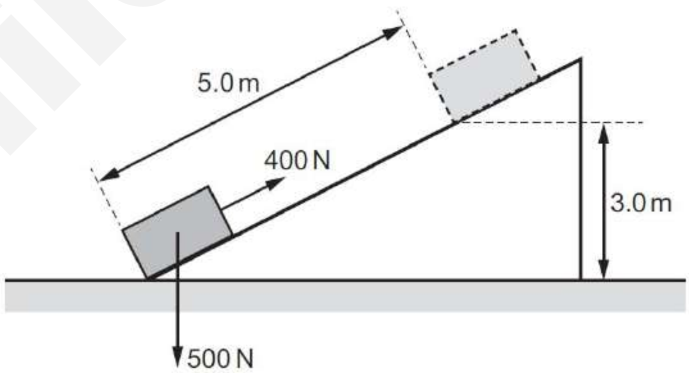
6 The diagram shows a muscle and bones in a person's arm. The hand holds a load of weight 40 N. The elbow acts as a pivot and the tension in the muscle keeps the lower part of the arm horizontal.



What is the tension in the muscle due to the load?

A 200 N **B** 240 N **C** 280 N **D** 1400 N

7 Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.



Part of the work done increases the gravitational potential energy E of the crate and the rest is work done W against friction.

What are the values of E and W?

	E/J	W/J
A	1500	500
B	1500	2000
C	2000	2500
D	3500	500

8 A parachutist has opened his parachute and is falling to Earth at constant speed.

What is the principal energy conversion taking place as he falls?

A kinetic energy → potential energy

B kinetic energy → thermal energy (heat)

C potential energy → kinetic energy

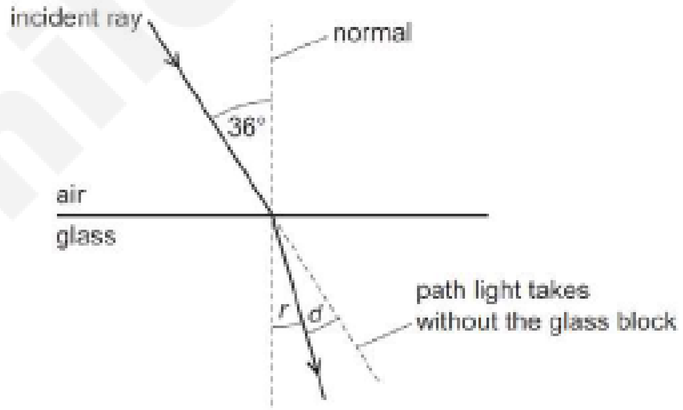
D potential energy → thermal energy (heat)

9 Water is poured into four dishes. In two of the dishes the water has a small surface area and in the other two it has a large surface area. The water in two of the dishes is cool and the water in the other two is warm.

From which dish does the water evaporate the quickest?

	surface area	temperature
A	large	cool
B	large	warm
C	small	cool
D	small	warm

10 A ray of light is incident on the surface of a glass block. The diagram is not drawn to scale. The refractive index of the glass is 1.5.

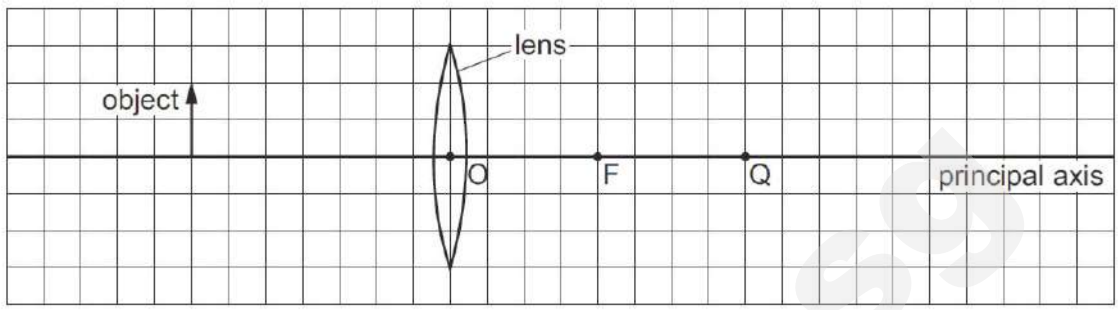


The angle of refraction is *r*. The angle between the refracted ray and the path the light takes without the glass block is *d*.

What are *r* and *d* ?

	r / °	*d* / °
A	23	12
B	24	12
C	23	13
D	24	13

11 The diagram shows an object on the principal axis of a converging (convex) lens. A principal focus of the lens is at F.



Where is the image formed by the lens?

A between O and F

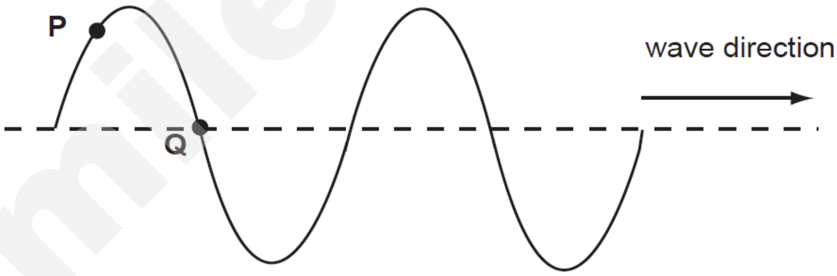
B between F and Q

C at Q

D to the right of Q

12 The diagram shows a wave on a string with two points P and Q marked.

The wave is moving in the direction shown.



What will happen next?

A P will move to the right.

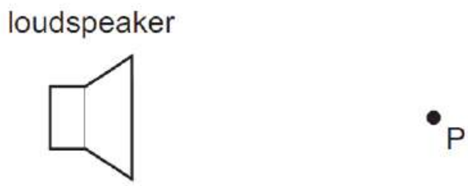
B P will move up.

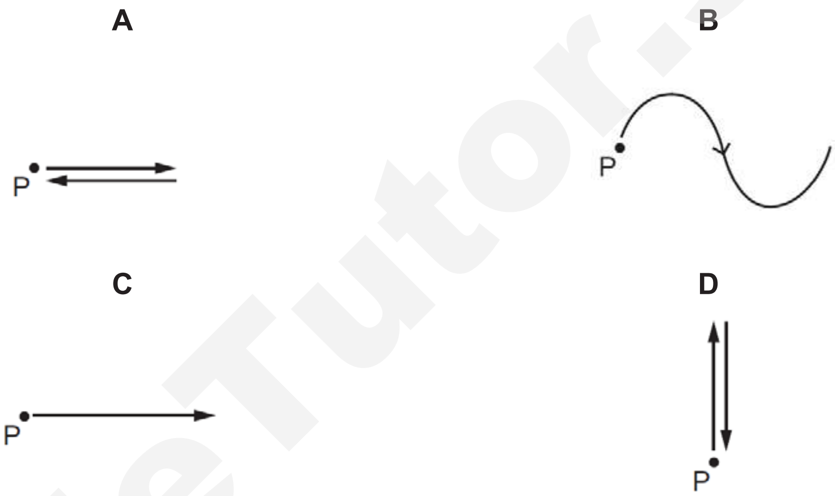
C Q will not move.

D Q will move up.

13 The diagram shows a loudspeaker that is producing a continuous sound wave of frequency 200 Hz in air.

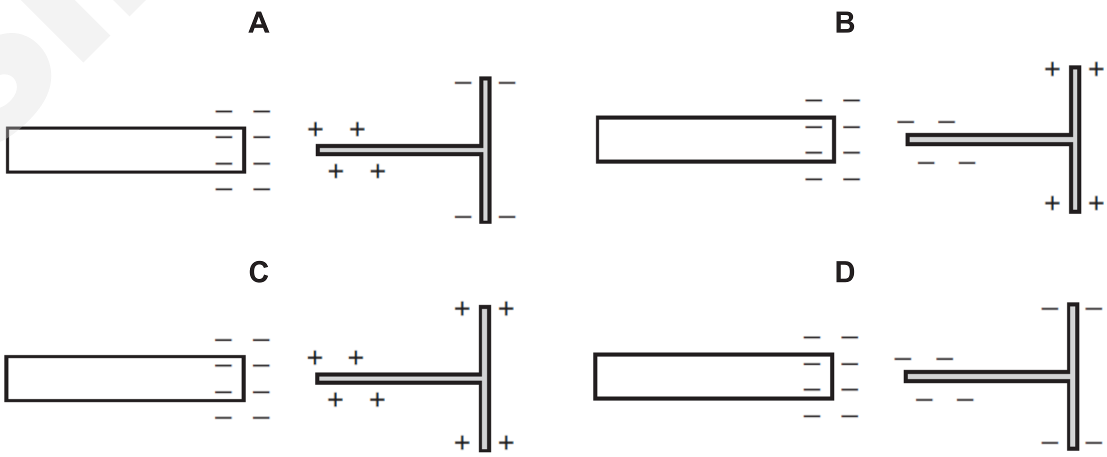
Which diagram best shows how the sound wave causes a molecule at P to move during 0.0050 s?





14 A negatively-charged rod is brought close to an isolated T-shaped piece of metal. Initially, the metal is uncharged.

Which diagram shows the induced charge on the metal?



[Turn Over

15 A television controller emits an infra-red beam.

Which statement about infra-red radiation in the television controller is correct?

A It causes ionisation.
B It consists of longitudinal waves.
C It has a higher frequency than ultra-violet light.
D It travels at the speed of light.

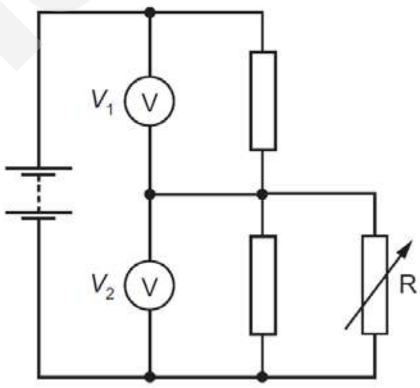
16 Many electrical appliances have metal cases.

To prevent the case from becoming 'live', the earth wire of the electric cable is attached to the case.

How does the earth wire prevent an electric shock?

A It allows a current to flow to earth, so that the appliance continues working.
B It allows a large current to flow to earth, blowing the fuse.
C It prevents the fuse from blowing.
D It reduces the current to a safe level.

17 The diagram shows a circuit with two equal fixed resistors with a variable resistor R connected in parallel to one of them.

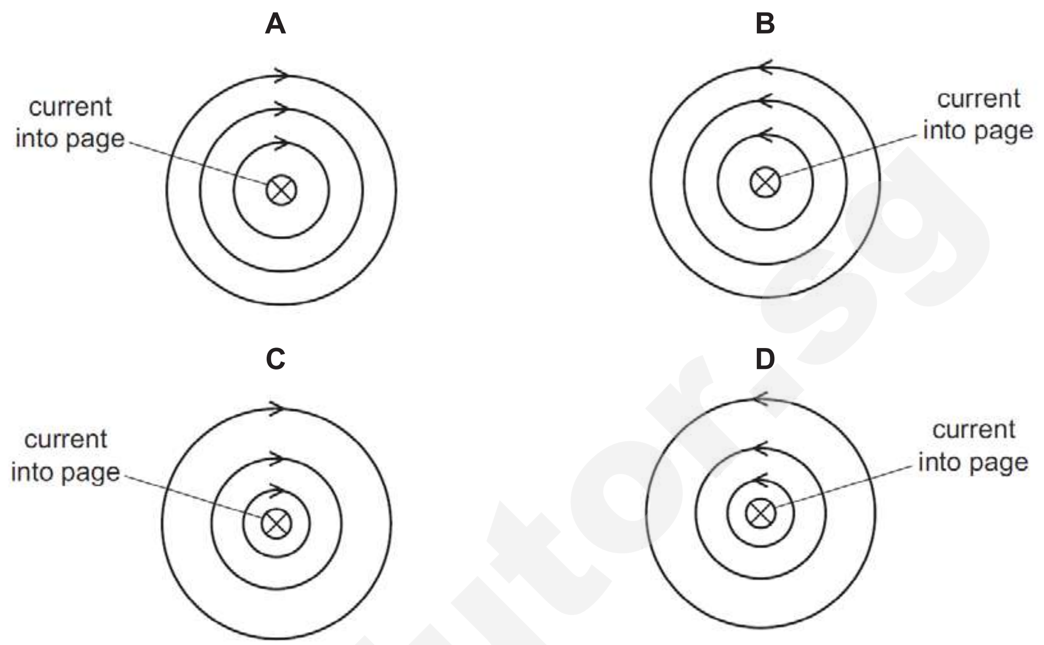


The resistance of R increases.

What happens to the two voltmeter readings?

	V_1	V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

18 An electric current in a wire is into the page.
Which diagram shows the shape and direction of the magnetic field around the wire?



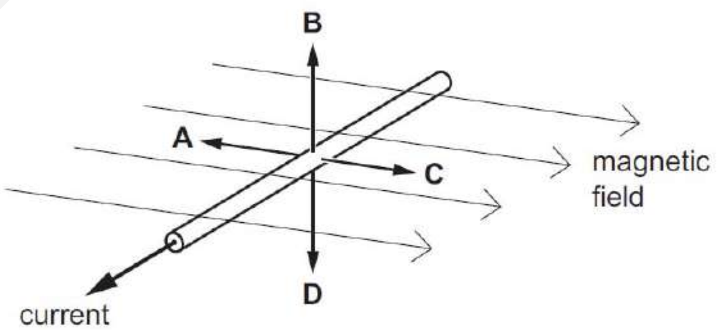
19 It costs \$0.20 for 1 kWh of electrical energy.

How much will it cost to run an electrical fan of 90 W for 10 hours?

A \$0.05 **B** \$0.18 **C** \$3.00 **D** \$18.00

20 The diagram shows a current-carrying wire in a horizontal magnetic field.

Which arrow shows the direction of the force experienced by the wire?



End of Paper

Candidate Name	Class	Register Number

CHANGKAT CHANGI SECONDARY SCHOOL

Preliminary Examination 2019

Subject	:	**Science (Physics)**
Paper No	:	**5076/02**
Level	:	**Secondary 4 Express/5 Normal Academic**
Date	:	**29th August 2019**
Duration	:	**1 hour 15 minutes**
Setter	:	**Mr Hong K K**

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, class and register number in the spaces at the top of this page.

Answer **all** questions in Section A and any **two** questions in Section B.

In calculations, you should show all the steps in your working, giving your answer at each stage.
Enter the numbers of the Section B questions you have answered in the grid below.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiners' Use	Marks
Section A	/ 45
Section B	
	/ 10
	/ 10
Total	/ 65
Personal Target	Actual Grade
Parent's / Guardian's signature	

This Question Paper consists of **18** printed pages.

[Turn Over

Section A [45 marks]
Answer all the questions in the spaces provided.

1. A girl of mass 35 kg, on a bicycle, accelerates from rest and travels down a slope in a straight line. The girl does not use the pedals.
Fig. 1.1 shows that the gradient of the slope is constant.

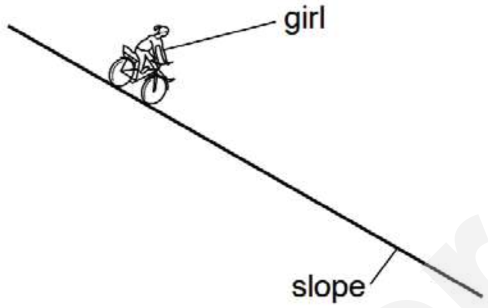


Fig. 1.1

(a) Calculate the resultant force on the girl when she is accelerating at 2.6 m/s^2.

resultant force = ………………… N [2]

(b) At first, her acceleration is constant. At time t_1, her acceleration starts to decrease gradually until she is travelling at a constant speed in a straight line.

On Fig. 1.2, sketch a speed-time graph for the girl from when she starts moving until she is travelling at a constant speed. [3]

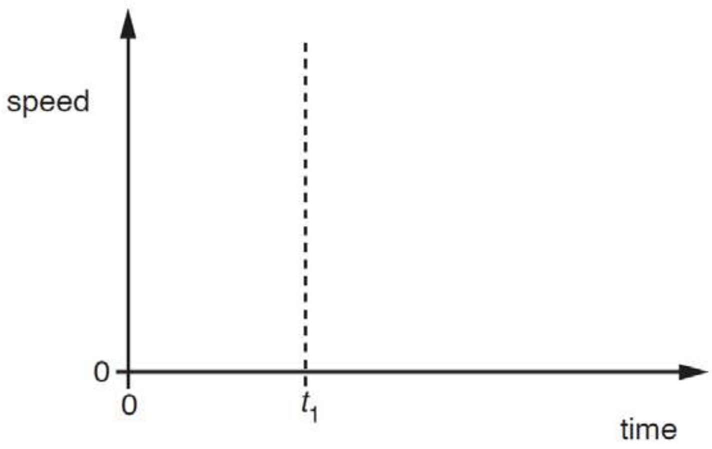


Fig. 1.2

2. Fig. 2.1 shows the dam and reservoir of a hydroelectric power station.

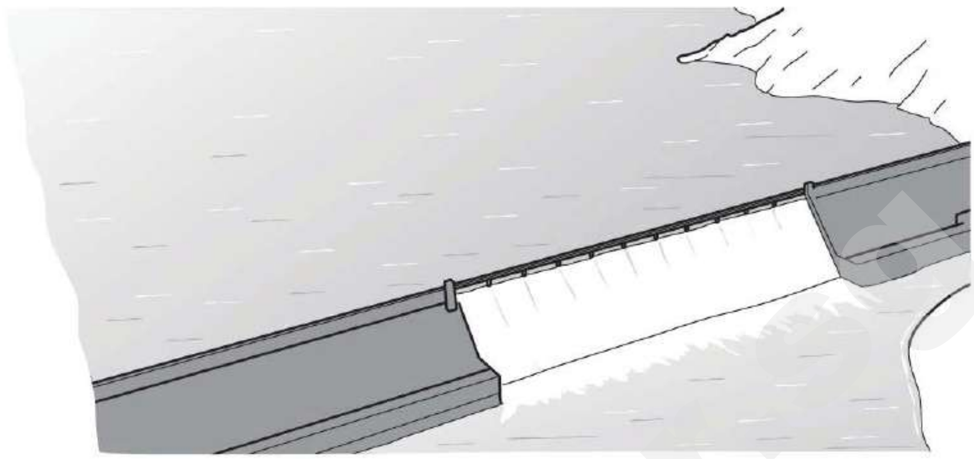


Fig. 2.1

A hydroelectric power station uses a renewable energy source.

(a) The water surface in the reservoir of the hydroelectric power station is at a vertical height of 170 m above the turbines.
In one hour, 1.6×10^{10} kg of water flows from the reservoir through the turbines.
The gravitational field strength *g* is 10 N/kg.

Calculate the loss in gravitational potential energy of the water in one hour.

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

(b) When the power station operates at full capacity, the electrical power output is 6.8×10^{9} W.

Calculate the electrical energy output in one hour when the power station operates at full capacity.

electrical energy output =………………………………….. [2]

(c) Calculate the total amount of other forms of energy produced in one hour.

other forms of energy =……………………………… J [2]

(d) Calculate the efficiency of the power station operating at full capacity, given that

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100\% .$$

efficiency =………………………………… [1]

3. A lamp is positioned at the bottom of a small pool of water.
The critical angle for light passing from water into air is 49°.

(a) Explain what is meant by the term *critical angle*.

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

……………………………………………………………………………………… [2]

(b) The lamp sends rays of light towards the surface of the pool.
Fig. 3.1 shows three rays of light that are at 30°, 60° and 90° to the horizontal.

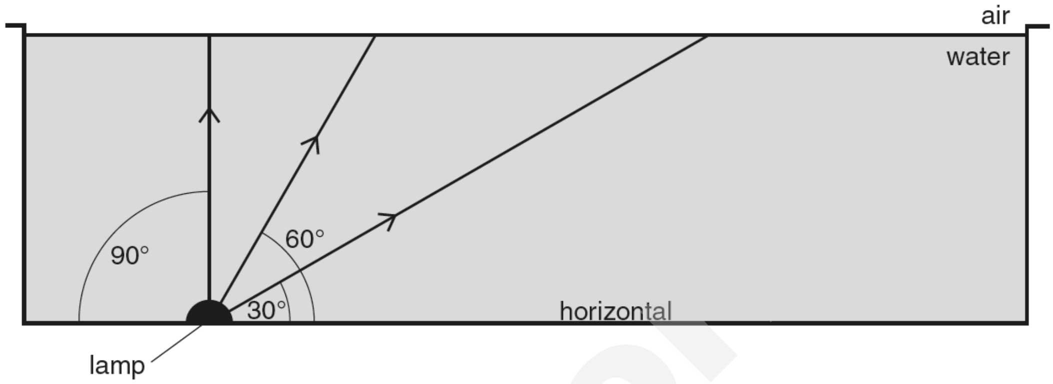


Fig. 3.1

On Fig. 3.1, draw the path taken by each of the three rays after they strike the surface of the water. [3]

4. Fig. 4.1 shows a girl standing at a distance in front of a large building.

Fig. 4.1

The girl uses a sound generator and a loudspeaker to send a short pulse of sound towards the building. The sound has a frequency of 3700 Hz.

A short time later, the girl hears an echo.

(a) Besides the hard flat surface of the building, state another important condition for the girl to be able to hear the echo clearly.

…………………………………………………………………………………………………

………………………………………………………………………………………………… [1]

(b) The pitch of the echo is the same as that of the original sound but the echo is not as loud.
State the changes, if any, on

(i) the amplitude of the echo,

.... [1]

(ii) the frequency of the echo.

.... [1]

(c) The speed of sound in air is 330 m/s.

Calculate the wavelength of this sound.

wavelength = ………………………m [2]

5. Fig. 5.1 shows a metal coffee cup on a metal warming plate.

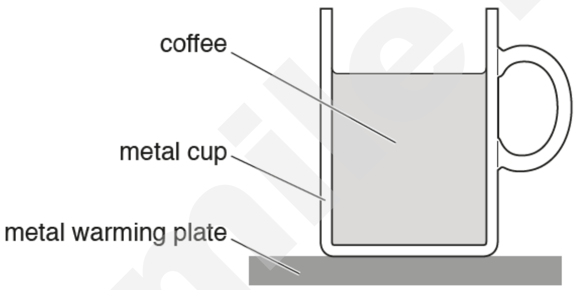


Fig. 5.1

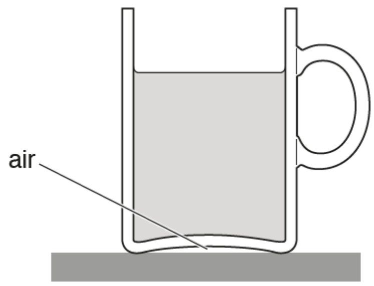


Fig. 5.2

There is a small electrical heater inside the warming plate that keeps the plate hotter than the coffee.

(a) Heat is transferred through the metal by conduction to the liquid.

Describe how heat is then transferred to all the liquid in the cup.

....

....

....

....

....

....

....

.... [2]

(b) A cup of a different shape is placed on the same heater, as shown in Fig. 5.2.
The two cups are made of the same metal and contain the same amount of coffee.

Explain why the coffee in the cup in Fig. 5.2 is not kept as warm as the coffee in the cup in Fig. 5.1.

....

....

....

....

.... [2]

(c) The outside surface of the cup can be either black or white and can be either dull or shiny.

(i) State a suitable choice of colour and texture for the outside surface of the cup.

.... [1]

(ii) Explain your answer to **(c)(i)**.

....

.... [1]

6. Two flexible iron strips, WX and YZ, are placed close to each other inside a solenoid (long coil). The end W of WX and the end Z of YZ are held firmly in position.

Fig. 6.1 shows that the solenoid is connected to a d.c. power supply and a switch.

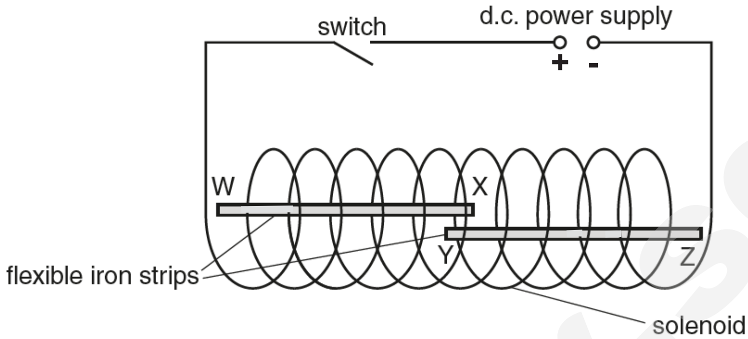


Fig. 6.1

The switch is closed and there is an electric current in the solenoid.

(a) **(i)** On Fig. 6.1, mark with an arrow the direction of current flowing in the solenoid at the turns near W and Z. [1]

(ii) State the type of magnetic pole produced at W, X, Y and Z.

1. W ....-pole
2. X ....-pole
3. Y ....-pole
4. Z ....-pole

[2]

(b) State and explain what happens to X and Y because the flexible iron strips are magnetised.

....

....

....

.... [1]

7. **(a)** Measurements of the current and the potential difference (p.d.) across a metal wire A are made.

Fig. 7.1 shows a graph of the current against the p.d. for the wire.

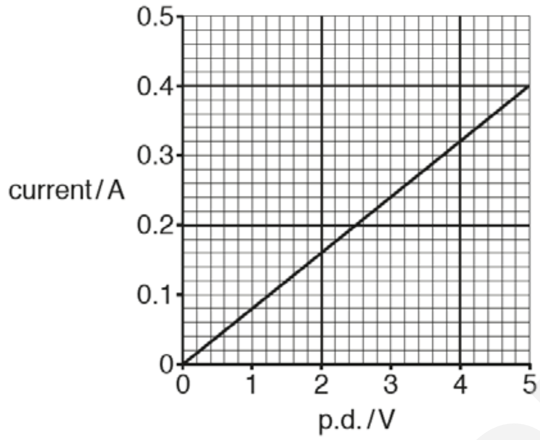


Fig. 7.1

(i) State and explain whether wire A is an ohmic or non-ohmic component.

....

.... [1]

(ii) State how the graph shows that the temperature of the wire does not change in the experiment.

....

.... [1]

(iii) Determine the resistance of the wire A.

resistance of wire A = ... Ω [2]

(b) Another wire B of the same material has the same length as the original wire A but has only half the cross-sectional area.

(i) Determine the resistance of the new wire B.

resistance of wire B = ... Ω [1]

(ii) On Fig. 7.1, draw the graph for the new wire B. [1]

[Turn Over

8. A student sets up the circuit shown in Fig. 8.1.

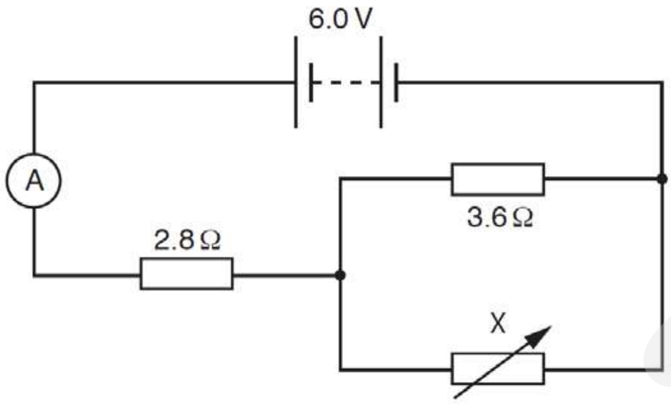


Fig. 8.1

The electromotive force (e.m.f.) of the battery is 6.0 V.

(a) The resistance of the variable resistor X is set to 1.8 Ω.

Determine

(i) the total resistance of the circuit,

total resistance = ... Ω [2]

(ii) the current measured by the ammeter.

current = ... A [2]

(b) **(i)** State what is meant by the potential difference (p.d.) across a component in a circuit.

....

....

.... [1]

(ii) The resistance of X is increased.

State what happens, if any, to the p.d. across the 2.8 Ω resistor. Explain your answer.

....

....

....

.... [2]

Section B [20 MARKS]
Answer any two questions in the spaces provided.

9. Fig. 9.1 shows a satellite in orbit around the Earth.

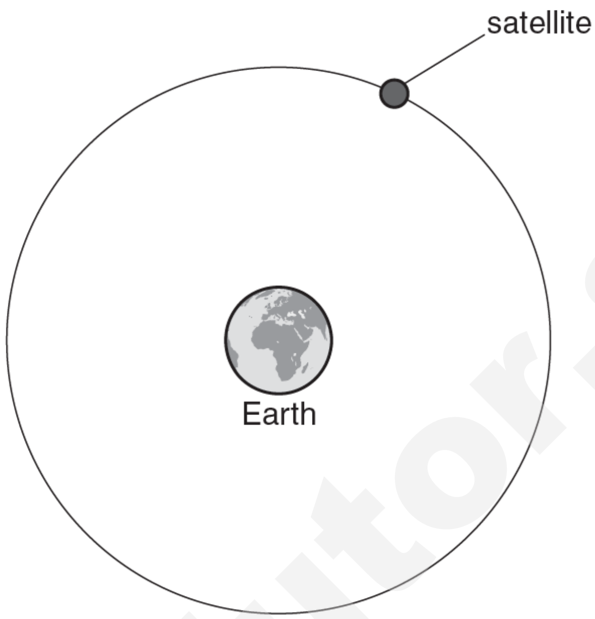


Fig. 9.1 (not to scale)

The satellite travels at a constant speed in a circular orbit.

(a) **(i)** State what is meant by velocity.

....

....

.... [1]

(ii) Explain why the velocity changes.

....

....

.... [1]

(iii) Indicate the direction of the force acting on the satellite by drawing an arrow to represent it on Fig. 9.1. [1]

(b) The satellite is placed into orbit by a rocket.

Fig. 9.2 shows the rocket as it takes off.

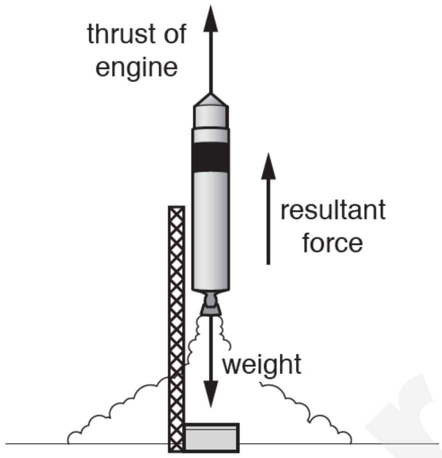


Fig. 9.2

The rocket and fuel have a total mass of 40 000 kg and a total weight of 400 000 N. The resultant force acting upwards on the rocket is 50 000 N.

(i) Calculate the thrust produced by the rocket engine.

thrust = …………………………..… [2]

(ii) Calculate the acceleration of the rocket.

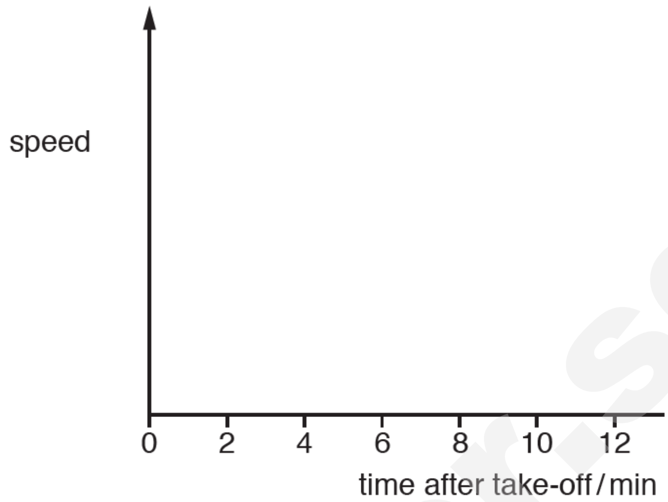
acceleration = …………………………… [2]

(iii) The table in Fig. 9.3 describes the motion of the rocket in the first 12 minutes.

time / minutes	motion of rocket
0 to 4	uniform acceleration
4 to 6	increasing acceleration
6 to 10	decreasing acceleration
10 to 12	constant speed

Fig. 9.3

On Fig. 9.4, sketch the speed-time graph of the rocket for the first 12 minutes.
You do not need to give values for the speed.



[3]

Fig. 9.4

10. Fig. 10.1 shows the brake pedal of a car which is connected to a master cylinder.

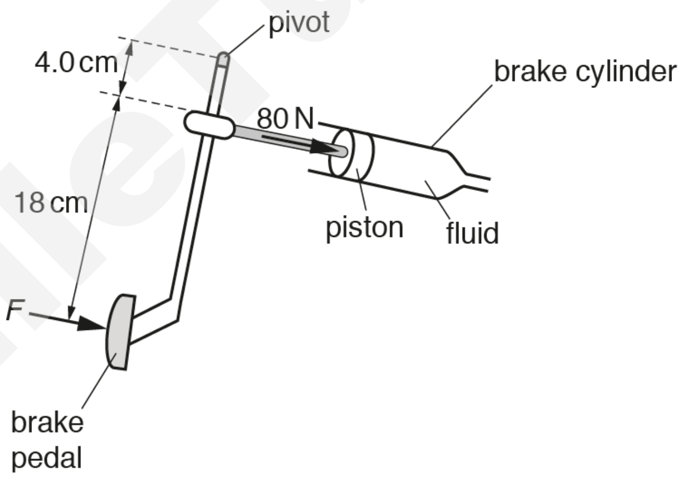


Fig. 10.1 (not to scale)

The brake is pressed with a force *F*. This force produces a moment about the pivot.

Pressing the brake causes a force of 80 N to act on the fluid in the brake cylinder.

(a) **(i)** State what is meant by the *moment of a force* about the pivot.

....

....

....

.... [1]

(ii) The magnitude of the force exerted on the piston by the fluid is 80 N and is acting in the opposite direction as indicated in Fig. 10.1.

Explain why this claim is correct.

....

....

.... [1]

(b) **(i)** Calculate the moment of the force acting on the piston.

moment of the force = ... [2]

(ii) Calculate the value of *F*.

force *F* = ... [2]

(iii) The cross-sectional area of the piston is 0.0012 m^2.

Calculate the pressure exerted by the brake piston on the fluid.

pressure = ... [2]

(c) Fig. 10.2 shows how the master cylinder (in Fig. 10.1) is connected to the car's braking system. The brake drum rotates with the wheel of the car.
.

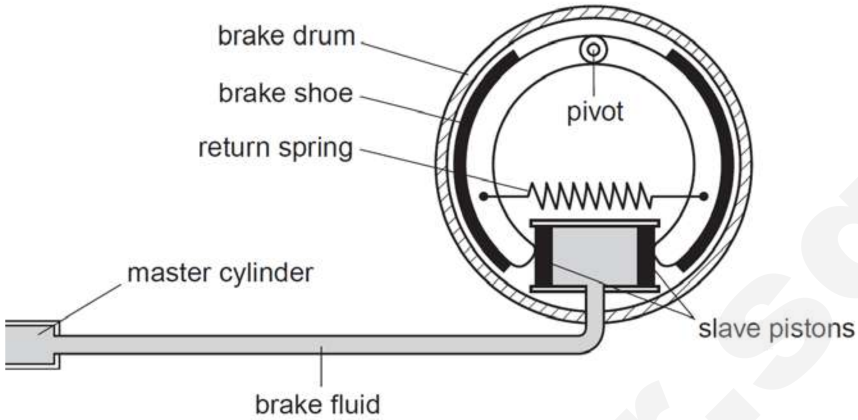


Fig. 10.2

The total cross-sectional area of the two slave pistons is 0.0040 m^2.

Calculate the total force exerted on the slave pistons by the brake fluid.

total force = …………………………… [2]

11. **(a)** Fig. 11.1 shows a vertical solenoid (long coil) with an iron core held in a wooden clamp above a laboratory bench.
The solenoid is connected in series with a battery, a switch S, an ammeter and a variable resistor.
There is a voltmeter in parallel with the solenoid.

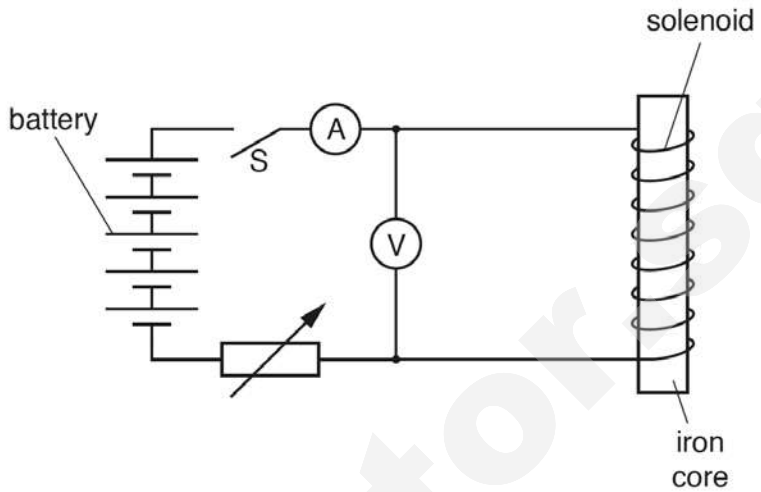


Fig. 11.1

The battery consists of five 1.5 V cells in series.

When the switch S is closed a reading of 4.0 A is shown in the ammeter.

(i) State the size of the electromotive force (e.m.f.) of the battery.

electromotive force (e.m.f.) of the battery = ... [1]

(ii) Calculate the total resistance of the circuit.

total resistance = ... [2]

(iii) The reading on the voltmeter is 6.5 V.

Calculate the power dissipated in the solenoid.

power dissipated = ... [2]

[Turn Over

(iv) The solenoid is made of copper and the student notices that, as time passes, the solenoid becomes extremely warm.

State and explain the effect of this temperature increase on the ammeter reading.

....

....

....

.... [2]

(b) The current in the solenoid magnetises the iron core. When a iron nail is brought very near (but not touching) the magnetised core, the iron nail jumps up towards it.

(i) Explain the changes in the iron nail that causes it to be attracted to the magnetised core.

....

....

....

....

....

.... [2]

(ii) The switch S is opened.

State and explain whether the iron nail remains in contact with the iron core.

....

....

....

.... [1]

End of Paper

Candidate Name	Class	Register Number

CHANGKAT CHANGI SECONDARY SCHOOL

Preliminary Examination 2019

Subject	**:**	**Science (Physics / Chemistry)**
Paper No	**:**	**5076/01**
Level	**:**	**Secondary 4 Exp/5 Normal Academic**
Date	**:**	**4th September 2019**
Duration	**:**	**1 Hour**
Setter	**:**	**Mr Hong KK / Ms Ling GK**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, class and register number in the spaces provided at the top of this page.
Do not use staples, paper clips, glue or correction fluid.

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 OTAS 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.

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

For Examiners' Use	Marks
Paper 1	/ 40
Personal Target	Actual Grade
Parent's / Guardian's Signature	

This Question Paper consists of **9** printed pages.

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

Candidate Name	Class	Register Number

CHANGKAT CHANGI SECONDARY SCHOOL

Preliminary Examination 2019

Subject	**:**	**Science (Physics)**
Paper No	**:**	**5076/02**
Level	**:**	**Secondary 4 Express/5 Normal Academic**
Date	**:**	**29th August 2019**
Duration	**:**	**1 hour 15 minutes**
Setter	**:**	**Mr Hong K K**

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For Examiners' Use	**Marks**
Section A	/ 45
Section B	
	/ 10
	/ 10
Total	/ 65
Personal Target	Actual Grade
Parent's / Guardian's signature	

This Question Paper consists of **18** printed pages.

[Turn Over

Section A [45 marks]
Answer all the questions in the spaces provided.

1. A girl of mass 35 kg, on a bicycle, accelerates from rest and travels down a slope in a straight line. The girl does not use the pedals.
Fig. 1.1 shows that the gradient of the slope is constant.

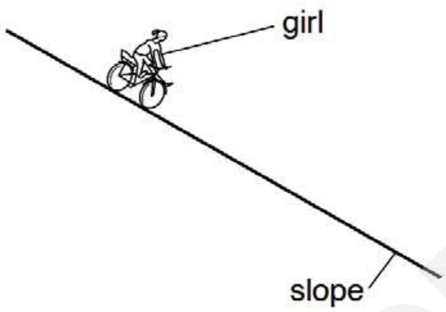


Fig. 1.1

(a) Calculate the resultant force on the girl when she is accelerating at 2.6 m/s^2.

F = ma = 35 x 2.6 [1]

= 91 N [1]

resultant force = ... N [2]

(b) At first, her acceleration is constant. At time t_1, her acceleration starts to decrease gradually until she is travelling at a constant speed in a straight line.

On Fig. 1.2, sketch a speed-time graph for the girl from when she starts moving until she is travelling at a constant speed. [3]

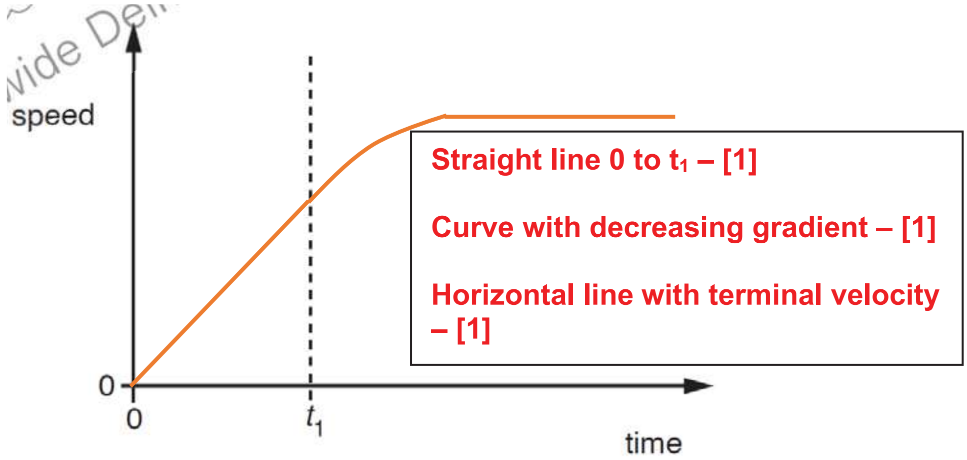


Fig. 1.2

2. Fig. 2.1 shows the dam and reservoir of a hydroelectric power station.

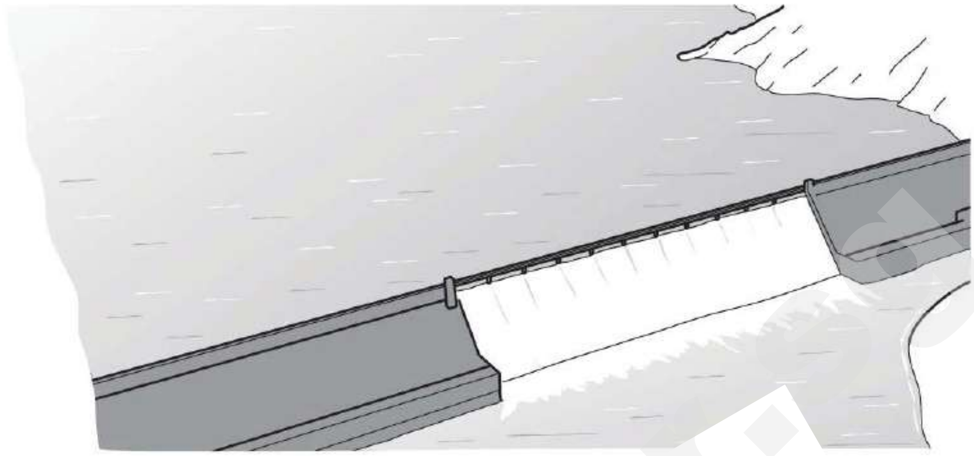


Fig. 2.1

A hydroelectric power station uses a renewable energy source.

(a) The water surface in the reservoir of the hydroelectric power station is at a vertical height of 170 m above the turbines.
In one hour, 1.6×10^{10} kg of water flows from the reservoir through the turbines.
The gravitational field strength g is 10 N/kg.

Calculate the loss in gravitational potential energy of the water in one hour.

gpe = mgh = $(1.6 \times 10^{10})(10)(170)$ [1]

$= 2.72 \times 10^{13}$ J [1 - 2 or 3 sf]

loss in gravitational potential energy =.. [2]

(b) When the power station operates at full capacity, the electrical power output is 6.8×10^9 W.

Calculate the electrical energy output in one hour when the power station operates at full capacity.

Energy, E = P x t = (6.8×10^9) (60 x 60) [1]

$= 2.45 \times 10^{13}$ J [1 - 2 or 3 sf]

electrical energy output =.. [2]

(c) Calculate the total amount of other forms of energy produced in one hour.

loss in gpe = electrical energy + other forms of energy
other forms of energy = $2.72 \times 10^{13} - 2.45 \times 10^{13}$ J [1]

= 2.72×10^{12} J [1 - 2 or 3 sf]

other forms of energy =.................................... J [2]

(d) Calculate the efficiency of the power station operating at full capacity, given that

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100\% .$$

Efficiency = $(2.45 \times 10^{13}) / (2.72 \times 10^{13}) \times 100\%$

= 90% [1]

efficiency =....................................... [1]

3. A lamp is positioned at the bottom of a small pool of water.
The critical angle for light passing from water into air is 49°.

(a) Explain what is meant by the term *critical angle*.

Critical angle is the angle of incidence for a ray travelling from an optically denser medium [1] to a less medium and the angle of refraction is 90°. [1]

....

....

.... [2]

(b) The lamp sends rays of light towards the surface of the pool.
Fig. 3.1 shows three rays of light that are at 30°, 60° and 90° to the horizontal.

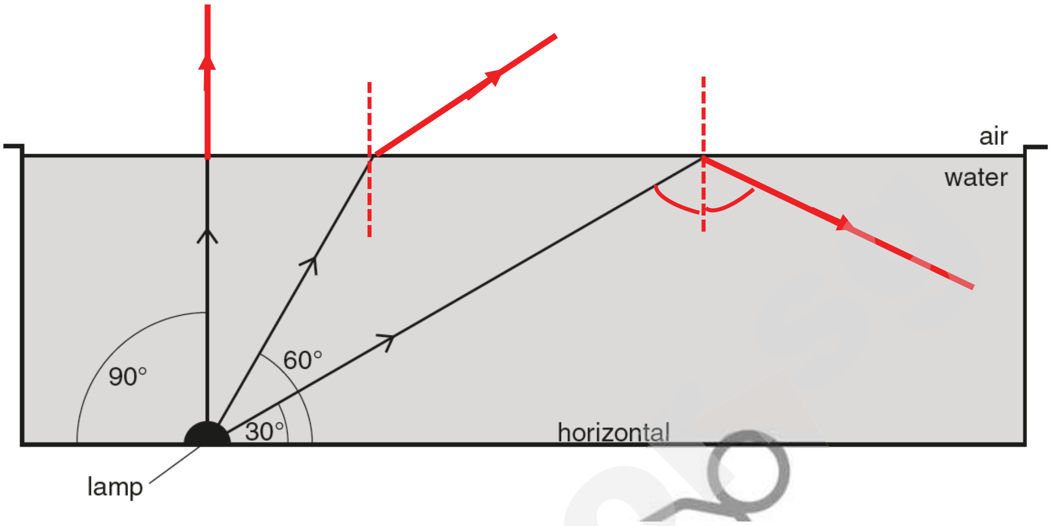


Fig. 3.1

On Fig. 3.1, draw the path taken by each of the three rays after they strike the surface of the water. [3]

4. Fig. 4.1 shows a girl standing at a distance in front of a large building.

Fig. 4.1

The girl uses a sound generator and a loudspeaker to send a short pulse of sound towards the building. The sound has a frequency of 3700 Hz.

A short time later, the girl hears an echo.

(a) Besides the hard flat surface of the building, state another important condition for the girl to be able to hear the echo clearly.

Distance of building must be at least 200 m [1] so the will be heard after 1.3 seconds later.

.... [1]

(b) The pitch of the echo is the same as that of the original sound but the echo is not as loud.
State the changes, if any, on

(i) the amplitude of the echo,

Smaller [1]

[1]

(ii) the frequency of the echo.

Unchanged [1]

[1]

(c) The speed of sound in air is 330 m/s.

Calculate the wavelength of this sound.

$\lambda = v / f = 330 / 3700$ [1]

$= 0.089$ m [1]

wavelength = ...m [2]

5. Fig. 5.1 shows a metal coffee cup on a metal warming plate.

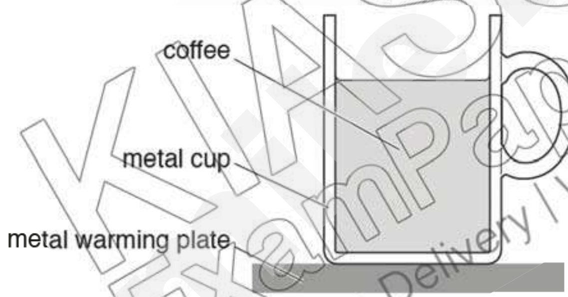


Fig. 5.1

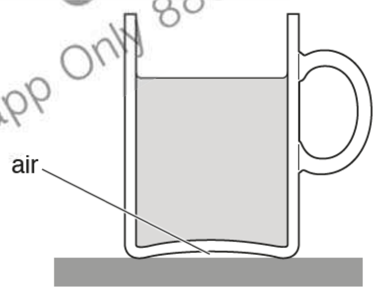


Fig. 5.2

There is a small electrical heater inside the warming plate that keeps the plate hotter than the coffee.

(a) Heat is transferred through the metal by conduction to the liquid.

Describe how heat is then transferred to all the liquid in the cup.

Liquid at the bottom of the cup is heated up and becomes less dense and rises. [1]

Colder liquid at the top is denser and sinks and a convection current is set up. [1]

....

....

....

.... [2]

(b) A cup of a different shape is placed on the same heater, as shown in Fig. 5.2. The two cups are made of the same metal and contain the same amount of coffee.

Explain why the coffee in the cup in Fig. 5.2 is not kept as warm as the coffee in the cup in Fig. 5.1.

For cup in Fig. 5.2, there is an air gap between the warming plate and the bottom of the cup. [1]

Air is a very poor conductor and reduce the heat transfer by conduction to cup. [1]

....

.... [2]

(c) The outside surface of the cup can be either black or white and can be either dull or shiny.

(i) State a suitable choice of colour and texture for the outside surface of the cup.

White and smooth surface. [1] .. [1]

(ii) Explain your answer to **(c)(i)**.

White and smooth surface is a poor emitter of heat so reduces the heat loss from the cup. [1]

.... [1]

6. Two flexible iron strips, WX and YZ, are placed close to each other inside a solenoid (long coil). The end W of WX and the end Z of YZ are held firmly in position.

Fig. 6.1 shows that the solenoid is connected to a d.c. power supply and a switch.

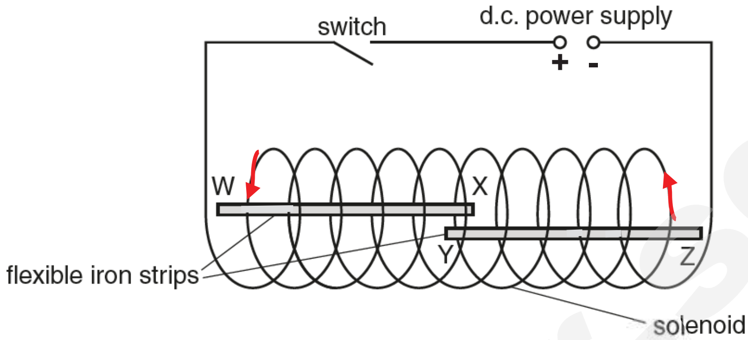


Fig. 6.1

The switch is closed and there is an electric current in the solenoid.

(a) **(i)** On Fig. 6.1, mark with an arrow the direction of current flowing in the solenoid at the turns near W and Z. See above diagram - arrows. [1] [1]

(ii) State the type of magnetic pole produced at W, X, Y and Z.

1. W ......North.....-pole
2. X ......South.....-pole
3. Y ......North.....-pole
4. Z ......South.....-pole

[2]

(b) State and explain what happens to X and Y because the flexible iron strips are magnetised.

As X and Y are unlike poles, they will attract. [1]

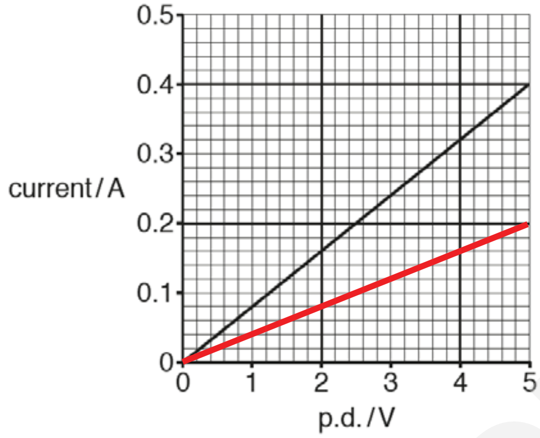
....

....

.... [1]

7. **(a)** Measurements of the current and the potential difference (p.d.) across a metal wire A are made.

Fig. 7.1 shows a graph of the current against the p.d. for the wire.



(b)(ii) straight line with as shown. [1]

Fig. 7.1

(i) State and explain whether wire A is an ohmic or non-ohmic component.

Wire A is ohmic as the graph is a straight line that passes through the origin OR the current is directly proportional to the p.d. [1]

.... [1]

(ii) State how the graph shows that the temperature of the wire does not change in the experiment.

Graph shows a constant gradient and thus a constant resistance so temperature is constant. [1]

.... [1]

(iii) Determine the resistance of the wire A.

R = 1/gradient or V/I = 5/0.4 [1]

= 12.5 Ω. [1]

resistance of wire A = ... Ω [2]

(b) Another wire B of the same material has the same length as the original wire A but has only half the cross-sectional area.

(i) Determine the resistance of the new wire B.

As cross-sectional area is halved, its resistance is doubled, R = 2 x 12.5 = 25 Ω. [1]

resistance of wire B = ... Ω [1]

(ii) On Fig. 7.1, draw the graph for the new wire B. [1]

[Turn Over

8. A student sets up the circuit shown in Fig. 8.1.

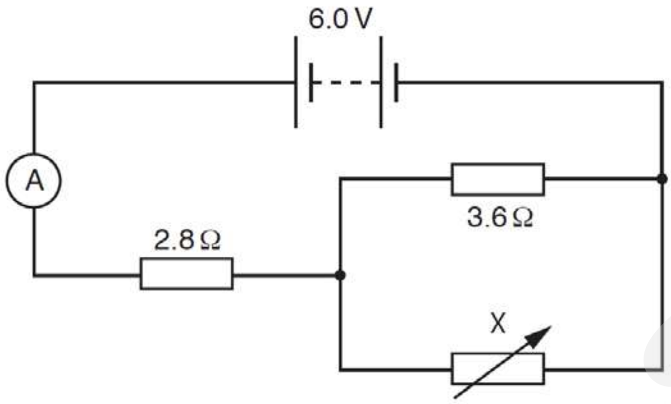


Fig. 8.1

The electromotive force (e.m.f.) of the battery is 6.0 V.

(a) The resistance of the variable resistor X is set to 1.8 Ω.

Determine

(i) the total resistance of the circuit,

$1/r = 1/3.6 + 1/1.8 = 3/3.6$
$r = 1.2\ \Omega$ [1]

$R = 1.2 + 2.8 = 4.0\ \Omega$. [1]

total resistance = ... Ω [2]

(ii) the current measured by the ammeter.

$I = V/R = 6 / 4$ [1]

$= 1.5$ A [1]

current = ... A [2]

(b) **(i)** State what is meant by the potential difference (p.d.) across a component in a circuit.

Potential difference is the work done is driving a unit charge across the component. [1]

.... [1]

(ii) The resistance of X is increased.

State what happens, if any, to the p.d. across the 2.8 Ω resistor. Explain your answer.

When X increases, the resistance of the two resistors in parallel increases. [1]

Current in the circuit decreases and causes the p.d. across the 2.8 Ω to decrease. [1]

[2]

Section B [20 MARKS]
Answer any two questions in the spaces provided.

9. Fig. 9.1 shows a satellite in orbit around the Earth.

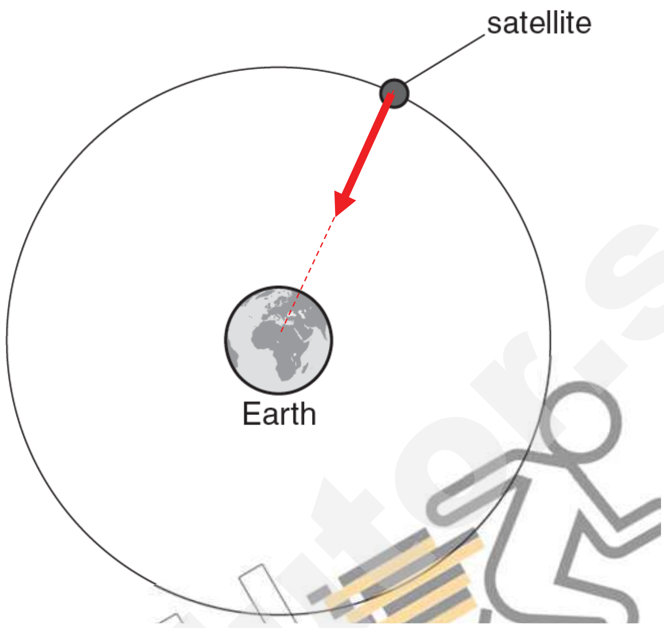


Fig. 9.1 (not to scale)

The satellite travels at a constant speed in a circular orbit.

(a) **(i)** State what is meant by velocity.

Velocity is the rate of change of speed in a specified direction
OR
Velocity is the rate of change of displacement. [1]

.... [1]

(ii) Explain why the velocity changes.

As the direction of motion of the satellite is constantly changing, its velocity changes [1] as a constant velocity requires both the speed and direction to be constant.

.... [1]

(iii) Indicate the direction of the force acting on the satellite by drawing an arrow to represent it on Fig. 9.1. [1]

Direction of force is towards the centre of the Earth [1].

(b) The satellite is placed into orbit by a rocket.

Fig. 9.2 shows the rocket as it takes off.

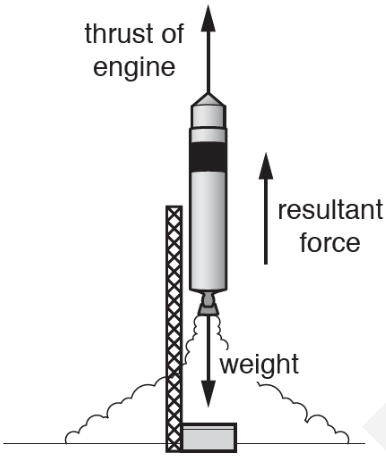


Fig. 9.2

The rocket and fuel have a total mass of 40 000 kg and a total weight of 400 000 N.
The resultant force acting upwards on the rocket is 50 000 N.

(i) Calculate the thrust produced by the rocket engine.

Resultant force, F = thrust – weight

50 000 = T - 400000 [1]

➔ T = 450 000 N [1]

thrust = ... N [2]

(ii) Calculate the acceleration of the rocket.

Resultant force, F = ma

a = F/m = 50000 / 40000 [1]

= 1.25 m/s^2 [1]

acceleration = ... m/s^2 [2]

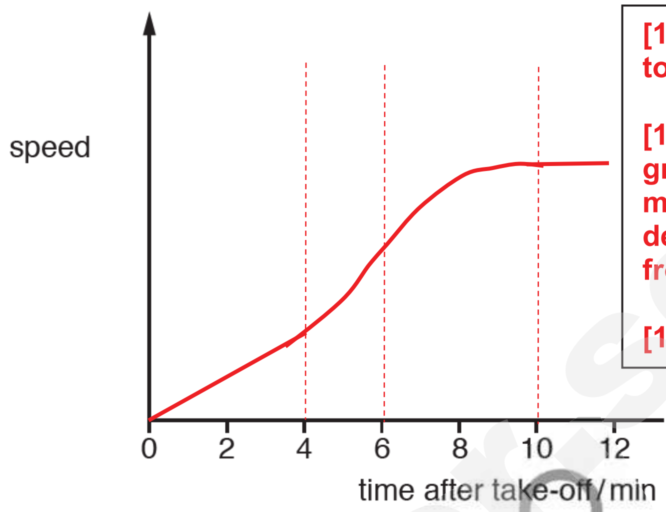
(iii) The table in Fig. 9.3 describes the motion of the rocket in the first 12 minutes.

time / minutes	**motion of rocket**
0 to 4	uniform acceleration
4 to 6	increasing acceleration
6 to 10	decreasing acceleration
10 to 12	constant speed

Fig. 9.3

[Turn Over

On Fig. 9.4, sketch the speed-time graph of the rocket for the first 12 minutes. You do not need to give values for the speed.



[1] – str line from 0 to 4 min;

[1] – increasing gradient from 4 to 6 min & then decreasing gradient from 6 to 10 min;

[1] – horizontal line

[3]

Fig. 9.4

10. Fig. 10.1 shows the brake pedal of a car which is connected to a master cylinder.

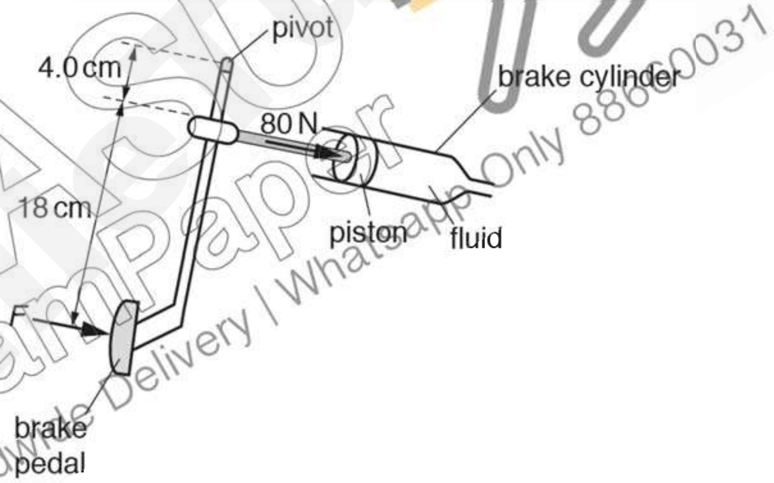


Fig. 10.1 (not to scale)

The brake is pressed with a force *F*. This force produces a moment about the pivot.

Pressing the brake causes a force of 80 N to act on the fluid in the brake cylinder.

(a) **(i)** State what is meant by the *moment of a force* about the pivot.

The moment of the force is turning effect produced
OR
The moment of the force is given by the product of the force and the perpendicular distance from the pivot. [1]

[1]

(ii) The magnitude of the force exerted on the piston by the fluid is 80 N and is acting in the opposite direction as indicated in Fig. 10.1.

Explain why this claim is correct.

Based on Newton's third law [1], which states that there is an equal but opposite force acting on the two bodies – the piston and the fluid.

.... [1]

(b) (i) Calculate the moment of the force acting on the piston.

moment = F x d = 80 N x 4 cm OR 80 N x 0.04 m [1]

= 320 N cm OR 3.20 N m [1]

moment of the force = ... [2]

(ii) Calculate the value of *F*.

***F* x 22 cm = 80 N x 4 cm OR *F* x 0.22m = 80 N x 0.04 m [1]**

***F* = 14.5 N [1]**

force *F* = ... [2]

(iii) The cross-sectional area of the piston is 0.0012 m^2.

Calculate the pressure exerted by the brake piston on the fluid.

P = F/A = 80 / 0.0012 [1]

= 67 000 Pa [1]

pressure = ... [2]

[Turn Over

(c) Fig. 10.2 shows how the master cylinder (in Fig. 10.1) is connected to the car's braking system. The brake drum rotates with the wheel of the car.

.

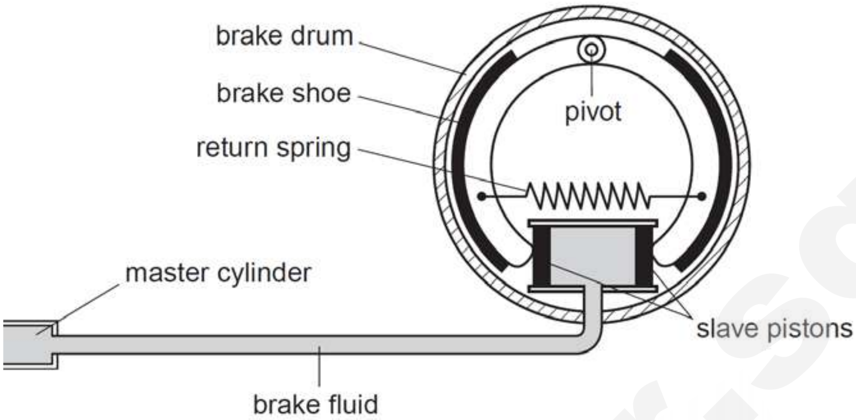


Fig. 10.2

The total cross-sectional area of the two slave pistons is 0.0040 m^2.

Calculate the total force exerted on the slave pistons by the brake fluid.

F / 0.0040 = 80 / 0.0012 [1]

F = 267 N [1]

total force = ... [2]

11. **(a)** Fig. 11.1 shows a vertical solenoid (long coil) with an iron core held in a wooden clamp above a laboratory bench.
The solenoid is connected in series with a battery, a switch S, an ammeter and a variable resistor.
There is a voltmeter in parallel with the solenoid.

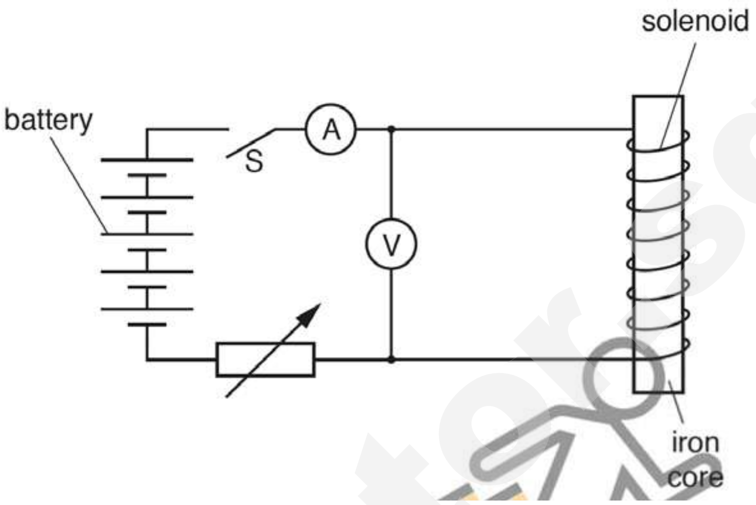


Fig. 11.1

The battery consists of five 1.5 V cells in series.

When the switch S is closed a reading of 4.0 A is shown in the ammeter.

(i) State the size of the electromotive force (e.m.f.) of the battery.

electromotive force (e.m.f.) of the battery = **5 x 1.5 = 7.5 V [1]** [1]

(ii) Calculate the total resistance of the circuit.

R = V/I = 7.5 / 4.0 [1]

= 1.88 Ω [1]

total resistance = ... [2]

(iii) The reading on the voltmeter is 6.5 V.

Calculate the power dissipated in the solenoid.

P = V I = 6.5 x 4.0 [1]

= 26 W [1]

power dissipated = ... [2]

[Turn Over

(iv) The solenoid is made of copper and the student notices that, as time passes, the solenoid becomes extremely warm.

State and explain the effect of this temperature increase on the ammeter reading.

Increased in temperature in wire increases its resistance. [1]

Total resistance increases and the current, thus ammeter reading decrease. [1]

....

....

[2]

(b) The current in the solenoid magnetises the iron core. When a iron nail is brought very near (but not touching) the magnetised core, the iron nail jumps up towards it.

(i) Explain the changes in the iron nail that causes it to be attracted to the magnetised core.

Magnetic induction occurs in the nail with the end of the nail nearer to the core being an unlike pole. [1]

Since unlike poles attract, the nail will be attracted by the core. [1]

....

....

.... [2]

(ii) The switch S is opened.

State and explain whether the iron nail remains in contact with the iron core.

Iron loses all its magnetism and thus the iron nail will not be attracted by the unmagnetised core. [1]

....

.... [1]

End of Paper

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

DAMAI SECONDARY SCHOOL
Preliminary Examination 2019

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS) **5076/02**

Paper 2 **16 September 2019**

Secondary 4 Express/ 5 Normal Academic **1 hour 15 minutes**

Setter: **65 Marks**

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagram, graphs or rough working.
Do not use staples, paper clips, highlighters, 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.

Section B
Answer only **two** questions.

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

This document consists of **18** printed pages including the cover page.

Section A (45 marks)

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

1 Electronic components can be damaged by overheating. To overcome this problem, the component, such as a computer chip, is fitted with a heat sink as shown in Fig. 1.1.

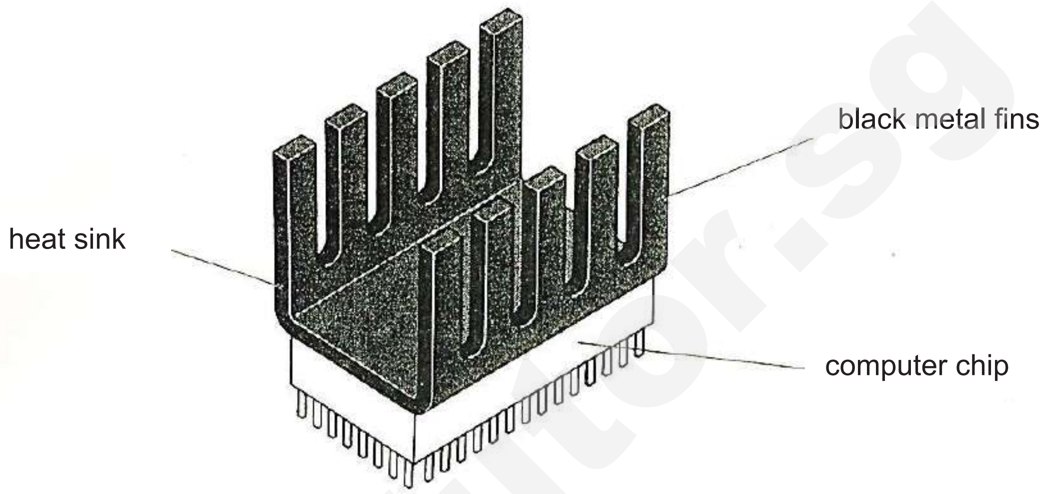


Fig. 1.1

The heat sink keeps the computer chip cool. Explain how the heat sink increases the loss of thermal energy by

(a) conduction ....

....[1]

(b) radiation ....

....

....[1]

2 A heated substance is cooled to the temperature of its surroundings. Fig. 2.1 shows more information about the substance and the process.

initial temperature of heated substance	110 ºC
boiling point of substance	70 ºC
melting point of substance	-10 ºC
temperature of surroundings	- 30 ºC

Fig. 2.1

Describe the changes to

(a) the arrangement of molecules from 110 ºC to – 10 °C,

....

....[1]

(b) the motion of molecules from 80 °C to 60 °C.

....

.... [1]

3 A U-tube is first filled with liquid **A** and then with liquid **B** in the right side of the tube as shown in Fig. 3.1.

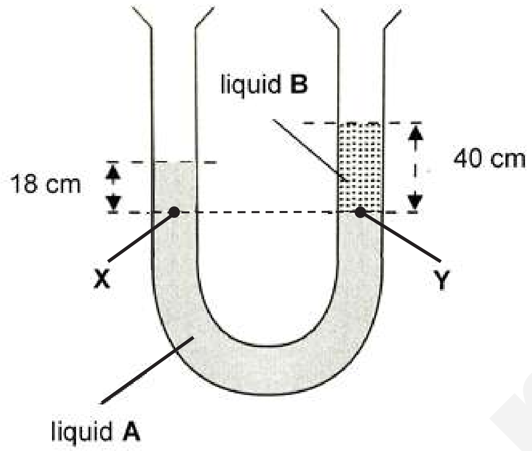


Fig. 3.1

The cross sectional area of the U-tube is 3.0 cm^2. The density of liquid **B** is 1.0 g/cm^3. Point **X** and **Y** are at the same horizontal level.

Take the Earth's gravitational field strength as 10 N/kg.

(a) Calculate the mass of liquid **B** in the U-tube.

mass = ……………….. g [2]

(b) Calculate the pressure at point **Y** due to liquid **B**.

pressure = ………….. N/m^2 [2]

(c) The pressure at point **X** and point **Y** are the same. Explain whether liquid **A** has a larger or smaller density than liquid **B**.

……

…… [1]

4 Fig. 4.1. shows a system for raising a heavy piece of metal at position **W** to a vertical position **X**.

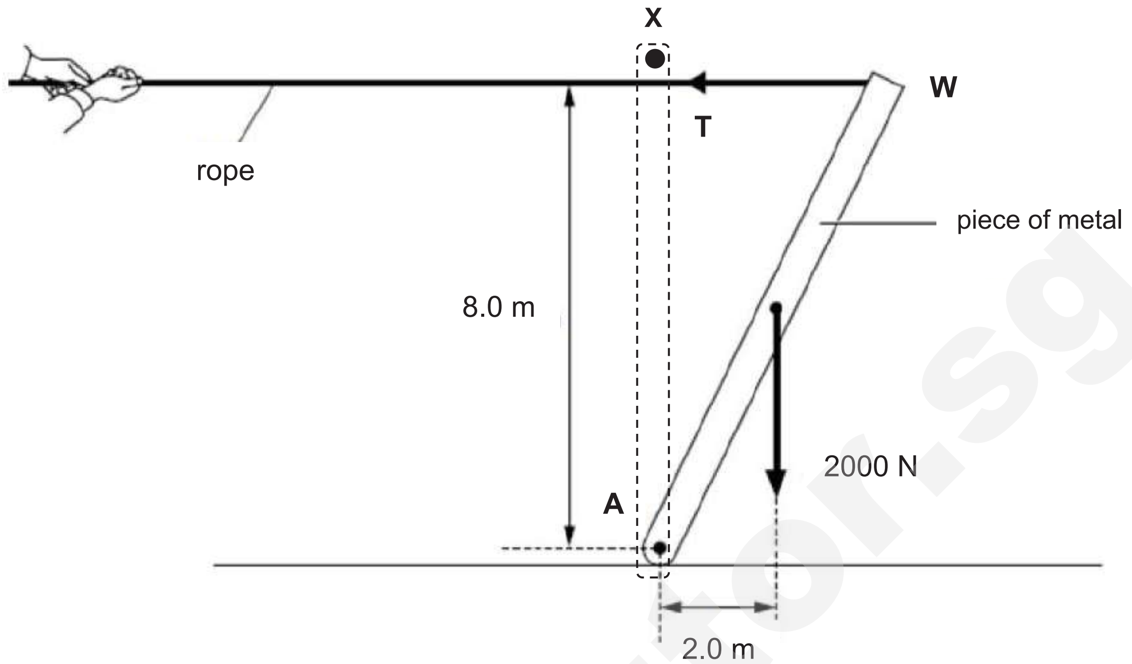


Fig. 4.1

A man pulls on a rope with a horizontal force **T**. The piece of metal has a weight of 2000 N and is freely pivoted at **A**. The system is in equilibrium.

(a) Calculate the moment produced by the metal's weight about pivot **A**.

moment = ……………. Nm [1]

(b) Hence, calculate the horizontal force **T**.

force **T** = ……………….. N [2]

(c) As the piece of metal moves from position **W** to **X** as shown in Fig. 4.1, explain how the moment produced by **T** changes if the magnitude of **T** remains constant.

……...

……………………………………………………………………………………………………….[2]

5 Fig. 5.1 shows a water ride at a theme park. A man sitting on a float is about to go down the water slide. The combined mass of the man and float is 80.0 kg. The Earth's gravitational field strength is 10 N/kg.

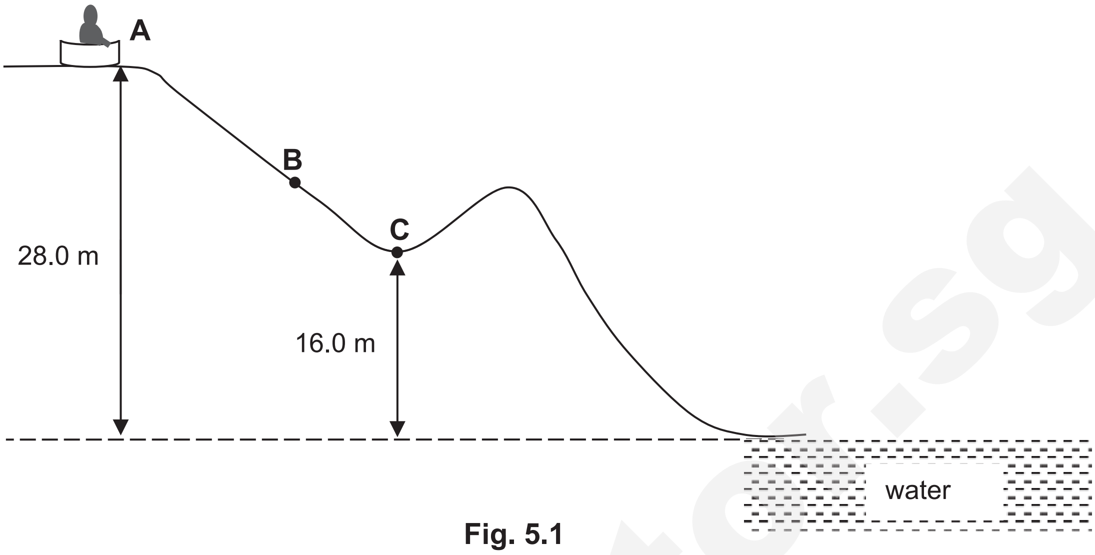


Fig. 5.1

The man slides down from rest from point **A** to point **C**.

(a) Assuming that the slide is frictionless,

(i) calculate the loss in gravitational potential energy,

loss in gravitational potential energy =………………. J [2]

(ii) the speed of the man at point **C**.

speed = …………….. m/s [2]

(b) In reality, friction is present between the slide and the float. The kinetic energy of the man and the float is 8800 J at point **C** and the length of the slide from **A** to **C** is 56.0 m. By considering the work done against friction, calculate the average frictional force acting on the man from **A** to **C**.

frictional force = ………… N [2]

6 Fig. 6.1 shows a ray of light entering an equilateral glass prism at the point of incidence **A**. The refractive index of the glass prism is 1.50.

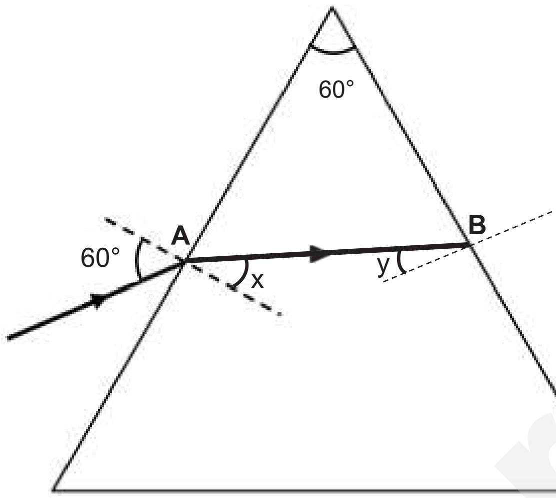


Fig. 6.1

(a) Calculate the angle of refraction at point **A**.

∡x = ………………... º [2]

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

critical angle = ………………. º [1]

(c) Calculate the angle of incidence y at point **B**.

∡y = ……………….. º [1]

(d) On Fig. 6.1, draw the path of the light ray after it hits the surface at **B**. [1]

7 A collector views a postage stamp of height 1.0 cm through a lens. The lens is 1.5 cm from the stamp. The height of the image of the stamp seen is 3.5 cm.

The stamp, the image of the stamp and the position of the lens are drawn to scale are shown in Fig. 7.1.

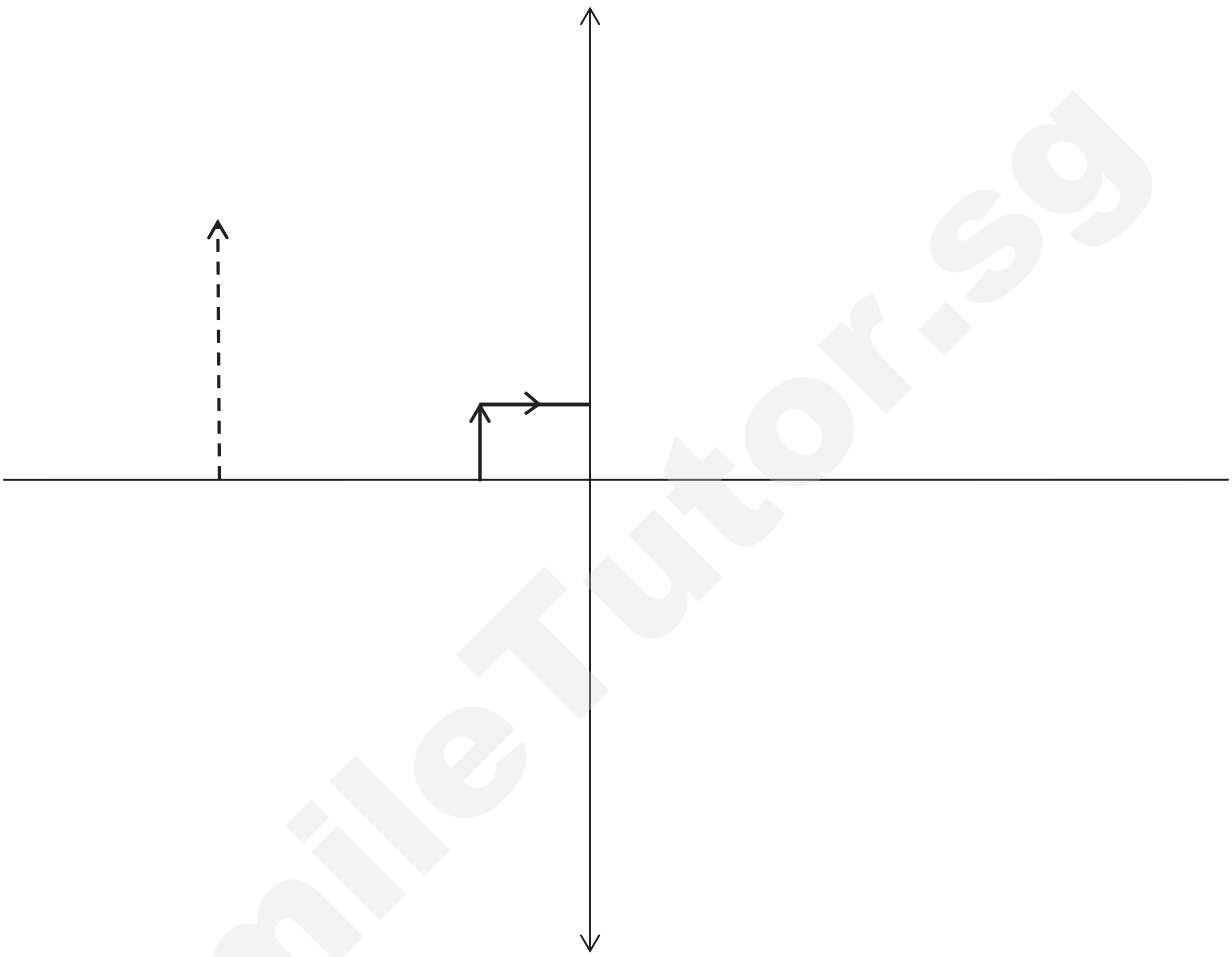


Fig. 7.1

A ray of light from the top of the stamp to the lens is shown in Fig. 7.1.

(a) On Fig. 7.1,

(i) complete the path of the ray from the top of the stamp after it passes through the lens. [1]

(ii) draw another ray from the top of the stamp to show how the image is formed. [1]

(b) From Fig. 7.1, determine the focal length of the lens.

focal length = …………….... cm [1]

8 Fig. 8.1 shows a section (**PQ**) of a sea waves approaching a beach at a speed of 1.5 m/s. Two complete waves hit the sand every 10 s.

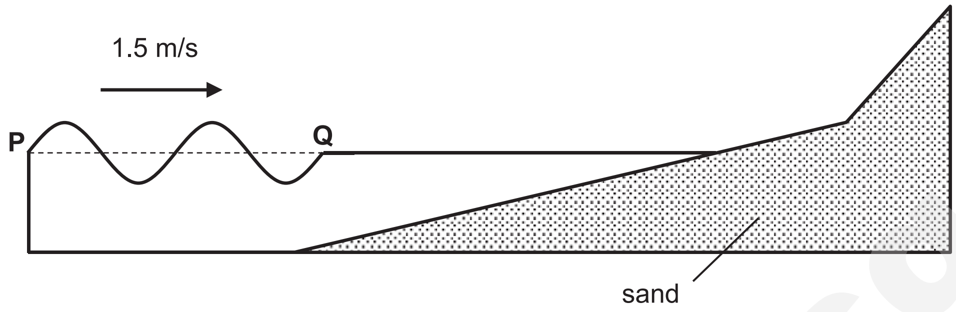


Fig. 8.1

(a) Calculate the wavelength of the wave between **P** and **Q**.

wavelength = ……………….. m [2]

(b) State the direction of movement of a particle at position **P** at the next instant.

………………………………………………………………………………………………… [1]

(c) Explain whether the wave shown in Fig. 8.1 is a transverse wave or a longitudinal wave.

…………………………………………………………………………………………………..

…………………………………………………………………………………………………[2]

9 Electromagnetic (EM) waves have many applications. Complete Fig. 9.1 by identifying the electromagnetic waves used for each of the applications.

application	EM waves
ear thermometer	
Global Positioning System (GPS)	
sterilization of medical equipment	
cancer treatment	

Fig. 9.1

[2]

10 During a thunderstorm, the base of a cloud is negatively charged. Fig.10.1 shows one such cloud above the ground.

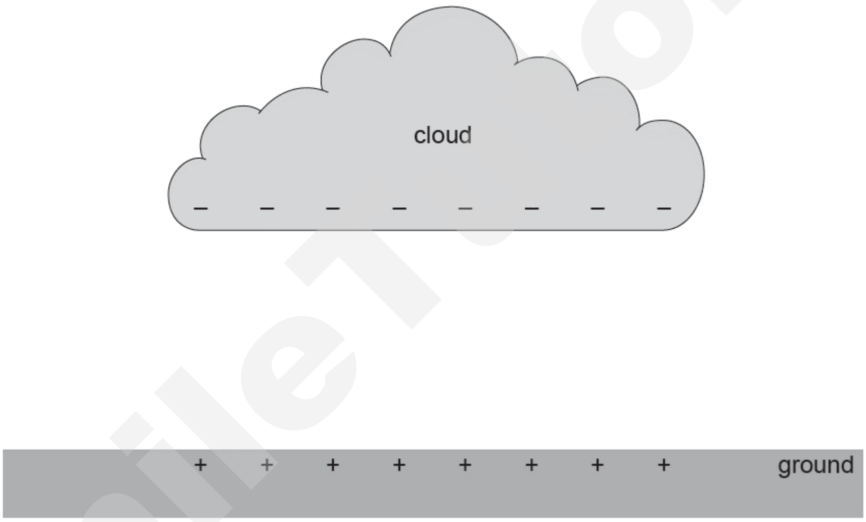


Fig. 10.1

(a) The cloud causes the ground beneath it to become positively charged. Explain, how the ground becomes positively charged.

………...

……..[1]

(b) A lightning strike occurs. Within a short duration of 1.5 ms, a charge of 180 C passes between the cloud and the ground.

Calculate the average current in the lightning strike.

current = ………………... A [2]

11 Fig. 11.1 shows a simplified household circuit. It consists of an air-conditioner and a lighting unit connected to the mains supply of 230 V.

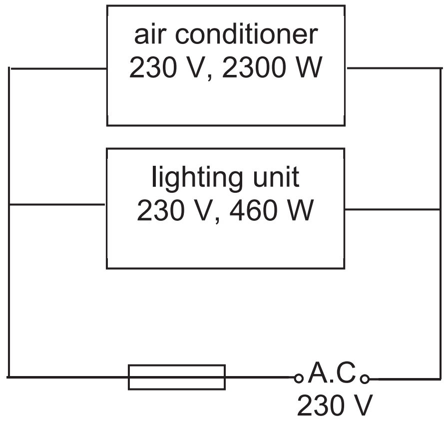


Fig. 11.1

(a) Explain how a fuse works.

………

……….[1]

(b) By using suitable calculations, suggest an appropriate rating for the fuse shown in Fig. 11.1.

fuse rating = ……………….. A [2]

12 Fig. 12.1 shows a light aluminum rod resting between the poles of a magnet. Each end of the aluminum rod rests on a brass strip, which is connected to an electric circuit.

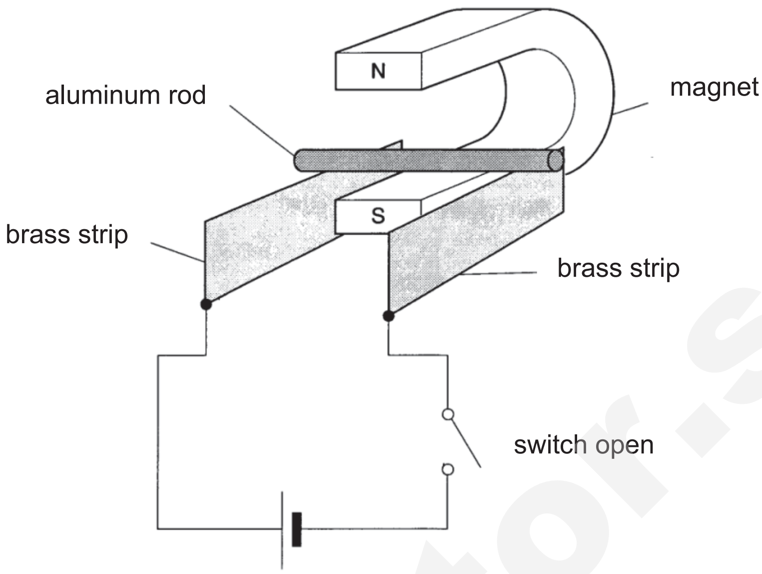


Fig. 12.1

(a) By means of an arrow, indicate on Fig. 12.1 the direction in which the aluminium rod will move when the switch is closed. [1]

(b) Suggest one way to increase the speed of the aluminium rod when it moves.

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [1]

(c) The battery is changed to an a.c. source of frequency of 0.50 Hz. Describe and explain what you will observe about the movement of the aluminium rod.

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

Section B (20 marks)

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

Write your answers in the spaces provided.

13 A motorcycle of mass 180 kg accelerates along a straight section of the racing track from a speed of 40 m/s. Fig. 13.1 shows the speed-time graph of the motorcycle.

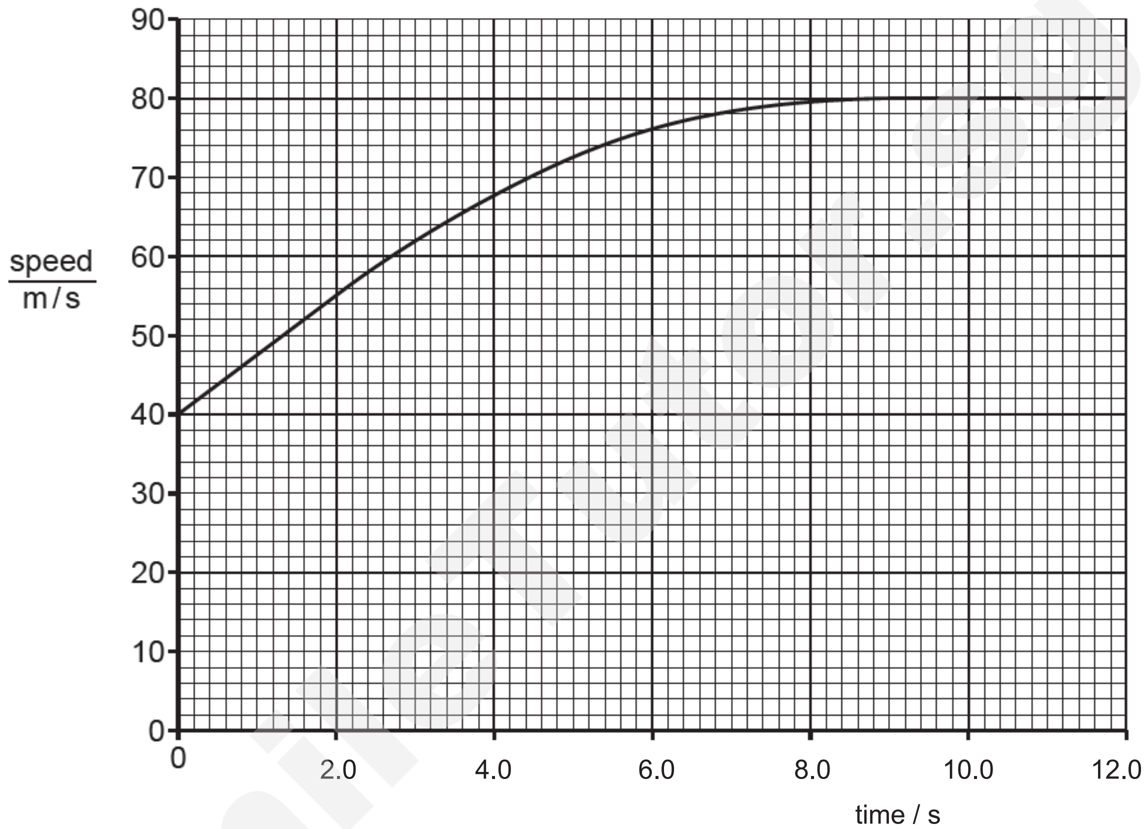


Fig. 13.1

(a) For time = 0 s to 2.0 s, determine

(i) the acceleration of the motorcycle,

acceleration = ………………….. [2]

(ii) the resultant force acting on the motorcycle.

resultant force = …………………. [2]

(b) The driving force acting on the motorcycle remains constant throughout the 12 s spent on the straight section of the track.

(i) Using Fig. 13.1, describe how the acceleration of the motorcycle changes during this time.

………

……… [2]

(ii) Explain, in terms of the forces acting on the motorcycle, why the acceleration changes in this way.

………

………

………

……… [3]

(iii) On Fig. 13.1, sketch a graph to show how its motion may look like if the motorcyclist now travels on a racing track with a rougher surface. [1]

14 A student measures the speed of sound in a laboratory, as shown in Fig. 14.1.

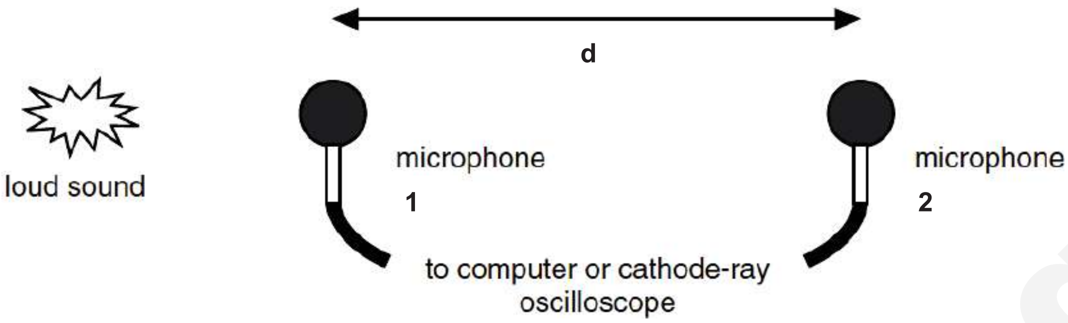


Fig. 14.1

(a) The sound is received by two microphones placed at a distance **d** apart. The time interval t between the sound arriving at the two microphones is recorded.

(i) Explain how sound travels through the air to microphones.

....

....

.... [2]

(ii) Explain why microphone **2** detects a softer sound than microphone **1**.

....

.... [1]

(b) Fig. 14.2 shows the trace observed when the signal from the microphones are fed to the two inputs of a cathode-ray oscilloscope.

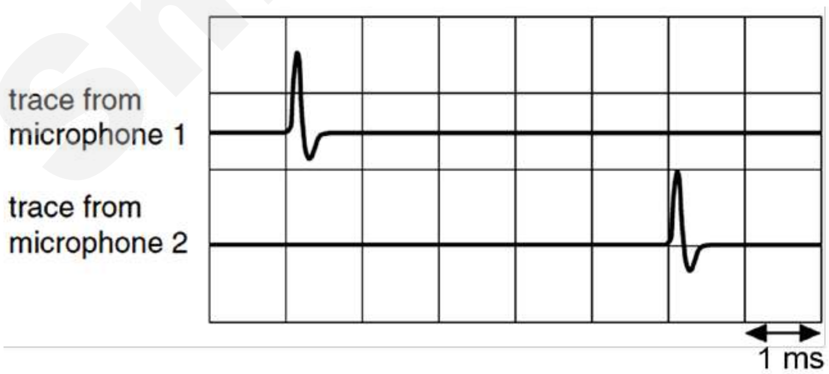


Fig. 14.2

If the speed of sound is 330 m/s, estimate the distance **d** between the two microphones.

distance **d** = ………………….. [3]

(c) Suggest two reasons why it is difficult to measure the speed of sound inside a building using only a stopwatch and a meter rule.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………… [2]

(d) The experiment is repeated under water when the microphones can still detect the sound. State and explain how the trace in Fig. 14.2 differs.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

15 The resistance of component **X** changes with temperature. It is connected in series with a light bulb of resistance 10 Ω and a 1.5 V battery, as shown in Fig. 15.1.

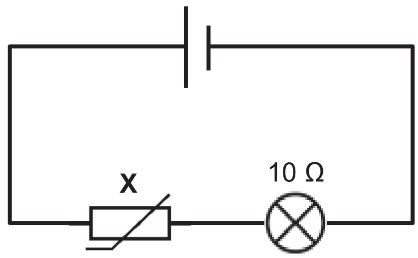


Fig. 15.1

Fig. 15.2 shows the variation in the resistance of **X** with temperature.

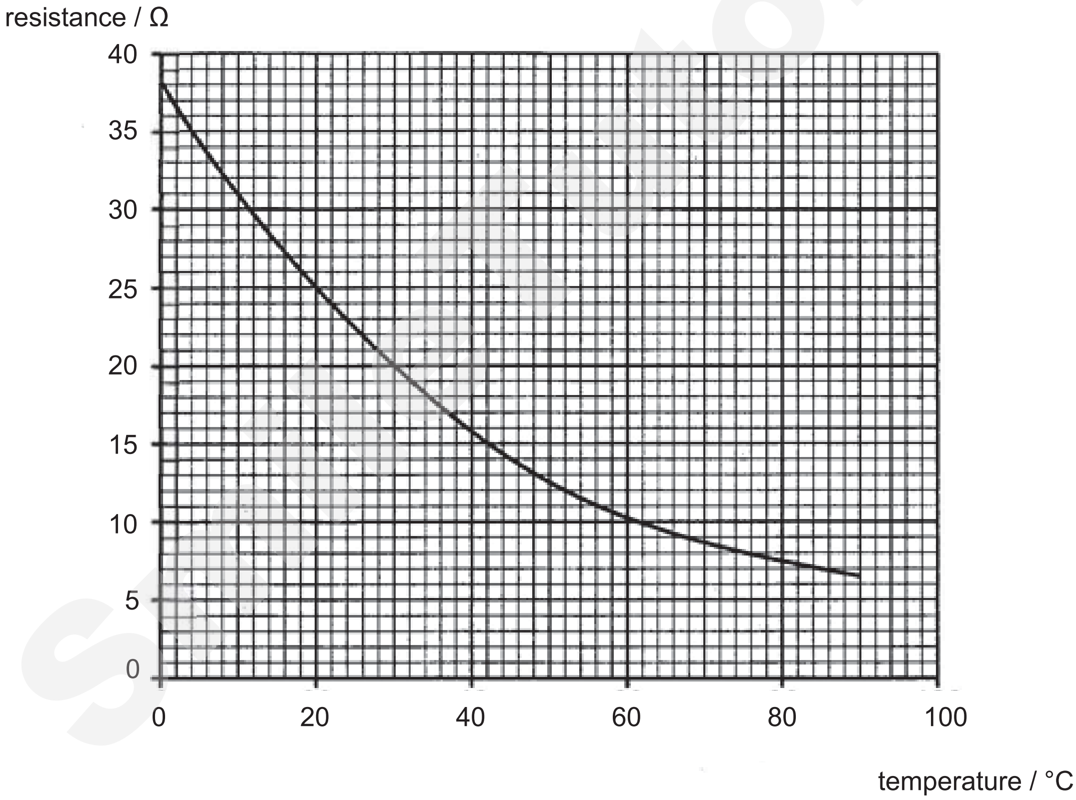


Fig. 15.2

(a) **(i)** Determine the resistance of **X** at 30ºC.

resistance of **X** = ………………….. [1]

(ii) Hence, calculate the potential difference across **X** at 30ºC.

potential difference across **X** = ………………….. [2]

(b) Describe and explain how the current in the circuit changes as temperature increases.

……

……

…… [2]

(c) Component **X** is connected in another circuit as shown in Fig. 15.3.

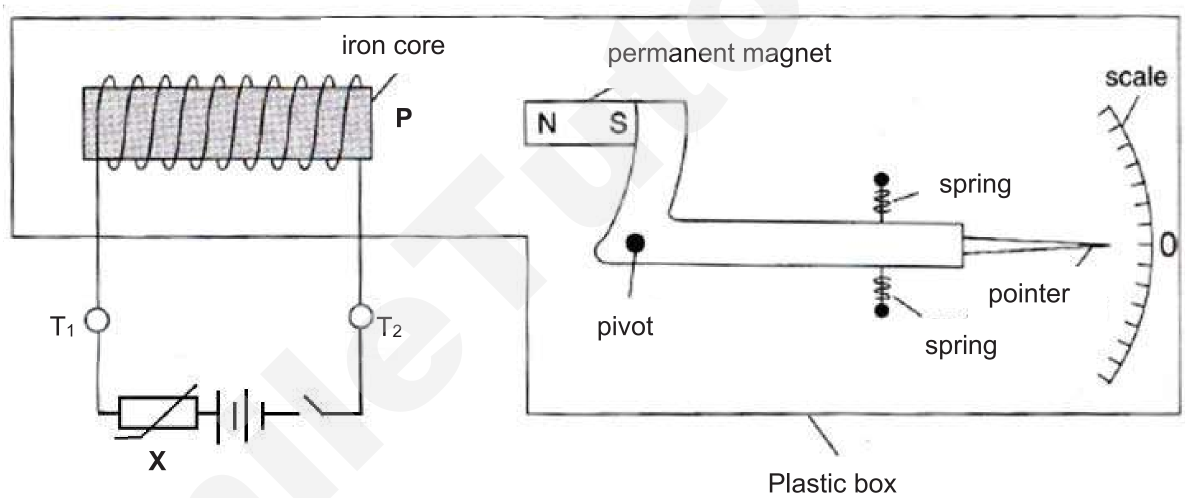


Fig. 15.3

(i) State the polarity of the solenoid induced at end **P** when the switch is closed.

………………………………………………………………………………………………….... [1]

(ii) Hence, state the direction, clockwise or anticlockwise, in which the pointer will turn when the switch is closed.

………………………………………………………………………………………………….... [1]

(iii) When the temperature increases, how does it affect the deflection of the pointer? Explain your answer.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………….... [3]

END OF PAPER

DAMAI SECONDARY SCHOOL
Preliminary Examination 2019

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS) **5076/01**

Paper 1 **17 September 2019**

Secondary 4 Express / 5 Normal (Academic) **30 min**

Setter: **20 Marks**

Additional Materials: Answer Sheet

READ THESE INSTRUCTIONS FIRST

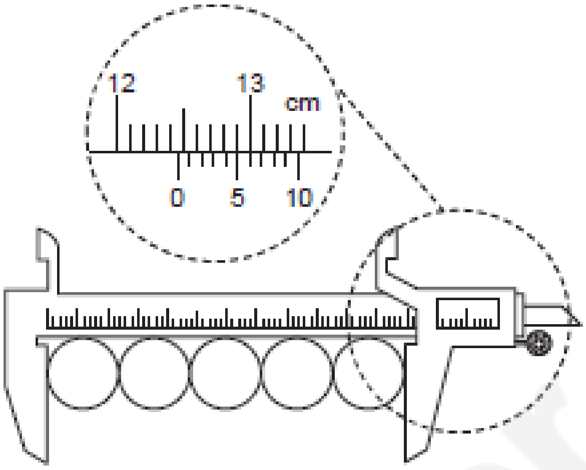
Write your name, index number and class on the Answer Sheet Provided using a 2B-pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

There are **twenty** questions in this booklet. 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 **2B-pencil** on the Answer Sheet.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

This document consists of **10** printed pages including the cover page.

[Turn over

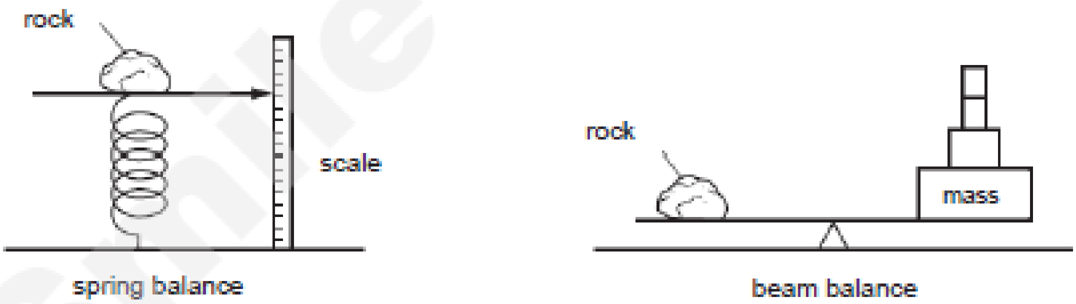
1 A pair of vernier calipers is used to measure the total length of 5 coins placed side by side.



Assuming that there is no zero error, what is the diameter of one coin?

A 2.45 cm **B** 2.49 cm **C** 2.59 cm **D** 2.95 cm

2 A scientist places a rock on a spring balance. She then places the same rock on a beam balance.

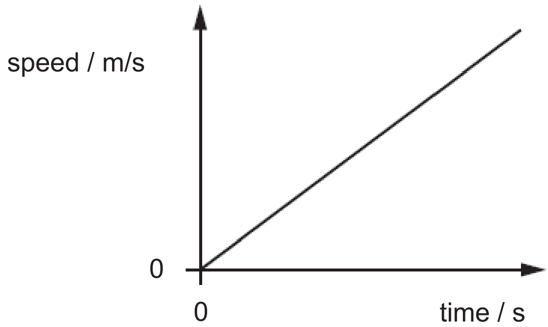


She performs the experiment at the North Pole and at the Equator. At the North pole, gravitational field strength is greater than at the Equator.

How do the readings at the North Pole compare to those at the Equator?

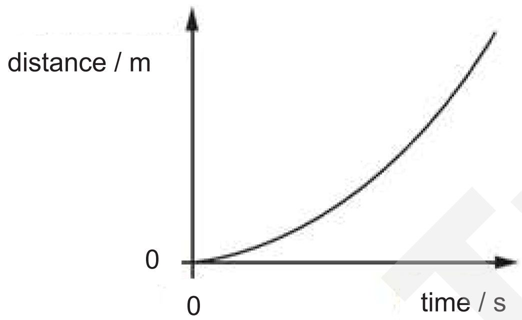
	scale reading on spring balance	masses needed on beam balance
A	different	different
B	different	same
C	same	different
D	same	same

3 The speed-time graph of a short journey is shown below.

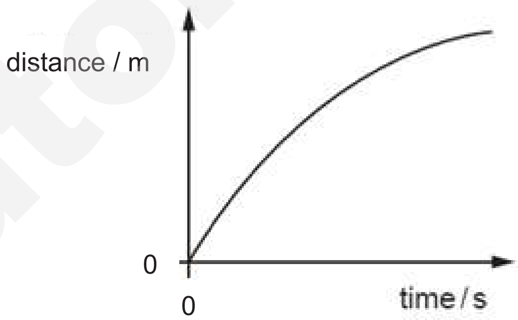


Which distance-time graph represents the same journey?

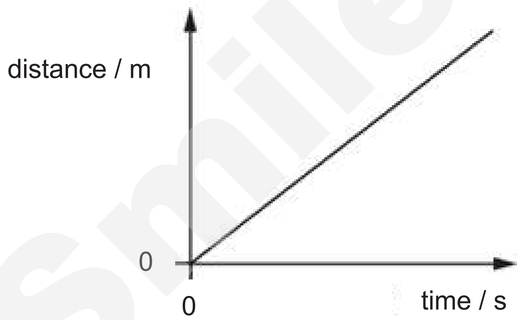
A



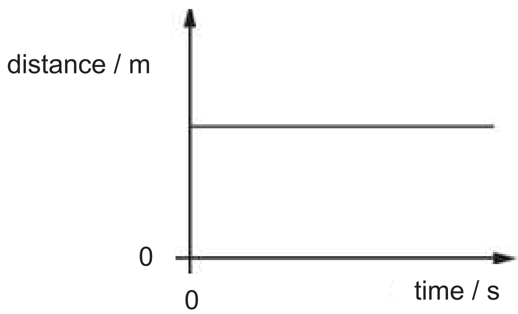
B



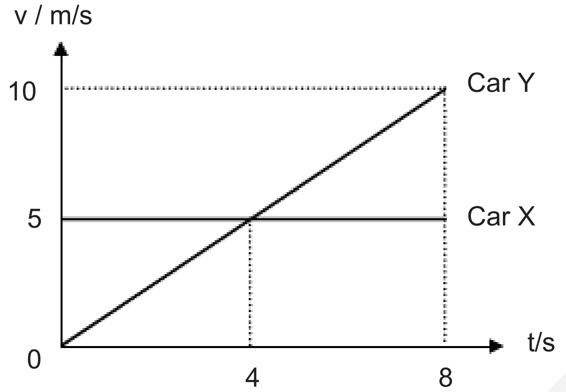
C



D



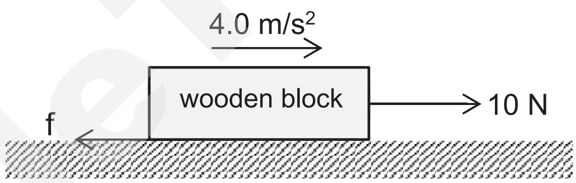
4 The diagram shows the speed-time graphs of cars X and Y. Both cars started moving off from the same position at the same time.



At what time will the two cars meet again?

A 4 s **B** 6 s **C** 8 s **D** 10 s

5 The diagram shows a wooden block of mass 0.80 kg on a rough horizontal surface. A 10 N force is applied to the block and it undergoes a constant acceleration of 4.0 m/s².

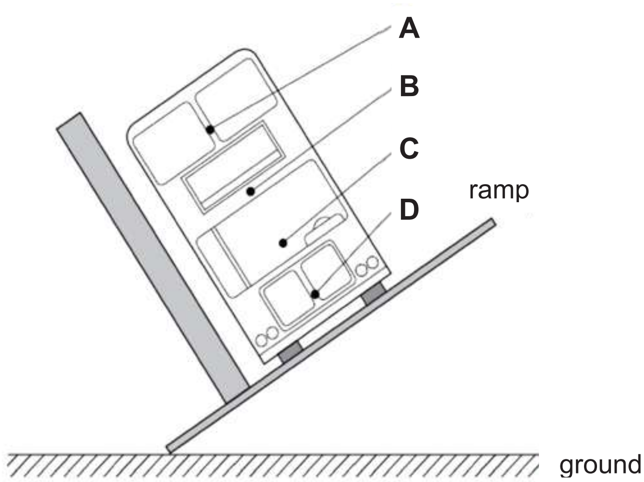


What is the magnitude of the frictional force f?

A 3.2 N **B** 6.8 N **C** 10 N **D** 13.2 N

6 The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over.

Where is the centre of gravity of the bus?

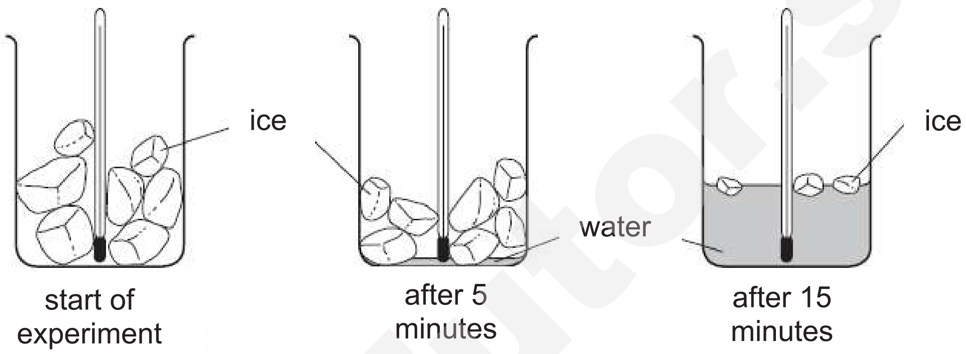


7 A builder carrying a bucket of bricks climbs a 5.0 m tall ladder in 8.0 s. The bucket of bricks has a total mass of 20 kg.

What is the average power in carrying the bucket of bricks to the top of the ladder?

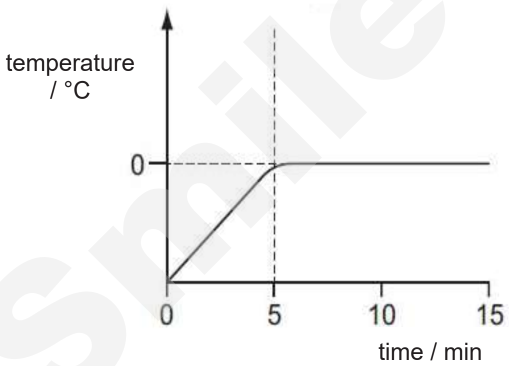
A 4 W **B** 40 W **C** 125 W **D** 1 000 W

8 A beaker containing ice and a thermometer is left in a warm room for 15 minutes. No water is visible in the beaker until 5 minutes have passed. After 15 minutes, some ice is still visible.

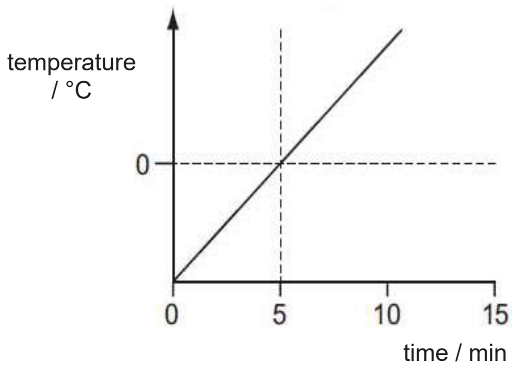


Which graph represents the process described above?

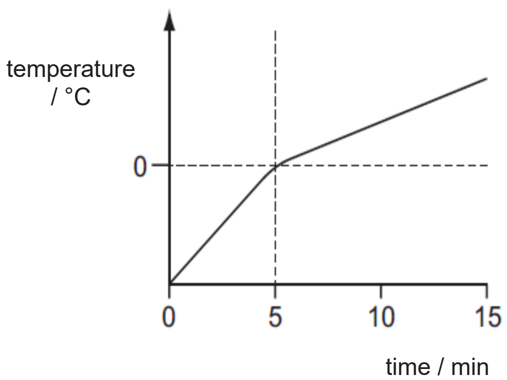
A



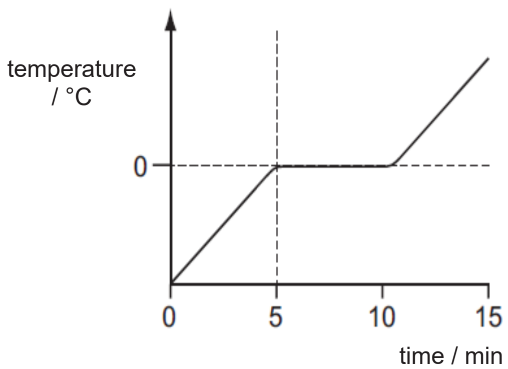
B



C



D



9 Which of the following occurs when a solid expands upon heating?

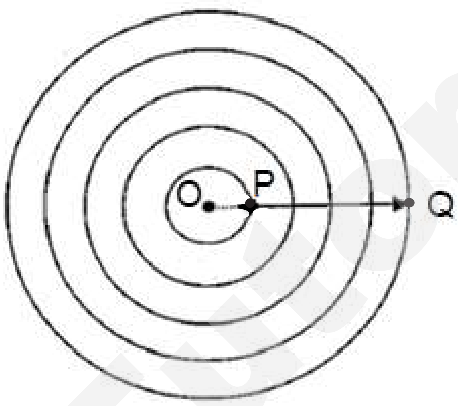
A The particles of the solid increase in number.

B The particles of the solid vibrate faster.

C The particles of the solid expand.

D The particles of the solid move further apart.

10 The diagram illustrates circular wavefronts radiating from a point source O.



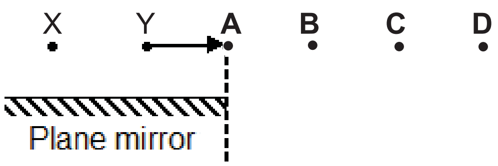
The time taken for the wave to travel from P to Q is 10 s, and the wavelength of the wave is 200 cm.

What is the speed of the wave?

A 20 cm/s **B** 80 cm/s **C** 100 cm/s **D** 2 000 cm/s

11 Two people are standing at points X and Y in front of a plane mirror as shown in the diagram. They see each other through reflection in the mirror.

If the person at Y walks away from X in the direction of the arrow shown, which is the furthest position he can walk to so that the two people will still be able see each other's reflection in the mirror?



12 If the image formed by a converging lens is real, magnified and inverted, the object must be at

A a distance equal to twice the focal length.

B a distance greater than the focal length but less than twice the focal length.

C a distance greater than twice the focal length.

D the principal focus.

13 A student stands at a distance *d* from the base of a tall cliff. He claps together two pieces of wood and measures the time that elapses before he hears the echo. He conducts the experiment five times and obtains these results.

0.72 s 0.80 s 0.71 s 0.81 s 0.71 s

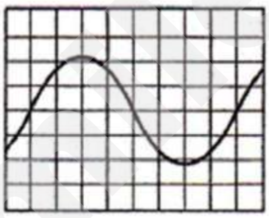
The speed of sound is 320 m/s. What is the distance *d?*

A 120 m **B** 240 m **C** 480 m **D** 600 m

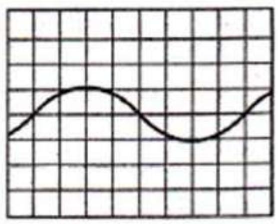
14 The diagrams show traces of sound waves picked up by microphones displayed on an oscilloscope. The oscilloscope controls are set in the same position for all the traces.

Which trace shows a sound that is the loudest but of lowest pitch?

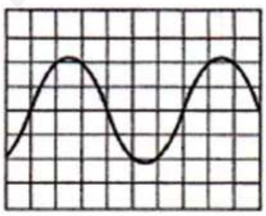
A



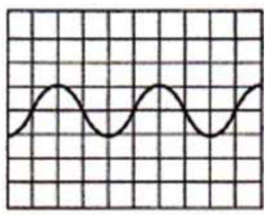
B



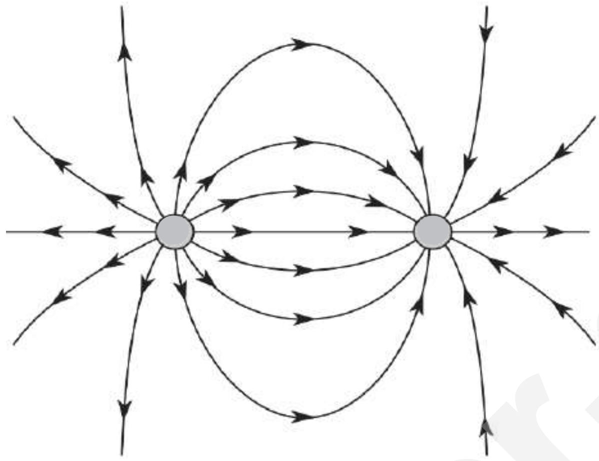
C



D



15 Two isolated point charges produce an electric field pattern as shown in the diagram.



Which pair of charges produce this pattern?

A

B

C

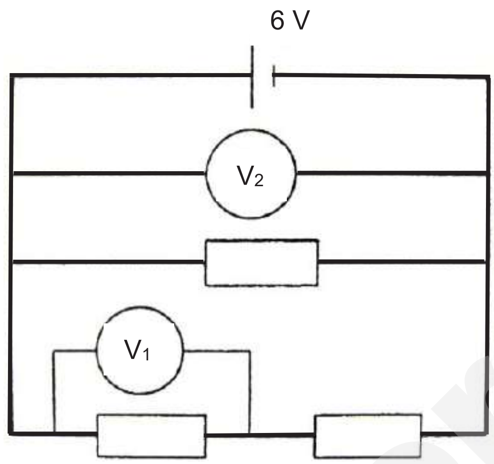
D

16 The potential difference across a light bulb is 3.0 V.

How much energy is required to move 42 C of charge across the light bulb?

A 0.071 J **B** 3.0 J **C** 14 J **D** 126 J

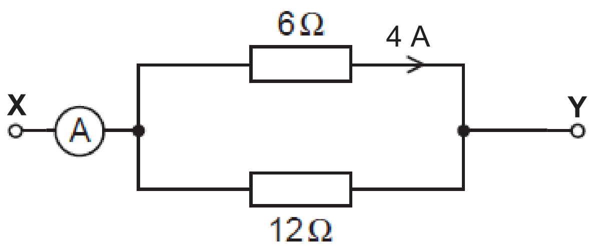
17 The diagram shows three identical resistors connected to a 6.0 V cell.



What would be the readings on voltmeters V_1 and V_2?

	V_1/V	V_2/V
A	2.0	2.0
B	3.0	6.0
C	6.0	3.0
D	6.0	6.0

18 Two resistors of 6 Ω and 12 Ω are arranged in parallel. The current through the 6 Ω resistor is 4 A.



What is the current shown on the ammeter?

A 2 A **B** 6 A **C** 8 A **D** 12 A

19 A metal bar PQ hangs from a thin thread and always comes to rest with end P pointing north. Another bar XY of the same metal settles in no definite direction.

What happens if the two bars are brought near one another?

A Both ends P and Q attract end X.

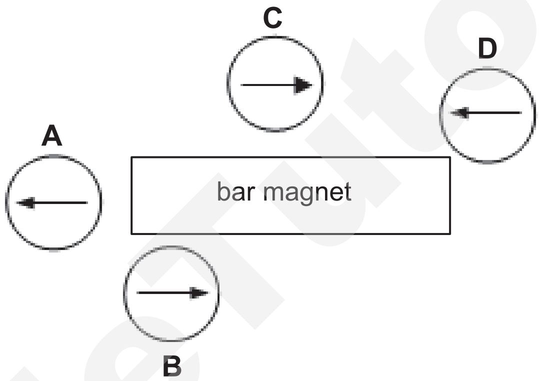
B End P attracts end X but repels end Y.

C End P neither attracts nor repels end X.

D End P repels end X but attracts end Y.

20 Four magnetic compasses are placed near a bar magnet as shown.

Which compass is faulty?



END OF PAPER

DSS Prelim 2019 Sc(Phy) Sec 4 E/5 N 5076

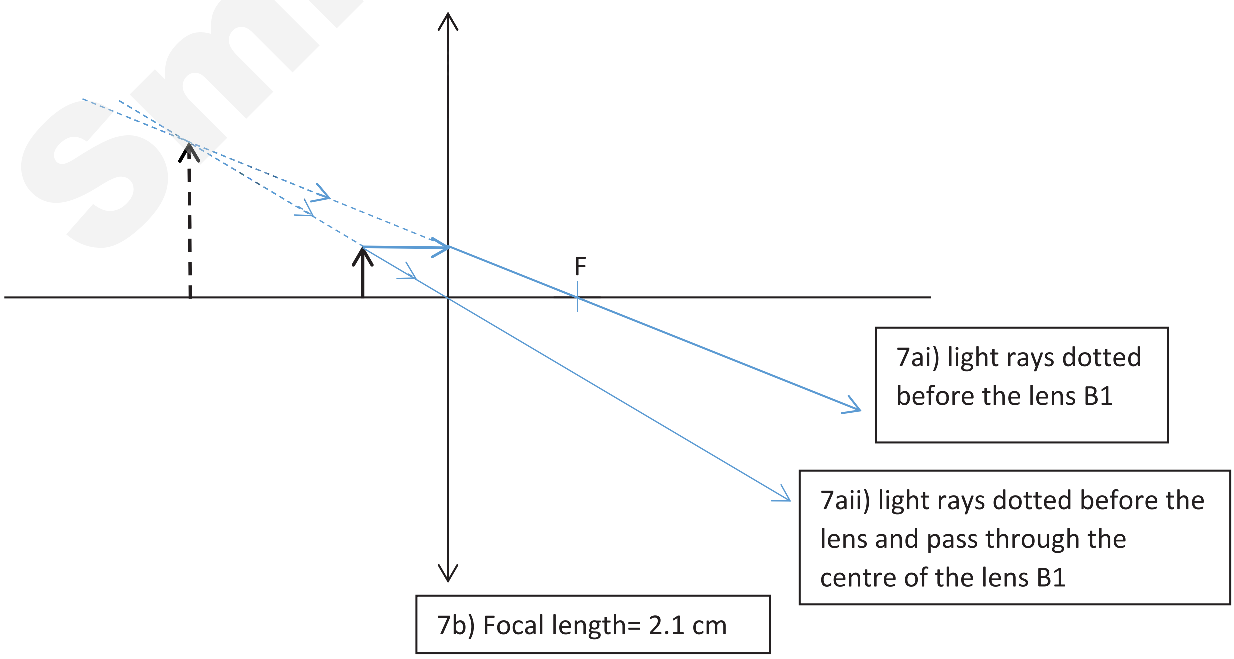
Section A MCQ

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

Section B

No.	Answer	Marks
1a	The heat sink is made up of metal, which is a good conductor of heat.	B1
1b	- The fins are black in colour, which is a good emitter of infrared radiation/radiant heat. *(*Zero marks if student also mentions good absorber of radiation too)* ***Or*** - The fins create a larger surface area for increased rate of emission of radiation.	B1
2a	Far apart to closely packed or Random to orderly/regular	B1
2b	move randomly at very high speeds to sliding past one another.	B1
3a	Mass of B = ρV = 1 x (3.0 x 40) = 120 g	 M1 A1
3b	Weight of B = 120/1000 x 10 = 1.2 N Pressure = 1.2/(3.0x0.0001) *(ecf)* = 4000 N/m^2	M1 A1
3c	The density of liquid A is higher than B. The pressure is the same at X and Y, hence mass of liquid A and B above points X and Y are equal. But volume of liquid A is smaller than B.	A1 M0
4a	2000 x 2.0 = 4000 Nm	 A1
4b	T = 4000/8.0 (ecf) = 500 N	M1 A1
4c	The moment increases. The perpendicular distance from the line of action of T to the pivot increases,	A1 M1

5ai	Loss in GPE = mgΔh = 80 x 10 x (28-16) = 9600 J	 M1 A1
5aii	Gain in KE = loss in GPE ½ x 80 x v^2 = 9600 v = 15.5 m/s	 M1 A1
5b	Ecf from 5a: Work done against friction = 9600-8800 = 800 J Friction x 56 = 800 Friction = 14.3 N	 M1 A1
6a	Sin 60/sin x = 1. 50 x = 35.3° (1 d.p.)	M1 A1
6b	Sin C = 1/n = 1/1.5 C = 41.8°	M0 A1
6c	y = 360-60-60-90-90-35.3 = 24.7° (1 d.p.) M0 A1	M0 A1
6d	Draw ray refracted away from the normal. (ecf from 5c)	B1
7ai aii	See diagram below. Award the marks even without arrows drawn. Dotted lines must be drawn to show virtual light rays.	B1 B1



7b	Accept 2.0 cm to 2.2 cm (2.1cm)	B1
8a	V = wavelength / Period Wavelength = V x Period = 1.5 x 5 = 7.5 m	 M1 A1
8b	Particle at P move down	B1
8c	Wave shown is a transverse wave because the particles of the wave moves in a direction perpendicular to the direction of the wave motion.	A1 A1
9a-d	Infrared radiation; Microwave Ultraviolet radiation Gamma rays	B1 (1 wrong) 0m (2 wrong)
10a	The negative charges at the bottom/ base of the cloud repels away the electrons in the ground, leaving excess positive charges. This is because like charges repel.	B1
10b	I = Q/t = 180/0.0015 = 120 000A	M1 A1
11a	When current exceeds the fuse rating flows through the fuse, the wire inside gets heated up and melts/fuse blows. This breaks the circuit.	B1
11b	Total power = 2300 + 460 = 2760 W Total I = P/V = 2760/230 = 12 A Or $I=I_1+I_2$ $=\frac{2300}{230}+\frac{460}{230}=12\ A$ Fuse rating = 13 A	 A1 A1
12a	Arrow pointing towards the inside of the magnet.	B1
12b	increase the current *reject: Add more batteries. Use stronger magnet / use a stronger magnetic field strength	Any – 1
12c	The rod will oscillate forward and backward with a frequency of 0.5 Hz. The current direction alternates, causing the direction of the force to alternate too.	B1 B1
13ai	a = (55-40)/2 = 7.5 m/s^2	M1 A1

13aii	F = ma = 180 x 7.5 (ecf : 1m) = 1350 N	M1 A1
13bi	0 to 2.0 s : constant acceleration / accelerating at constant rate. 2.0 s to 8.4 s : decreasing acceleration / accelerate at a decreasing rate. 8.4 s to 12 s : no acceleration / constant speed First two points correct – 1m Last point correct – 1m	 B1 B1
13bii	As the motorcycle accelerates, it experiences more air resistance. This decreases the resultant force and since resultant force = mass x acceleration, acceleration decreases. The total resistive force eventually equal to the driving force, causing resultant force to be zero and hence acceleration will also be zero.	B1 B1 B1
13biii	Draw a graph with a smaller gradient, reaching a lower top speed.	B1
14ai	Sound travels through a series of compressions and rarefactions of particles. Particles vibrate parallel to the direction of wave propagation.	B1 B1
14aii	Some of the sound energy is lost to the surroundings /converted to thermal energy as it travels further to microphone 2.	B1
14b	Time = 5 intervals x 1 ms = 0.005 s d = speed x time = 330 x 0.005 = 1.65 m *penalise 1 m for not converting time to seconds	M1 M1 A1
14c	• There may be multiple echoes due to the surrounding walls. • When using the stopwatch to measure time, there could be a human reaction time error incurred. • When measuring the distance between the microphones, it is difficult to measure length of more than 1 meter accurately using a metre rule.	Any 2 - B2
14d	The traces from microphone 1 and 2 will be closer to each other. Sound travels faster in water than in air. / Smaller amplitude because some energy maybe absorbed by the water particles.	B1 B1
15ai	20 Ω	A1
15aii	Total R = 20 + 10 = 30 Ω Total I = 1.5/30 = 0.05 A Potential difference = 0.05 x 20 = 1.0 V OR Total R= 20 + 10 = 30 Ω p.d. = 20/30 x 1.5 = 1 V	 M1 A1 or M1 A1
15b	As temperature increases, the resistance of X decreases. Since emf remains constant and V = RI, the current will increase.	B1 B1

15ci	South	B1
15cii	Anticlockwise	B1
15ciii	- As the current increases, the solenoid will be magnetised more strongly / strength of induced magnetism at P increases. - The permanent magnet will be attracted more strongly / This increases the forces of attraction, - Thus pointer deflect in the anticlockwise moment about the pivot. (This causes the pointer to deflect on the scale above zero mark.)	B1 B1 B1

O

GAN ENG SENG SCHOOL
Preliminary Examination 2019

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS, CHEMISTRY)
FOUR EXPRESS / FIVE NORMAL ACADEMIC
Paper 1 Multiple Choice

5076/01
17 September 2019
1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the OTAS in the spaces unless this has been done for you.

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 **soft pencil** on the separate OTAS.

Read the instructions on the OTAS 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 Periodic Table is printed on page **19.**

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

Total Marks
40

1 Which of the following has the most appropriate order of magnitude?

A Diameter of Earth: 1×10^7 m
B Diameter of an atom: 1×10^{-5} m
C Length of a bus: 1×10^4 m
D Thickness of a human hair: 1×10^{-3} m

2 Amber takes 6.0 s to walk from point **W** to point **X**, and takes 6.0 s to walk from point **X** to point **Y** and finally another 6.0 s to walk from point **Y** to point **Z** as shown below in Fig. 2.

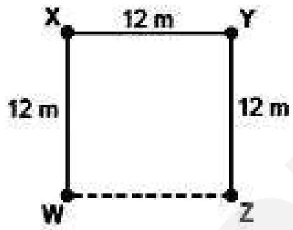


Fig. 2

The points **WXYZ** form a square with side 12 m. What is the magnitude of her average speed and velocity?

	Average Speed (m/s)	Average Velocity (m/s)
A	2.0	0.50
B	2.0	0.67
C	2.0	2.0
D	6.0	0.67

3 Zonglin, an astronaut, held a feather in one hand and a hammer in the other while on the moon. He dropped both objects together from the same height and both arrived at the same time on the ground.

This experiment shows that ……………….. .

A the gravitational field on the moon is the same as that on Earth
B objects on the moon has no weight
C the same force was acting on each object
D both the feather and the hammer fell with the same acceleration

4 Fig. 4 shows part of a car braking system.

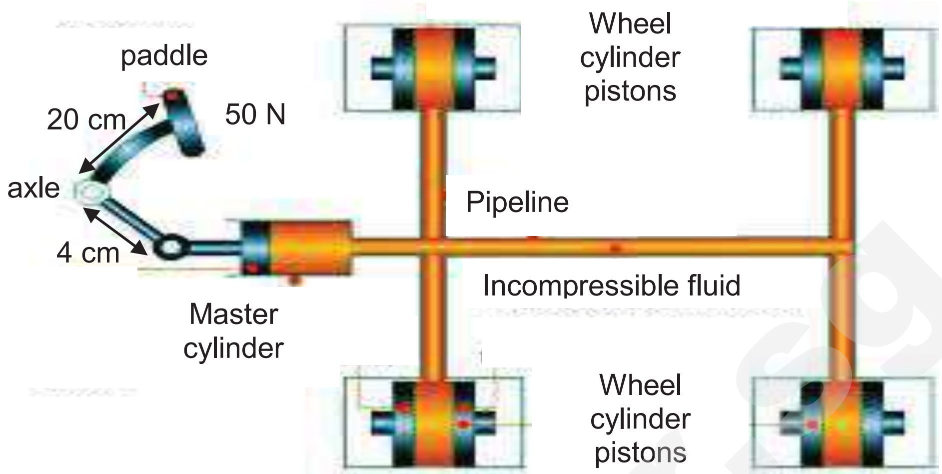
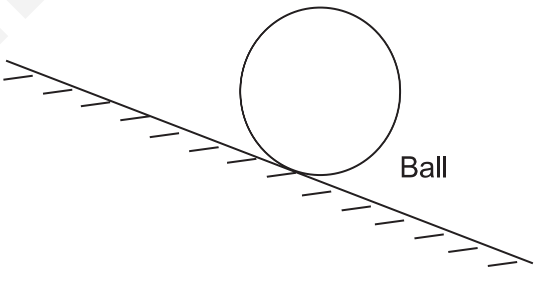


Fig. 4

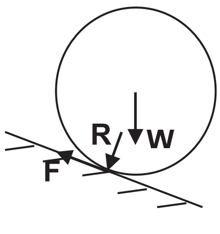
If the driver exerts a force of 50 N on the paddle, what is the pressure transmitted to the fluid in the master cylinder of cross sectional area 5.0 cm^2, $\mathbf{P_m}$, and the pressure transmitted to the 4 small cylinders of the wheels of cross sectional area 1.0 cm^2, $\mathbf{P_w}$?

	P_m / N cm^{-2}	P_w / N cm^{-2}
A	250	250
B	250	63
C	50	50
D	50	13

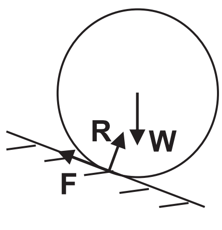
5 The diagram below shows a ball with a weight of **W** that is rolling down a slope at constant velocity. The frictional force **F** is acting on the ball. **R** is the contact force acting on the ball.



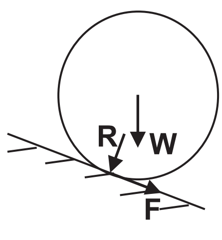
Which of the following shows the correct free-body diagram?



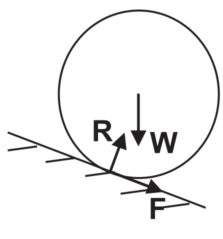
A



B

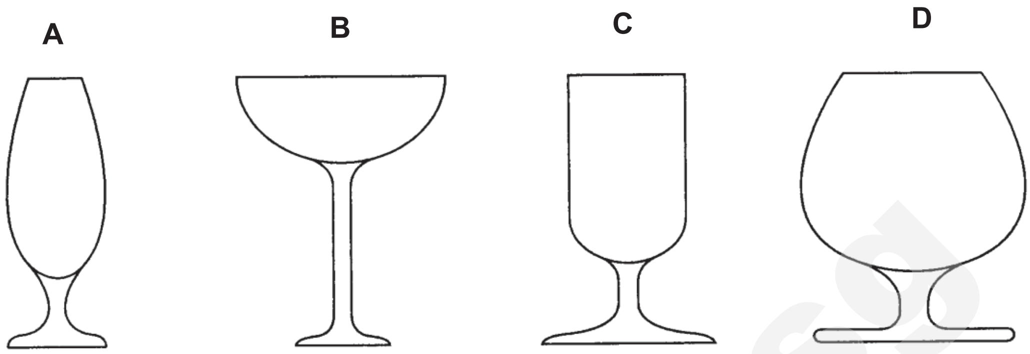


C

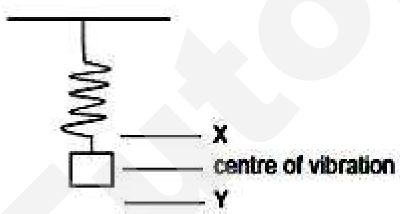


D

6 The diagrams below show the cross-section of different glasses. Which one is the least stable when they are filled to the brim with water?



7 A mass M is hung from a spring. It is then pulled down slightly and allowed to vibrate vertically between **X** and **Y**.



Which correctly describes the energy at **X** and **Y**?

	Energy at X	**Energy at Y**
A	Kinetic	Kinetic
B	Kinetic	Potential
C	Potential	Kinetic
D	Potential	Potential

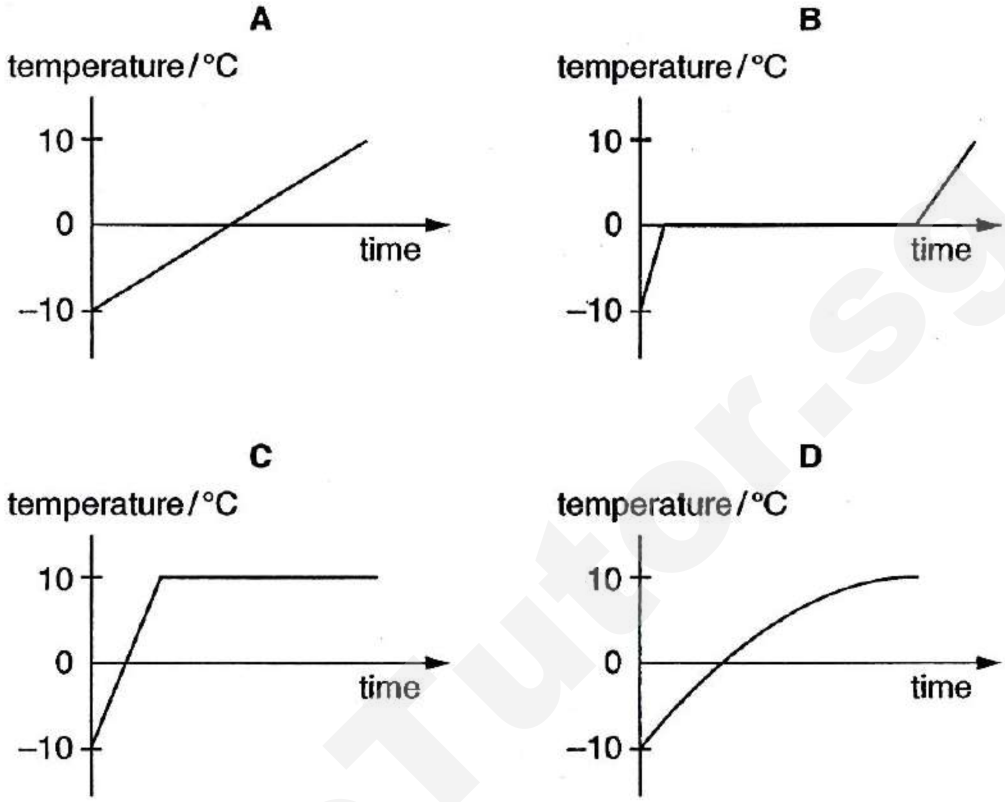
8 A gas is heated in a sealed container. Which of the following does not increase?

A The average distance between the gas molecules.
B The average kinetic energy of the gas molecules.
C The number of collisions of gas particles on the walls of the container.
D The average force exerted by the gas on the walls of the container.

9 Which of the following statements about the vacuum flask is **incorrect**?

A Loss of thermal energy by radiation is minimized by keeping hot water in a double-walled glass container.
B Loss of thermal energy is minimized by using a cork or plastic stopper to close up the neck of the glass container.
C The vacuum in the double-walled glass container effectively prevents conduction and convection.
D The walls of the glass container are silvered to reduce radiation.

10 Ice at –10°C is heated at a constant rate until it is water at +10°C.
Which graph shows how the temperature changes with time?



11 Fig. 11 shows the top view of the wave-fronts of water waves radiating from a vibrating source in a pool.

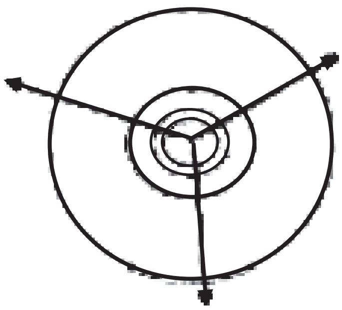
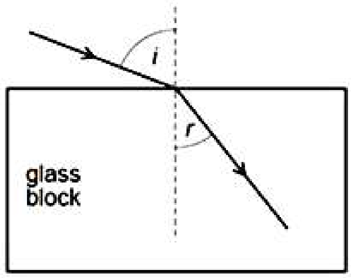


Fig. 11

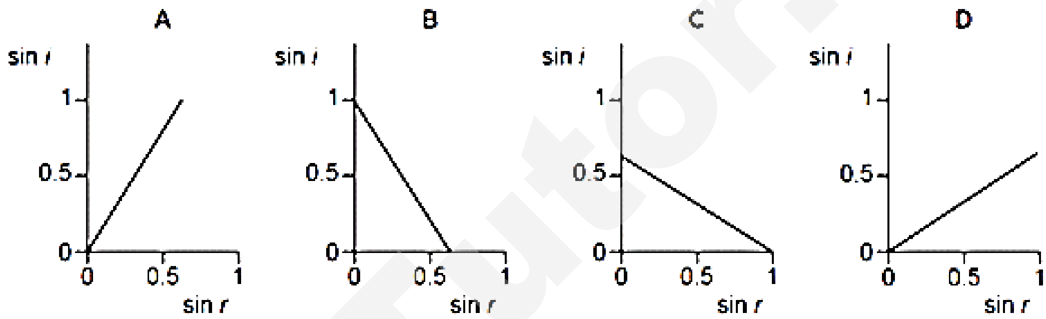
As the wave travels away from the vibrating source, its …………………

A speed increases.
B frequency increases.
C wavelength decreases.
D frequency is decreases.

12 A ray of light enters a glass block at an angle of incidence *i*, producing an angle of refraction *r* in the glass.



Several different values of *i* and *r* are measured, and a graph is of sin *i* against sin *r* is drawn. Which graph is correct?



13 Jovan conducts an experiment in which a lens forms a blurred image of an object on a screen as shown in Fig. 13.

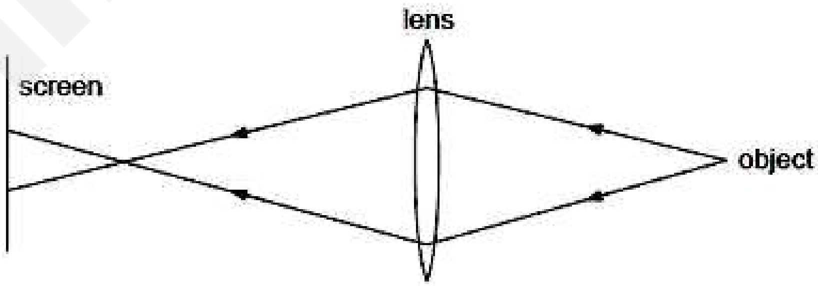


Fig. 13

How can Jovan ensure that the image is focused on the screen?

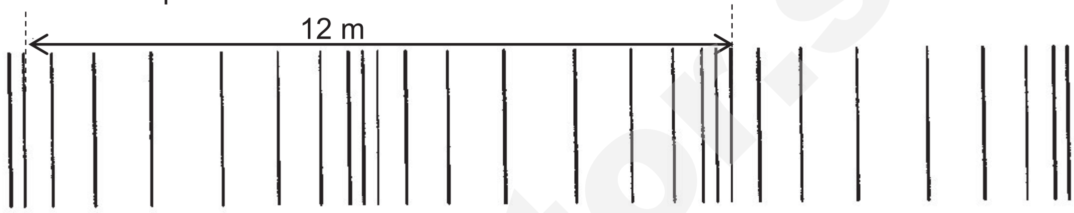
A Use a lens with a shorter focal length at the same position
B Move the screen away from the lens
C Move the object closer to the lens
D Use a brighter object at the same position

14 Which of the following statement is **true** about **R** in the following electromagnetic spectrum?

Radiowave	**P**	**Q**	Visible light	**R**	**S**	Gamma ray

A It comes from radioactive materials.
B It has the shortest wavelength.
C It is given out by a hot object.
D It causes tanning of the skin.

15 A series of compressions and rarefactions of a sound wave is as shown below.



Given that the speed of sound is 300 m/s, what is the frequency of this sound wave?

A 12.5 Hz
B 25.0 Hz
C 50.0 Hz
D 75.0 Hz

16 Fig. 16.1 shows a drum inside a photocopier. After an intense beam of light is shone on the image on the paper, positive charges remain on the drum as shown. Fig. 16.2 shows the drum rolling and toner power is attracted to the drum. Fig. 16.3 shows a piece of paper passing over the drum's surface.

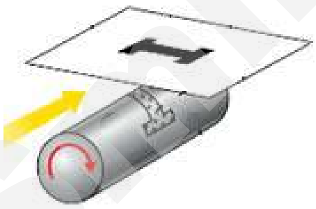


Fig. 16.1

Fig. 16.2

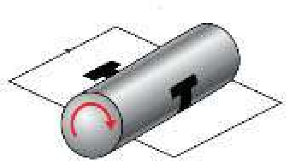
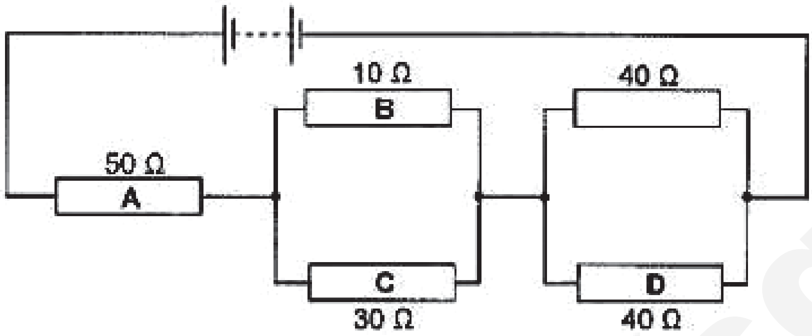


Fig. 16.3

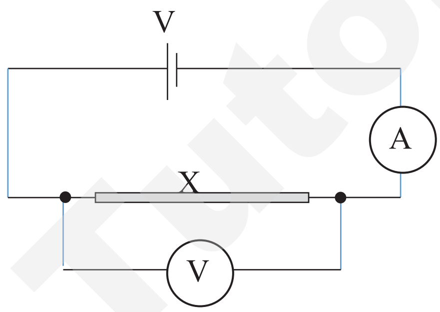
Which row of the table correctly states the charge of the toner and the paper?

	charge of toner	charge of paper
A	positive	negative
B	negative	positive
C	positive	positive
D	negative	negative

17 The diagram shows a circuit containing five resistors connected to a battery. In which resistor is the current the smallest?



18 A resistor X is made from a length L of resistance wire with a cross sectional area A. It is connected to a simple electrical circuit and the voltmeter and the ammeter readings are recorded.



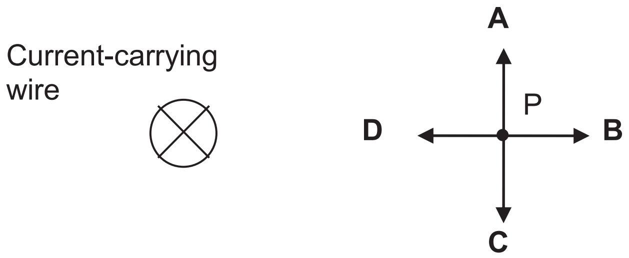
A second resistor Y made from wire of the same material has a length 2L and cross-sectional A. It is then connected in parallel with wire X to the electrical circuit.
Which of the following **correctly** describes the readings observed from the voltmeter and ammeter?

	Voltmeter Reading	Ammeter Reading
A	Decrease	Decrease
B	Decrease	Increase
C	No Change	Decrease
D	No Change	Increase

19 Five electrical appliances were left switched on for different times. In which appliance is the greatest amount of energy converted?

	Appliance	Time
A	3 kW water heater	0.5 h
B	1.5 kW hot-plate	2.0 h
C	750 W pressing iron	3.0 h
D	100 W lamp	15.0 h

20 The diagram shows a wire carrying current into the plane of the page. What is the direction of the magnetic field at point P?



21 The table below contains details of four different particles. The letters are **not** chemical symbols.

	K	**L**	**M**	**N**
nucleon number	3	14	19	23
proton number	2	7	10	11
total number of electrons	2	7	10	11

Which of the particles **K, L**, **M** and **N** will form an ionic compound with chlorine?

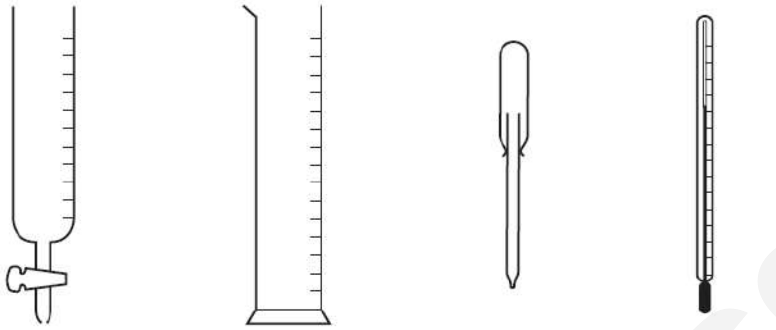
A K

B L

C M

D N

22 The four pieces of apparatus shown below are used in chemical experiments.



Which statement about the apparatus is correct?

A The burette can be used to measure 17.30 cm^3 of solution to a flask.

B The measuring cylinder measures the mass of a substance used in an experiment.

C The pipette can be used to add 250 cm^3 of liquid to a beaker.

D The thermometer collects and measures the temperature of a water-soluble gas.

23 Alcohol and water are completely miscible. This means when mixed together they form only one liquid layer.

Which method is used to separate alcohol from water?

A filtration

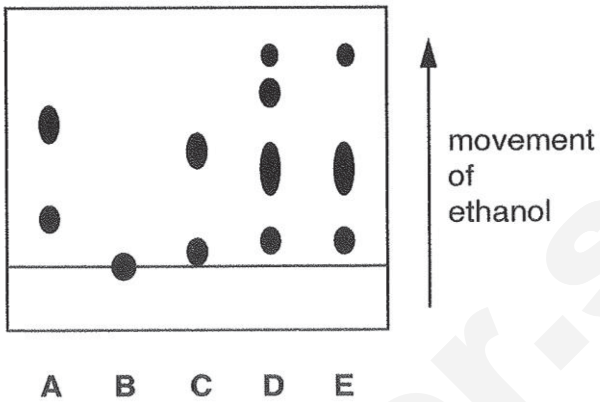
B fractional distillation

C precipitation

D crystallisation

24 Food scientists use paper chromatography to compare the food colourings in food. The colourings labelled **A, B, C, D** and **E** were separated into their components using chromatography with an ethanol solvent.

Their results are shown as a chromatogram.



Which two of **A, B, C, D** and **E** contain similar food colourings?

A A and C

B C and D

C B and C

D D and E

25 The initial temperatures of the silver nitrate and sodium chloride solutions are measured and recorded after a few minutes.

initial temperature of silver nitrate solution = 28.0 °C

initial temperature of sodium chloride solution = 29.0 °C

The sodium chloride solution is then immediately poured into the Styrofoam cup containing the silver nitrate solution. The mixture is stirred and the following temperature is recorded.

highest temperature of the mixture = 37.5 °C

Which of the following statements is true?

A The reactants have a lower energy level as compared to the products.

B Heat is lost by the reactants to the surrounding.

C Heat is gained by the reactants from the surrounding.

D The products gained energy from the surrounding.

26 What is always true for a pure substance?

A It always boils at 100 ºC.

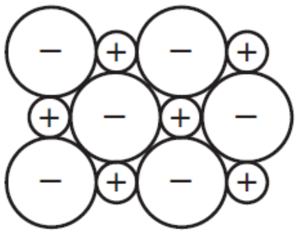
B It contains only one type of atom.

C It has a fixed melting point.

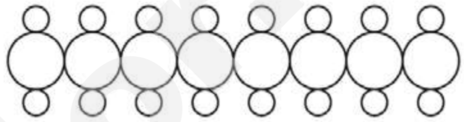
D It is solid at room temperature.

27 Which diagram could represent the structure of an alloy?

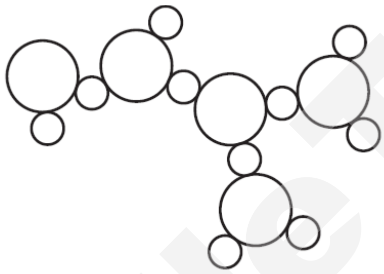
A



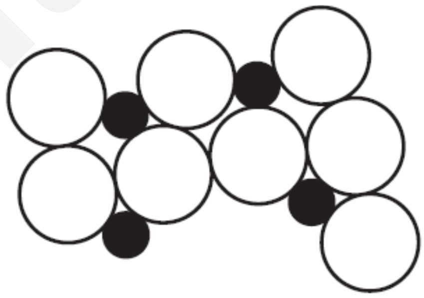
B



C



D



28 Sodium chloride is an ionic solid.

Which statement is **not** correct?

A Ions are formed when atoms lose or gain electrons.

B Ions in sodium chloride are held together by weak intermolecular forces of attraction.

C Ions of opposite charge attract each other.

D Solid sodium chloride cannot conduct electricity.

29 20 cm^3 of methane is reacted with 70 cm^3 of oxygen.

The equation for the reaction is shown.

$$CH_4\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (l)$$

All volumes are measured at r.t.p.

What is the **total** volume of gas remaining at the end of the reaction?

A 90 cm^3
B 50 cm^3
C 30 cm^3
D 20 cm^3

30 Which of the following reacts with ammonium salt to produce ammonia gas?

A hydrochloric acid
B sulfuric acid
C sodium chloride solution
D sodium hydroxide

31 Aluminium is the most common metal in the Earth's crust.

Which is **not** a property of aluminium?

A ductile
B malleable
C good conductor of electricity
D low melting point

32 The table shows the formula of oxides of different elements.

	sulfur	**potassium**	**aluminium**
formula of oxide	SO_2	K_2O	Al_2O_3

Which row describes the nature of oxide for different elements?

	sulfur	**potassium**	**aluminium**
A	acidic	acidic	amphoteric
B	acidic	basic	amphoteric
C	basic	acidic	basic
D	neutral	basic	basic

33 What is the approximate composition of dry air?

A 78% nitrogen, 21% oxygen and the remainder being noble gases

B 78% nitrogen, 21% oxygen and the remainder being noble gases and carbon dioxide

C 78% nitrogen, 20% oxygen and the remainder being carbon dioxide

D 78% nitrogen, 20% oxygen and the remainder being noble gases and carbon dioxide

34 Which equation shows a reduction reaction?

A $CaCO_3 \rightarrow CaO + CO_2$

B $NaOH + HCl \rightarrow NaCl + H_2O$

C $Cl_2 \rightarrow 2Cl^-$

D $Zn \rightarrow Zn^{2+}$

35 Astatine is an element in Group VII of the Periodic Table.

What are the likely properties of astatine?

	colour	**state**
A	black	solid
B	dark brown	liquid
C	green	gas
D	yellow	solid

36 Which reaction does **not** take place in the dark?

A $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

B $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

C $C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$

D $C_2H_4 + H_2 \rightarrow C_2H_6$

37 The table below describes several changes.

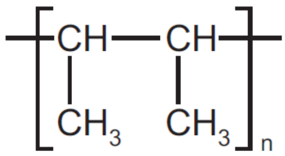
Process I	sugar solution and yeast	$\longrightarrow$	formation of ethanol
Process II	silver nitrate solution and hydrochloric acid	$\longrightarrow$	insoluble silver chloride formed
Process III	carbon	$\longrightarrow$	carbon dioxide formation

What are the suitable descriptions of the following changes?

	process I	**process II**	**process III**
A	fermentation	precipitation	oxidation
B	hydrogenation	neutralisation	oxidation
C	oxidation	neutralisation	polymerisation
D	fermentation	hydrogenation	oxidation

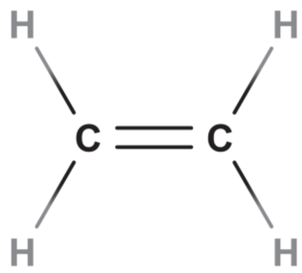
38 Polymers are made by addition polymerisation of simple molecules called monomers.

The structural formula of a polymer is given below.

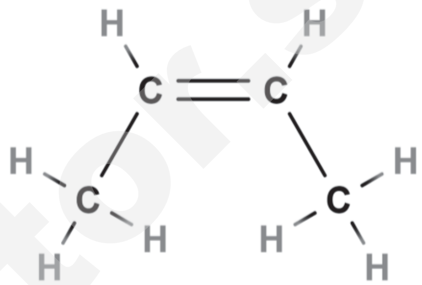


Which is the structural formula of its monomer?

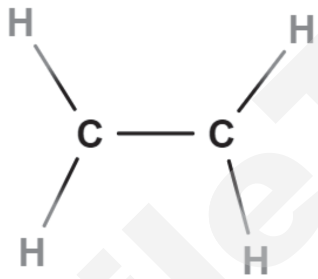
A



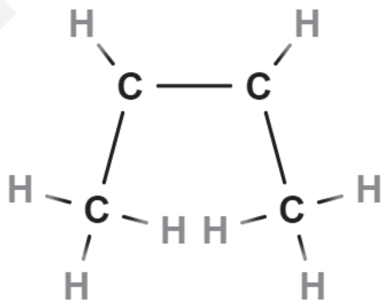
B



C

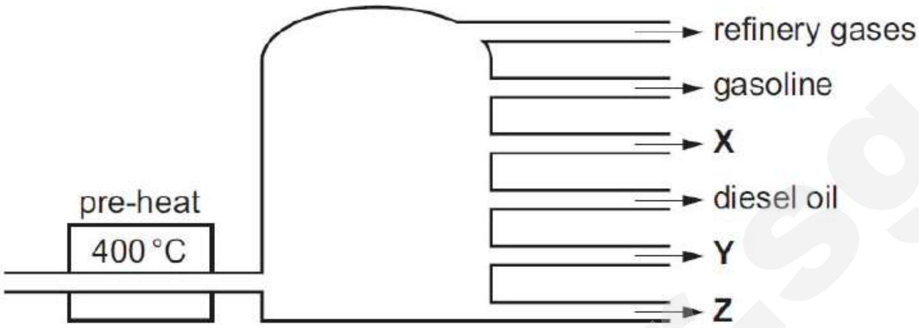


D



39 Petroleum is a mixture of hydrocarbons. In an oil refinery, it is separated into useful fractions.

The diagram shows some of these fractions.



What are fractions **X, Y** and **Z**?

	X	Y	Z
A	paraffin (kerosene)	naphtha	bitumen
B	naphtha	paraffin (kerosene)	bitumen
C	paraffin (kerosene)	bitumen	lubricating oil
D	paraffin (kerosene)	lubricating oil	bitumen

40 When left exposed to air, butanol is slowly oxidised to form a product.

Which statements about the product are correct?

1. It is a compound with a $–CO_2H$ group.
2. It burns in air and can be used as a fuel.
3. It has the general formula of C_nH_{2n}.

A 1, 2 and 3
B 1 and 2 only
C 1 and 3 only
D 2 and 3 only

END OF PAPER

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

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9			**Key** proton (atomic) number atomic symbol name relative atomic mass								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.).

O

GAN ENG SENG SCHOOL
Preliminary Examination 2019

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE (PHYSICS) 5076/02
FOUR EXPRESS / FIVE NORMAL ACADEMIC

3 September 2019

1 hour 15 minutes

Paper 2

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

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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 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
Section B	20
…………………….....	
……………………....	
Total	65

Section A [45 marks]

For Examiner's Use

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

1 Delton uses a pair of vernier calipers to measure the internal and external diameter of a hollow pipe. The readings are shown in Fig. 1.

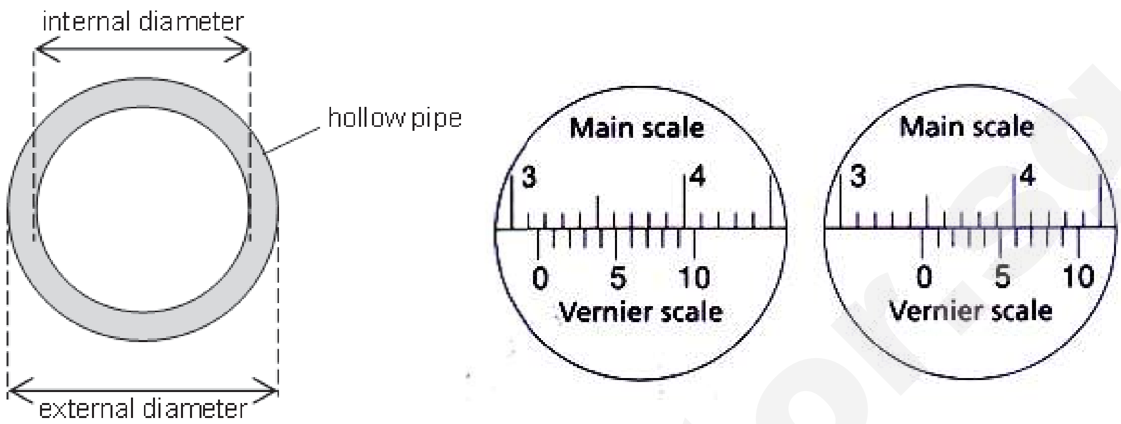


Fig. 1

(a) If the vernier caliper has a negative zero error of 0.08 cm, calculate the thickness of the pipe.

Thickness = …………………………[2]

(b) Suggest a method to increase the accuracy of the readings.

……………………………………………………………………………………………………

……………………………………………………………………………………………………[1]

2 Dave pushes a block of mass 500 g up a rough inclined plane with an initial velocity of 9.0 m/s. The block returns to its starting point 4 seconds later with a velocity of 3.0 m/s. Fig. 2 shows the set-up and the corresponding graph.

For Examiner's Use

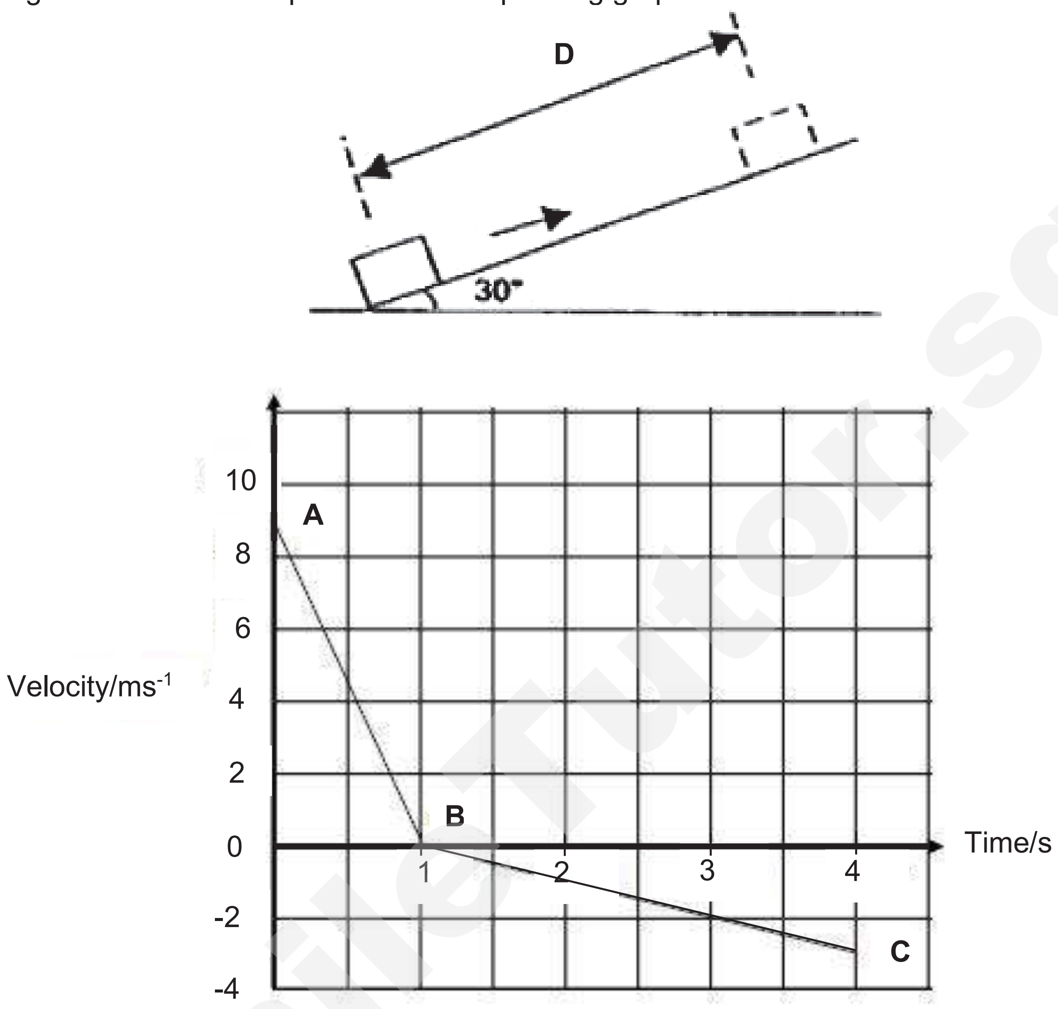


Fig. 2

(a) Using values that can be taken from the graph, describe the motion of the object:

(i) between **A** and **B**, and

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………..[1]

(ii) at **B**.

……………………………………………………………………………………………..

……………………………………………………………………………………………..[1]

2 **(b)** Calculate the maximum distance **D** that the object has travelled up on the inclined plane.

Maximum distance **D** = ………………[2]

3 During the National Day Parade, a 70 kg sky diver jumped off from a height of 1000 m carrying a parachute of 10 kg. The diver falls freely before opening his parachute. Fig. 3 shows a table indicating the upward air resistance acting on the diver for the first 7 seconds of his fall.

Air Resistance / N	0	100	240	450	800	800	800	2400
Time / s	0	1	2	3	4	5	6	7

Fig. 3

State and explain during the period of time during which the diver falls at constant speed.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………[2]

4 Fig. 4.1 shows a rectangular barge of dimensions 2.0 m x 1.2 m x 0.4 m.

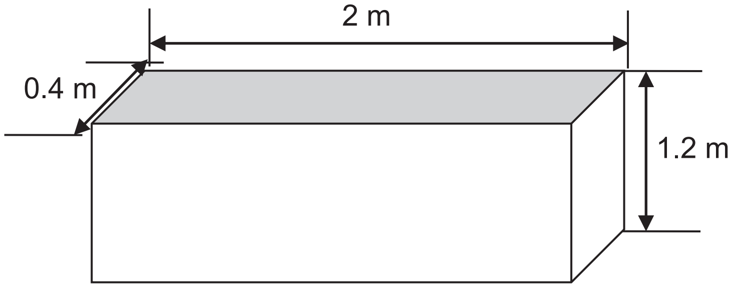


Fig. 4.1

(a) Given that the density of the block is 7800 kg/m^3, calculate the mass of the block.

Mass = ……………………………[2]

(b) Calculate the maximum pressure that can be exerted by the barge on the ground.

Maximum pressure = ……………………………[2]

4 **(c)** The barge is submerged in seawater and tethered by a taut rope as shown in Fig. 4.2. The current in the seawater is pushing the barge with a force of 50 kN to the right, causing the rope to have an angle of 30 ° to the vertical.

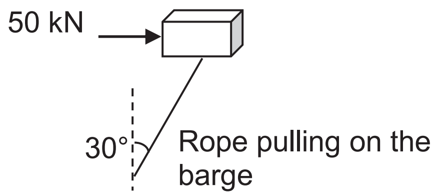


Fig. 4.2

Draw a scaled vector diagram to determine the tension in the rope. Indicate the scale that you are using.

Scale = ……………………………

Tension = ………………….[4]

5 Fig. 5.1 shows a section of a vertical door with a horizontal hinge along its lower edge. C_1 is the position of the centre of gravity of the door. Fig 5.2 shows the door with a piece of wood attached so that the door is less likely to open by itself. The new position of the centre of gravity of the door and the wood is C_2. The thickness of the door is 8.0 cm.

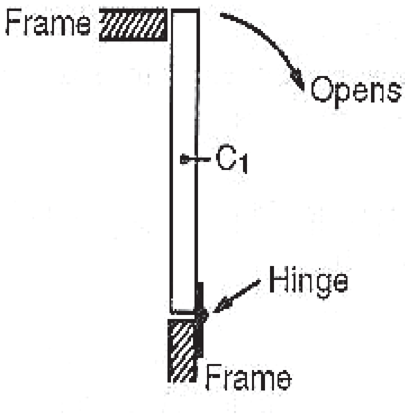


Fig. 5.1

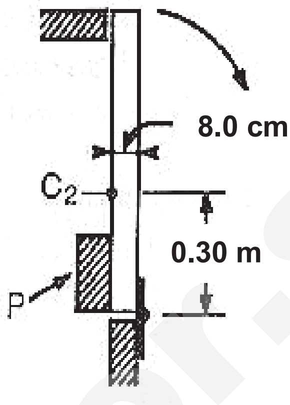


Fig. 5.2

(a) Explain why the door is less likely to fall open with wood P attached to it.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………[2]

(b) The combined weight of the door and wood P is 35 N. Calculate the moment required to hold the door closed when it is in the vertical position, as shown in Fig. 5.2.

Moment = …………………… [2]

6 Fig. 6 shows a section of a solar heating system which helps to provide hot water for a house.

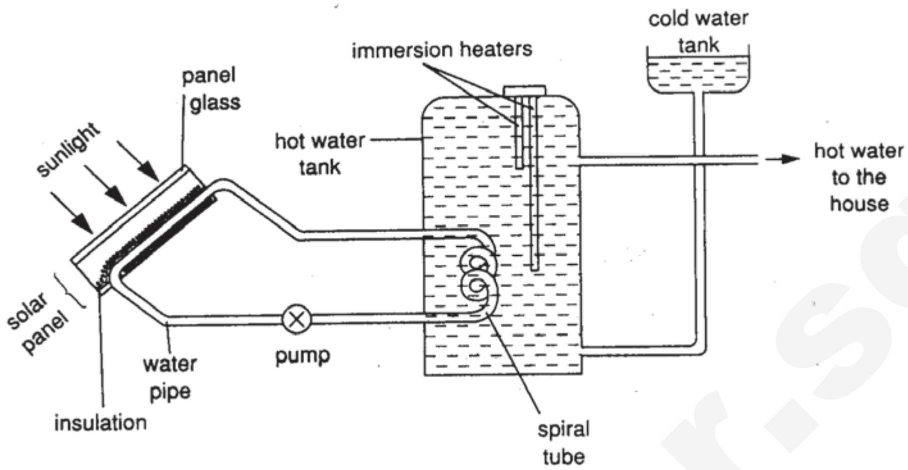


Fig. 6

It consists of a solar panel placed outdoor on a roof. Connected to this panel are water pipes. Heat from the Sun warms the water in these pipes which is then pumped to a hot water tank inside the house. Inside the hot water tank, the hot water transfers its heat, becomes cooled and circulates back to the solar panel.

Explain the purpose of the following features.

(a) The solar panel is covered with a sheet of glass.

....

....[1]

(b) The insulation for the water pipe in the solar panel.

....

....[1]

(c) The water pipe in the hot water tank is spiral in structure, painted black and made from copper.

....

....

....

....

....

....[3]

For Examiner's Use

7 (a) Fig. 7.1 shows the displacement-distance graph of a vibrating string at time t = 0 s.

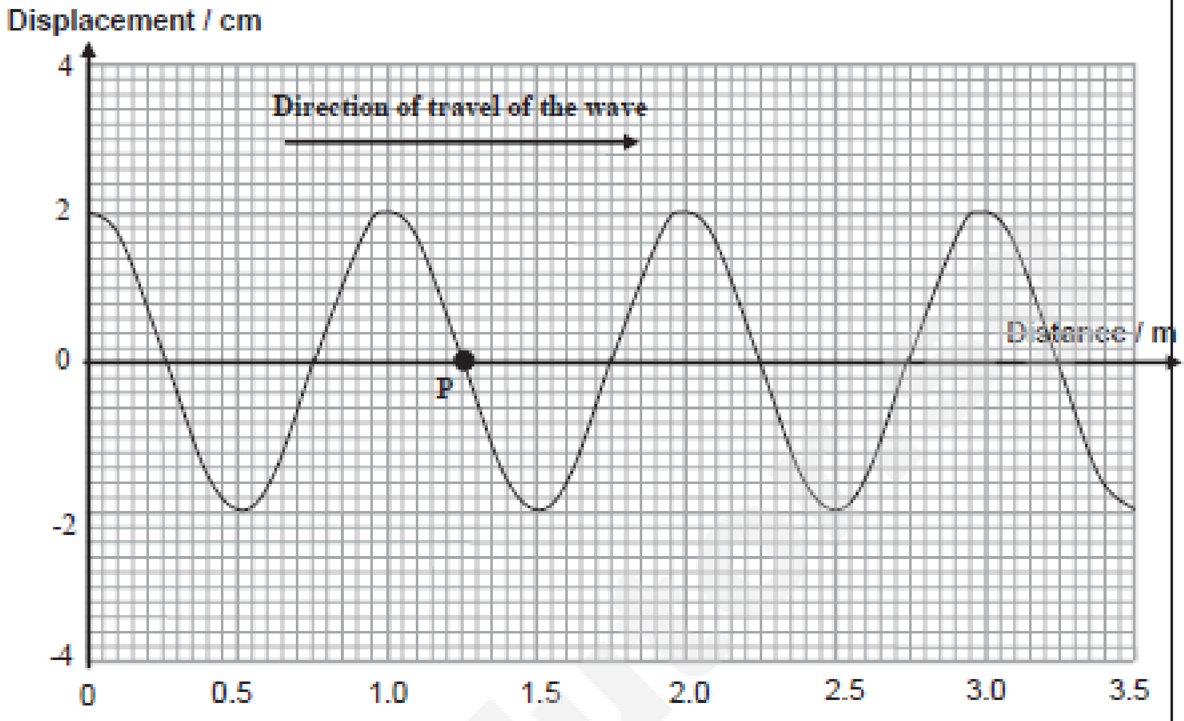


Fig. 7.1

(i) Describe the direction of movement of P for one complete cycle starting from time t = 0 s.

....

....

....[2]

(ii) It takes 0.6 s for point P to move two cycles. Calculate the speed of the wave.

Speed = ...[2]

7 (b) Fig. 7.2 shows a very large plane mirror, inclined at 45° to the horizontal, beneath a pattern on the high ceiling of a hall.

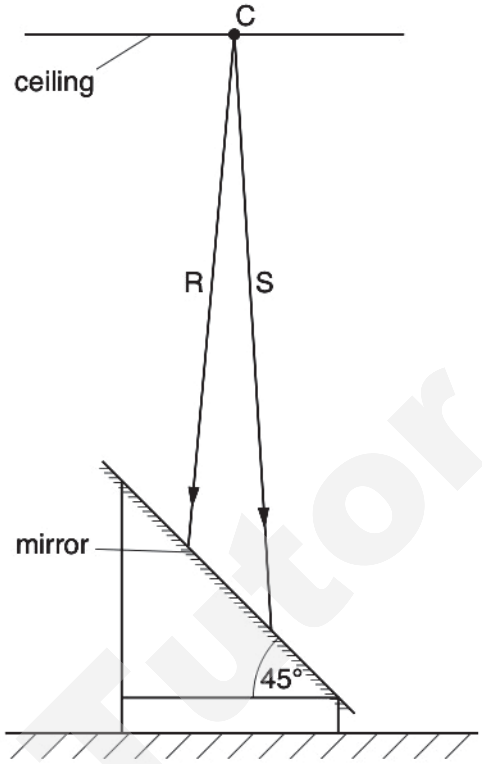


Fig. 7.2

The mirror is set on a stand at head-height immediately below the centre C of the pattern. R and S are two rays of light from C that strike the mirror.

(i) On Fig 7.2, draw the rays R and S after they strike the mirror. [1]

(ii) Show how these rays can be used to locate the image of C. Mark and label the position of this image with the letter **I**. [2]

For Examiner's Use

8 Fig. 8 shows a circuit with three switches S_1, S_2 and a lamp L_1.

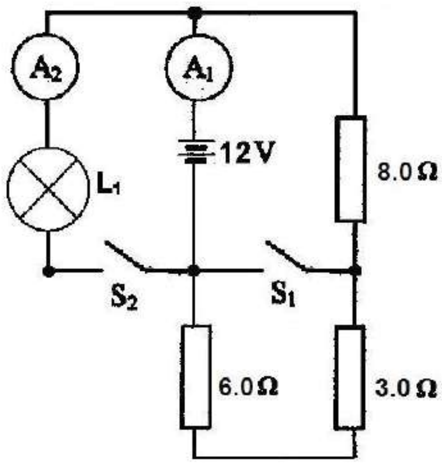


Fig. 8

(a) Calculate A_1 when S_1 is closed.

A_1 = ……………………………..[2]

(b) When both S_1 and S_2 are closed, A_2 shows 0.8 A. What is the resistance of L_1?

Resistance = …………………………[2]

(c) Explain how the brightness of the lamp is affected when S_1 is opened while S_2 is closed.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………[2]

9 **(a)** Fig. 9.1 shows the electrical wiring of a house.

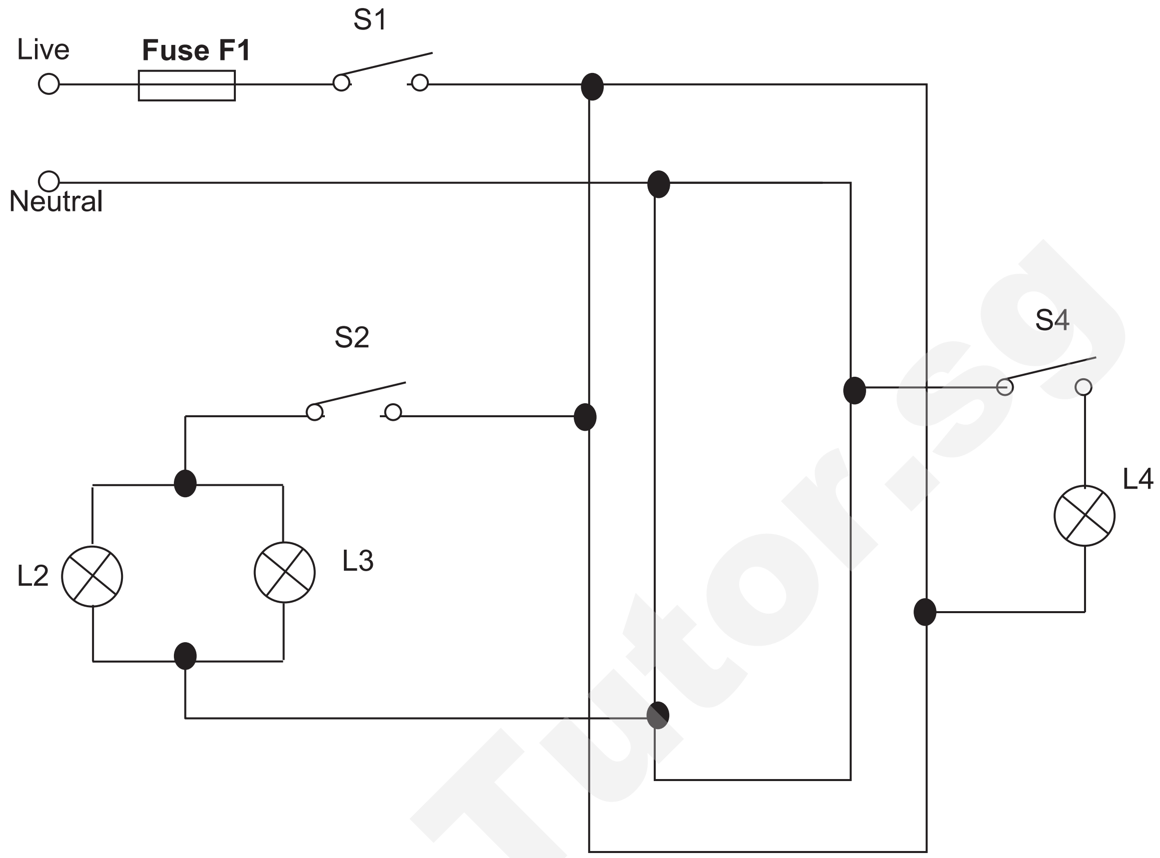


Fig. 9.1

(i) State why lamp L4 is wrongly connected.

....

....[1]

(ii) State the purpose of the fuse.

....

....[1]

(iii) Explain why the switch and fuse should be placed on the live wire.

....

....[1]

9 (b) Fig. 9.2 shows an iron rod AB resting in a magnetic field and connected to a circuit. The rod can move freely in the magnetic field.

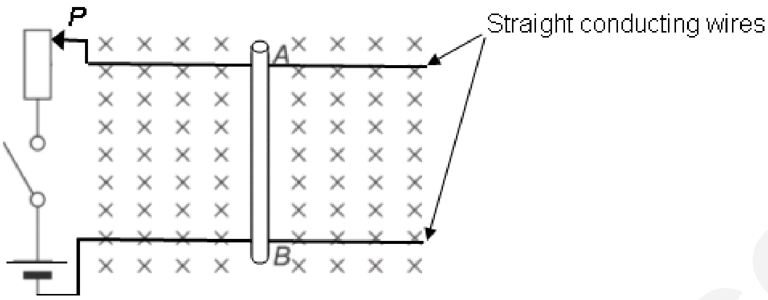


Fig. 9.2

(i) State and explain what happens to the rod when the switch is closed.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

(ii) State what happens to the rod when P is moved closer to the switch.

……………………………………………………………………………………………

……………………………………………………………………………………………[1]

Section B [20 marks]

For Examiner's Use

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

Write your answers in the spaces provided.

10 (a) Singapore experiences many thunderstorms every year. Tall buildings and trees have a higher likelihood of being hit by lightning in these storms. Fig 10.1 shows a thunder cloud with a flat, positively charged base. It passes over a cluster of trees growing on a flat, open land.

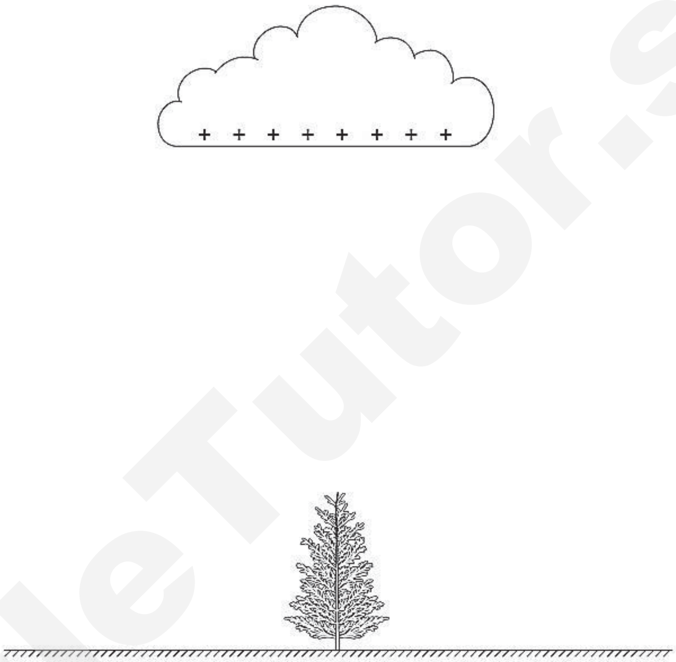


Fig. 10.1

(i) On Fig. 10.1, mark the charges on the tree. [1]

(ii) Explain how the tree may be struck with lightning.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………[2]

(iii) In the lightning strike, a charge of 620 C passes from the cloud to the tree. Given that the strike took place in 2.5×10^{-4} s, calculate the average current in the lightning strike.

Current = ……………………..[2]

10 (b) Zhetai set up the apparatus as in Fig. 10.2 in a lab. Two flat metal plates are positioned horizontally with one above the other. He connected the positive terminal of a high voltage power supply to the bottom plate and the negative terminal to the top plate.

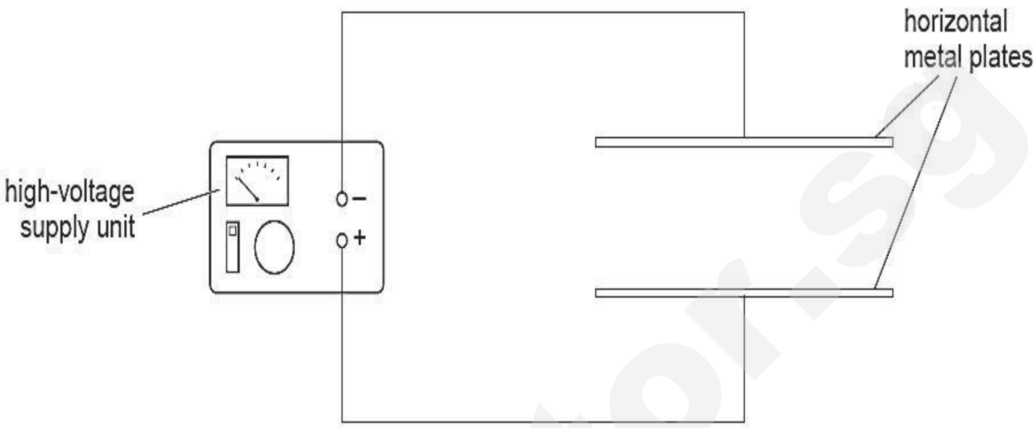


Fig. 10.2

(i) On Fig 10.2, draw the shape and direction of the electric field produced. [2]

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

....

....[1]

(iii) Zhetai observed that when a small, charged oil droplet was placed between the metal plates, it accelerated downwards. State the charge of the oil droplet and explain the observed movement.

....

....

....

....[2]

11 Ships can make use of ultrasound waves to determine the depth of the sea. An ultrasound pulse is emitted from a ship and the echo is received by a receiver on the ship. The receiver then records the time, t, at which the echo returns to the ship.

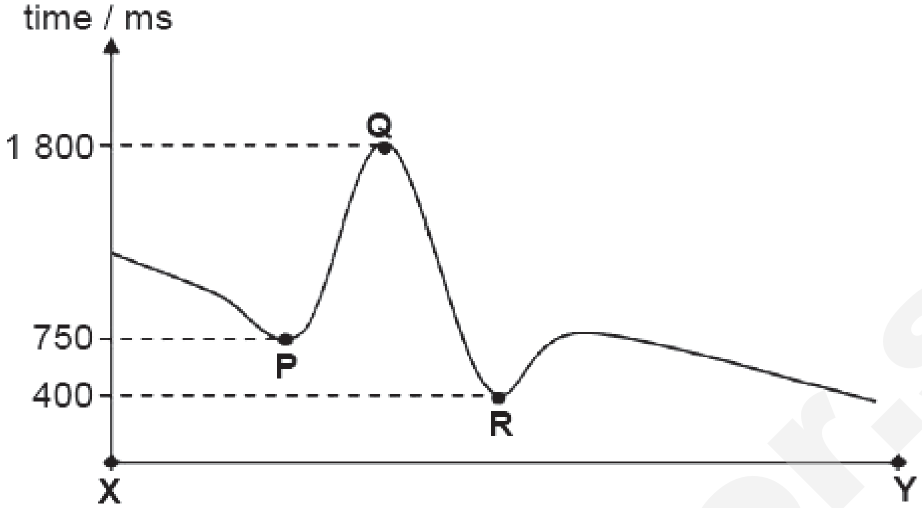


Fig. 11.1

Fig. 11.1 shows the graph recorded by the receiver indicating the duration taken for the ultrasound pulse to return to the receiver as the ship moves from point X to point Y.

(a) State what is meant by *ultrasound waves*.

……………………………………………………………………………………………....

……………………………………………………………………………………………..[1]

(b) Describe how the ultrasound waves travel from the ship to the seabed.

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………....

……………………………………………………………………………………………[2]

(c) Determine which point, **P**, **Q**, or **R**, is deepest. Explain your answer.

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

……………………………………………………………………………………..…………[2]

(d) Calculate the depth of the seabed at point **P**. The speed of sound in water is 1500 m/s.

Depth of seabed = ………………………[2]

For Examiner's Use

11 (e) Given that the frequency of the ultrasonic waves is 45 kHz, determine the wavelength of the ultrasound waves in water.

Wavelength = …………………………[2]

(f) As the ship approaches more shallow regions of the sea, the receiver produces a sound wave as shown in Fig. 11.2.

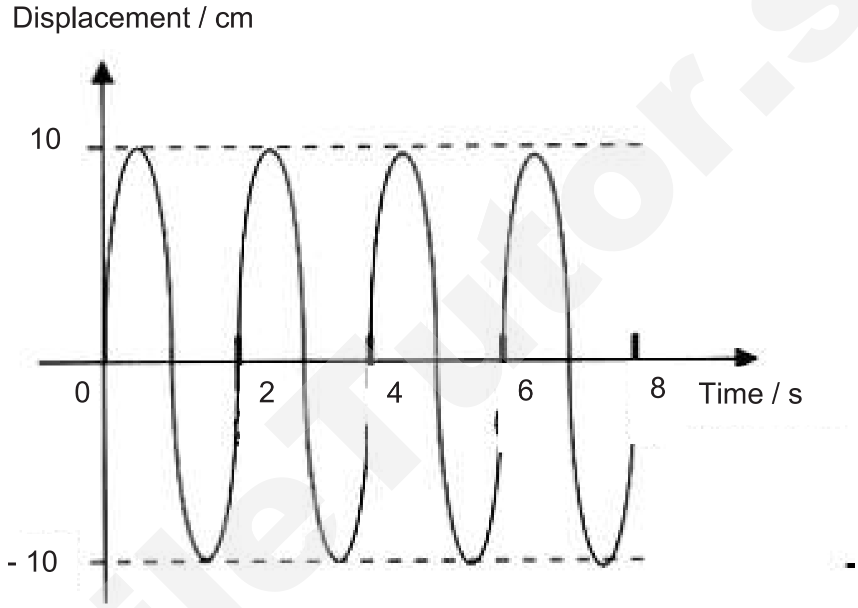


Fig. 11.2

The transmitter is tuned to produce a new sound wave that has double the frequency and half the loudness of the sound wave in Fig. 11.2. Sketch on Fig.11.2, a well-labelled displacement-time graph for the new sound as it passes through the same location.

[1]

12 Pole vaulting is an Olympic track and field event in which an athlete uses a long and flexible pole to jump over a bar. To do so, the athlete sprints towards the bar before planting the pole into a vault box to initiate the jump.

Fig. 12.1 shows a sprinting athlete holding a straight pole just before he plants the pole into the vault box. Fig. 12.2 shows the athlete during the jumping phase of the vault as he launches himself in an attempt to clear the bar.

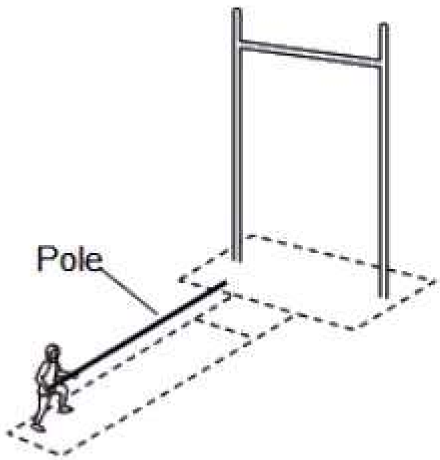


Fig. 12.1

Fig. 12.2

(a) State and explain the energy changes that have taken place for the athlete and the pole between the events in Fig. 12.1 and Fig. 12.2.

(i) Athlete: …………………………………………………………………………………

……………………………………………………………………………………………[1]

(ii) Pole: …………………………………………………………………………………..

……………………………………………………………………………………………[1]

(b) The athlete releases the pole and reaches a height of 6.1 m, clearing the bar. He has a mass of 70 kg.

(i) Calculate the average speed at which he was running, such that he could clear the bar.

Average speed = …………………[2]

For Examiner's Use

12 (b) (ii) Calculate the output power of the athlete if he can run up to the vault in 5.4 s.

Power = ……………………………[2]

(iii) Calculate the force exerted by the athlete on a 1.5 m landing foam if it deforms by 0.50 m when he lands on it.

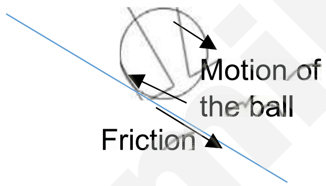
Force = ……………………………[2]

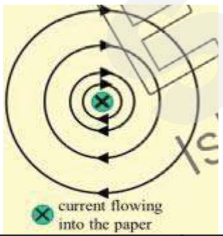
(iv) State and explain if the answer you calculated in **(b)(i)** is higher, same or lower than the actual average speed of the athlete.

…………………………………………………………………………………………

…………………………………………………………………………………………[2]

END OF PAPER

No	Answer	Remark
1	A	Diameter of the Earth : 1.2 x 10^7 m Diameter of atom : 1 x 10^{-10} m Length of bus: 1 x 10^1 m Thickness of hair: 1 x 10^{-4} m
2	B	Average speed = total distance / total time = 36 / 18 = 2 m/s Average velocity = total displacement / total time = 12 / 18 = 0.67 m/s
3	D	Without the effect of air resistance, objects that are dropped from a height will experience free-fall, meaning that the only force acting on it is its weight. Hence, both objects will experience the same acceleration due to gravity.
4	C	Sum of moments about axle are equal: 50 N x 0.20 = Force on master cylinder x 0.04 Force on master cylinder = 250 N Pressure on master cylinder, P_m = F/A = 250 / 5 = 50 N cm^{-2} $P_w = P_m$ = 50 N cm^{-2}
5	D	Since the ball **rolls** down the slope, the motion of the ball at the point of contact between the ball and slope is upwards. Hence, friction is downwards. 
6	B	As all the glasses are filled with water, the CG of glass B will be higher. The CG of glasses A, C, D will be lower than that of B.
7	D	Both X and Y are turning points in the motion of the mass M. Hence, the speed of the mass at these points is minimum, leading it to have maximum gravitational potential energy at X and maximum elastic potential energy at Y.
8	A	As a gas in a sealed container is heated, the average kinetic energy of the molecules increases as the temperature increases too. Thus, the number of collisions of the gas on the walls of the container increases and the average force exerted by the molecules on the walls increases as well. However, the gas does not expand as it is in the a sealed container and thus, the average distance does not increase.
9	A	Radiation is minimised through changes in surface area, colour and texture. Hence, using a double walled glass container does not minimize radiation but instead conduction (since glass is a thermal insulator).
10	B	Ice melts at 0 °C.

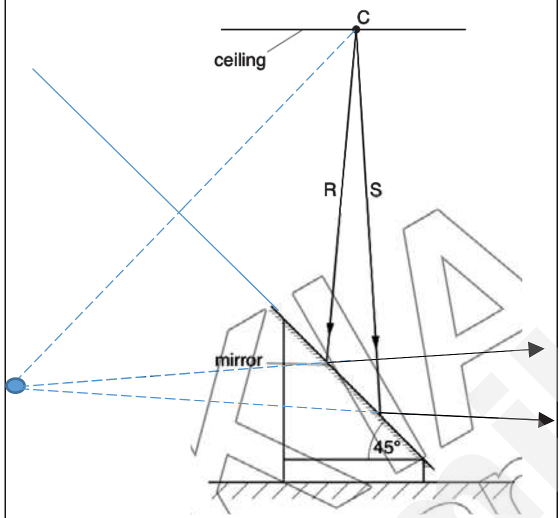
11	A	As the wave moves away, the distance between the wavefronts is increasing. This indicates an increase in wavelength. Since v = fλ, the speed is increasing.
12	A	Given that the light ray enters a glass block, the incident angle, i, is always larger than refracted angle, r (light ray will bend towards the normal). Hence, we know that the value of sin i should be larger than the value of sin r. Additionally, we know that the gradient of sin i – sin r graph should be positive due to our knowledge of refractive index: n = sin i / sin r .
13	C	The image is formed at the intersection of the two rays. To ensure the image on the screen is focused, the intersection of the rays should occur at the screen. Using a shorter focal length would make the rays bend more and the image will be formed closer to the lens. Moving screen away will make the image more blurry. Moving object closer to the lens will cause the intersection of the rays to occur further away from the lens. Changing the brightness of the object will not improve the focus of the image.
14	D	R – ultraviolet rays. S – Xrays.
15	C	Wavelength (distance between successive compressions/rarefactions) = 12/2 = 6 m v = fλ 300 = f (6) f = 50.0 Hz
16	B	The question states that the drum is positive. If the toner is attracted to the drum, it is negatively charged as unlike charges attract. Similarly, for the toner to be attracted to paper, it must be positively charges as unlike charges attract.
17	C	Current in A is the largest as it is the only resistor in series. In the parallel branch of B and C, more current flows through B as it has a lower resistance than C. As for the parallel branch of D, both resistors will have the same current (half of current in A) as they have the same resistance. Hence, C has the least current.
18	D	Resistance wire with length 2L has twice the resistance of X. However, since in parallel with X, total resistance in the circuit will drop. Hence, the current in the circuit will increase. Since X is parallel with the new resistor, the p.d. across both wires are still the same.
19	B	Water heater: 3 kW x 0.5 h = 1.5 kWh Hot plate: 1.5 kW x 2.0 h = 3.0 kWh Iron: 0.75 kW x 3.0 h = 2.25 kWh Lamp: 0.1 kW x 15.0 h = 1.5 kWh
20	C	The direction of the current is into the paper. To find the magnetic field, use the right hand grip to find that the direction of the magnetic field: 

Paper 2

No	Answer	Mark	Remarks
1a	External diameter = 3.47 cm Internal diameter = 3.16 cm Thickness = (3.47 – 3.16) / 2 = 0.155 cm	1 1	
1b	More measurements can be taken from different locations on the pipe to find an average thickness.	1	

2ai	The object slows from 9 m/s to 0 m/s at a uniform rate of 9 m/s^2 as it goes up the ramp.	1	
aii	The object stops momentarily before it increases its velocity from rest to 3 m/s in the opposite direction at a constant rate of 1 m/s^2.	1	
b	Distance travelled = area under the graph = ½ x 9 x 1 = 4.5 m	1 1	
3	The diver falls at constant speed between 4 s to 6 s. This is because the force from the air resistance is the same as the total combined weight of the diver and his load. Since the forces are balanced, the resultant force is zero.	1 1	
4a	Mass = density x volume = 7800 x (0.4x 2 x 1.2) = 7488 kg = 7490 kg	 1 1	
4b	Pressure = F / A = 74880 / (1.2 x 0.4) = 156000 Pa	 1 1	
4c	1 cm : 10 kN (or appropriate scale)	1	

	Labelled forces, arrows Correct Diagram Tension = 10 cm x 10kN = 100 kN (95 kN – 105 kN)	1 1 1	
5a	Adding wood P has lowered and changed the location of the centre of gravity of the door such that it is on the left of the hinge. The line of action of the weight through the new cg causes an anticlockwise moment about the hinge, which prevents the door from opening.	1 1	
5b	Moment = F x d = 35 x 0.08 = 2.8 Nm	 1 1	
6ai	Glass traps the heat from the sunlight much like a greenhouse effect.	1	
6aii	The water pipe is insulated to prevent heat loss.	1	
6aiii	Spiral features are to increase the surface area of the pipe.	1	

	Black is a good emitter of heat Copper is a good conductor of heat.	1 1	
7ai	At t = 0 s, P is at a distance of 1.25 m. It then is displacement in the positive direction until a maximum of 2 m before displacement in the negative displacement until a maximum of – 2 m. It then returns to the original position.	1 1	
7aii	Period = 0.6/2 = 0.3 s Speed = 1.0/0.3 = 3.33 m/s	 1 1	
7b	 Rays R and S (with arrow, correct angle) Position of image perpendicular to mirror extension, labelled.	 1 1 1	

8a	When S1 closed: $V = IR$ $12 = I\,(8)$ $I = 1.5$ A	 1 1	
8b	When both are closed: $V = IR$ $12 = (0.8)\,R$ $R = 15\ \Omega$	 1 1	
8c	No change to brightness. Since S2 is parallel, the PD across the light bulb does not change regardless whether the switch S2 is open or closed.	1 1	
9ai	The switch should be on the live instead of the neutral wire.	1	
9aii	The fuse will melt and break the circuit to protect the circuitry from damage when excessive current that exceeds the fuse rating flows through it.	1	
9aiii	The switch and fuse should be placed on the live wire so that the appliances will be disconnected from high potential when the switch is off or when the fuse is blown.	1	
9bi	AB will move to the right. There will be a resultant force that acts on AB as it is a current carrying conductor in a magnetic field.	1 1	
9bii	AB moves to the right with greater force/speed	1	
10 ai	Negative charges clustered on the top of the tree, positive charges at the bottom half.	1	
aii	The positive charges at the bottom of the cloud induces a negative charge at the top of the tree as unlike charges attract. The charges build up until there is a discharge from the tree to the cloud.	1 1	

aiii	Current = Charge / Time = 620 / (2.5 x 10^{-4}) = 2.48 x 10^{6} A	1 1	
bi	Field direction from + to – Parallel lines	1 1	
bii	Electric field is a region in which a charge experiences a force.	1	
biii	Negatively charge It moves downward towards the positively charged plate as unlike charges attract.	1 1	
11a	Ultrasound waves are waves that have a high frequency beyond the normal hearing range of 20kHz.	1	
11b	The pulse from the ship causes adjacent water molecules to vibrate. This allows the sound energy to travel through the water in a series of compressions and rarefactions as a longitudinal wave.	1 1	
11c	Q is the deepest The time taken for the echo to return from Q is the longest.	1 1	
11d	Speed = 2d/t 1500 = 2d / (750 x 10^{-3}) D = 562.5 m	1 1	
11e	v = f λ 1500 = 45000 x λ λ = 0.0333 m	1 1	
11f	Amplitude labelled at 5 m Period labelled at 1 s	1	
12ai	When running, kinetic energy to gravitational potential energy and kinetic energy	1	

aii	Kinetic energy to elastic potential energy and gravitational potential energy	1	
bi	Change in GPE = Change in KE Mgh = ½ mv^2 v^2 = 2gh = 2 x 10 x 6.1 = 122 v = 11.0 m/s	1 1	
bii	Output power = total energy/time = mgh/time = 70 x 10 x 6.1 / 5.4 = 790.7 W = 791	1 1	
biii	KE of athlete = 70 x 10 x (6.1 – 1.5) = 3220 J Work done to stop athlete = 3220 F x d = 3220 F = 6440 N	1 1	
biv	Higher. Work is also done to overcome air resistance.	1 1	

0

JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
Secondary 4 Express / 5 Normal (Academic)

STUDENT NAME	
CLASS	
INDEX NUMBER	

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 Multiple Choice

30 August 2019

1 hour

Additional Materials: Multiple Choice Answer Sheet.

READ THESE INSTRUCTIONS FIRST

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

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue, correction tape or correction fluid.
Write your name, index number and class in the spaces at the top of this page.

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 multiple choice answer sheet.

Each correct answer will score one mark. No mark will 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 16.
A copy of the Periodic Table is printed on page 17.
The use of an approved scientific calculator is expected, where appropriate.

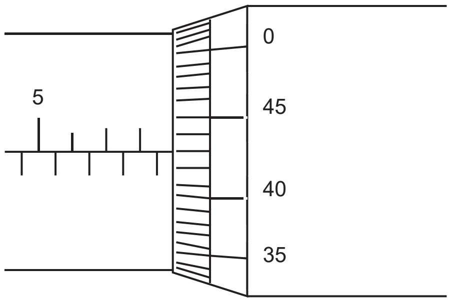
Take acceleration due to gravity on Earth, g, to be 10 m / s^2 unless stated otherwise.

For Examiner's Use
/ 40

Setter: Ms Toh P.B. & Ms Karine Nai

This document consists of **17** printed pages.

1 The diagram below shows part of a micrometer screw gauge used to measure the diameter of a ball bearing. It is known that the micrometer screw gauge has a zero error of – 0.02 mm.

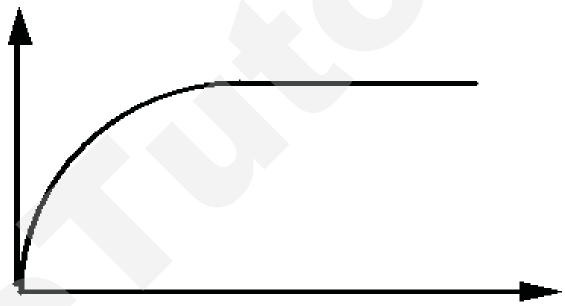


What is the diameter of the ball bearing?

A 8.563 mm **B** 8.523 mm **C** 8.91 mm **D** 8.95 mm

2 The graph shows how the displacement of a car changes over time.

displacement / m



time / s

Which of the following statements is true?

A The car accelerates and then moves with a steady velocity.

B The car accelerates at a decreasing rate.

C The car decelerates then moves with a steady velocity.

D The car decelerates until it stops.

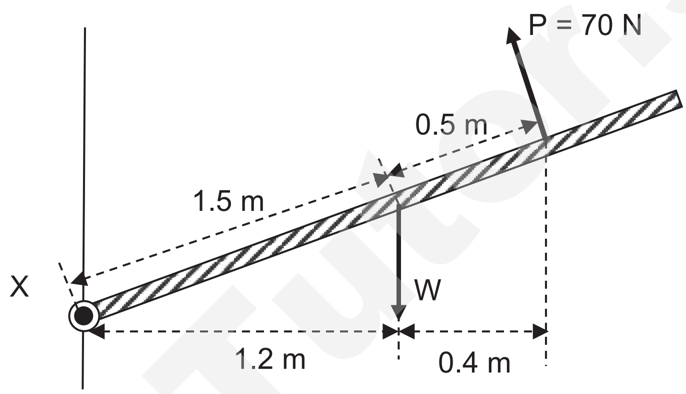
3 An elevator, with a mass of 500 kg, is moving upwards at a constant speed of 11 m / s. What is the tensional pulling force in the cable that is pulling the lift upwards? (Take g = 10 N / kg)

A 0 N **B** 500 N **C** 5000 N **D** 5500 N

4 The table shows the mass and weight of some objects on the surface of four different planets. Which planet has the greatest gravitational field strength?

planet	mass / kg	weight / N
A	0.5	20
B	0.5	40
C	2.0	20
D	2.0	40

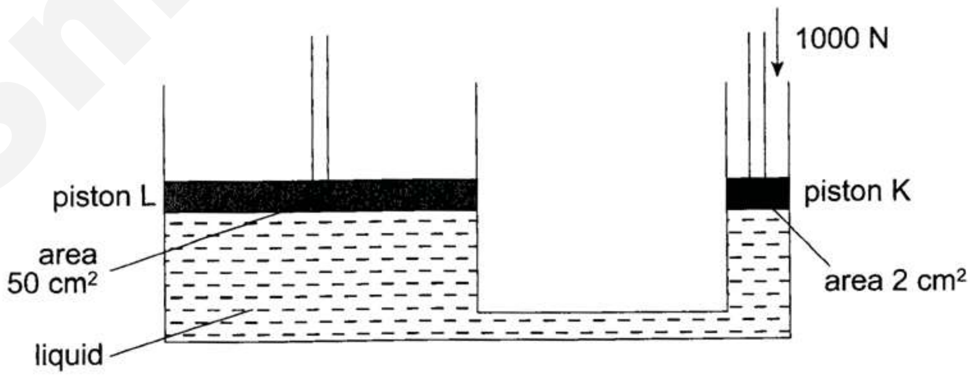
5 The diagram below shows a uniform wooden beam of weight W hinged at X. A force, P, of 70 N acts on it.



What is the weight, W, of the wooden beam?

A 74.7 N **B** 93.3 N **C** 117 N **D** 1170 N

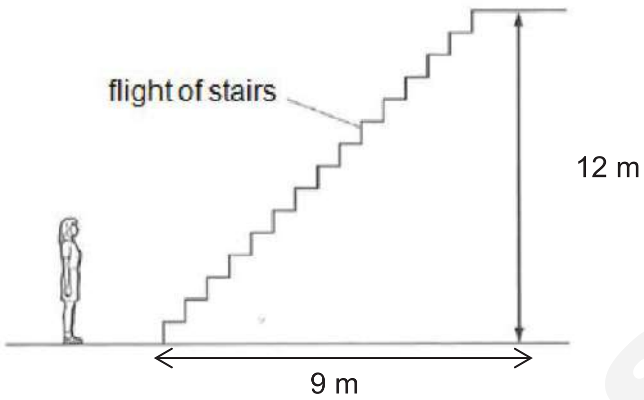
6 The diagram shows a hydraulic system used to lift heavy loads in a workshop.



Given that the pressure throughout the liquid is constant, if a downward force of 1000 N is exerted on piston K, what will be the load supported by piston L?

A 40 N **B** 1000 N **C** 25000 N **D** 50000 N

7 A woman of weight 490 N runs up a flight of stairs in 8 seconds. The vertical height of the stairs is 12 m. The horizontal distance that she covers is 9 m.



What is the average useful power developed by the woman?

A 735 W **B** 919 W **C** 4410 W **D** 5880 W

8 Why is the conduction of thermal energy generally slower in liquids than in solids?

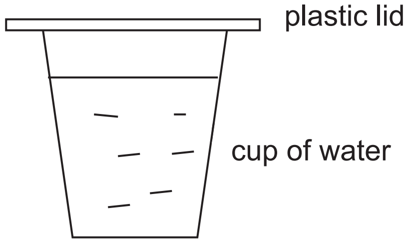
A Liquid molecules are larger than solid molecules.

B Liquids generally have higher densities than solids.

C The average distance between molecules in a liquid is larger than that in a solid.

D The speed of molecules moving in a liquid is slower than that in a solid.

9 Adam places a flat plastic lid over the cup to reduce the rate of evaporation from a cup of water, as shown below.



How does this help to reduce the rate of evaporation?

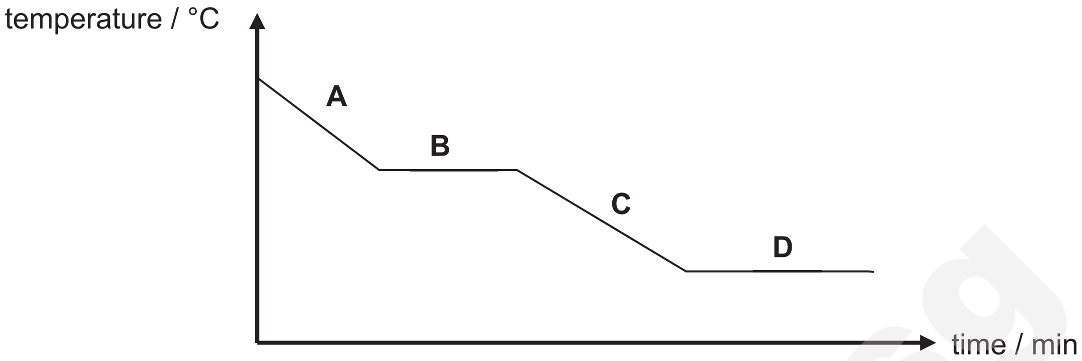
A The plastic lid creates a vacuum which prevents evaporation.

B The plastic lid helps to increase the boiling point of the water in the cup.

C The plastic lid is a good insulator of heat.

D The plastic lid reduces the wind moving across the water surface.

10 The diagram below shows the temperature-time graph of a liquid placed into a refrigerator and cooled steadily.

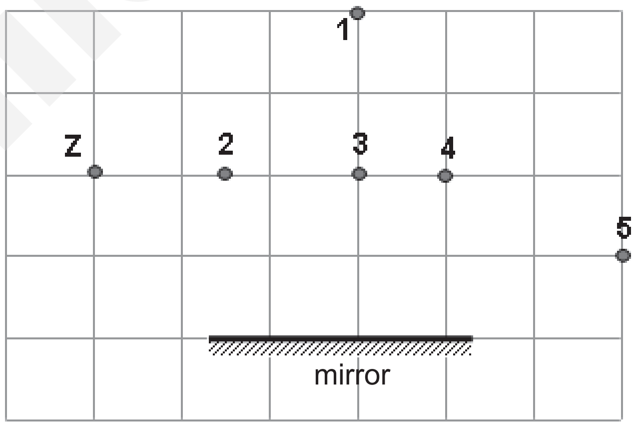


Which point would the substance be a mixture of solid and liquid?

11 Visible light, X-rays and microwaves are all part of the electromagnetic spectrum. Which of the following shows these waves in order of increasing frequency?

	low frequency	→	high frequency
A	microwaves	visible light	X-rays
B	microwaves	X-rays	visible light
C	X-rays	microwaves	visible light
D	X-rays	visible light	microwaves

12 A person stands at a point **Z** as shown.



Which of the pin's (**1**, **2**, **3**, **4** or **5**) images will the person be able to see in the mirror?

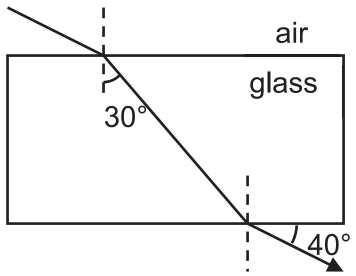
A pins **1** and **3** only

B pins **2** and **4** only

C pins **2**, **3** and **5** only

D pins **3**, **4** and **5** only

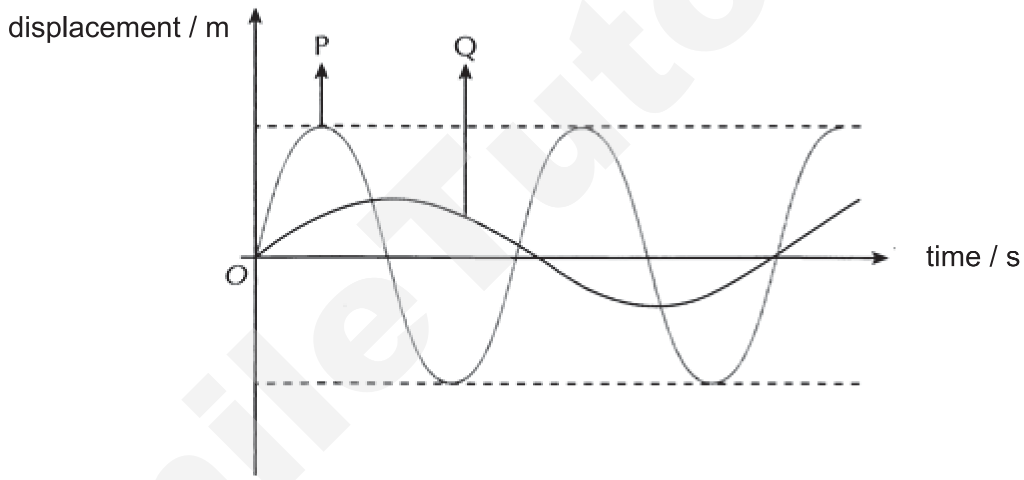
13 A ray of light is incident on a piece of glass block as shown below.



Which one of the following expressions should be used to calculate the refractive index of the glass block?

A $\frac{\sin 30°}{\sin 40°}$ **B** $\frac{\sin 30°}{\sin 50°}$ **C** $\frac{\sin 40°}{\sin 30°}$ **D** $\frac{\sin 50°}{\sin 30°}$

14 The graph illustrates the vibration of a molecule in the air caused by two sounds, P and Q.



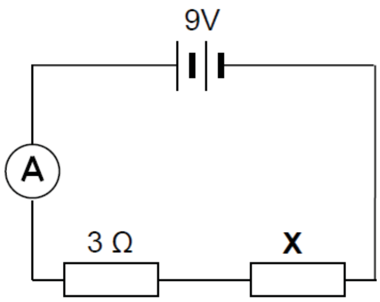
Which statement about P and Q is correct?

A P has a higher pitch and is louder than Q.
B P has a lower pitch and is softer than Q.
C Q has a higher pitch and is softer than P.
D Q has a lower pitch and is louder than P.

15 A negatively charged rod repels a suspended rod. Which of the following statements about the suspended rod is correct?

A It is negatively charged.
B It is positively charged.
C It is uncharged.
D It may be uncharged or negatively charged.

16 In the circuit, the reading on the ammeter is 2 A.



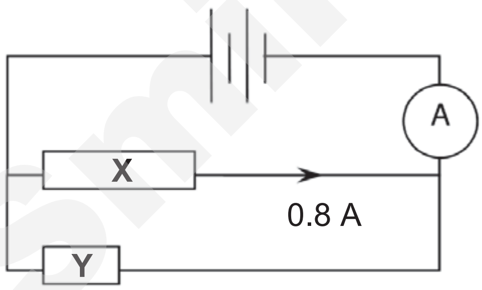
What is the value of the potential difference across resistor **X**?

A 1.5 V　　**B** 2 V　　**C** 3 V　　**D** 6 V

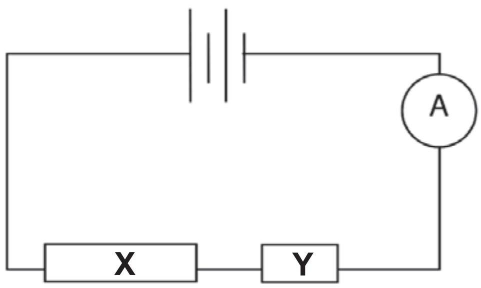
17 Which of the following appliances is likely to blow its fuse when connected to a 240 V supply?

	appliance	fuse rating
A	150 W lamp	1 A
B	1 kW vacuum cleaner	5 A
C	2.5 kW heater	10 A
D	3 kW electric fire	13 A

18 Two resistors, **X** and **Y**, are made of the same material. Resistors **X** and **Y** have the same cross-sectional area but **X** is twice as long as **Y**.



circuit 1

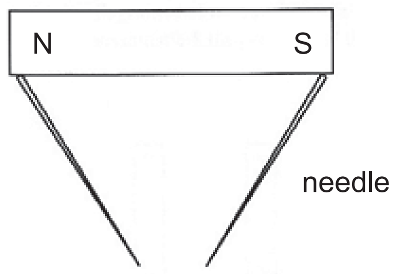


circuit 2

The two resistors are connected to the same power supply differently in the circuit 1 and circuit 2 shown above. What are the ammeter readings in circuit 1 and circuit 2?

	circuit 1	circuit 2
A	1.20 A	0.80 A
B	1.20 A	0.53 A
C	2.40 A	0.80 A
D	2.40 A	0.53 A

19 Two iron needles hanging from the ends of a bar magnet are observed as shown.



Which of the following statements best explains the observation?

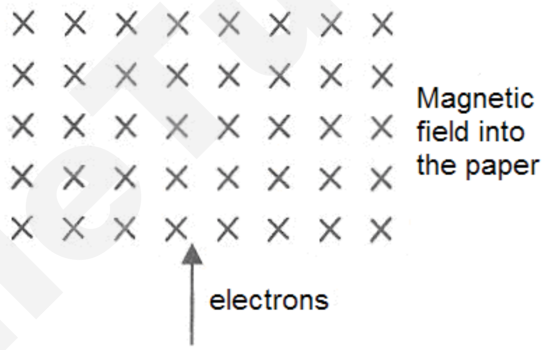
A The ends of the needles are both north poles.

B The ends of the needles are both south poles.

C The needles are induced temporary magnets.

D The needles have become permanently magnetised.

20 An electron beam is directed into a uniform magnetic field that is 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.

21 Which apparatus is most appropriate to measure exactly 24.5 cm^3 of a liquid?

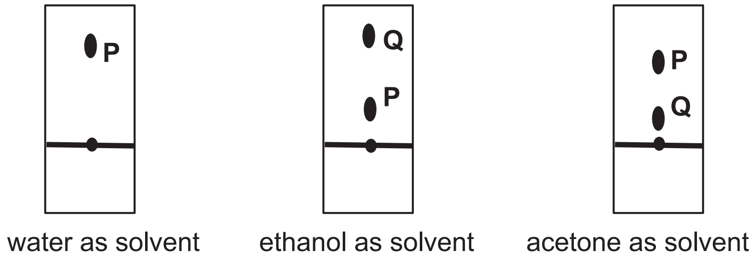
A beaker

B burette

C measuring cylinder

D pipette

22 A scientist suspects that some canned drinks contain a mixture of two toxic dyes, **P** and **Q**. He analyses the mixtures using chromatography with three different solvents. The results of the analysis are shown below.



What can you conclude about the solubility of **P** and **Q**?

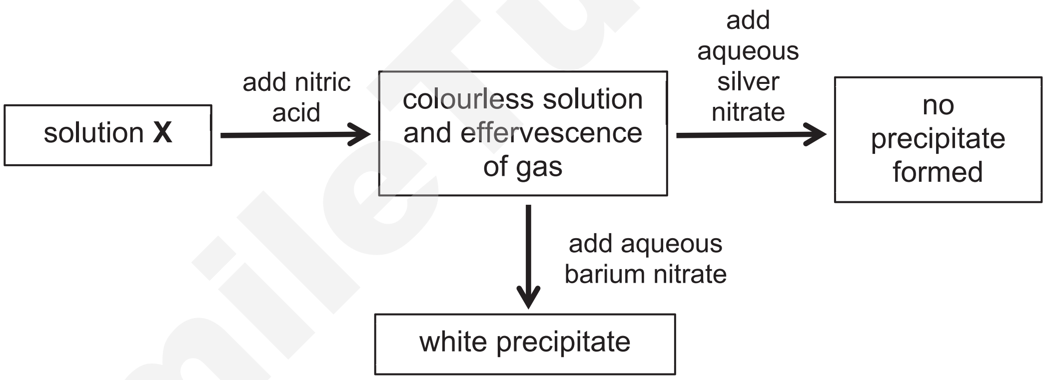
A **P** is insoluble in water but **Q** is soluble.

B **P** is more soluble in ethanol than in acetone.

C **Q** is soluble in ethanol but insoluble in acetone.

D **Q** is less soluble in acetone than in ethanol.

23 Solution **X** contains two anions. Tests were carried out as shown in the diagram below.



What are the two anions found in solution **X**?

A carbonate ions and nitrate ions

B carbonate ions and sulfate ions

C chloride ions and nitrate ions

D chloride ions and sulfate ions

24 A student uses his understanding of particles to explain the properties of solids, liquids and gases.

Which of his explanations is correct?

A Gases are less dense than liquids because the particles in a gas move randomly.

B Liquids flow because the particles in a liquid are closer than in a gas.

C Solids are rigid because the particles in a solid vibrate.

D Solids, liquids and gases become less dense when heated because the average separation between the particles increases.

25 Chlorine exists as isotopes, $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

Which of the following is a property of the isotopes of chlorine?

A They have the same boiling point.

B They have the same density.

C They have the same solubility in a given solvent.

D They react chemically in the same way.

26 Which statement is true of a pure compound?

A A pure compound can be separated by distillation.

B A pure compound consists of one type of atoms chemically combined.

C A pure compound has a different property from the constituents it is made up of.

D A pure compound melts and boils over a range of temperature.

27 The equation shows the reaction between oxide of metal **M** and dilute sulfuric acid.

$$\mathbf{M}O\ (aq) + H_2SO_4\ (aq) \rightarrow \mathbf{M}SO_4\ (aq) + H_2O\ (l)$$

Which particles are responsible for the electrical conductivity in **M**, **M**O and **M**SO_4?

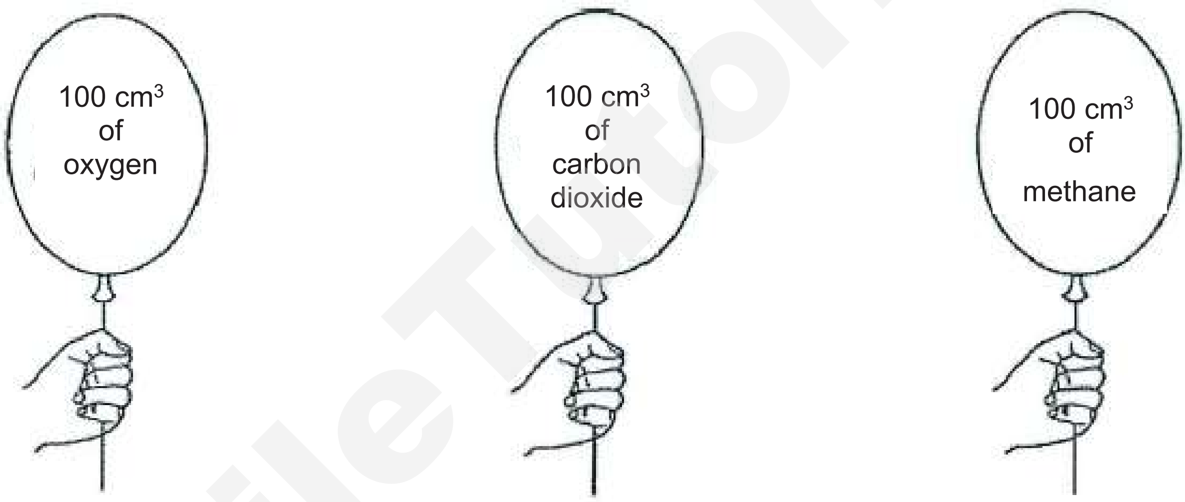
	metal **M**	**M**O	**M**SO_4
A	electrons	electrons	ions
B	electrons	ions	ions
C	ions	electrons	electrons
D	ions	ions	ions

28 An element **X** has an electronic structure of 2.8.8.1. Element **Y** has an electronic configuration of 2.8.6.

What type and formula of compound is formed when **X** and **Y** react?

	type of compound	formula of compound
A	covalent	$\mathbf{X_2Y}$
B	covalent	$\mathbf{XY_2}$
C	ionic	$\mathbf{X_2Y}$
D	ionic	$\mathbf{XY_2}$

29 The diagram shows three balloons filled with different gases.



Which statements are correct?

1 The mass of gases in the three balloons is different.
2 The number of moles of gases in the three balloons is the same.
3 The number of molecules in the three balloons is different.

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

30 Which reagent, when mixed and heated with ammonium sulfate would liberate ammonia?

A acidified potassium dichromate(VI)
B aqueous bromine
C dilute hydrochloric acid
D potassium hydroxide solution

31 Most salts can be prepared by reacting a carbonate with an acid.

Which salt cannot be prepared by the above method?

A calcium nitrate

B lead(II) chloride

C potassium sulfate

D zinc chloride

32 How does the property change when going across a period of the Periodic Table from Group I to Group VII?

A acidic oxides to basic oxides

B less reactive to more reactive

C metallic characteristic to non-metallic characteristics

D negative ions to positive ions

33 **P**, **Q** and **R** are three metals that form cations $\mathbf{P}^{2+}$, $\mathbf{Q}^{2+}$ and $\mathbf{R}^{+}$ respectively.

Given the following information

$$\mathbf{P}^{2+} + \mathbf{R} \rightarrow \text{no reaction}$$
$$2\mathbf{R}^{+} + \mathbf{Q} \rightarrow \mathbf{Q}^{2+} + 2\mathbf{R}$$
$$\mathbf{Q}^{2+} + \mathbf{P} \rightarrow \mathbf{Q} + \mathbf{P}^{2+}$$

Which of the following is the correct order of decreasing reactivity of the metals?

A **P**, **Q**, **R**

B **Q**, **P**, **R**

C **Q**, **R**, **P**

D **R**, **Q**, **P**

34 Metal **M** is placed between zinc and iron in the reactivity series.

Which prediction made about metal **M** is correct?

A Metal **M** displaces magnesium from an aqueous solution of a magnesium salt.

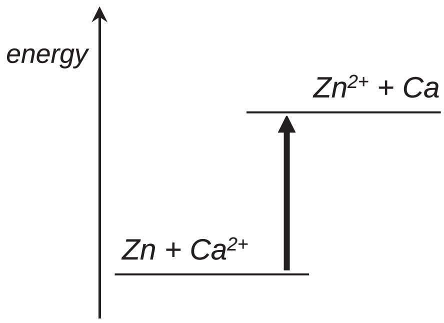
B Metal **M** forms a hydroxide which is soluble in water.

C Metal **M** is extracted from its ores by electrolysis.

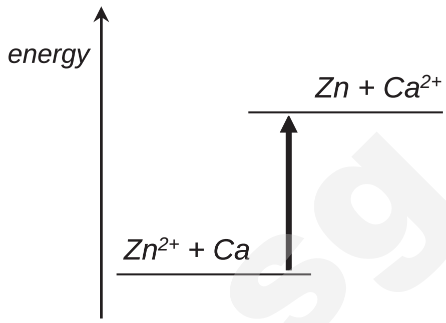
D Metal **M** reacts with dilute hydrochloric acid to produce hydrogen.

35 The reaction between calcium and aqueous zinc nitrate gives out heat energy.

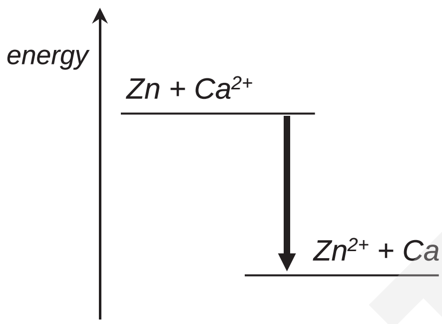
Which energy level diagram accurately represents the reaction?



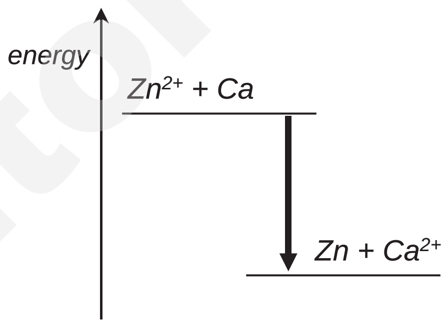
A



B



C



D

36 In which substance does carbon have the smallest oxidation number?

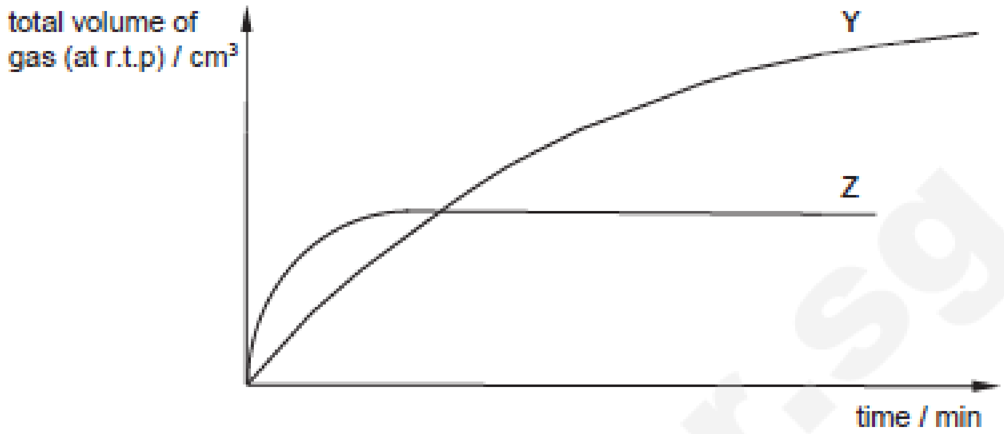
A C

B CO

C CO_2

D $CaCO_3$

37 In the graph shown below, curve Y represents the results of reacting excess of magnesium powder with 25 cm^3 of 1.0 mol / dm^3 sulfuric acid at 40 °C.



Which changes could produce curve Z?

A Using 12.5 cm^3 of 1.0 mol / dm^3 sulfuric acid at 20 °C.

B Using 12.5 cm^3 of 1.0 mol / dm^3 sulfuric acid at 60 °C.

C Using 25 cm^3 of 1.0 mol / dm^3 sulfuric acid at 20 °C.

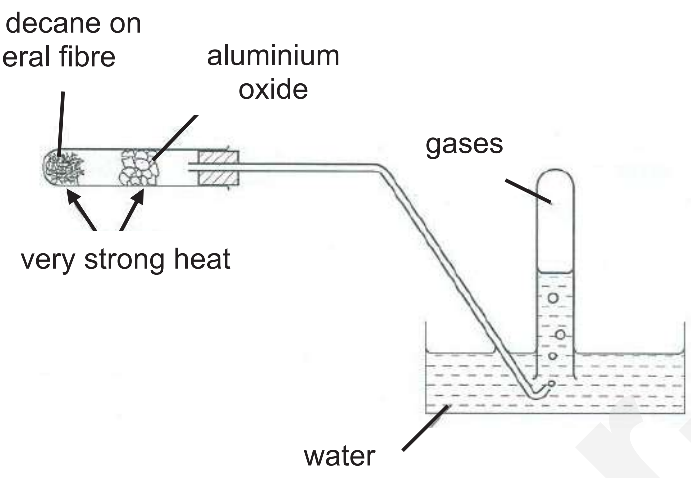
D Using 25 cm^3 of 1.0 mol / dm^3 sulfuric acid at 60 °C.

38 The table shows some gases found in polluted air and their possible effects.

Which row is not correct?

	gas	effect
A	CH_4	increases greenhouse effect
B	CO_2	leads to global warming
C	CO	prevents breathing in of oxygen
D	NO_2	forms acid rain

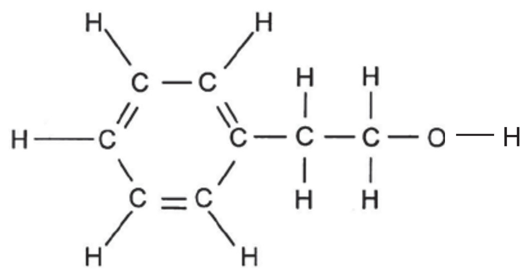
39 The apparatus shown below was set up and a sample of decane, $C_{10}H_{22}$, was heated strongly in the presence of aluminium oxide. The products obtained were a mixture of gaseous compounds and a diatomic gas.



Which row correctly indicates the process that occurred and the equation for the change that took place?

	process	equation
A	cracking	$C_{10}H_{22} \rightarrow 3C_2H_4 + C_4H_{10}$
B	cracking	$C_{10}H_{22} \rightarrow 3C_2H_4 + C_4H_8 + H_2$
C	reduction	$C_{10}H_{22} \rightarrow 2C_2H_4 + 2C_3H_6 + H_2$
D	subsitution	$C_{10}H_{22} \rightarrow 3C_2H_4 + C_4H_8 + H_2$

40 2-phenylethanol is responsible for the fragrance of roses. The structure of 2-phenylethanol is shown below.



Which statement about this molecule is correct?

A It can be oxidised by acidified potassium dichromate(VI).

B It can react with a metal carbonate to liberate carbon dioxide.

C It does not decolourise bromine water under any conditions.

D It is a saturated organic compound.

End of Paper

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

The Periodic Table of the Elements

Key
proton (atomic) number
atomic symbol
name
relative atomic mass

Group																	
I	II											III	IV	V	VI	VII	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 226	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

[Turn over

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JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
Secondary 4 Express/ 5 Normal (Academic)

STUDENT NAME

CLASS

INDEX NUMBER

SCIENCE(PHYSICS) 5076/02

Paper 2 **27 August 2019**

Candidates answer on the Question Paper. **1 hour 15 minutes**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue, correction tape or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.
Units should be stated in the answer where required.

There are two sections in this paper.

Section A:
Answer **ALL** the 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.
The number of marks is given in brackets [ ] at the end of each question or part question.
Take acceleration due to gravity on Earth, g, to be 10 m / s^2 unless stated otherwise.

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

For Examiner's Use	
Section A	/ 45
Section B	
…………	/ 10
…………	/ 10
Total	/ 65

Setter: Mr Lam Seng Tat

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

1 Fig. 1.1 below shows an electric scooter used by Danial to travel from home to school. He accelerates uniformly from rest to 2.5 m / s in 3 s. He continues at this speed for 9 s on a straight horizontal path before decelerating uniformly in 5 s.

Fig. 1.1

(a) Draw on Fig. 1.2 the variation of speed of the electric scooter with time. [2]

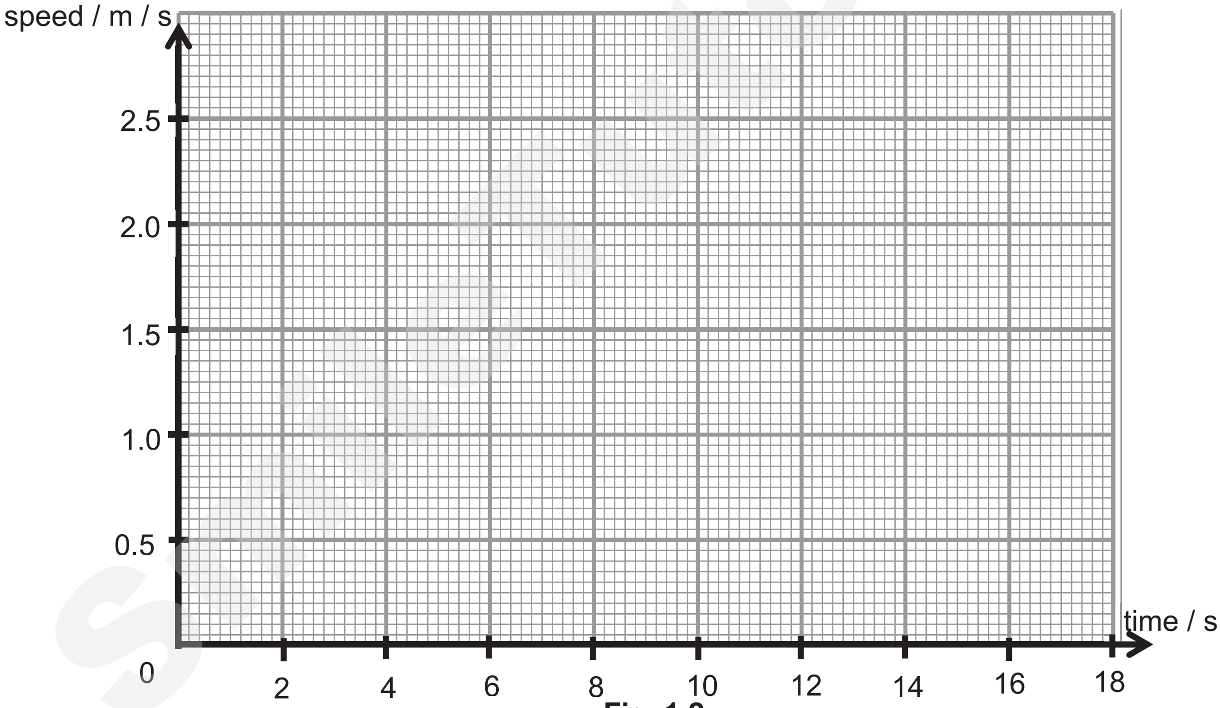


Fig. 1.2

(b) Calculate the average speed of the electric scooter for the journey.

average speed = ... m / s [2]

[Total: 4]

2 Fig. 2.1 below shows a bobby, commonly found in ice skating rink to aid beginners in ice skating. Fig 2.2 shows the top view of two forces, **P** and **Q**, acting on the handle of the bobby. Magnitude of force **P** is 50 N while magnitude of force **Q** is 80 N.

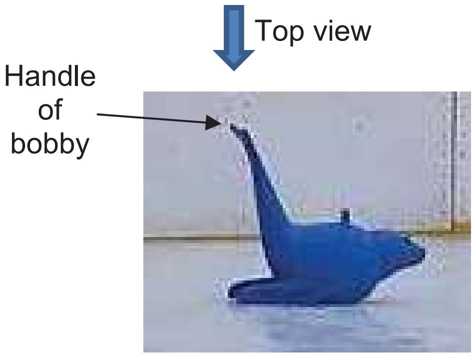


Fig. 2.1

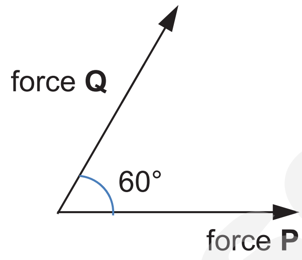


Fig. 2.2

(a) Draw a scaled vector diagram to determine the resultant force of **P** and **Q** acting on the bobby. [1]

scale of vector diagram: ………………… [1]

magnitude of resultant force = …………………N [1]

(b) The mass of the bobby is 6 kg. If the friction acting against the bobby is negligible, determine the acceleration of the bobby due to the resultant force determined in **2(a)**.

acceleration = …………………m / s^2 [2]

[Total: 5]

3 Fig. 3.1 and 3.2 below show Liang Qi jumping on a trampoline. Fig. 3.1 shows her at the lowest point on the trampoline while Fig. 3.2 shows her at the highest point.

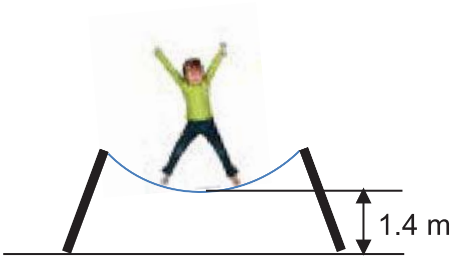


Fig. 3.1

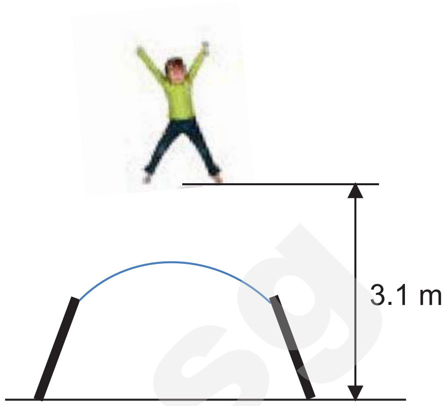


Fig. 3.2

(a) If Liang Qi has a mass of 48 kg, calculate the gain in her gravitational potential energy when she is jumping on the trampoline.

gain in gravitational potential energy = ………………..…J [2]

(b) Explain, in terms of conversion of energy, why Liang Qi is momentarily stationary when she is at the highest point in Fig. 3.2.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………[2]

[Total: 4]

4 Fig. 4.1 shows a fireman standing next to his fire engine. The fireman is wearing a mesh T-shirt and holding to his fire-protective jacket.

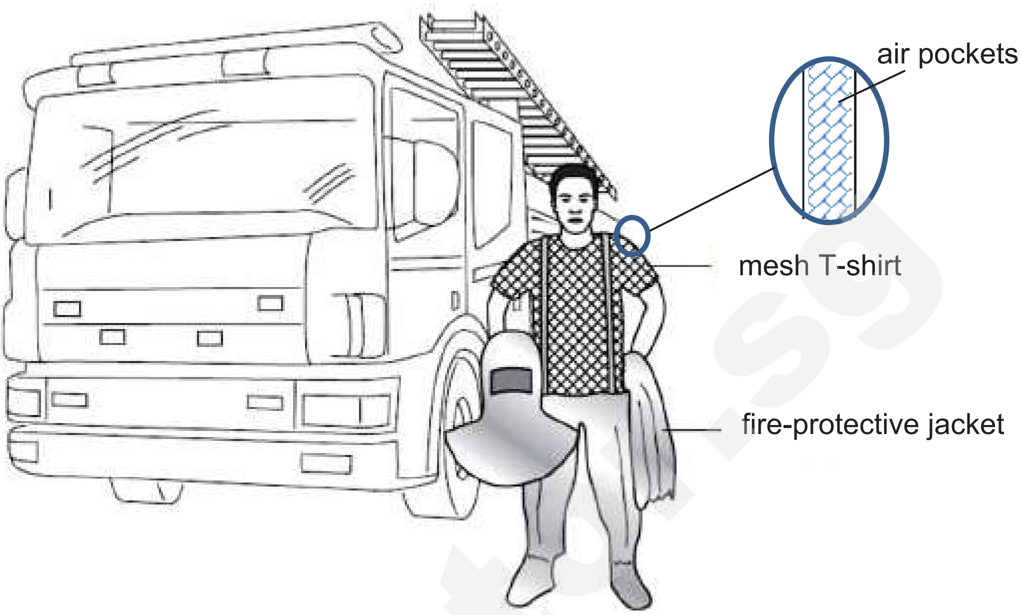


Fig. 4.1

(a) Describe and explain how the loosely woven mesh T-shirt helps to keep the fireman cool when he is close to the fire.

....

....

....

....

....[2]

(b) Describe the choice of colour for the fire-protective jacket to reduce thermal energy to the fireman. Explain your answer.

....

....

....

....

....[2]

[Total: 4]

5 Fig. 5.1 shows a cylinder with a movable piston. Air is trapped inside the cylinder by the piston.

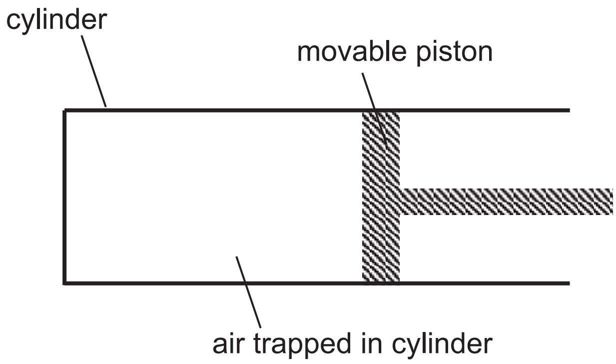


Fig. 5.1

(a) Describe the arrangement and motion of the molecules of the air in the cylinder.

....

....

....

....

....[2]

(b) State how, in terms of energy, the arrangement and motion of the molecules of air in the cylinder change when it is heated.

....

....

....

....

....[2]

[Total: 4]

6 Fig. 6.1 shows a boy swimming inside a swimming pool. A light source at the bottom of the swimming pool shines light onto the surface of the water. The boy is able to see the light source as shown by the path of the light ray.

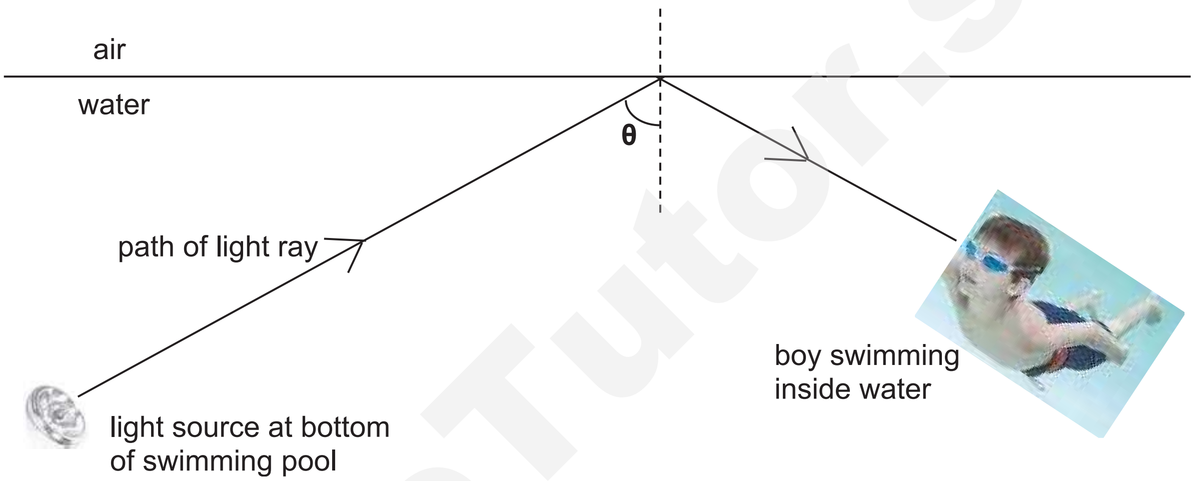


Fig. 6.1

(a) State the phenomenon which light is able to reach the boy inside the water

……………………………………………………………………………………………..………………[1]

(b) Describe the condition required for angle **θ** needed such that the boy can see the light source.

……………………………………………………………………………………………..………………

………[1]

(c) Given that the speed of light in water is 2.25 x 10^8 m / s, calculate the refractive index of water.

refractive index of water = ………………………… [2]

(d) Mark on Fig. 6.1 with 'x' the position of the image of the light source as seen by the boy. [1]

[Total: 5]

7 Fig. 7.1 shows a thundercloud approaching a building with a lightning rod at the top of the building. The lightning rod is connected to the ground with a lightning conductor.

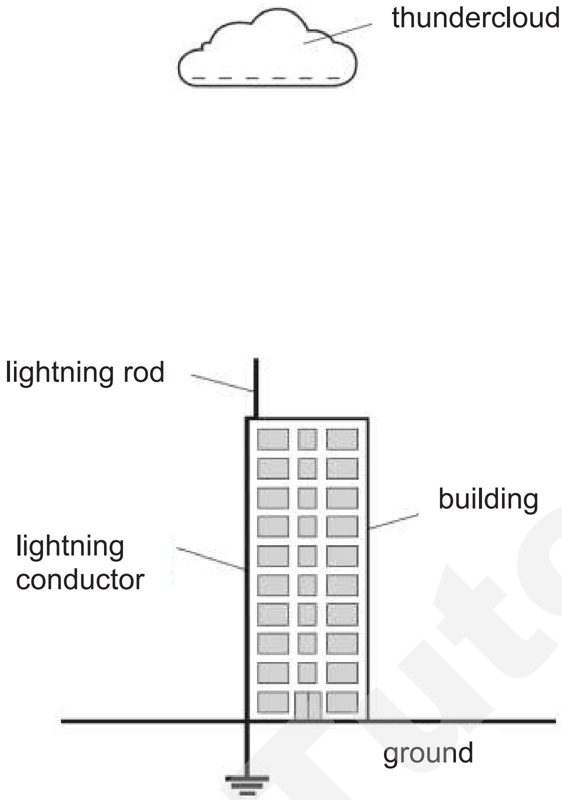


Fig. 7.1

(a) State the charge that will form at the top end of the lightning rod if the thundercloud is negatively charged. Explain your answer.

……

……

……

……

……………………………………………………………………………………………………[2]

(b) Describe, in terms of movement of charged particles, what will happen if lightning occurs between the thundercloud and the building.

……

……

……

……

……………………………………………………………………………………………………[2]

[Total: 4]

8 Fig. 8.1 shows an electrical circuit with a fixed resistor and light bulb connected to a 20 V battery in parallel. The fixed resistor has a resistance of 100 Ω and the light bulb has resistance of 50 Ω.

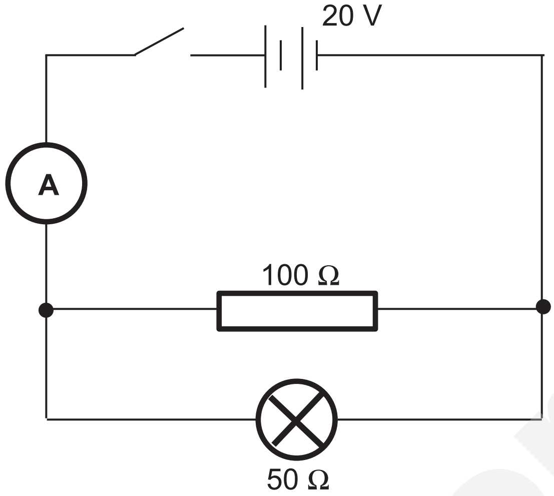


Fig. 8.1

(a) Calculate the effective resistance of the fixed resistor and light bulb connected in parallel.

effective resistance = ………………………… Ω [1]

(b) Determine the reading of the ammeter when the electrical circuit is switched on.

ammeter reading = …………………………A [2]

(c) If the light bulb becomes spoilt and does not light up, state if the current will flow through the fixed resistor when the electrical circuit is switched on. Explain your answer.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………[2]

[Total: 5]

9 Fig. 9.1 shows a magnet and two iron nails attracted to the north pole of the magnet.

Fig. 9.1

(a) State the magnetic pole at the pointed end of the second iron nail. Describe what has occurred to the two iron nails.

....

....

....

....

....[2]

(b) Describe the difference in the magnetic effect if steel nails were used instead of iron nails.

....

....

....

....

....[2]

(c) Draw on Fig. 9.2 the magnetic field pattern between the two magnets. [2]

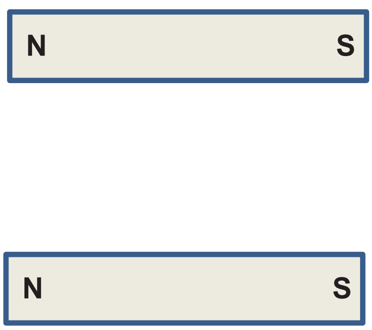


Fig. 9.2

[Total: 6]

10 Fig. 10.1 shows an electrical circuit consisting of a straight conducting wire connecting a variable resistor with a battery.

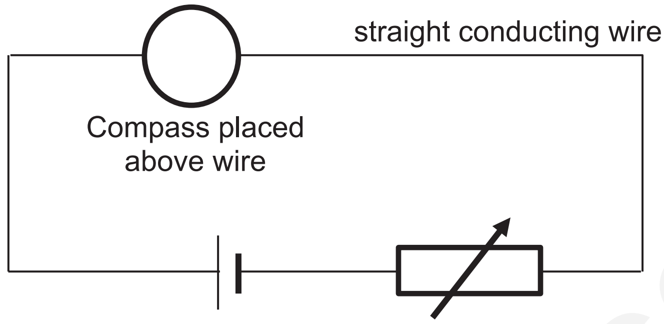


Fig. 10.1

(a) Draw the direction of the compass needle on Fig. 10.1 when current is flowing in the straight conducting wire. [1]

(b) Explain how the increase in variable resistor value will affects the magnetic field around the straight conducting wire.

……

……

……

……[2]

(c)

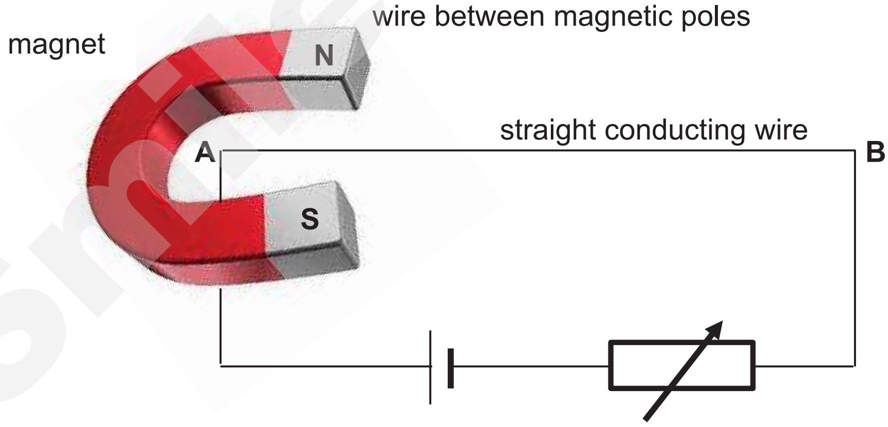


Fig. 10.2

Fig. 10.2 shows the same electrical circuit as in Fig. 10.1 but the compass has been replaced by a magnet. The poles of the magnet are placed between the straight conducting wire **AB**. Describe, if any, the force acting on the conducting wire between the poles of the magnet.

……

……

……[1]

[Total: 4]

Section B (20 marks)

Answer any <u>two</u> questions in the spaces provided.

11 Fig. 11.1 shows a face towel, a pair of jeans and a t-shirt. The face towel has a mass of 100 g. The pair of jeans has a mass of 1.2 kg while the mass of the t-shirt has a mass of 400 g.

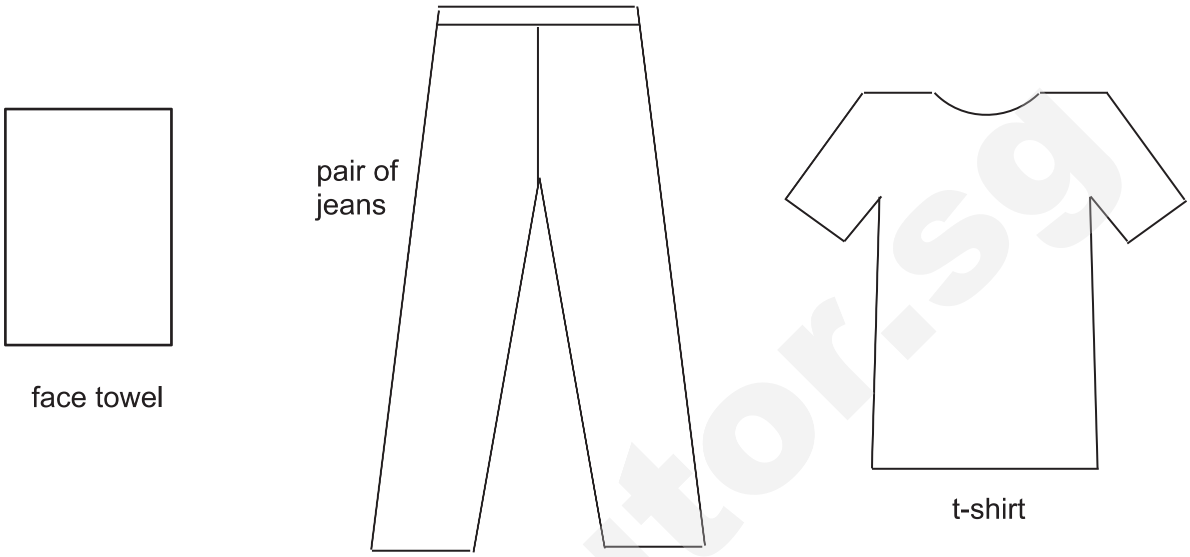


Fig. 11.1

(a) State which item has the greatest amount of inertia. Explain the reason for your answer.

....

....

....

....

....[2]

(b) Calculate the total weight of the three items.

total weight of the three items = ... [2]

11 (c) Derrick was tasked to place the three items onto a bamboo pole for them to dry. Fig. 11.2 shows the arrangement of the three items on the bamboo pole. The position of the centre of gravity of the individual item to the left end of the pole is indicated.

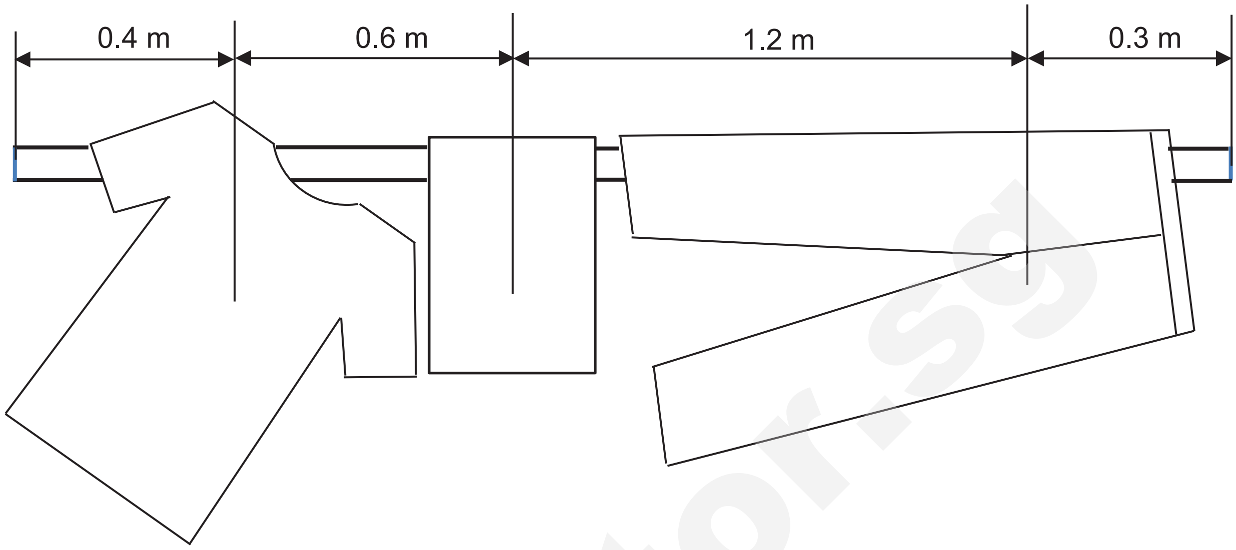


Fig. 11.2

(i) Explain what is meant by the *centre of gravity* of an object.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………[1]

(ii) Calculate the moment of the three items on the bamboo pole about the left end of the pole. State the unit.

moment about the left end of pole = ………………………. [3]

(iii) Describe and explain how the items can be arranged on the bamboo pole such that the moment about the left end of the pole is the smallest.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………[2]

[Total: 10]

12 **(a)** Fig. 12.1 shows a pressure-time graph of a sound wave.

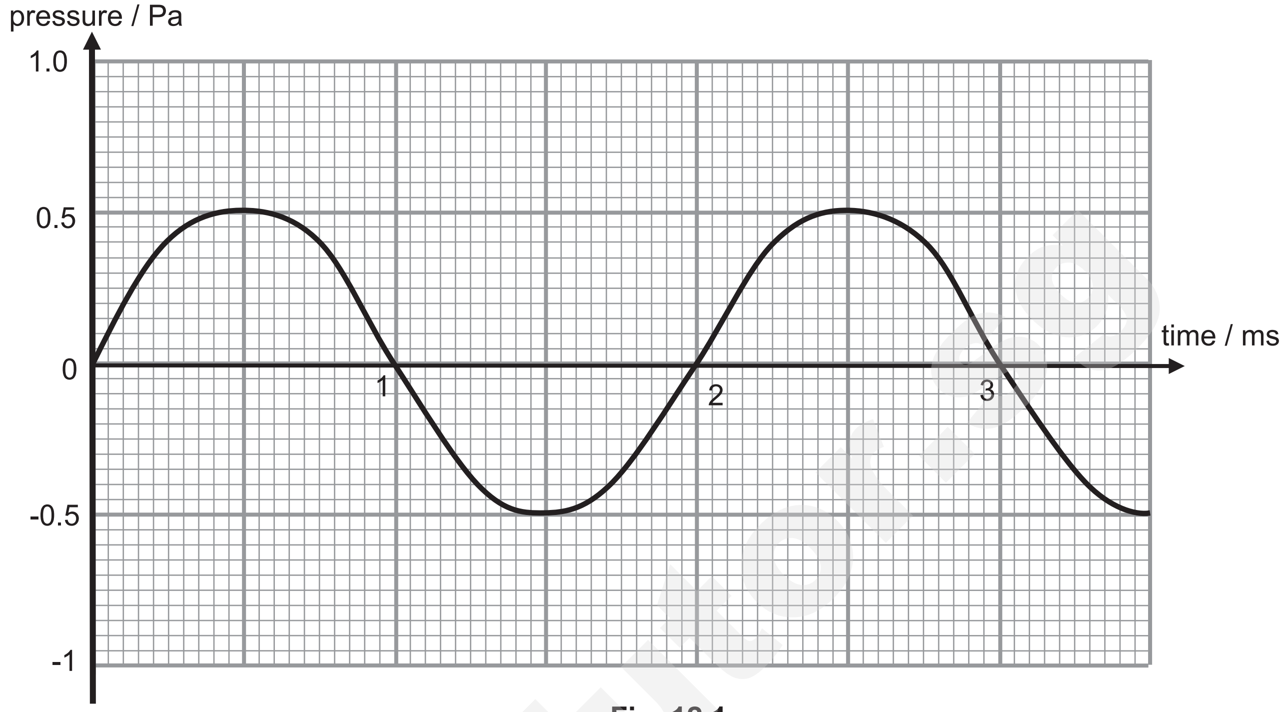


Fig. 12.1

(i) From the graph, state the period of the sound wave. Hence determine the frequency of the wave.

period of wave = …………………[1]

frequency of wave = …………………[1]

(ii) Draw on Fig.12.1 another wave that has the same frequency but twice as loud. [2]

(iii) Describe the relationship between pressure of the wave in terms of compression and rarefaction.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………[1]

12 **(b)** Fig. 12.2 shows a portable counterfeit currency detecting device.

Fig. 12.2

(i) State the electromagnetic wave used by the device to detect counterfeit currency.

……

……………………………………………………………………………………………………....[1]

(ii) The electromagnetic wave given out by the device has a wavelength of 2×10^{-7} m and frequency of 1.48×10^{15} Hz. Calculate the speed of the wave.

speed of wave = ………………….[2]

(iii) State two property differences between the electromagnetic wave and sound wave.

Difference 1:………………………………………………………………………………….

…………………………………………………………………………………………………..

…………………………………………………………………………………………………

Difference 2:………………………………………………………………………………….

…………………………………………………………………………………………………

…………………………………………………………………………………………………[2]

[Total: 10]

13 Fig. 13.1 shows an electrical circuit for an oven and a toaster connected to 240 V supply. The oven has a power rating of 2500 W while the toaster has a power rating of 1 kW.

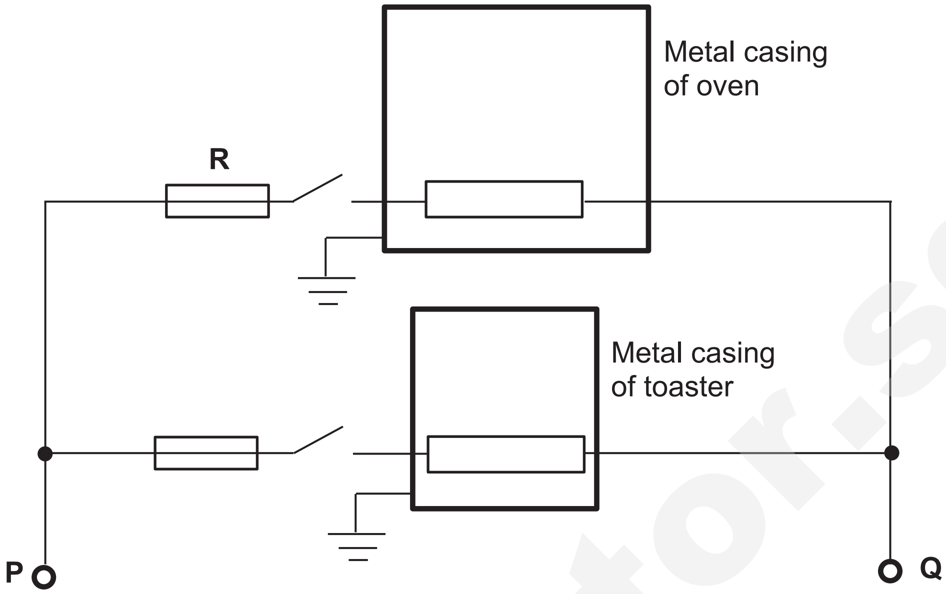


Fig. 13.1

(a) State the name for wires **P** and **Q**. Explain how you deduce your answer.

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………[2]

(b) Determine the current flowing through the oven when it is switched on. Hence select a suitable fuse at **R**. Available fuse are 3 A, 5 A, 10 A and 13 A.

current flowing through oven = …………………………..[1]

suitable fuse at **R** = …………………………..[1]

(c) Explain why the oven and toaster are connected in parallel in the circuit.

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………[1]

13 (d) Describe the function of the fuse as a safety device.

……

……

……

……

……[2]

13 (e) (i) The oven was switched on for five hours while the toaster was switched on for two hours. Calculate the electrical energy consumed for both oven and toaster.

electrical energy consumed for oven and toaster = ………………………[2]

(ii) Hence calculate the cost of electricity used by the oven and toaster if each unit of electrical energy cost $0.30.

total cost of electricity for oven and toaster = ………………………[1]

[Total: 10]

End of paper

Jurongville Secondary School
Science Department 2019
Marking Scheme & Marker's Report

Assessment: Prelim Examination **Level:** Sec 4E / 5N

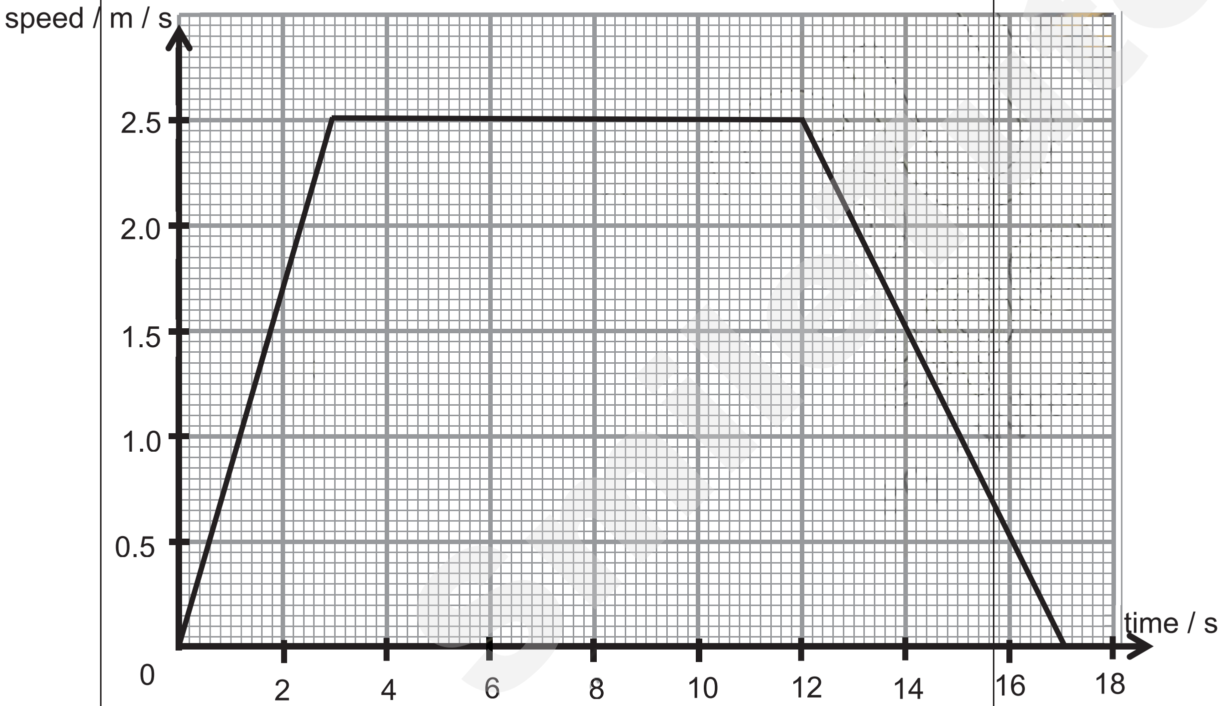
PAPER 1

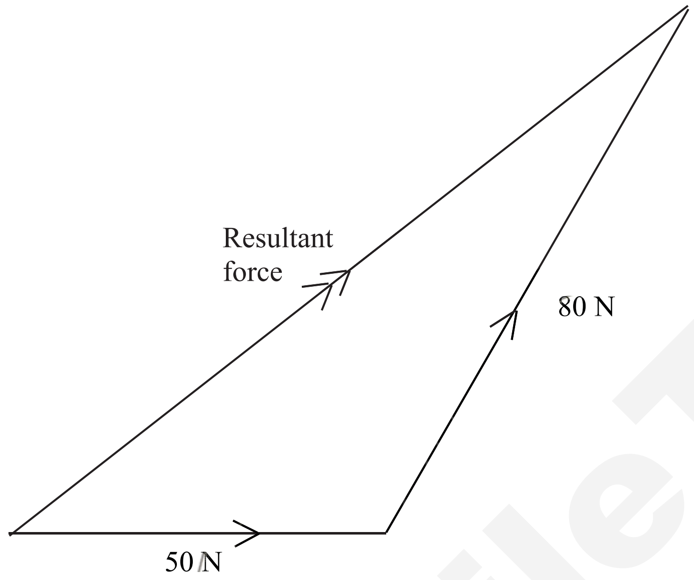
Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans
1	D	2	D	3	C	4	B	5	C	6	C	7	A	8	C	9	D	10	B
11	A	12	D	13	D	14	A	15	A	16	C	17	C	18	D	19	C	20	C
21	B	22	D	23	B	24	D	25	D	26	C	27	B	28	C	29	A	30	D
31	B	32	C	33	A	34	D	35	D	36	A	37	B	38	C	39	B	40	A

Jurongville Secondary School
Science Department 2019
Marking Scheme & Marker's Report

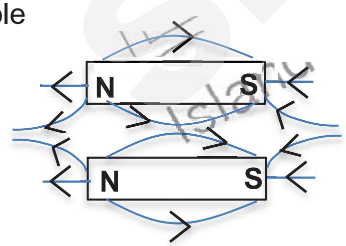
Assessment: **Preliminary Examination Sc(Physics) (5076)** **Level:** **4 Express / 5NA**

Paper 2

Qn	Marking Scheme	Remarks	Marks	Marker's Report
Section A				
1a		Correct straight lines Correct time duration	B1 B1	Most were able to get the correct graph. A few students did not read the question carefully and drew with wrong time.
1b	Distance travelled = 1/2 (9 +17) (2.5) = 32.5 m Average speed = 32.5 / 17 = 1.91 m / s	Correct distance with working. Correct average speed with working	Allow for ecf in (a) B1 B1	Most were able to calculate total distance and average speed. A few students made careless mistakes in using 18 s instead of 17 s.

Qn	Marking Scheme	Remarks	Marks	Marker's Report
2a	Scale 1 cm rep 10 N 114 N ± 1 N Info – direction is 38° anticlockwise from horizontal 	Correct vector diagram Correct scale Correct magnitude	B1 B1 B1	Most were able to draw vector diagram correctly. A few students did not draw orientation of forces correctly and were penalized. A few students drew wrong direction arrows and were also penalized. Common mistake was to write scale as 1cm = 10 N which was penalized. Another error was to write as scale as 10 N : 1 cm which was also not accepted. Magnitude out of range was rejected.
2b	Resultant force = mass x acceleration 114 = 6 x a a = 19 m / s^2	Accept ecf from a Correct answer with working.	C1 A1	Most were able to do this question. A few students left this blank.
3a	Gain in gravitational potential energy = 48 x 10 x (3.1 – 1.4) = 816 J	Correct answer with working.	C1 A1	Most students were able to do this. A few students did not include g in calculation. A few use either 3.1 m or 1.4 m height instead of the difference.
3b	As she rises from the trampoline, the **kinetic energy decreases and is converted to gravitational potential energy**. At the **highest point, all the kinetic energy has been converted to gravitational potential energy. Thus she is momentarily stationary at the highest point**.	OWTTE	B1 B1	Some students wrote that gravitational potential energy has converted to kinetic energy instead. A few students stated Principle of Conservation of energy without applying to this situation.

Qn	Marking Scheme	Remarks	Marks	Marker's Report
4a	The loosely woven mesh T-shirt **traps air which is a bad thermal conductor**. This **reduces the transfer of thermal energy by conduction from the fire to the fireman's body and thus keeping him cool**.	OWTTE	B1 B1	Many students did not state that air is a bad conductor. Many wrote that air cools the fireman down without explaining correctly.
4b	The fireman's jacket should be **silver** in colour as silver colour is a **bad absorber of thermal energy** and thus reduces transfer of thermal energy by radiation.	Accept white. OWTTE	B1 B1	Some students wrote bright and shiny colour. Accepted shiny as BOD.
5a	The **molecules of air in the cylinder are far apart from each other** and **moving randomly at high speed**.	OWTTE	B1 B1	Some students did not state that air particles are far apart from each other. Some students also did not state that the air particles are moving at high speed.
5b	**When air is heated, the air molecules gain kinetic energy**. This would cause the **air molecules to move even further apart and move even faster**.	OWTTE	B1 B1	Some students wrote about energy needed to break the intermolecular bonds and was penalized.
6a	Total internal reflection	CAO	B1	A few students wrote 'reflection'. A few wrote 'total internal refraction'.
6b	The **angle θ must be greater than critical angle of water**.	OWTTE	B1	A few students wrote 'lesser'.
6c	Refractive index of water = $3 \times 10^8 / 2.25 \times 10^8$ = 1.33	Correct calculation. Must show speed of light in air.	C1 A1	Most students were able to do this question.
6d	Position of 'x' at same distance perpendicularly above the surface of water as the light source is at distance below the surface of water.	Accept tolerance of 5 mm	B1	Most were not able to answer this. Some students placed the image at point on water surface at normal.
7a	Since the cloud is negatively charged, the **top end of the lightning rod should be positively charged**. This is because the **electrons on the lightning rod would be repelled by the electrons on the thundercloud leaving protons behind**.	OWTTE	B1 B1	Many students wrote that the lightning rod is negatively charged. Some thought that negatively charged rod will repel the thundercloud. Only a few students can explain correctly.
7b	If lightning occurs, the **electrons in the thundercloud would travel through the air and hit the building at the lightning rod**. The **electrons would transfer to the ground through the lightning conductor**	OWTTE	B1 B1	Most students did not mention the electrons from the thundercloud flowing to the ground through the lightning conductor. A few students were penalized for not stating clearly

Qn	Marking Scheme	Remarks	Marks	Marker's Report
				that electrons flow from thundercloud to lightning rod.
8a	Effective resistance = (1/100 + 1/50)$^{-1}$ = 33.3 Ω	Correct working and answer	B1	Some students did not write working correctly and were penalized. Some students made wrong calculation. Some wrote 100 + 50.
8b	Ammeter reading = 20 / 33.3 = 0.6 A Or Ammeter reading = (20/100) + (20/50) = 0.2 + 0.4 = 0.6 A	Allow for ecf in (a) Correct working and answer	B1 B1	Most students were able to do this. A few students used the wrong formula.
8c	The **current in the fixed resistor will still flow** because the **fixed resistor and light bulb are connected in parallel and current flow would not be affected by the spoilt light bulb**.	OWTTE	B1 B1	Most students can answer correctly. But a few students left this blank.
9a	The pointed end of the **second nail is north pole** since the iron nails has **become induced magnets**. The **magnetic domains in the iron nail has aligned itself with north pole pointing away from the north pole of the magnet**.	OWTTE	B1 B1	Most students can identify that the pole is North. But only some students correctly stated the iron nails becoming induced magnets. Some wrote that the iron nails had become electromagnets.
9b	**Iron nails are easily magnetized but lose its magnetism easily** while **steel nails are not as easily magnetized but does not lose its magnetism easily**.	OWTTE	B1 B1	Some students wrote that steel is not a magnetic material and thus will not be attracted to the magnet. Some students were confused by stating steel is stronger magnet because it is used as permanent magnet. Some students were penalized for not stating the difference between magnetic effect of iron and steel.
9c	Correct pattern of magnetic field lines with arrows pointing from north to south pole 	Correct arrow Correct pattern	B1 B1	Most students indicated the correct direction of arrow. But most students are not able to draw the pattern of magnetic field lines correctly.

Qn	Marking Scheme	Remarks	Marks	Marker's Report
10a	Compass needle with arrow pointing downwards using right-hand grip rule.	Correct direction of needle arrow	B1	Most students indicated arrow direction to the right in the direction of current. Need to revise such questions with students.
10b	By increasing the variable resistor value, the **current in the circuit will decrease**. This will cause the **magnetic effect around the straight conducting wire to decrease**.	OWTTE	B1 B1	Most students answered correctly. A few students did not state that current had decreased.
10c	The force will be acting into the paper.	OWTTE Reject 'downwards'	B1	Many students wrote downwards and was penalized.
11a	The **pair of jeans has the greatest amount of inertia because inertia is dependent on mass of object.**	OWTTE Accept if student state jeans has 'greatest mass'.	B1 B1	Most students answered jeans correctly. But only some students stated that inertia is dependent on mass of object.
11b	Total weight = (0.1 + 1.2 + 0.4) x 10 = 17 N	Convert g to kg Correct answer	C1 A1	Many students did not multiply by g. Many students wrote kg instead of N.
11ci	Centre of gravity **is the point where the whole weight of object appears to act.**	OWTTE	B1	Many students wrote about balance or equilibrium.
11cii	Moment = (0.4 x 10 x 0.4) + (0.1 x 10 x 1.0) + (1.2 x 10 x 2.2) = 1.6 + 1.0 + 26.4 = 29 N m	Allow for ecf in (b) Correct working with answer Correct unit	C1 A1 B1	Most students are not able to calculate this as they did not use the correct distance from the left end. Many students did not write the correct unit.
11ciii	The **jeans should be placed nearest to the left end. The t-shirt is placed in the centre while face towel is place furthest from the left end**. This is because **the heaviest item is nearest to the pivot while the lightest is furthest from the pivot to reduce the moment about the left end.**		B1 B1	Many students left this blank. Some students did not explain why moment is smallest.
12ai	Period = 2 ms = 0.002 s Frequency = 1 / 0.002 = 500 Hz	Accept 2 ms Correct working with answer. Correct unit	B1 B1	Most students did not write the correct unit for period. Most students did calculate frequency correctly.
12aii	Same period but with twice the amplitude	Correct amplitude Correct period	B1 B1	Most students were able to answer this correctly.
12aiii	The higher pressure is the compression region while the lower pressure region is the rarefaction region.	OWTTE	B1	Many students are not able to answer this correctly. Need to revise this.

Qn	Marking Scheme	Remarks	Marks	Marker's Report
12bi	Ultraviolet radiation	CAO	B1	Many students are not able to answer this correctly. Need to revise this.
12bii	Speed = $1.48 \times 10^{15} \times 2 \times 10^{-7}$ = 2.96×10^{8} m/s	Correct working with answer. Correct unit	C1 A1	Most students can calculate this. Some students did not write the unit.
12biii	Electromagnetic waves are transverse waves while sound waves are longitudinal waves. Electromagnetic waves can travel through vacuum but sound waves cannot travel through vacuum.	Any suitable answer	B1 B1	Many students wrote that electromagnetic waves are longitudinal and sound is transverse. Some students describe longitudinal and transverse waves as second difference.
13a	P is the live wire while Q is the neutral wire. This is because the fuse and switch are on the live wire.	OWTTE	B1 B1	Some students wrote that Q is earth wire. Most students were able to state that fuse and switch is on the live wire.
13b	Current flowing through oven = 2500 / 240 = 10.4 A Suitable fuse would be 13 A fuse	Correct answer and unit with working.	B1 B1	Most students can answer this. A few students selected the lower rating fuse.
13c	The oven and toaster are connected in parallel so that if there is a fault in the oven or toaster, the appliance will still work.	OWTTE	B1	Most students answered this correctly. A few gave wrong answers like current being shared to prevent overheating.
13d	The **fuse consist of a thin wire which will melt when it excess the amount of current allowed in the fuse rating**. This will **cut current flow to the appliance thus protecting it**.	OWTTE	B1 B1	Most students can answer this question.
13ei	Electrical consumption for oven = (2.5 x 5) + (1 x 2) = 14.5 kWh	Correct answer and unit with working. Correct unit	C1 A1	Most students are able to answer this question.
13eii	Total cost of electrical consumption = 14.5 x 0.3 = $4.35	Correct answer and unit with working	B1	

NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary Four Express and Five Normal Academic

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 **20 September 2019**

Additional materials provided: Answer Sheet (OTAS Sheet) **1 hour**

READ THESE INSTRUCTIONS FIRST

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

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.

At the end of the examination, submit the Answer Sheet (OTAS sheet) separately.

Setter: Mdm Nor Rasidah / Mdm Nilasari
Vetter: Ms Tan Lay Huay / Mr Koh Ee Beng

1 A student uses a micrometer screw gauge to measure the thickness of a pipe.

Diagram 1 shows the reading when it is closed without the pipe.
Diagram 2 shows the reading when it is closed with the pipe.

diagram 1

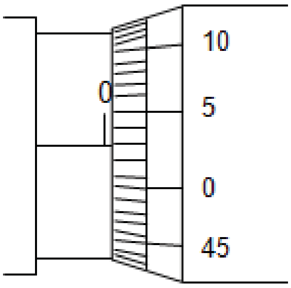
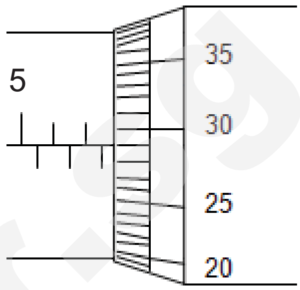


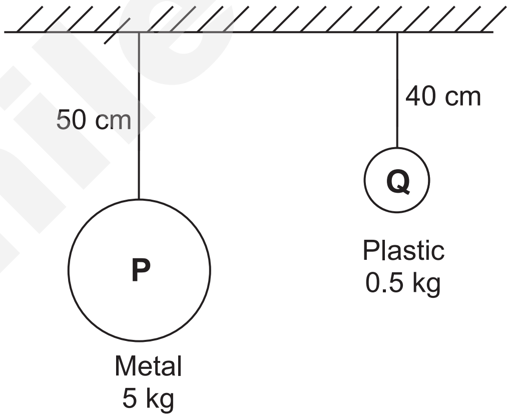
diagram 2



What is the thickness of the pipe?

A 5.51 mm
B 5.57 mm
C 7.76 mm
D 7.82 mm

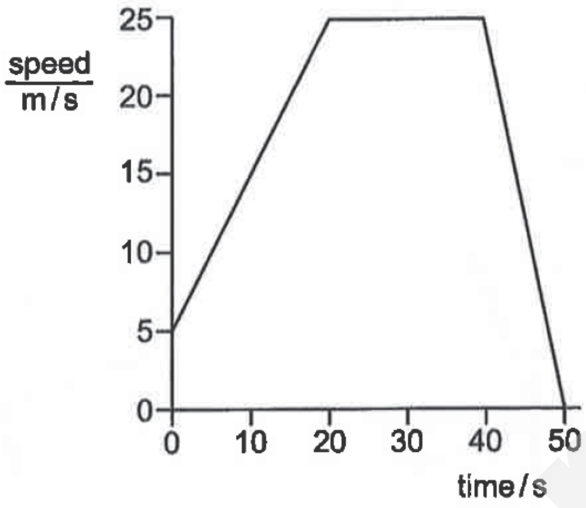
2 **P** and **Q** are two pendulums of different lengths, masses, sizes and materials.



Which statement is true?

A **P** has a longer period as it is larger in size.
B **Q** has a longer period as it is smaller in size.
C **P** has a longer period as it is longer.
D **Q** has a longer period as it is shorter.

3 The diagram below shows a speed time graph of a car.



What is the average speed of the car for the first 20 s?

A 10.0 m/s
B 12.5 m/s
C 15.0 m/s
D 17.5 m/s

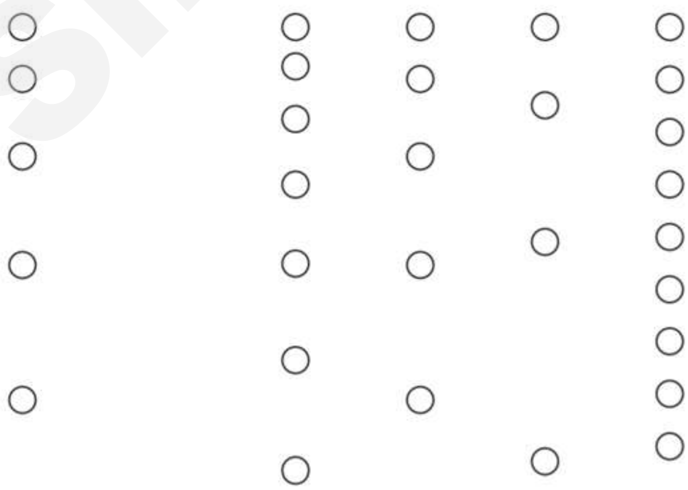
4 A ball is dropped in a vacuum tube. A series of photographs is taken at equal time intervals from the time of release.

Another ball of the same size but twice its mass is also dropped in the same tube and photographed.

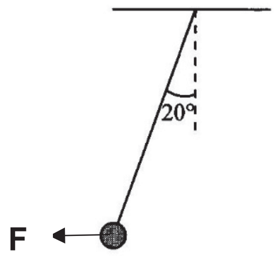
Which diagram shows the motion of the heavier ball?

First Ball **heavier ball which is double in mass**

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



5 The diagram shows a pendulum bob, which is attached to one end of a string, suspended in mid-air. It is pulled to one side and held stationary.



The forces acting on the bob are its weight ***W***, the tension ***T*** in the string and pulling force ***F***.

Which of the following diagrams correctly shows the forces acting on the bob?

A

B

C

D

6 The friction between a body of mass 3 kg and the rough floor is 5.0 N.

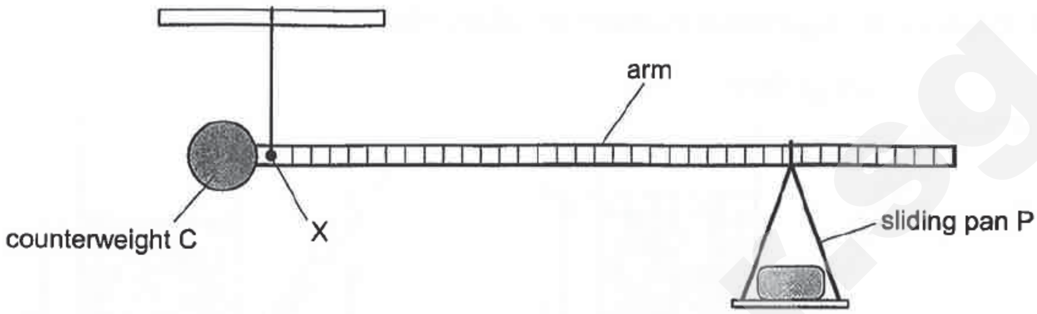
What is the force required to push it across the rough floor with an acceleration of 3.0 m s^{-2}?

A 4.0 N
B 9.0 N
C 14.0 N
D 18.0 N

7 A weighing machine consists of a counterweight, **C**, an arm and a sliding pan **P**. The arm is free to rotate about the point **X**.

The sliding pan is moved along the arm until the arm balances as shown.

All moments are measured about **X**. The weight and moment of the arm can be ignored.



Why does the arm balances in the position?

A The moment of **C** equals the moment of **P**. The weight of **C** equals the weight of **P**.
B The moment of **C** equals the moment of **P**. The weight of **C** is greater than the weight of **P**.
C The moment of **C** greater than the moment of **P**. The weight of **C** equals the weight of **P**.
D The moment of **P** equals the weight of **C**.

8 A boy launches a remote control helicopter up to the sky at a constant acceleration.

What are the changes in the gravitational potential energy and the kinetic energy?

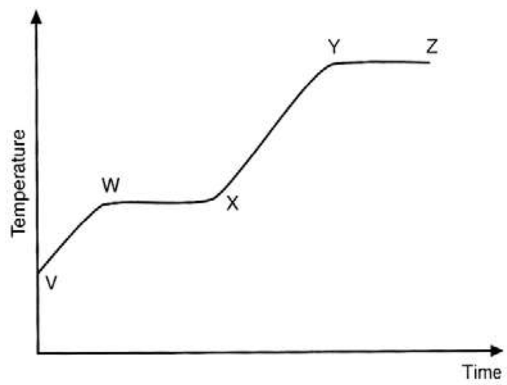
	Gravitational Potential Energy	Kinetic Energy
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

9 A substance consists of particles that are close together and moving past each other at random. The average speed of the particles is gradually decreasing.

What best describes the substance?

A a liquid being cooled
B a solid being cooled
C a gas being condensed to form a liquid
D a liquid being frozen to form a solid

10 A beaker of ice is heated until the beaker contains boiling water. The graph shows the temperature of the contents of the beaker during the experiment.



Between which two points are the contents in both liquid and solid states?

A V and W
B W and X
C X and Y
D Y and Z

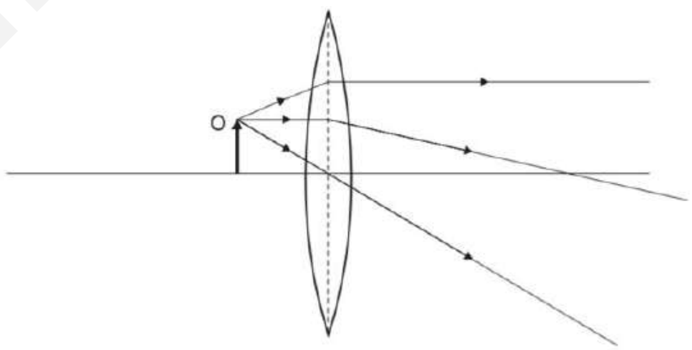
11 A cup of tea is stirred with two spoons, one metal and one plastic.

Why does the metal spoon feel hotter than the plastic one?

A Convection occurs in metal faster than in plastic.
B Metal conducts heat faster than plastic.
C Metal needs more heat than plastic for the same rise in temperature.
D Metal radiates heat better than plastic.

12 An object **O** is placed close to a converging lens.

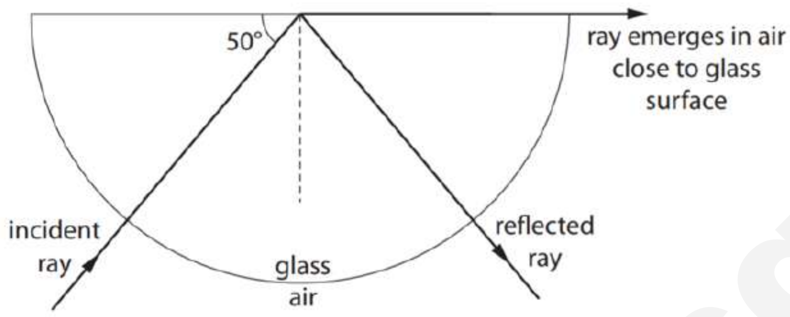
The diagram represents three rays from the top of **O** passing through the lens.



Which type of image is produced by the lens when the object is in this position?

A real and diminished
B real and enlarged
C virtual and inverted
D virtual and enlarged

13 The diagram shows a ray of monochromatic light passing through a semi-circular glass block.

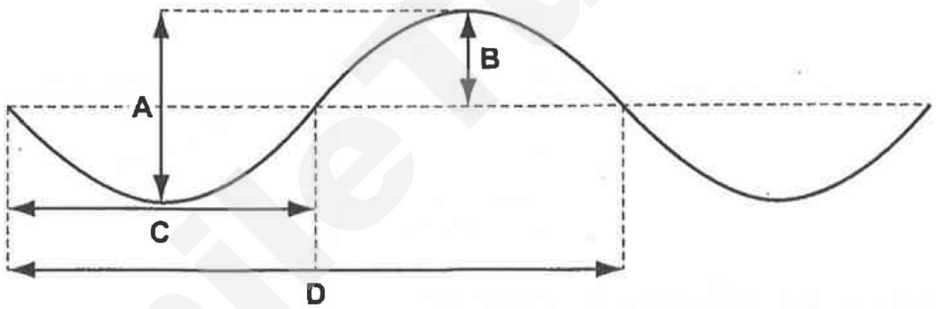


What is the critical angle of the glass?

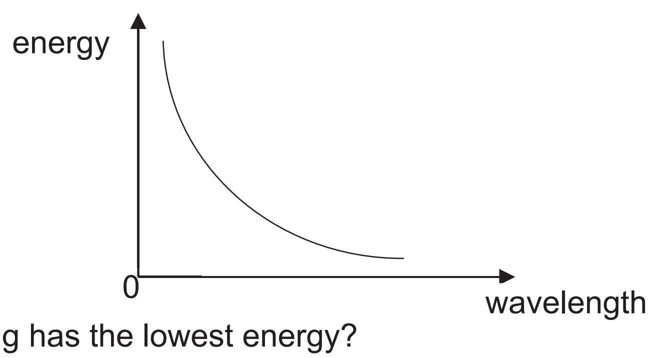
A 0 °
B 40 °
C 50 °
D 55 °

14 The diagram represents a wave.

Which letter marks the amplitude of the wave?



15 The diagram shows the relationship between energy and the wavelength of electromagnetic waves.

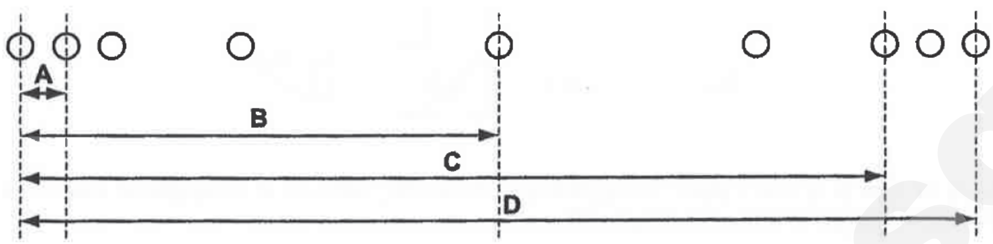


Which of the following has the lowest energy?

A gamma ray
B infra red
C microwaves
D x-rays

16 A sound wave passes through air. The diagram represents the arrangement of air molecules at one instance.

Which distance is the wavelength of the sound wave?

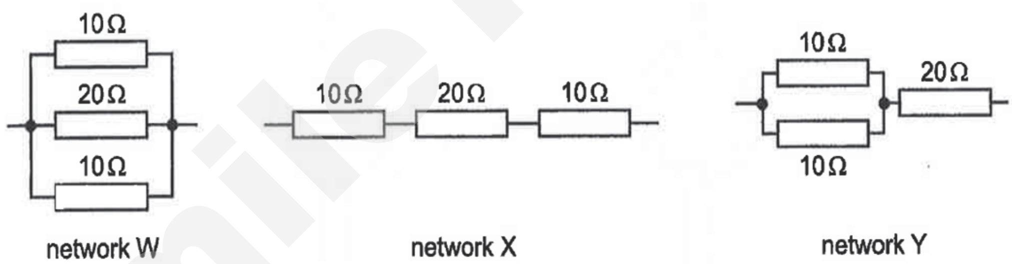


17 An electrical quantity is defined as 'the energy converted by a source in driving a unit charge round a complete circuit.'

What is this quantity called?

A electromotive force
B potential difference
C power
D voltage

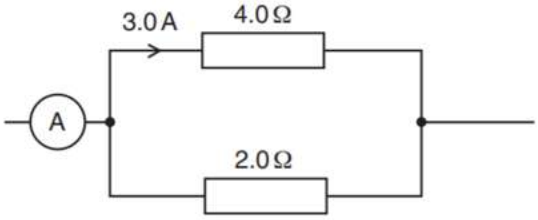
18 Three resistors are connected together to form three different networks.



What is the correct order, going from the network with the smallest resistance to the network with the largest resistance?

A W → X → Y
B W → Y → X
C X → W → Y
D Y → X → W

19 The diagram shows an electrical circuit. The current flowing through the 4.0 Ω resistor is 3.0 A.



What is the current through the ammeter?

A 3.0 A
B 4.5 A
C 6.0 A
D 9.0 A

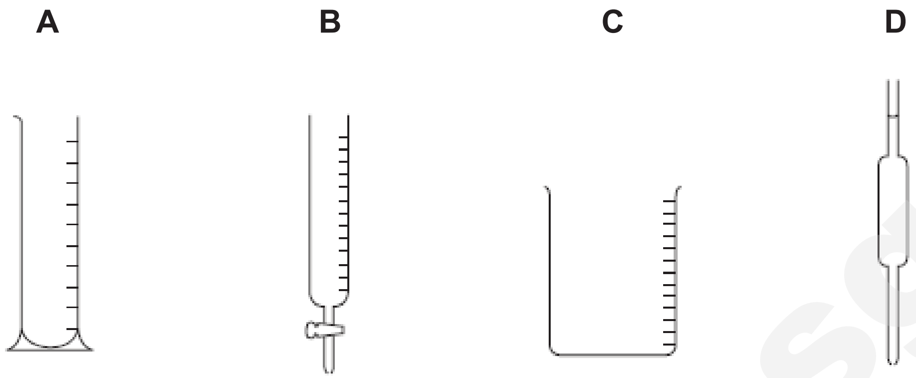
20 A main socket supply (240 V) is fitted with a 13 A fuse.

Heating coils, each rated at 240 V and 1 000 W, are connected to the socket.

What is the maximum number of such heating coils that can be connected to the socket?

A 1
B 2
C 3
D 4

21 Which piece of apparatus is used to measure exactly 28.3 cm^3 of a liquid?



22 A label is missing from a bottle of a colourless solution **X**.

In order to identify the solution, two simple chemical tests are carried out.

test 1	A few drops of aqueous ammonia are added to a sample of **X**. A white precipitate is formed. This precipitate dissolves when more aqueous ammonia is added.
test 2	Aqueous sodium hydroxide and aluminium are added to another sample of **X** and warmed. A pungent gas, which turns moist red litmus paper blue, is produced.

What is **X**?

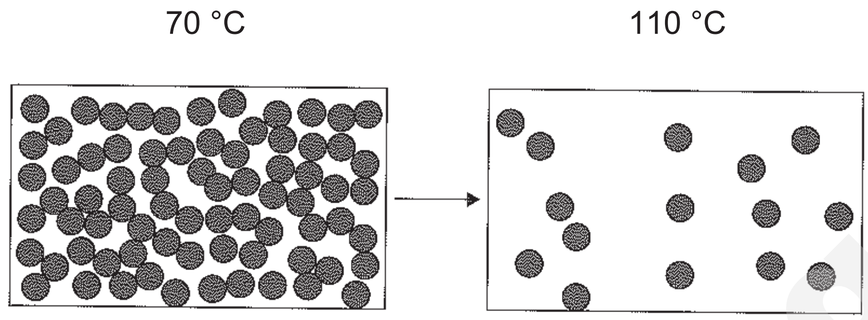
A ammonium carbonate

B copper(II) chloride

C zinc chloride

D zinc nitrate

23 The diagrams below show the change in the arrangement of atoms in a substance.



Which statement is correct?

A There is a drop in the energy of the particles.

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

C The substance is a solid at 100 °C.

D The substance is an element.

24 An element **X** of proton number 20 reacts with an element **Y** of proton number 17 to form a compound.

Which of the following is correct when this compound is formed?

		formula of compound
A	each atom of **X** gives away one electron	$\mathbf{X_2Y}$
B	each atom of **Y** receives one electron	$\mathbf{XY_2}$
C	each atom of **X** shares an electron with an atom of **Y**	$\mathbf{X_2Y}$
D	each atom of **Y** shares an electron with an atom of **X**	$\mathbf{XY_2}$

25 The symbol for an atom of boron is ${}^{11}_{5}\mathrm{B}$.

What does the number 11 represent for an atom of boron?

A the number of protons which determines its position in the Periodic Table

B the number of nucleons

C the number of protons

D the total number of protons, neutrons, and electrons

26 Which substances will **not** react with each other?

A calcum oxide and silicon dioxide

B carbon monoxide and potassium oxide

C lead(II) oxide and sodium hydroxide

D magnesium oxide and hydrochloric acid

27 The colour of an indicator **X** in solutions of different pH is shown below.

Indicator **X** can be used to distinguish between ……………………………..

A ethanoic acid and hydrochloric acid.

B sodium chloride solution and sodium hydroxide solution.

C sodium hydroxide solution and aqueous ammonia.

D sodium hydroxide solution and water.

28 What is the oxidation state of sulfur in zinc sulfate, $ZnSO_4$?

A -6 **B** -2

C +6 **D** +8

29 Which element has the **least** number of moles of atoms?

A 1 g argon, ^{40}Ar

B 1 g lithium, ^{7}Li

C 1 g neon, ^{20}Ne

D 1 g sodium, ^{23}Na

30 Ammonia gas, NH_3, decomposed according to the equation

$$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$$

What volume of hydrogen (at room temperature and pressure) would be formed if 100 cm^3 of ammonia were decomposed?

A 25 cm^3

B 75 cm^3

C 100 cm^3

D 150 cm^3

31 Which reaction does **not** involve either oxidation or reduction?

A $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

B $Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$

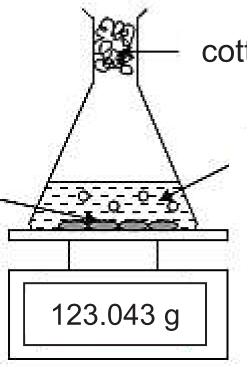
C $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$

D $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

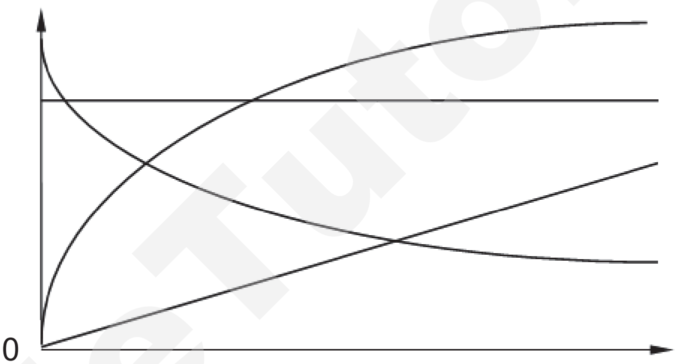
32 The table shows the initial and final temperatures in a series of experiments. Which experiment is most exothermic?

	initial temperature / °C	final temperature / °C
A	16.0	24.5
B	18.0	25.0
C	20.0	15.5
D	22.0	12.0

33 The diagram shows an experiment to investigate the rate of a reaction.
Readings of the total mass are taken every 30 seconds.



What is the correct graph for this experiment?



34 Carbon monoxide is formed when carbon is heated with the oxide of metal **X**. No carbon monoxide is formed when carbon is heated with the oxide of metal **Y**.

Which row shows the order of reactivity of carbon, metal **X** and metal **Y**?

	least reactive	→	most reactive
A	carbon	**X**	**Y**
B	carbon	**Y**	**X**
C	**X**	carbon	**Y**
D	**Y**	carbon	**X**

35 Four elements have the following electronic configurations.

W	2, 1
X	2, 2
Y	2, 5
Z	2, 8

Which statement is correct?

A All four elements are in period 2.

B All four elements belong to Group II.

C **X** and **Y** are metals, **W** and **Z** are non-metals.

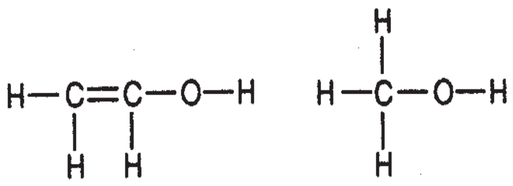
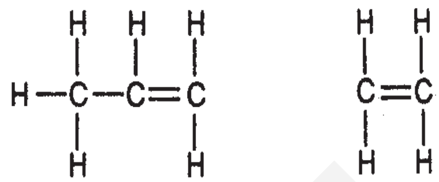
D **Z** is a halogen and **X** is an alkali metal.

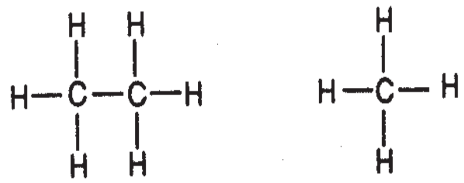
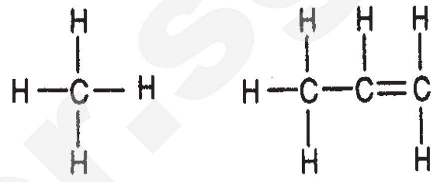
36 When petrol is burnt in a car engine, a gas that is produced reacts with hemoglobin to reduce its ability to transport oxygen throughout the body.

What reaction has taken place and name the gas produced?

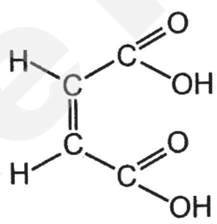
	reaction	name of gas
A	complete combustion	carbon dioxide
B	incomplete combustion	carbon monoxide
C	substitution	hydrogen chloride
D	cracking	hydrogen

37 Which pair of molecules satisfies the general formula of C_nH_{2n}?

A  **C** 

B  **D** 

38 A compound **X** has the molecular structure as shown.



Which statement is **incorrect** about compound **X**?

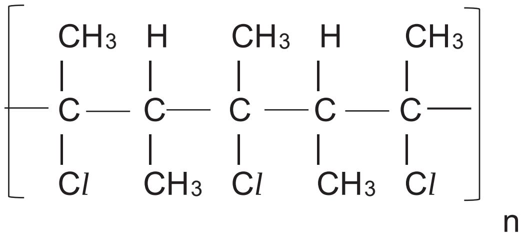
A **X** can be described both as an alkene and as a carboxylic acid.

B **X** will react with sodium carbonate to give carbon dioxide gas.

C **X** will decolorize reddish brown aqueous bromine.

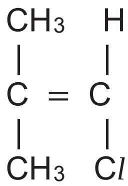
D **X** will react with sodium hydroxide to produce a white precipitate.

39 The diagram shows part of the structure of an addition polymer.

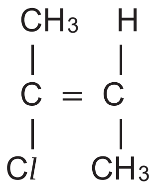


Which monomer is used to make this polymer?

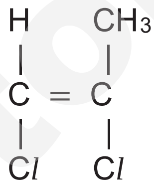
A



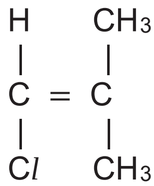
B



C



D



40 Which product(s) is formed when glucose undergoes fermentation?

A CH_3OH and CO_2

B CH_3COOH and O_2

C C_2H_4 and O_2

D C_2H_5OH and CO_2

End of Paper 1

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

The Periodic Table of Elements

Group I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key proton (atomic) number atomic symbol name relative atomic mass									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.).

NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary Four Express and Five Normal Academic

SCIENCE (PHYSICS) 5076/02

Paper 2 Physics **17 September 2019**

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

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name and index number on 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, and 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 [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.

At the end of the examination, fasten all your work securely together.
The number of marks is given in the brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
TOTAL	65

Setter: Mdm Nor Rasidah

Vetter: Ms Tan Lay Huay

Section A
Answer **all** the questions in the spaces provide

1. In a experiment, a student drops a small metal ball into a cylinder of oil. The ball falls alongside a vertical ruler and a camera records its position at time intervals of 1.0 s, as shown in Fig. 1.1.

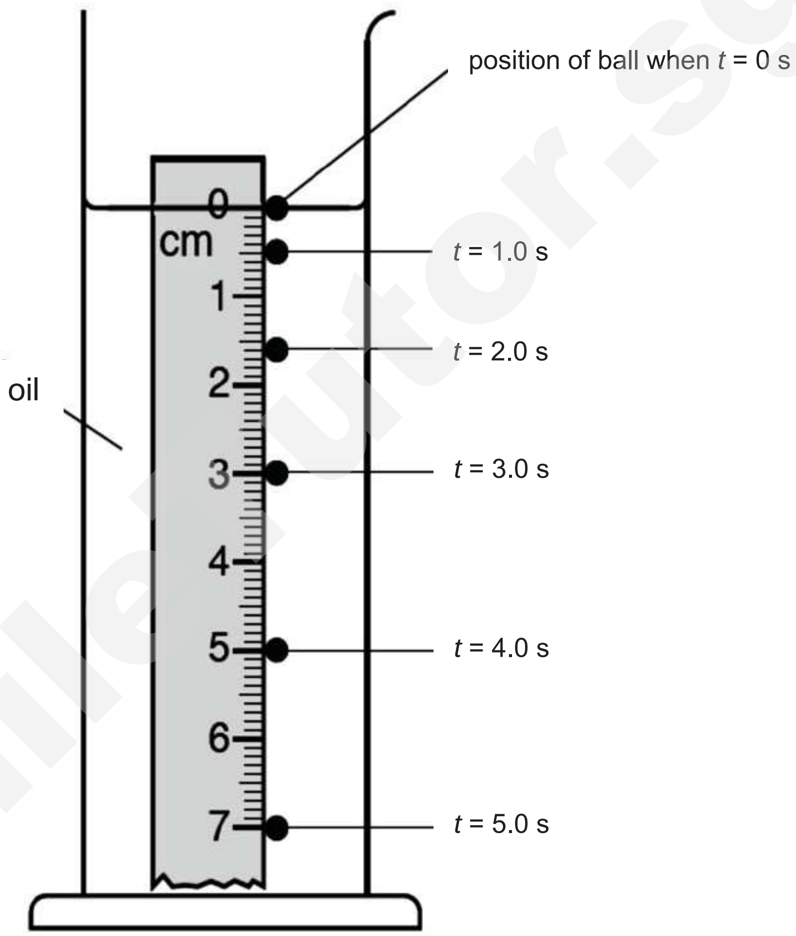


Fig. 1.1

(a) On the grid in Fig. 1.2, plot a distance-time graph for the ball. [2]

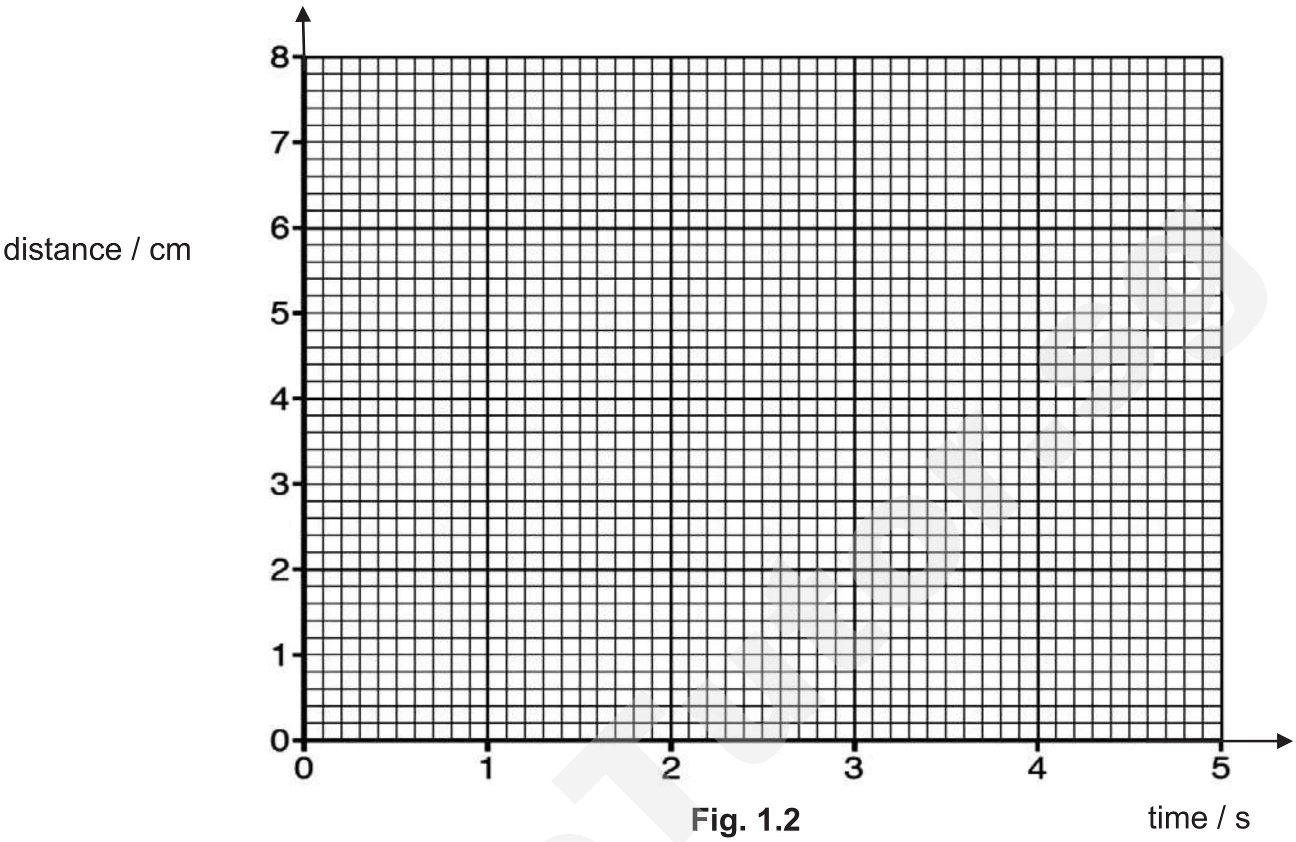


Fig. 1.2

(b) Describe the motion of the ball for the whole 5 seconds.

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

2. Fig 2.1 shows a kitchen cupboard mounted securely to a vertical wall. The cupboard rests on a support at **A**.

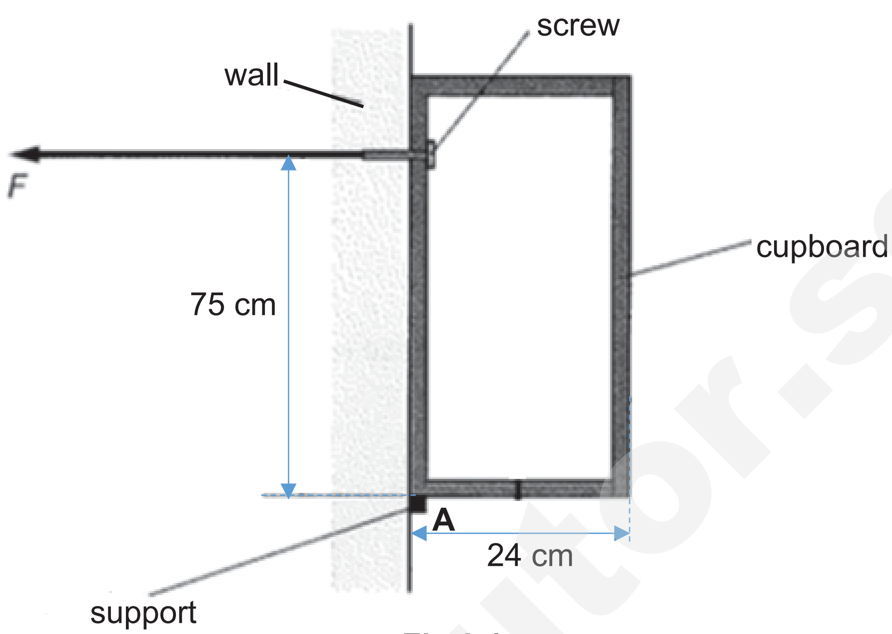


Fig 2.1

The total weight of the cupboard and its content is 200 N. The screw securing the cupboard to the wall is at a vertical distance of 75 cm from **A**.

(a) Mark the center of gravity and draw an arrow to represent the weight of the cupboard on Fig. 2.1. [1]

(b) The direction of ***F*** provided by the screw on the cupboard is horizontal as shown in Fig. 2.1.

Calculate the magnitude of ***F***.

force ***F*** = ……………. N [2]

(c) State and explain how the magnitude of ***F*** would change, if at all, if the same screw is secured much closer to point **A**.

…………………………………………………………………………………………

…………………………………………………………………………………………[2]

3. A 50 g golf ball is released from the top of a smooth track as shown in Fig. 3.1. The golf ball moves round the loop **BCD** and then along the track **DE**.

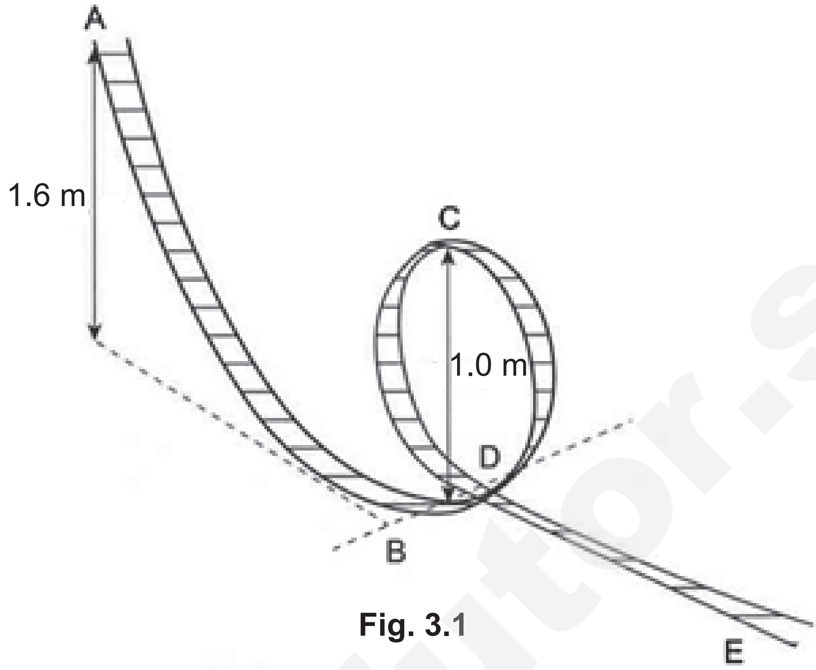


Fig. 3.1

(a) Calculate the gravitational potential energy of the golf ball at **A**.

gravitational potential energy = ……………… J [2]

(b) Calculate the speed of the golf ball at **B**.

speed = …………… m/s [2]

(c) Calculate the kinetic energy of the golf ball at **C**.

kinetic energy at **C** = …………… J [2]

4. Thermal flasks are used to store hot liquids such as soup to keep them warm for a period of time. Fig. 4.1 shows a thermal flask that uses foam as an insulating material and Fig. 4.2 shows one that uses vacuum.

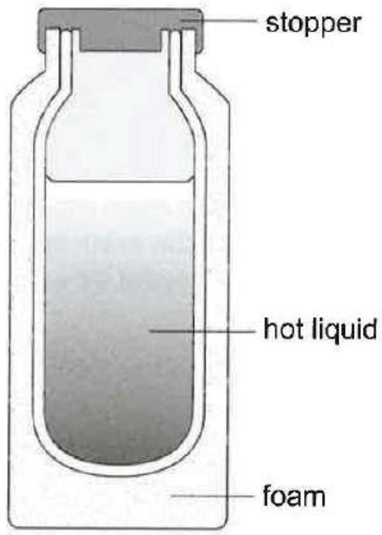


Fig. 4.1

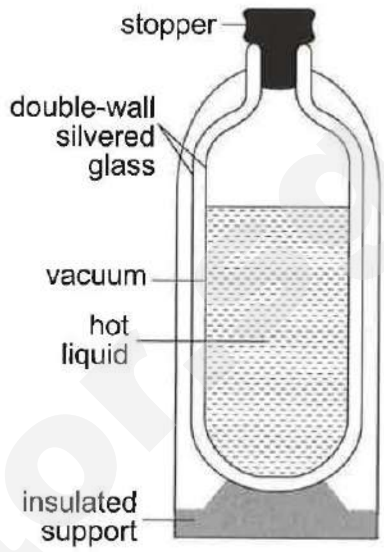


Fig. 4.2

(a) Explain why it is important for the stopper to be in place in order to keep the liquid hot.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

(b) Why does the vacuum flask store hot liquid better than the flask with foam?

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

(c) State the purpose of the silvered glass.

……………………………………………………………………………………………[1]

(d) Explain why the vacuum flask can also be used to maintain cold drinks at a low temperature.

……………………………………………………………………………………………

……………………………………………………………………………………………[1]

5. A ray of light passes through the glass prism as shown in Fig. 5.1.

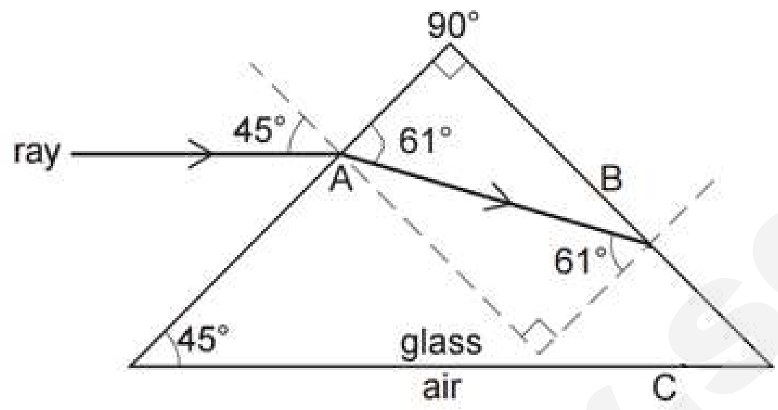


Fig. 5.1

(a) Calculate the refractive index of the glass.

refractive index = ……………. [2]

(b) Calculate the critical angle of glass.

critical angle = ……………° [1]

(c) **(i)** Draw what happens to the light ray when it incident on surface **B**.

(ii) Label the relevant angle clearly. [2]

6. An image, **I**, of a candle is seen to be inverted in front of a convex lens. The image formed by the lens is 20 cm high and is 35 cm away from the lens.

The focal length of the lens is 15 cm.

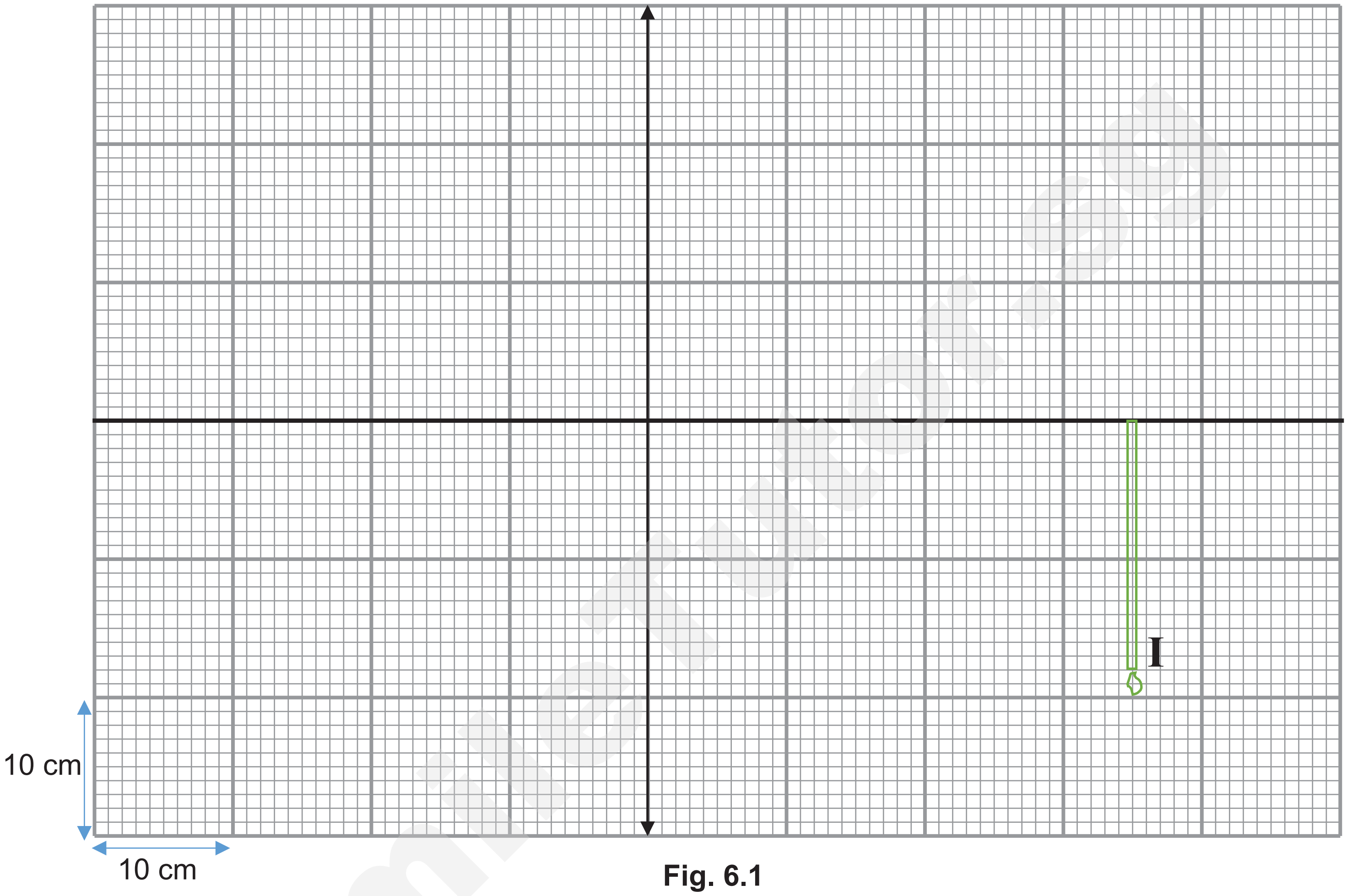


Fig. 6.1

(a) On Fig. 6.1, construct a ray diagram to show how the image is formed. [3]

(b) State the object distance of the object from the lens.

distance = ………………. cm [1]

(c) State **two** other characteristics of the image formed.

……….………………………………………………………………………………[1]

7. Two small positively charged metal spheres **A** and **B** are suspended using insulating thread, as shown in Fig. 7.1.

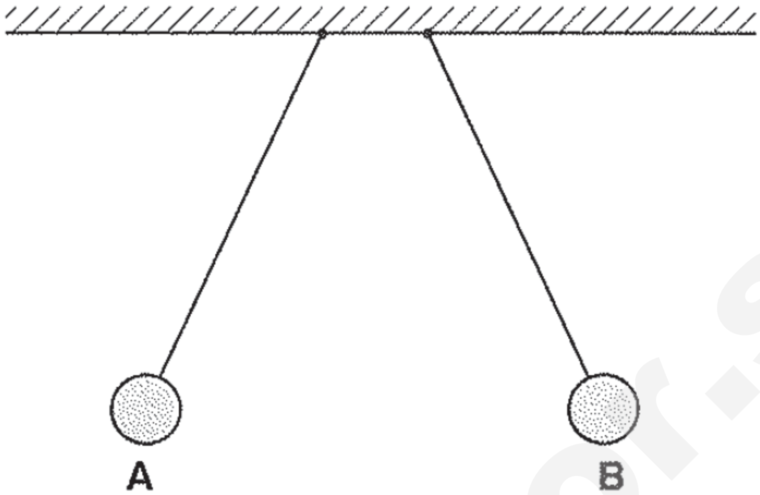


Fig. 7.1

(a) Draw the electric field between the spheres. [2]

(b) A conductor rod touch the metal sphere **B**. 0.02 C of charge flow in 0.05 s. Calculate the current flow.

current = ……………… A [1]

8. Fig. 8.1 shows two lamps and a 4 Ω resistor connected in a circuit with a 6 V cell. The lamps have a resistance of 2 Ω each.

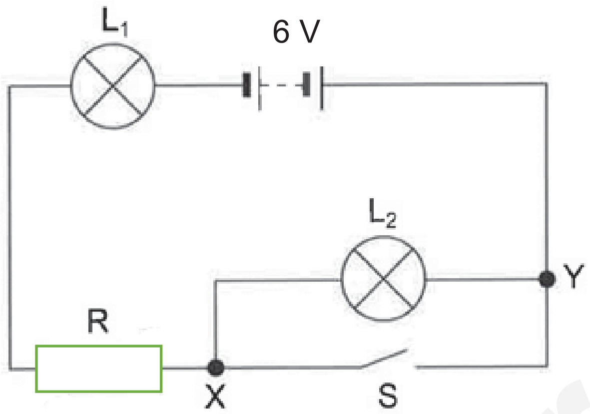


Fig. 8.1

(a) Calculate the current through the resistor in the circuit as shown in Fig. 8.1.

current = ……………… A [2]

(b) Compare the brightness of L_1 and L_2. Explain your answer.

………………………………………………………………………………………

……………………………………………………………………………………[2]

(c) The switch is closed.
Calculate the current flowing through the resistor.

current = ……………… A [2]

9. Fig. 9.1 shows a copper rod **XY** hung at rest in a uniform magnetic field pointing into the paper. The two contacts **X** and **Y** at the ends of the copper rod can move smoothly along the fixed vertical conducting rails **PQ** and **RS** which are connected to a power supply. As a result, current flows through the copper rod.

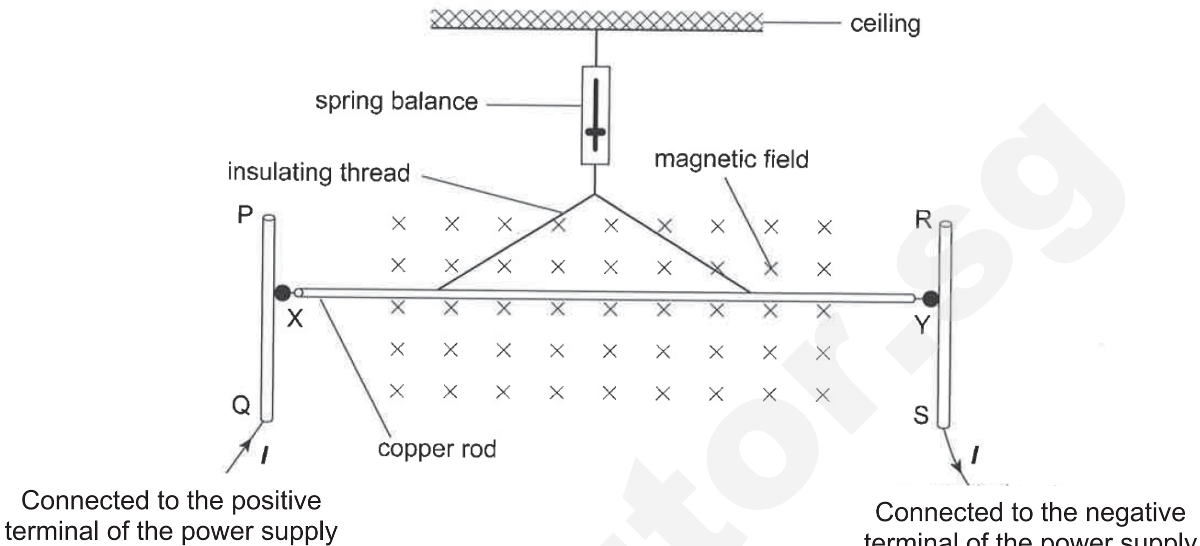


Fig. 9.1

(a) On Fig. 9.1, indicate the direction of force acting on the copper rod due to the current flowing from **X** to **Y**. [1]

(b) Suggest **one** way to increase the force acting on the copper rod.

………..………………………………………………………………………….[1]

(c) The current supply is switched off. Fig. 9.2 shows the tensions in the insulating thread drawn to scale. Complete the vector diagram and calculate the weight of the copper rod.

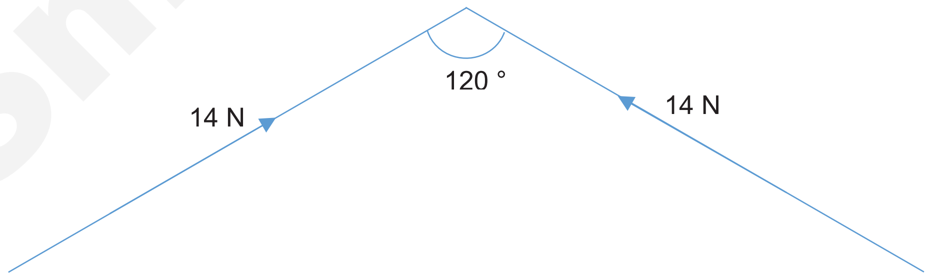


Fig. 9.2

weight of copper rod = ………………….[3]

Section B

Answer any **two** questions in this section.
Write your answers in the spaces provided.

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

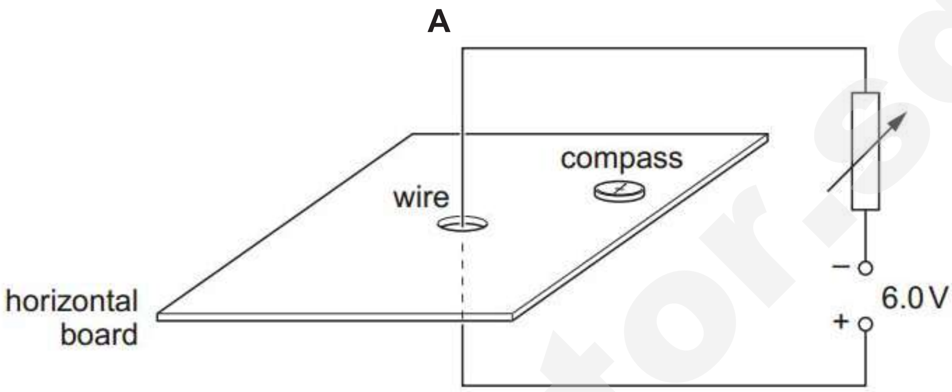


Fig 10.1

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. [2]

(b) Ryan designed a simple doorbell as shown in Fig. 10.2. When the switch **S** is pressed and then released, two notes are produced.

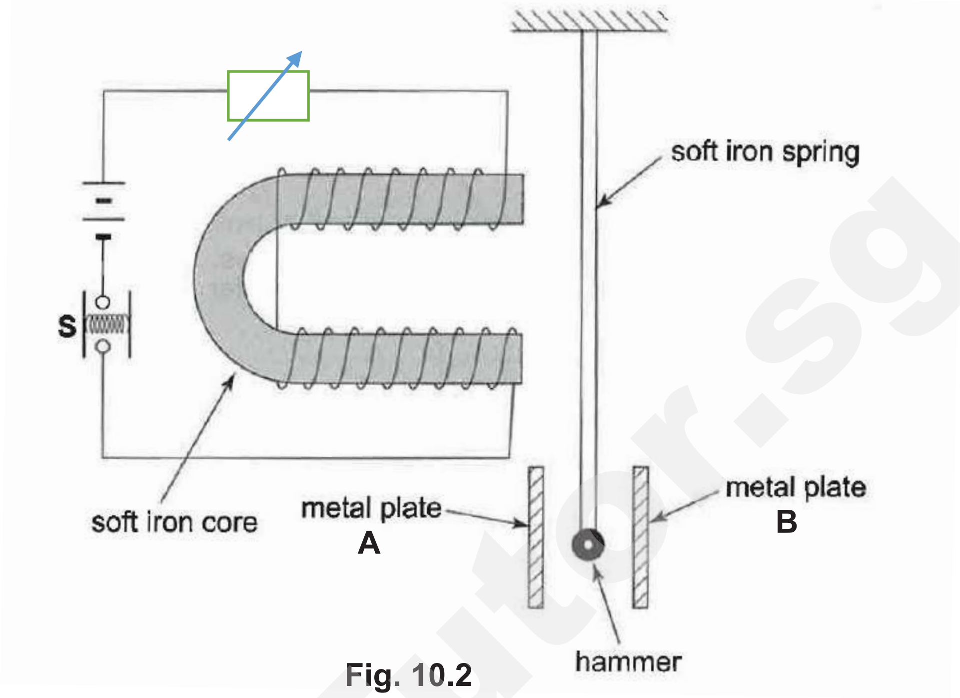


Fig. 10.2

(i) Explain why the two notes are produced when the switch is pressed and then released.

....

....

....

....

....[4]

(ii) The two metal plates are of different thickness. When the metal plate **A** is hit, it has more vibrations per second than metal **B**.

State and explain the difference in the sound heard when Plate **A** and Plate **B** are hit.

....

....[2]

(iii) When Ryan pressed the bell, Nigel who was in the house heard the sound 70 ms later. The speed of sound is 330 m/s.

Calculate Nigel's distance from the doorbell.

distance= ……………m [2]

11. Fig. 11.1 shows a rheostat. Terminal **Y** is connected to a moving contact, which rests on a circular carbon resistance track.

Terminals **X** and **Y** are connected to an external circuit.

The resistance between **X** and **Y** (R_{XY}) changes with the angle through which the shaft has been turned (θ). When the moving contact is at **Z**, it corresponds to an angle of 300˚.

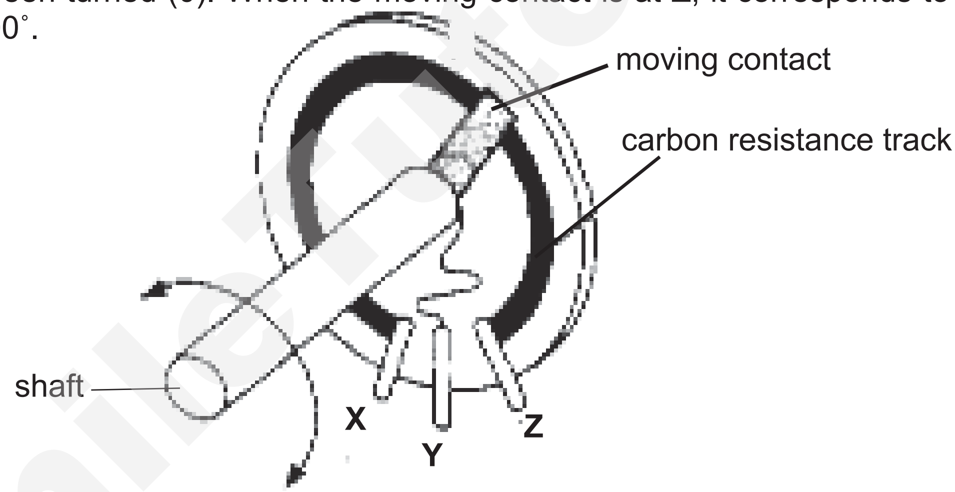


Fig. 11.1

Fig. 11.2 shows the graph of R_{XY}, against the entire range of θ (angle between **X** and **Y**).

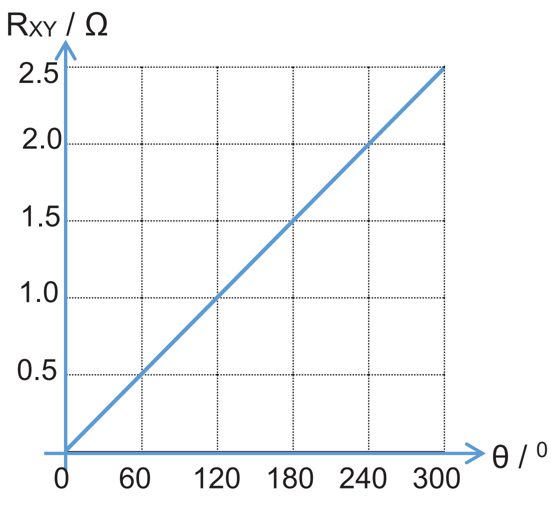


Fig. 11.2

(a) The angle of the shaft is placed at 180°. The current that flows through the rheostat is 0.3 A. Calculate the amount of thermal energy generated in the rheostat in 20 minutes.

energy = ……………J [3]

(b) The rheostat is used to control the volume of a radio. Explain how by turning the shaft, the volume of the radio can be changed.

…………………………………………………………………………………………

…………………………………………………………………………………………[2]

(c) The radio has a power rating of 4 W. It is used for 16 hours a day. The cost of electricity is 28 cents per kilowatt hour.

Calculate the cost of using the radio for 30 days.

cost = ……………… cents [2]

(d) Some radios use two pins plugs while others use three pins plug. Explain the purpose of the additional pin.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………[3]

12. Fig. 12.1 shows a hollow iron cylinder containing air, floating in a pond.

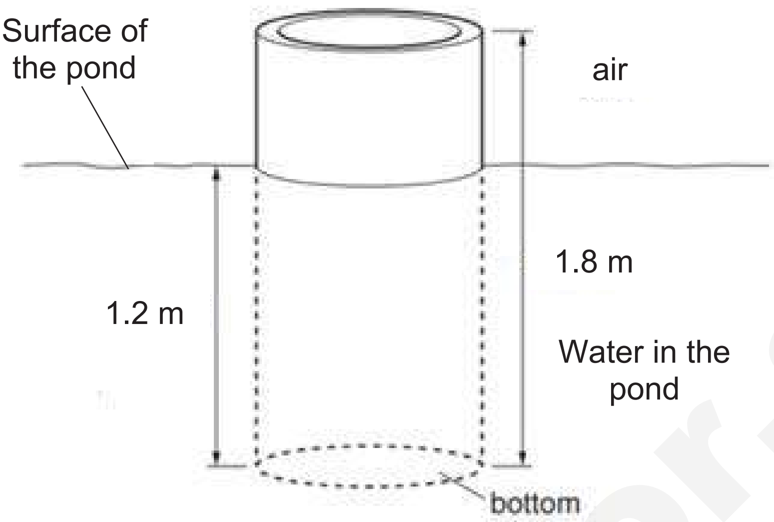


Fig. 12.1

The cylinder has a length of 1.8 m. It floats with 1.2 m submerged in water in the pond. The bottom of the cylinder has an area of 0.60 m^2. The pressure exerted on the bottom of the cylinder due to the depth of seawater is 12 240 Pa.

(a) Calculate the force exerted on the bottom of the cylinder.

force = ……………… N [1]

(b) Deduce the total weight of the cylinder and the air in it. Explain your answer.

…………………………………………………………………………………

………..…………………………………………………………………………[2]

(c) Calculate the average density of the cylinder.

density = ……….…… kg/m^3 [2]

(d) Explain why the cylinder floats.

………..…………………………………………………………………………[1]

(e) A wave passes through the water. Explain by the movement of the cylinder why the wave is a transverse wave.

……………………………………………………………………………………………

………..…………………………………………………………………………….[1]

(f) The period of the wave produced is 20 ms. The distance between two crests as shown in Fig. 12.2 is 30 cm.

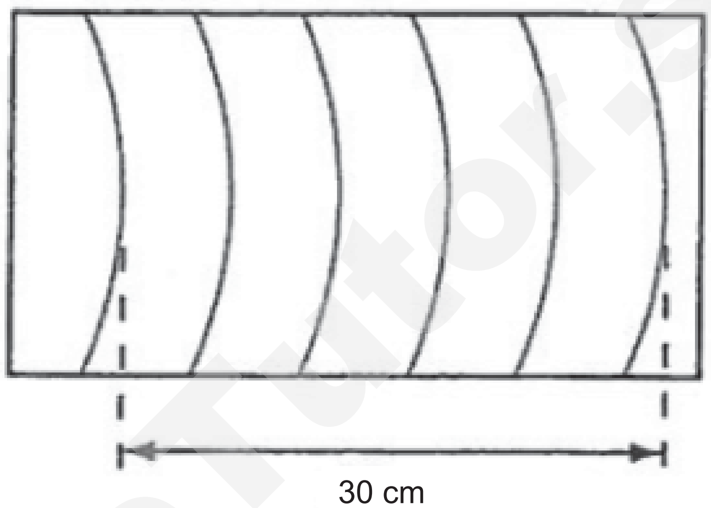


Fig. 12.2

Calculate the speed of the wave in the pond.

speed of the wave = ……………… m/s [3]

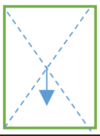
- End of paper -

NSS Prelim 2019
Science Physics O level

Paper 1

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

Paper 2

1a	Plotting [1] Line [1]	
b	0 – 3 s: Increasing speed [1] 3-5 s: Constant speed [1]	
a		
2b	12 x 200 = F x 75 [1] F = 32 N [1]	
c	The **perpendicular distance** to point A will be **smaller** [1], To obtain the **same value of moment**, the value of **F** will **increase**. [1]	
3a	50 g = 0.05 kg [1] GPE = mgh = 0.05 x 10 x 1.6 = 0.8 J [1]	
b	$\frac{1}{2}$ mv^2 = 0.8 $\frac{1}{2}$ x 0.05 x v^2= 0.8 [1] V = 5.66 m/s [1]	
c	Ke at C = lost in GPE from A to C = 0.05 x 10 x (1.6 – 1) [1] = 0.3 J [1]	
4a)	Stopper reduce heat lost by convection. [1] Hot air will rise out of the flask due to the low density. [1]	
b)	Foam is a poor conductor of heat but heat can still be transferred through conduction. [1] Conduction and convection cannot takes place through vacuum. [1]	
c)	Reduce heat lost by radiation	
d)	The features reduce heat transfer; either from the surrounding to the flask or from the flask to the surroundings.	
5a)	Sin 45 / sin 29 [1] = 1.458 = 1.46 [1]	

b)	1.458 = 1 / sin c C = 43.3 °	
c)	Total internal reflection [1] Angle of reflection 61 ° [1]	
6a	Focal point and arrows [1] Ray through optical centre [1] Ray through focal point [1]	
b)	26 cm	
c)	Real and magnified	
7a	Arrows pointing away from the spheres Correct shape of electric field.	
b	0.02 / 0.05 = 0.4 A [1]	
8	V = RI 6 = 8 I [1] I = 0.75 A [1]	
b)	Same brightness [1] They are connected in series, current through both the bulb is the same. Resistance of the bulbs are also the same. [1]	
c)	V = RI 6 = 6 I (Short circuit) [1] I = 1 A [1]	
9a	Up	
b	Increase the magnitude of the current Increase the strength of the magnetic field	
c	Draw the parallelogram Resultant force downwards Weight = 14 N (accept 13.8 N – 14.2 N)	
10a)	Anticlockwise directions Gaps gets bigger further away from wire	
b)	When the switch is on, the iron core becomes an electromagnet. [1] It will attract the soft iron spring and the hammer will hit the metal plate on the left.[1] When the switch is released, the iron core loses its magnetism [1] The spring is no longer attracted, therefore the force in the spring will cause it to move to the right and hit the other metal plate. [1]	
c)	Metal A will have a higher pitch As it has a higher frequency	
d	D = s x t = 70 / 1000 x 330 [1] = 23.1 m [1]	
11a	R = 1.5 [1]	

	t = 5 min = 300 s [1] P = I^2 Rt = 0.3 x 0.3 x1.5 x 300 = 162 W [1]	
b)	As θ increase, the length of the carbon resistance track in the circuit increase, resistance increase. [1] As θ increase, current decrease, volume decrease [1]	
c)	Energy = 4 x 16 x 30 = 1920 = 1.92 kWh [1] 1.92 x 0.28 = 53.76 cents [1]	
d)	Additional pin is Earth wire, which is connected to the metal casing. [1] If there is a fault, earth wire will cause a short circuit. [1] The fuse will melt and protect the user from electric shock [1]	
12a)	F = P x A = 12240 x 0.6 = 7 344 N	
b)	Total weight is equal to 7 344N . [1] Since the cylinder is not moving, resultant force is zero. [1]	
c)	Mass = 734.4kg or vol = 1.08 m^3 [1] Density = mass / vol = 734.4 / 1.8x 0.6 = 680 kg/m^3 [1]	
d)	The average density of the cylinder is lower than the density of water (1000 kg/m^3).	
e)	Cylinder moves up and down while the energy is transferred horizontally.	
f)	F= 1/0.02 = 50 Hz [1] Wavelength = 30 / 5 = 6 cm = 0.06 m [1] Speed = 0.06 x 50 = 3 m/s [1]	

Name	Class	Index Number

UNITY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY FOUR EXPRESS

SECONDARY FIVE NORMAL ACADEMIC

SCIENCE (PHYSICS) 5076/01 **30 AUGUST 2019**

PAPER 1 **1 HOUR**

Additional Materials : Optical Answer Sheet

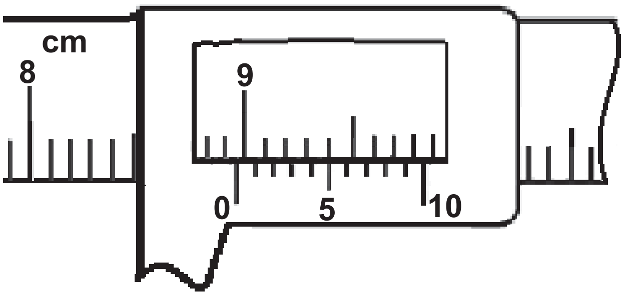
READ THESE INSTRUCTIONS FIRST

1. This paper consists of **20** Multiple Choice Questions.
2. Answer all questions on the Optical Answer Sheet (**OAS**).
3. Write your name, class and shade your register number in the spaces on the **OAS**
4. Do not fold nor use any correction fluid on the **OAS**. Read the instructions on the **OAS** carefully.
5. The total mark for this paper is 20 marks.

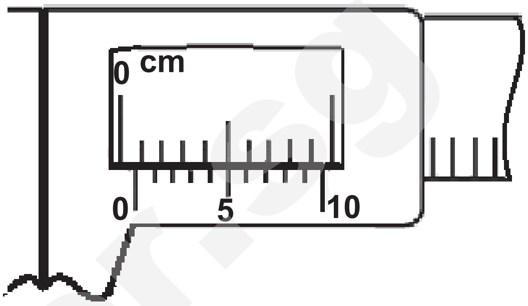
This paper consists of **8** printed pages, including this cover page.

Answer **ALL** the questions in this paper.

1 A student used a pair of vernier calipers to measure the external diameter of a cylindrical glass beaker. The diagrams show the observed reading of the external diameter of the glass beaker and the zero error that is obtained when the jaws are closed.



observed reading



zero error

What is the corrected diameter of the glass beaker?

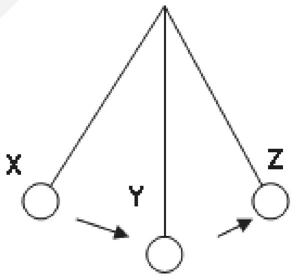
A 8.90 cm

B 8.95 cm

C 9.40 cm

D 9.45 cm

2 A pendulum oscillates between positions **X** and **Z** as shown in the figure below. It takes 0.4 s to go from positions **Y** to **Z** to **Y**.



What is the time taken for 20 oscillations of the pendulum swing?

A 8 s

B 16 s

C 24 s

D 32 s

3 A student constantly jumps up and down on a trampoline during his physical education lesson.

Which of the following statement about the motion of the student is **TRUE**?

A The student has a constant speed throughout his jump.

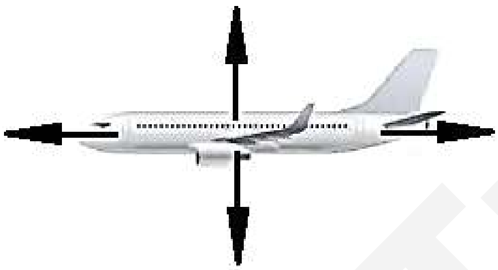
B The student has a decreasing speed throughout his jump.

C The student has a constant deceleration at the highest height of his jump.

D The student has a decreasing acceleration at the highest height of his jump.

4 Which of the following shows the **CORRECT** free body diagram of an aeroplane cruising forward with a constant speed of 250 m/s?

A



B

C

D

5 The density of an iron block of volume 0.002 m^3 is found to be 7500 kg/m^3. An astronaut transported only 0.01 m^3 of this iron block to the Moon. The gravitational field strength of Moon is given as 1.7 N/kg.

What is the weight of the 0.01 m^3 iron block on the Moon?

A 75 N

B 128 N

C 150 N

D 255 N

6 A SMRT train slows down when it is approaching a train station. A standing man who is not holding to any railings, is observed to fall forward.

Which of the following is **TRUE** for the man to fall forward?

A The inertia of the man tends to resist motion.

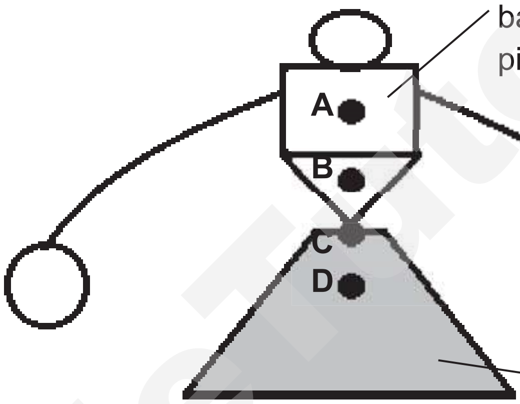
B The standing man's centre of gravity is too high.

C The man is being thrown forward by the slowing SMRT train.

D The friction between the standing man's shoes and the floor is too large.

7 The diagram shows a balancing toy that is pivoted on a triangular stand at **C**. When the toy is tilted slightly, it swings back to its original position.

Where is the centre of gravity of the balancing toy?



8 A man lifts a 15 kg box from the floor to a height of 0.8 m. He then walks forward for 3 m. The gravitational field strength g is given as 10 N/kg.

What is the work done by the man on the box?

A 12 J

B 57 J

C 120 J

D 570 J

9 A 45 kg student runs up a flight of stairs to a height of 2 m in 10 s. The gravitational field strength g is given as 10 N/kg.

What is the power exerted by the student to run up the flight of stairs.

A 9 W

B 90 W

C 900 W

D 9000 W

10 A piece of ice is heated to water and then to steam.

Which of the following statements 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 intermolecular force of attraction decreases as ice changes to steam.

11 The rate of energy transfer by heat radiation is affected by the colour and texture of the surface of an object.

Which of the following surfaces is the best absorber and the best emitter of heat radiation?

	Best absorber	**Best emitter**
A	dull black	dull black
B	dull black	shiny white
C	shiny white	dull black
D	shiny white	shiny white

12 Which of the following statements is **INCORRECT** about the processes of evaporation and boiling?

A Evaporation is a slow process but boiling is a fast process.

B Evaporation takes place at the surface of the liquid but boiling takes place throughout the whole of the liquid.

C Evaporation takes place at all temperatures but boiling takes place at 100 °C.

D Bubbles are formed throughout the liquid during boiling but not during evaporation.

13 Which of the following statements is **TRUE** of all electromagnetic waves?

A They travel at 3×10^8 m/s.

B They require a medium to travel.

C They carry electric charges.

D They carry energy.

14 A sound wave travels from air into water.

How does the frequency, the wavelength and the speed of the sound change?

	Frequency	Wavelength	Speed
A	remains the same	increases	increases
B	increases	decreases	increases
C	decreases	increases	decreases
D	remains the same	decreases	decreases

15 Which of the following about electric field is/are **CORRECT**?

I An electron experiences a force when it is placed in an eletric field.

II Field lines cannot intersect each other.

III Field lines flow from positively charged object to negatively charged object.

A **I** and **II**

B **II** and **III**

C **I** and **III**

D **I**, **II** and **III**

16 A mobile charging device which contains 120 C of charges is connected to a circuit to charge a mobile phone.

What is the time taken to discharge the device completely if the charging current in the circuit is 3 A?

A 0.025 s

B 0.67 s

C 40 s

D 6 min

17 An electricity supplier charges a household $0.25 per unit of electricity.

How much does it cost for a household to operate an air-conditioner rated at 2500 W, 250 V for 5 hours daily in 30 days?

A $ 3.13

B $ 93.80

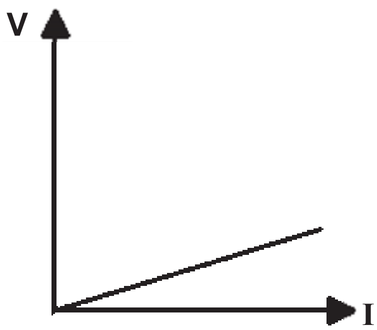
C $ 188

D $ 3130

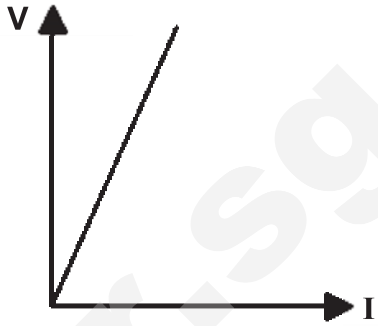
18 The V-I graphs of 4 resistors are shown.

Which of these V-I graphs shows a resistor with increasing resistance?

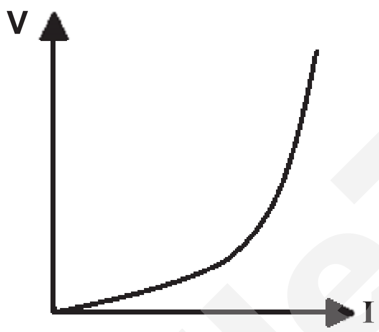
A



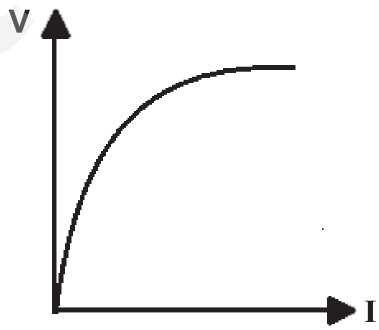
B



C



D



19 Which of the following is the correct sequence to effectively demagnetize a steel bar using the electrical method?

1 Insert the steel bar into a solenoid.

2 Connect direct current to a solenoid.

3 Connect an alternating current to a solenoid.

4 Pull the steel bar slowly out of the solenoid.

5 Switch off the current supply.

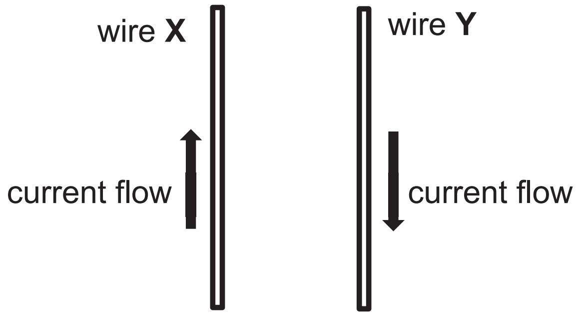
A **1, 2, 4, 5**

B **2, 1, 4, 5**

C **3, 1, 4, 5**

D **1, 3, 5, 4**

20 Two current carrying wires are arranged in parallel as shown.



What is the direction of the electromagnetic force on each wire?

	Wire X	**Wire Y**
A	to the left	to the left
B	to the left	to the right
C	to the right	to the left
D	to the right	to the right

*** **END OF PAPER** ***

Name	Class	Index Number

UNITY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY FOUR EXPRESS

SECONDARY FIVE NORMAL ACADEMIC

SCIENCE PHYSICS 5076/02 **30 AUGUST 2019**

PAPER 2 **1 HOUR 15 MINUTES**

Additional Materials : NIL

READ THESE INSTRUCTIONS FIRST

1. Answer **ALL** questions in Section **A** on the question paper.
2. Answer any **TWO** questions in Section **B** on the lined pages provided.
3. All workings and constructions must be shown clearly. Omission of essential working will result in loss of marks.
4. The number of marks is given in brackets [ ] at the end of each question or part question.
5. You are expected to use an electronic calculator to evaluate explicit numerical expression.
6. The total mark for this paper is 65 marks.

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

Section A [45 Marks]

Answer **ALL** the questions in this section. Write your answers in the spaces provided on the question paper.

1 Fig. 1.1 below shows the distance-time graph of a school van travelling towards the school.

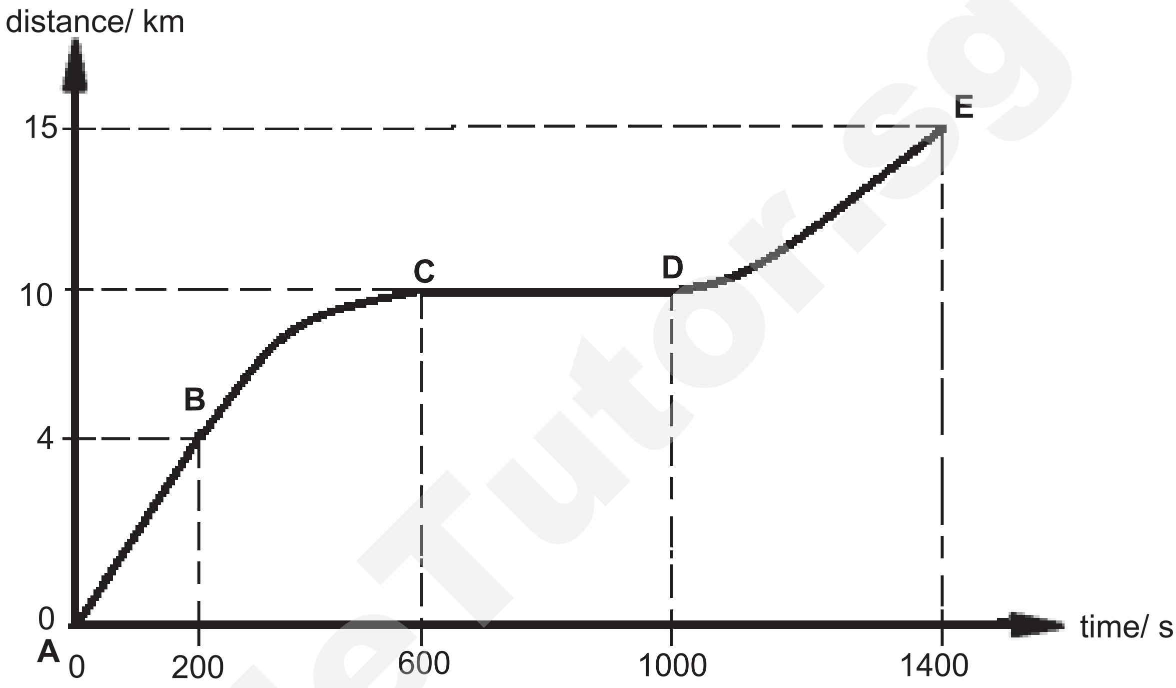


Fig. 1.1

(a) Use the graph to determine which of the marked section(s) (**AB**, **BC**, **CD** and/or **DE**) describes the motion of the school van when

(i) the school van is travelling at a constant speed; ……………………...……. [1]

(ii) the school van picks up students along its journey. ……………………....... [1]

(b) Determine the average speed travelled by the school van between t = 600 s to t = 1400 s.

average speed = ... m/s [2]

2 **(a)** A uniform metre rule is pivoted at the 35 cm mark shown in Fig. 2.1. A weight of 8 N is suspended from the 10 cm mark. A weight of 4 N is suspended from the 80 cm mark so that the rule is balanced horizontally.

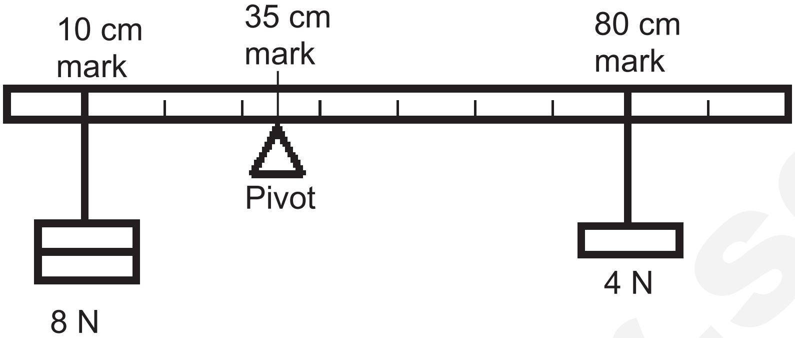


Fig. 2.1

(i) On Fig. 2.1, draw an arrow to represent the weight of the metre rule. [1]

(ii) Calculate the weight of the metre rule.

weight = ... [2]

(b) The pivot is now shifted from 35 cm mark to 30 cm mark and the position of the 8 N weight remains the same at the 10 cm mark.

Using the principle of moments, state and explain where the 4 N weight should be shifted to so that the rule can be balanced horizontally.

....

....

.... [2]

3 Fig. 3.1 shows a concrete block with dimensions of 0.3 m x 0.6 m x 0.2 m resting on a horizontal surface. The density of the concrete block is 25 kg/m^3.

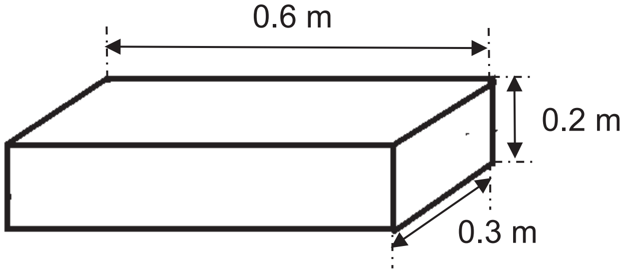


Fig. 3.1

(a) Calculate the mass of the concrete block.

mass = ... [2]

(b) The concrete block can be turned so that any one of the faces is in contact with the horizontal surface. The gravitational constant, *g* is given as 10 N/kg.

Calculate the maximum amount of pressure that the concrete block can exert on the horizontal surface.

pressure = ... [2]

4 An immersion heater is placed in the water in a water tank as shown in Fig. 4.1. Two temperature sensors **P** and **Q** are placed in the water.

Sensor **P** is near the surface of water and Sensor **Q** is at the bottom of the water tank. The temperature change registered by Sensor **P** is significantly higher than the temperature change registered by Sensor **Q**.

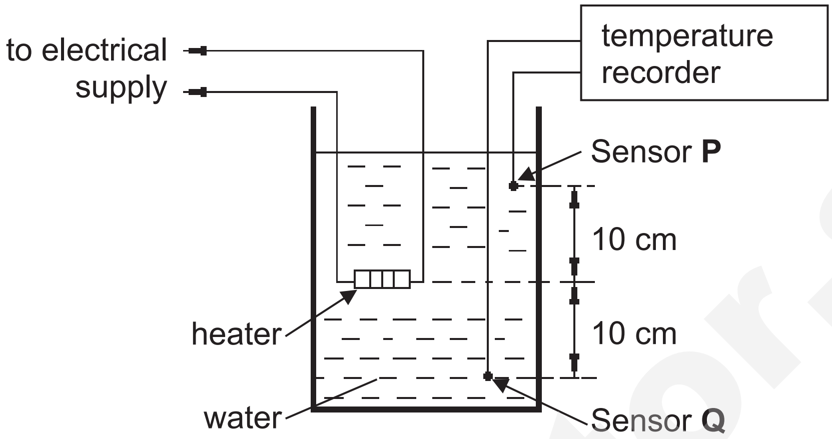


Fig. 4.1

(a) Explain why the temperature change registered by Sensor **Q** is so much lower than Sensor **P** although the immersion heater has the same distance from sensors **P** and **Q**.

....

....

....

.... [2]

(b) Suggest, with reason, a new position for the immersion heater so that both sensors **P** and **Q** can record approximately the same temperature.

....

....

....

.... [2]

5 Fig. 5.1 shows how the temperature of a pure substance changes with time when it is heated at a constant rate.

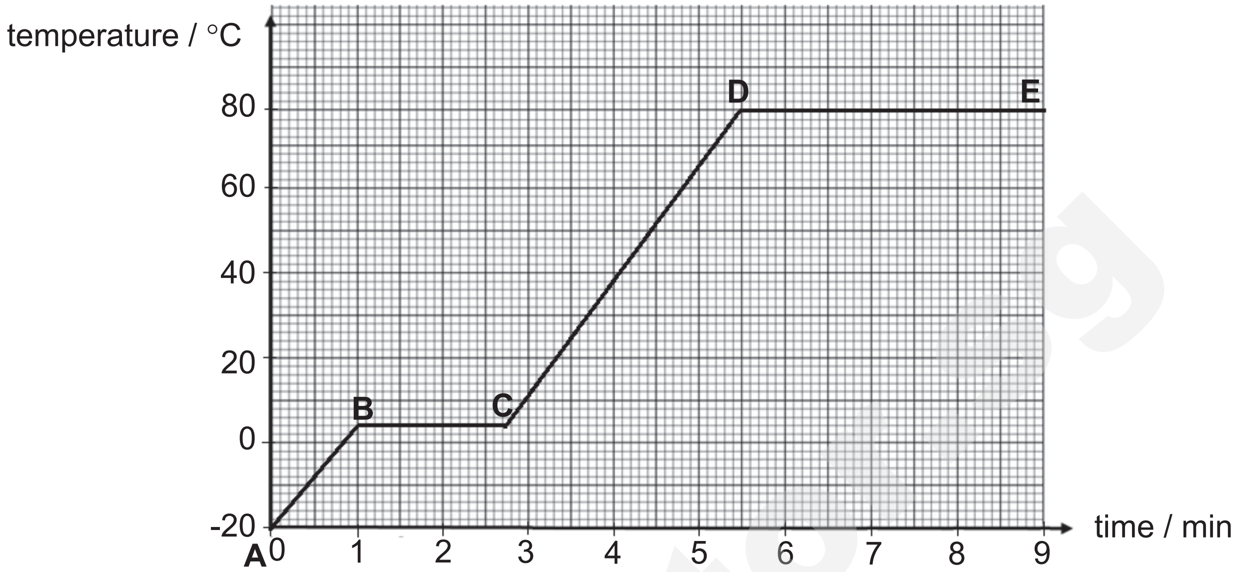


Fig. 5.1

At point **E**, all the substance has changed to vapour.

(a) State and explain, in molecular terms, the changes to the substance between points **D** and **E**.

....

....

....

.... [3]

(b) Describe the movement and the arrangement of the molecules of the substance at the temperature of 40 °C.

....

....

....

.... [2]

6 Fig. 6.1 shows an object **AB** is placed in front of a converging lens. The focal points of the converging lens are indicated on the principal axis at points **F**.

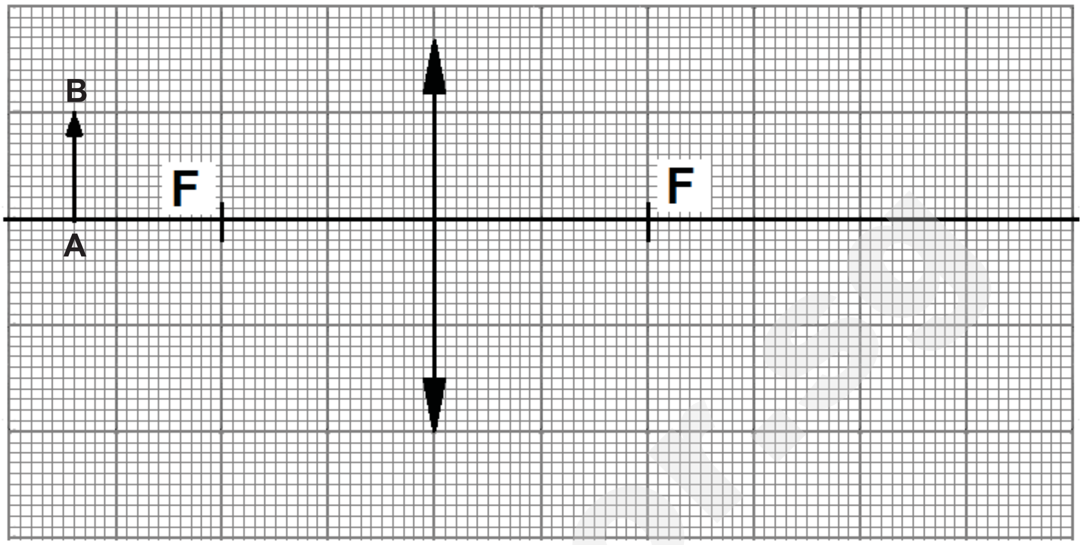


Fig. 6.1

On Fig. 6.1,

(a) draw two suitable light rays to locate the position of the image and label it **I**. [3]

(b) state the three characteristics of the image formed.

.... [2]

(c) state an application of the converging lens for the situation shown in Fig. 6.1.

.... [1]

7 Fig. 7.1 shows an arrangement that is used to remove dust particles from the exhaust in an industrial chimney.

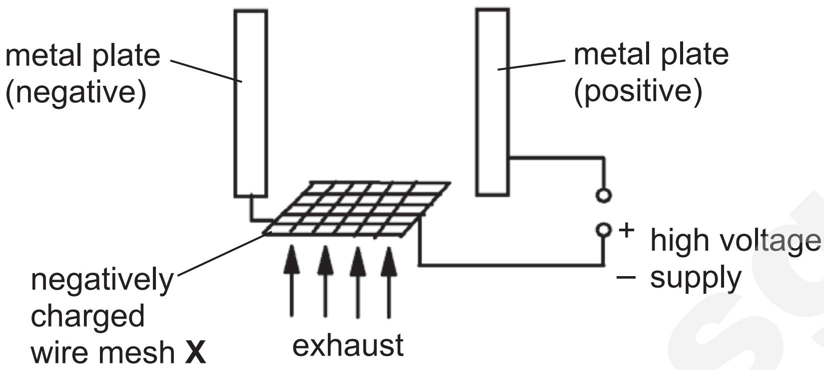


Fig. 7.1

When the exhaust passes through the wire mesh **X**, the dust particles are given a negative charge.

(a) Explain why the dust particles becomes negatively charged when they pass through the wire mesh **X**.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [1]

(b) State and explain what will happen to the dust particles when they pass through the electric field.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

(c) The dust particles repel each other before they enter the electric field.

In Fig. 7.2, draw to show the electric field between these two dust particles. [1]

Fig. 7.2

8 In a satellite communication system, microwaves are transmitted from transmitter **A** to a satellite as shown in Fig. 8.1. The satellite then transmits the signal to receiver **B**. The satellite is 36000 km from transmitter **A** and 44000 km from receiver **B** respectively.

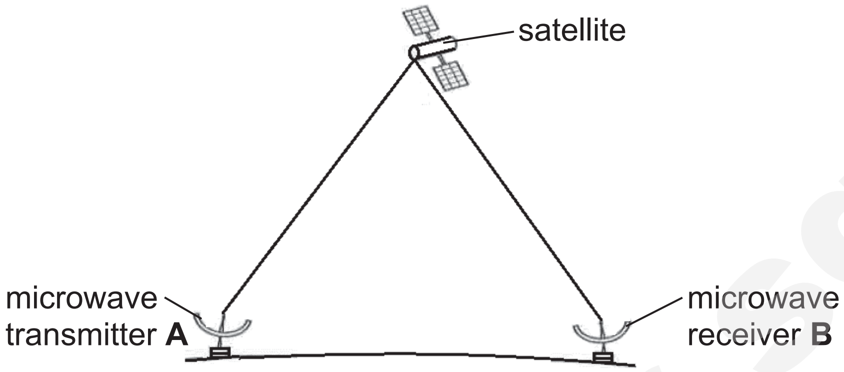


Fig. 8.1

The microwaves have a frequency of 8000 MHz and a wavelength of 0.04 m

(a) Calculate the speed of the microwaves.

speed = ... [2]

(b) Calculate the time taken for the microwaves to travel from transmitter **A** to the satellite and to receiver **B**.

time = ... [2]

(c) Explain why microwaves are used in satellite communications.

....

.... [1]

9 Fig 9.1 shows how the pressure changes with time, at a person's ear, for two different sound waves **A** and **B**. The sounds are produced by two different sources.

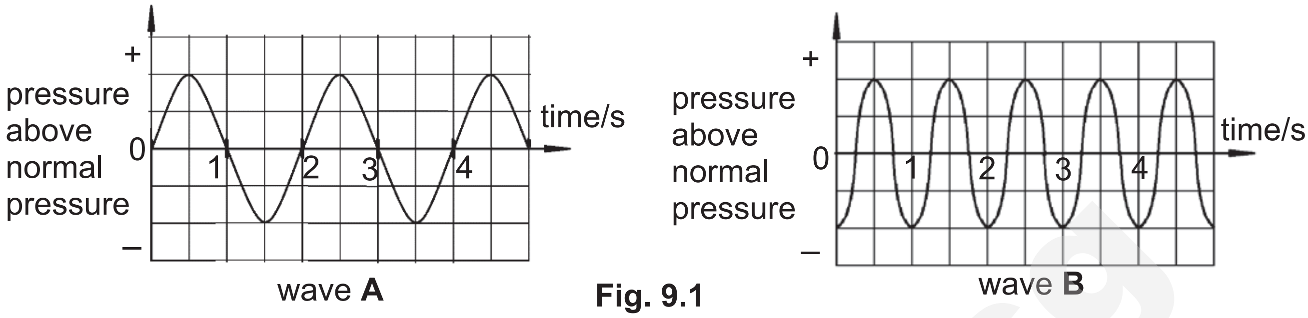


Fig. 9.1

(a) State and explain one difference between the 2 sounds.

....

.... [2]

(b) State and explain one similarity between the 2 sounds.

....

.... [2]

10 A coil is wound on an iron core. It is placed near a permanent magnet as show in Fig. 10.1.

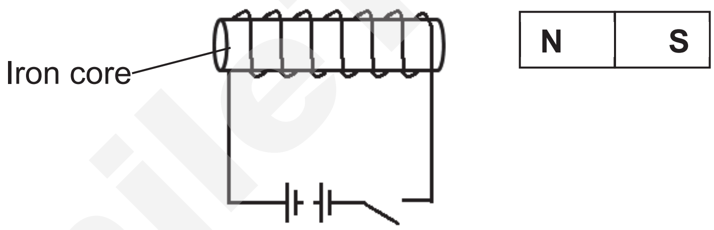


Fig. 10.1

The switch is closed.

(a) Explain why the permanent magnet moves away from the iron core.

....

....

.... [2]

(b) The switch is opened and the permanent magnet is replaced by an iron rod.

State and explain what will happen to the iron rod when the switch is closed.

....

....

.... [2]

Section B [20 Marks]
Answer any **TWO** questions. Write your answers in the spaces provided on the question paper.

11 Fig. 11.1 shows a rectangular glass block of refractive index 1.42. The light ray enters the glass block at an angle of 60 ° from the surface **AB** of the block.

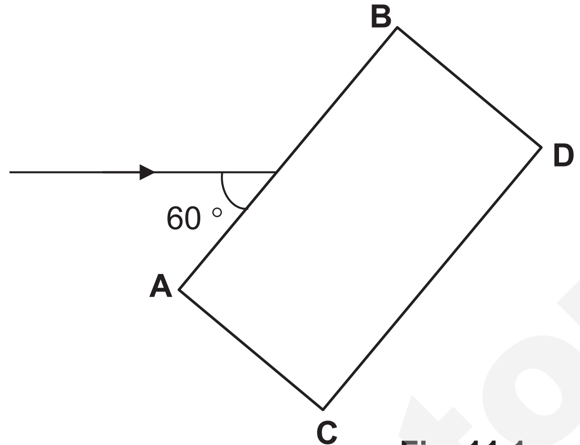


Fig. 11.1

(a) Define critical angle.

....

.... [1]

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

critical angle = ... [2]

(c) Determine the angle of refraction of the light ray.

angle = ... [2]

(d) On Fig 11.1, draw the light ray as it passes through surface **AB** and emerges from surface **CD**. [2]

(e) State what is meant by total internal reflection.

....

.... [1]

(f) Explain why a ray of light that strikes surface **CD** cannot be totally internally reflected at surface **CD**.

…………………………………………………………………………………………………..…….

…………………………………………………………………………………………………..…….

…………………………………………………………………………………………………..…….

……………………………………………………………………………………………………….. [2]

12 Fig. 12.1 shows a circuit consisting of three fixed resistors. The potential difference measured by the voltmeter across the 18 Ω resistor is 6 V.

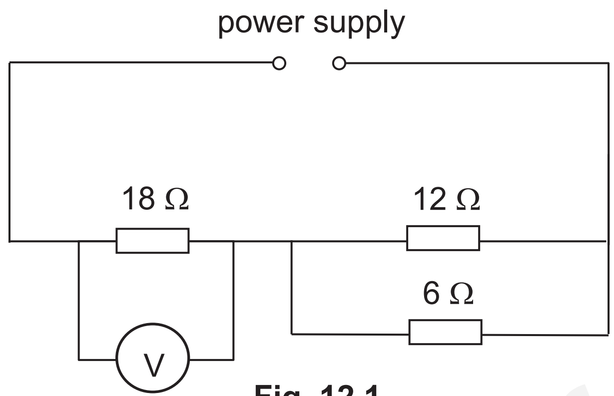


Fig. 12.1

(a) State the name given to the arrangement of the 12 Ω and the 6 Ω resistors.

.... [1]

(b) Determine the effective resistance of the 12 Ω and the 6 Ω resistors.

effective resistance = ... [2]

(c) Determine the e.m.f. of the power supply.

e.m.f. = ... [3]

(d) Calculate the current flowing through the 12 Ω resistor.

current = ... [2]

(e) The 6 Ω resistor in the circuit consists of a nichrome wire of length 0.3 m and cross-sectional area of 0.02 m^2.

Explain what will happen to the overall resistance of the circuit when this resistor is replaced by a nichrome wire of length 0.6 m and cross-sectional area of 0.01 m^2.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

13 A man connects three electric blowers each rated "240 V 600 W" in his house. He makes a domestic wiring as shown in the Fig.13.1 below. The mains supply is at 240 V and **L**, **N** and **E** denote the live, neutral and earth wire respectively.

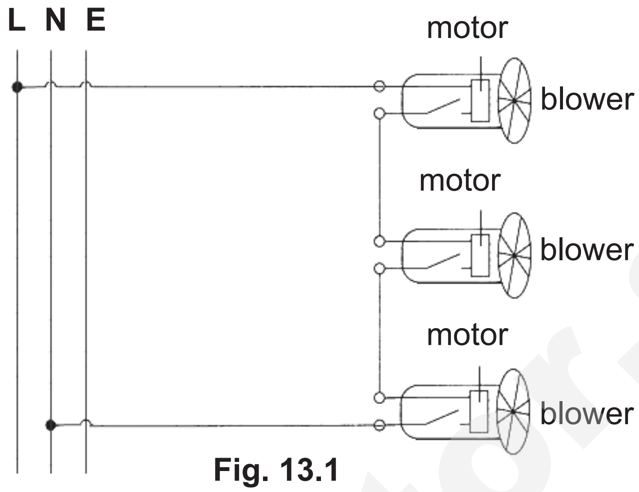


Fig. 13.1

(a) State the **THREE** mistakes that the man has made in this electrical wiring.

Mistake 1: ....

....

Mistake 2: ....

....

Mistake 3: ....

.... [3]

(b) Complete Fig. 13.2 to show the correct wiring of the blowers. [3]

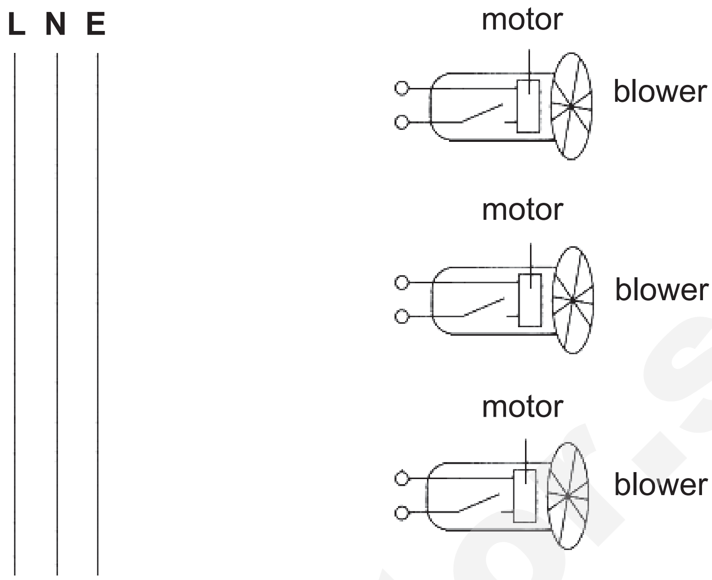


Fig. 13.2

(c) After correcting the mistakes, calculate the total current drawn from the mains supply when all the blowers are switched on.

total current = ... [2]

(d) There is an electric component missing inside the blower. Name the missing component and state its function.

....

....

....

.... [2]

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

Sec 4E5N Express Sc(Physics) Prelim Exam Marking Scheme 2019

Paper 1 MCQ:

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

Paper 2 Section A:

1(a) **(i) AB [A1] (ii)CD [A1]**

1(b) average speed $=\frac{(15-10)km}{(1400-600)s}[\boldsymbol{M1}] = \frac{5000}{800} = 6.25\ m/s$ **[A1]**

2(a) **(i)** W (with arrow) is at the centre of the rule exactly at the 50 cm mark **[A1]**

2(a) **(ii)** Using Principle of moments (50-35) x W+(80-35) x 4 = (35-10) x 8 **[M1]**
15W = 200-180 =20, W=1.33 N [**A1**]

2(b) moment arm of 4N must reduce OR move 4N towards pivot OR 0.4N position less than 80 cm mark.(any value given that is smaller) **[A1]**
As the moment arm of 0.8 N is shorter, anticlockwise moment is smaller **OR** clockwise moment caused by weight is increased, Clockwise moment of 4N must be reduced.

3(a) Volume = 0.6x0.3x0.2 = 0.036 m^3, mass = 0.036 x 25 **[M1]** = 0.9 kg **[A1]**

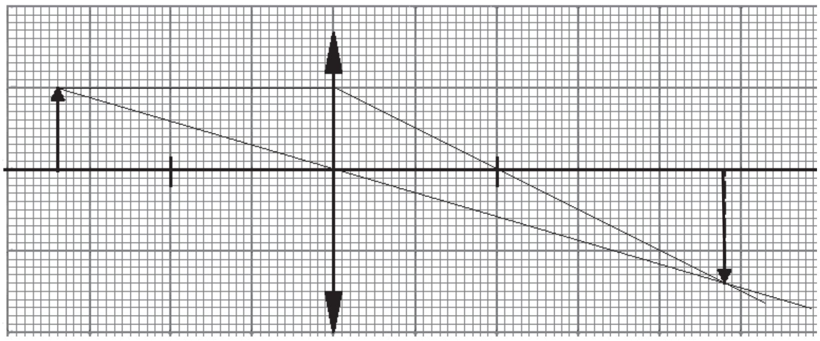
3(b) Weight = 0.9 x 10 = 9, Pressure (max) = 9/(0.3 x 0.2) **[M1]** =150 Pa **[A1]**

4(a) Water is a poor conductor of heat/ insulator so the heat cannot conduct easily from heater to Sensor Q by conduction. **[A1]**
Little convection occurs below heater at Sensor Q as heated, less dense water from heater rises above it **[A1]** while cold, more dense water replaces the risen water.
By just mentioning about convection current affecting P and Q will not get any marks.

4(b) Lower the heater down 10cm /same level as Sensor **Q** OR bottom of the beaker **[A1]**
Now heated, less dense water from heater rises above it while cold, more dense water replaces the risen water, setting up convection current **[A1]**

5(a) Molecules sliding over one another **[A1]**
Molecules gain energy and overcome intermolecular forces **[A1]**
Molecules moved further apart **[A1]**

5(b) From graph, substance is liquid at 40 °C.
The molecules are arranged in a disorderly manner/ randomly **[A1]**
The molecules can slide past one another **[A1] No mark if moving randomly.**



6(a) **(i)** image, label **I** [**A1**] (No mark if no label)
Connect object through optical centre lens to image **[A1]**
Connect object to lens, from lens to image [**A1**],
Note: Subtract only 1 mark for missing arrows or dotted rays or both.

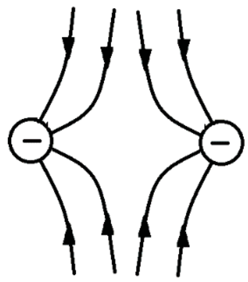
6(a) **(ii)** inverted, magnified or enlarged, real [**2 ans** correct for **A1**, 3 for **A2**]

6(a) **(ii)** projector [**A1**]

7(a) The dust particles gain electrons from the wire mesh and becomes negatively charged. **[A1]**

7(b) The negatively charged dust particles are attracted towards the positively charged metal plate.**[A1]** Like charges repel **[A1] OR** The negatively charged dust particles are repelled away from the negatively charged metal plate.**[A1]** Unlike charges repel **[A1]**

7(c) pattern must symmetrical with the neutral zone and arrow directions correct**[A1]**



8(a) v= fλ, Speed = 8000 000 x 0.04 **[M1]** = 320 000 000 m/s **[A1]**

8(b) time = (36000+44000)x 1000/320 000 000 **[M1]** ecf 8a= 0.25 s **[A1] ecf 8a**

8(c) Transmission of microwaves not affected/obstructed by cloud cover/water droplets and need no medium (in space) to transmit. **[A1]**

9(a) Pitch of Wave B higher **[A1]** than Wave A. Frequency of Wave B higher **[A1]** than Wave A, giving higher pitch

9(b) Loudness of Wave B is the same **[A1]** as Wave A. Amplitude of Wave B same **[A1]** as Wave A, giving same loudness

10(a) When current is switched on. The iron core becomes an electromagnet**[A1]**. Based on the Right hand grip, North pole is induced by the electric current flowing in the coils of wire onto the right side of the iron core **[A1]** and like poles repel.
By saying that it is North pole on the right of iron core with no reason and mentioning like poles repel will not get any mark.

10(b) The iron rod will be attracted to the iron core **[A1]** when current in turned on. Based on the Right hand grip, North pole is induced on the right hand side of the iron core which will induce an opposite pole onto the magnetic iron rod. **[A1]** Unlike poles attract.

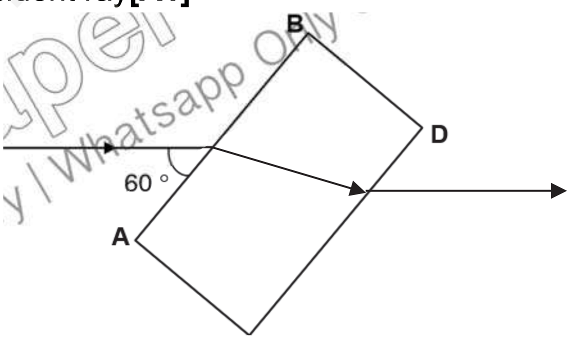
11(a) Critical angle is the angle of incidence in the optically denser medium when the angle of refraction in the optically less dense medium is 90 ° (*no optical word will be marked wrong)

11(b) Critical angle = $\sin^{-1}(1/1.42)$ **[M1]** = 44.8° **[A1]**

11(c) Angle of incidence = 90° – 60° = 30°

n of glass block = $\frac{\sin i}{\sin r} = \frac{\sin 30}{\sin r}$ = 1.42 **[M1]**, r = 20.6 ° **[A1]**

11(d) Refracted ray bend towards normal **[A1]**
Emergent ray must be // incident ray**[A1]**



11(e) When the angle of incidence in the optically* dense medium exceeds the critical angle, the light ray will no longer be refracted into the optically less dense medium and total internal reflection occurs. **[A1]** *Do not award marks if optical is missing

11(f) As the angle of incidence in the optically* dense medium does not exceed the critical angle **OR** all the incident light rays on surface AB does nto exceed 90 ° **[A1]**, the light ray will always be refracted **[A1]** into the optically less dense medium and no total internal reflection occurs. *Do not award marks if optical is missing

12(a) parallel **[A1]**

12(b) $1/R_{eff}$ **=** $1/6 + 1/12$ **[A1]** $= 1/4 \Rightarrow R_{eff} = 4\ \Omega$ **[A1]**

12(c) Total Current = 6/18 = 0.333 A **[M1]**

Total resistance = 18 + 4 , emf = 0.333 x 22 **[M1]** = 7.33 V **[A1] ecf 12b,c**

12(d) potential difference = total EMF- $V_{18\ \Omega}$ = 7.33 - 6 [M1] = 1.33 V**[A1]**

Current across 12 Ω = 1.33/12 = 0.111 A **[A1] ecf 12c**

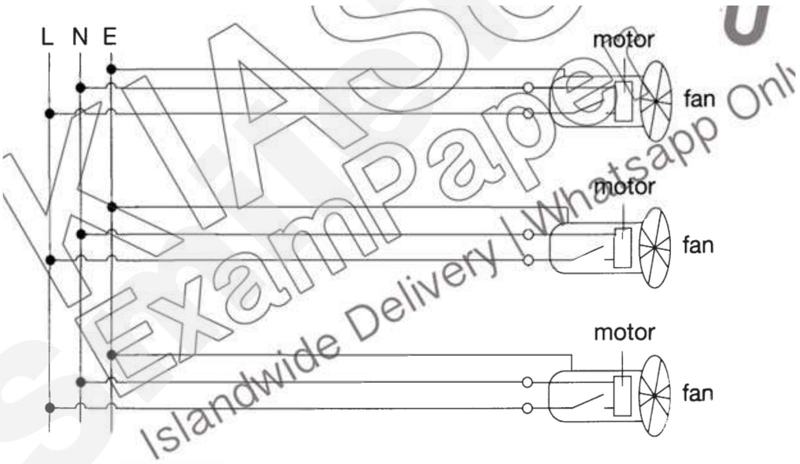
12(e) Increase Length of wire 2x doubles the resistance of wire. Reduce diameter/cross sectional area/ thinner wire by half doubles the resistance.**[A1]**. For the parallel circuit, the effective resistance is calculated to be higher, thereby increasing overall resistance **[A1]** of the whole circuit.

13(a) Series connection instead of parallel connection **[A1]**

Switch is connected to neutral instead of live wire **[A1]**

The casing is not earthed/ connected to earth wire **[A1]**

13(b)



[A3]

13(c) Current for 1 fan = Power / Potential Difference

= 600 W / 200 V = 3 A **[M1]**

Current for 3 fan = 3 x 3 A = 9 A **[A1]**

13(d) Fuse **[A1]**

When the current in the circuit exceeds the current rating of the fuse, the fuse will melt or break**[A1]**, thus preventing overheating/ fire. No mark if voltage is mentioned instead.

YUHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

4E/5N	CANDIDATE NAME	
	CLASS		INDEX NUMBER	

SCIENCE (PHYSICS, CHEMISTRY) — 5076/01

Paper 1 Multiple Choice

3 Sept 2019
1 hour

Additional Materials : Multiple Choice Answer Sheet

Setter: Mr Yeh Bao Yaw
Ms Cheong Ai Hwa

READ THESE INSTRUCTIONS FIRST

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

Use soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your *Class*, *Name* and *Class Index Number* in the spaces at the top of this page and on the Multiple Choice Answer Sheet.

Read the instructions on the Multiple Choice Answer Sheet carefully

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 **soft pencil** on the separate Multiple Choice 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 Data Sheet is printed on page **18**.
A copy of the Periodic Table is included on page **19**.

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

This document consists of **19** printed pages, inclusive of this page.

[Turn over

1 A micrometer screw gauge is used to measure the diameter of a copper wire.

Fig. 1.1 shows the reading when the anvil and the spindle are tightly closed.
Fig. 1.2 shows the observed reading when the wire is placed between the anvil and the spindle.

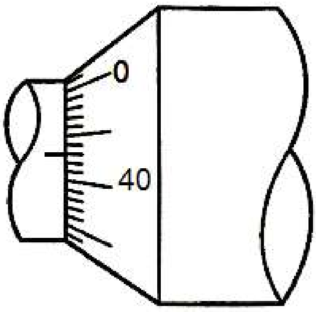


Fig. 1.1

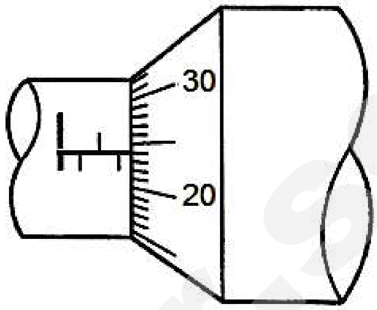
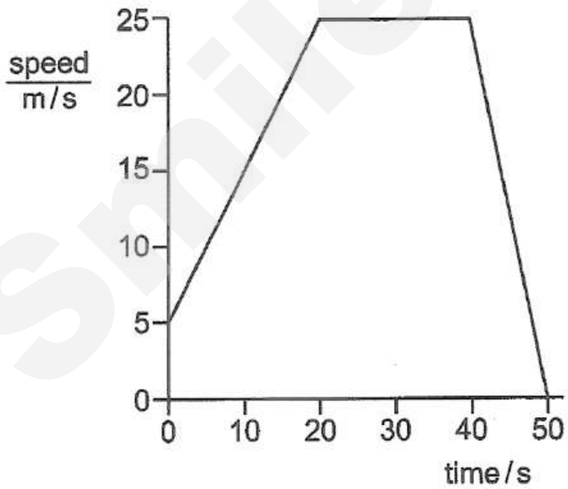


Fig. 1.2

What is the thickness of the copper wire?

A 1.67 mm
B 1.74 mm
C 1.81 mm
D 2.17 mm

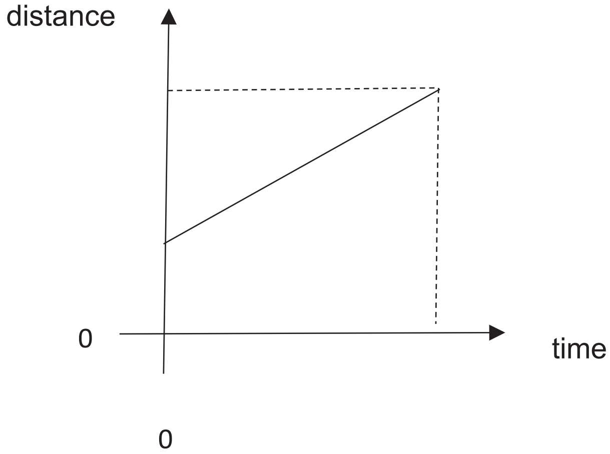
2 The diagram below is a speed-time graph for a car.



Which two quantities are needed to find the average speed of the car for this 50 s period?

A the area under the graph and the total time taken
B the gradient at 50 s and the total time taken
C the initial speed and final speed
D the maximum speed and the time taken to reach it

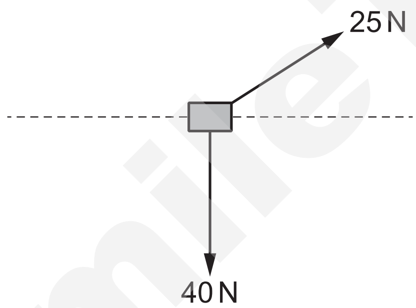
3 The following distance-time graph shows the distance travelled by a moving car.



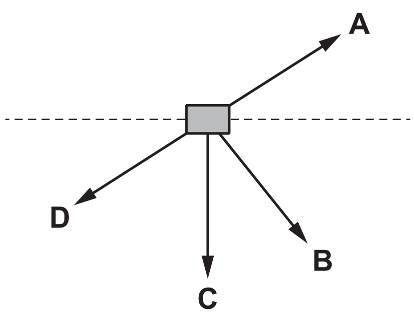
Which feature of the graph gives the speed of the car?

A the area between the line and the distance axis
B the area between the line and the time axis
C the difference between the starting and finishing distances
D the gradient of the line

4 Forces of 25 N and 40 N act on an object in the directions shown.



Which arrow shows the direction of the resultant force on the object?



5 A boat of 3000 kg moves with a constant velocity of 7 ms^{-1} through a lake over a time period of 5 s.

What is the resultant force acting on the boat?

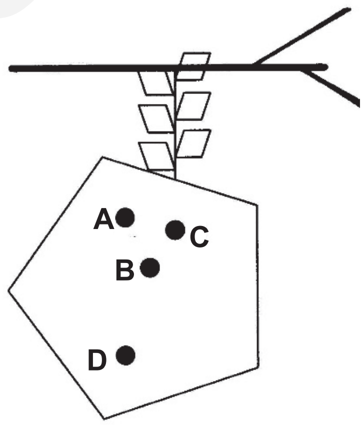
A 0 N
B 1400 N
C 4200 N
D 21000 N

6 An Eskimo stands on snow wearing snow-shoes. The mass of the Eskimo is 40 kg and the snow-shoes have a total area of 0.5 m^2 in contact with the snow. A 1 kg mass has a gravitational force of 10 N acting on it.

What pressure does the Eskimo exert on the snow?

A 20 N / m^2
B 80 N / m^2
C 200 N / m^2
D 800 N / m^2

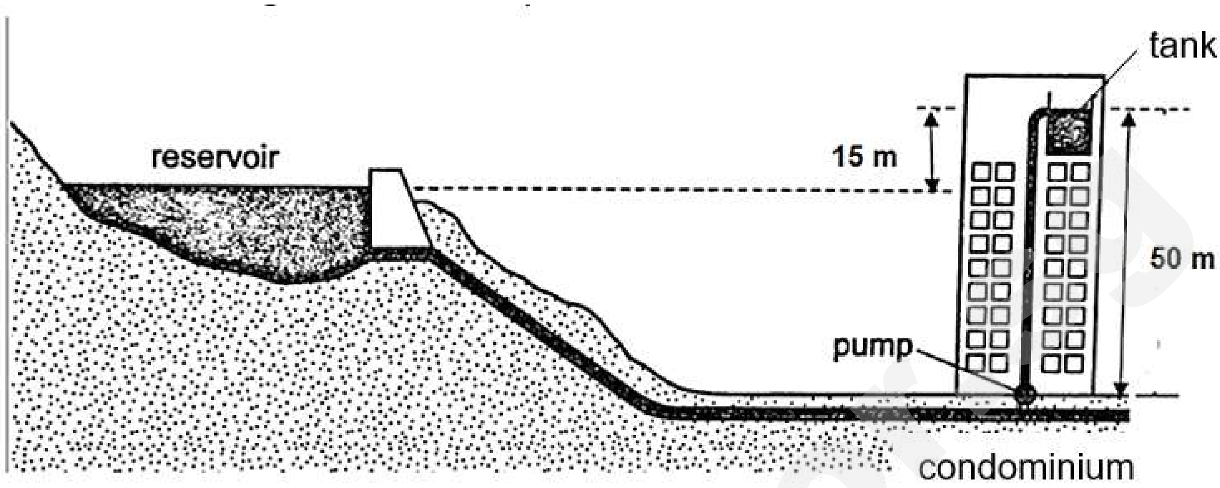
7 A kite hangs freely on the branch of a tree and comes to rest in the position as shown in the diagram below. Which labelled point is most likely to be the centre of gravity of the kite?



8 Which of the following statements correctly describes a stable equilibrium?

A the centre of gravity rises before returning to its original height
B the centre of gravity drops
C the centre of gravity remains at the same height
D the centre of gravity drops before returning to its original height

9 Water flows freely from a nearby reservoir into the condominium without any loss of energy. A pump is required to provide additional energy to lift the water into a storage tank at the top of the condominium. The gravitational field strength is 10 N/kg.



How much additional energy does the pump need to supply to lift each kilogram of water into the tank?

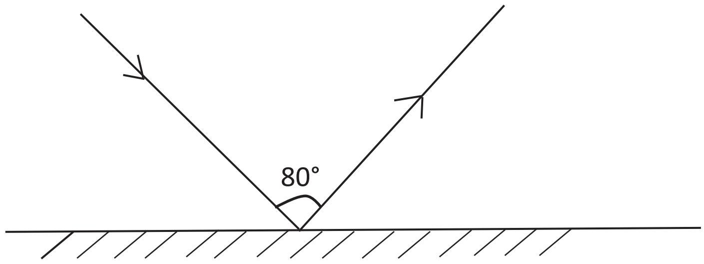
A 50 J
B 150 J
C 350 J
D 500 J

10 The hot water for a house can be produced by absorbing solar energy, using copper panels through which the water circulates.

What is the best finish for the top surface of the copper panels?

A clear plastic
B dull black paint
C highly polished
D white paint

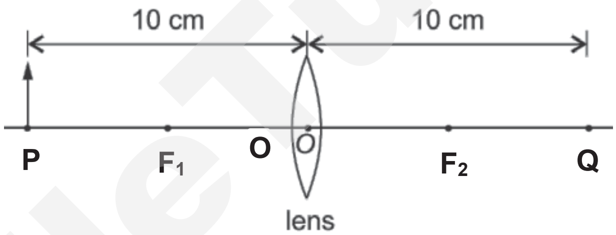
11 The diagram shows a ray of light striking a plane mirror.



What must the angle of incidence be if the total angle between the incident and reflected rays is 80°?

A 40°
B 50°
C 80°
D 100°

12 The diagram shows an object placed 10 cm away from a converging lens which has a focal length of 5 cm.



At which point will the image be formed?

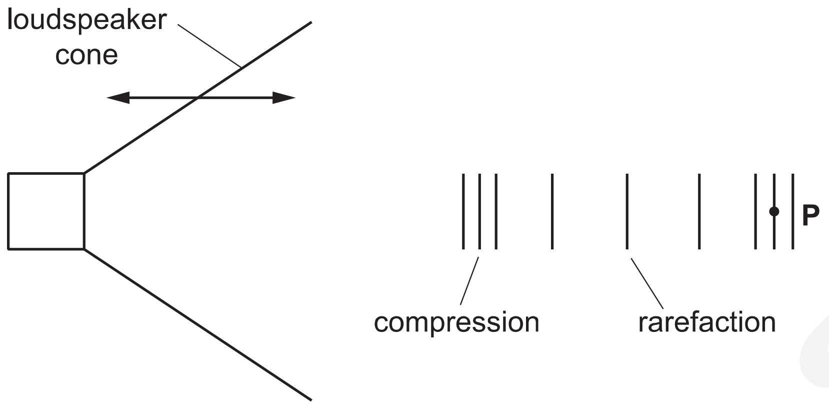
A $\mathbf{F_2}$
B **Q**
C Between **O** and $\mathbf{F_2}$
D Between $\mathbf{F_2}$ and **Q**

13 Radio waves, visible light and X-rays are all part of the electromagnetic spectrum.

What is the correct order of these components in increasing wavelength?

	shortest wavelength	→	longest wavelength
A	Visible light	Radio waves	X-rays
B	Visible light	X-rays	Radio waves
C	X-rays	Radio waves	Visible light
D	X-rays	Visible light	Radio waves

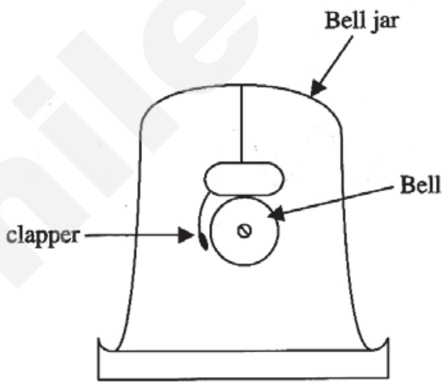
14 A series of compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forwards. The frequency of the vibration is 40 Hz.



A compression is found to be at point **P**. How much time would have passed before the next rarefaction arrives at **P**?

A 0.0125 s
B 0.025 s
C 20 s
D 40 s

15 An electric bell is suspended in a bell jar as shown. An observer outside the bell jar can see the clapper striking the bell but cannot hear any sound produced by the striking. What is a possible reason?



A The bell jar contains a vacuum.
B The bell jar is filled with inert gas.
C The bell jar is filled with water.
D The bell jar has very thick glass walls.

16 The amplitude and frequency of a sound wave are both increased. How are the loudness and pitch of the sound affected?

	loudness	pitch
A	increased	raised
B	increased	lowered
C	decreased	raised
D	decreased	lowered

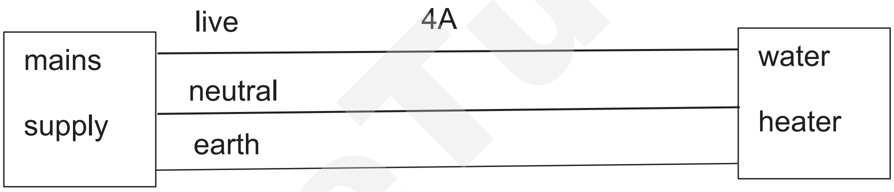
17 A piece of wire 0.5 m long has an area of cross-section of 1 mm^2. Which wire of the same material **A, B**, **C** or **D** has twice the resistance?

	length / m	area / mm^2
A	0.25	1.0
B	0.25	2.0
C	0.50	0.5
D	0.50	2.0

18 An electric oven rated at 3500 W operates from a 240 V mains.
What is the correct fuse rating for its plug to be connected to the mains socket?

A 13 A
B 16 A
C 20 A
D 30 A

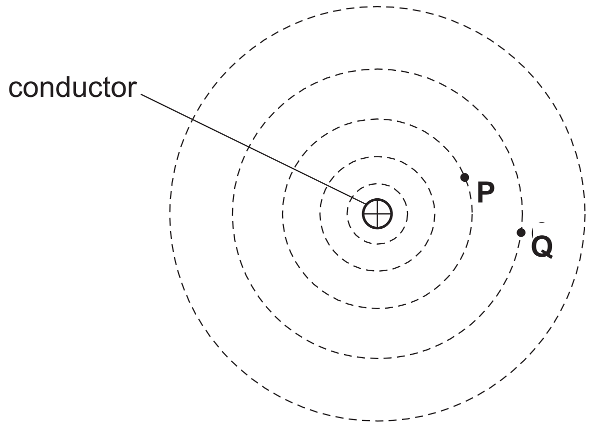
19 The diagram shows the three wires of an electrical mains supply connected to an electric water heater.



What are the currents in the neutral and earth wire corresponding to a current of 4 A in the "live" wire?

	neutral	earth
A	4 A	4 A
B	4 A	0 A
C	2 A	2 A
D	0 A	4 A

20 The diagram shows the shape of the magnetic field lines near a current-carrying conductor.



The current in the conductor is flowing into of the plane of the diagram.
Which row correctly states the direction of the field lines and compares the strength of the field at points **P** and **Q**?

	direction of field lines	stronger field at
A	clockwise	**P**
B	clockwise	**Q**
C	anti-clockwise	**P**
D	anti-clockwise	**Q**

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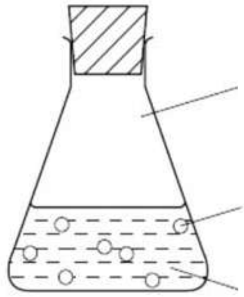
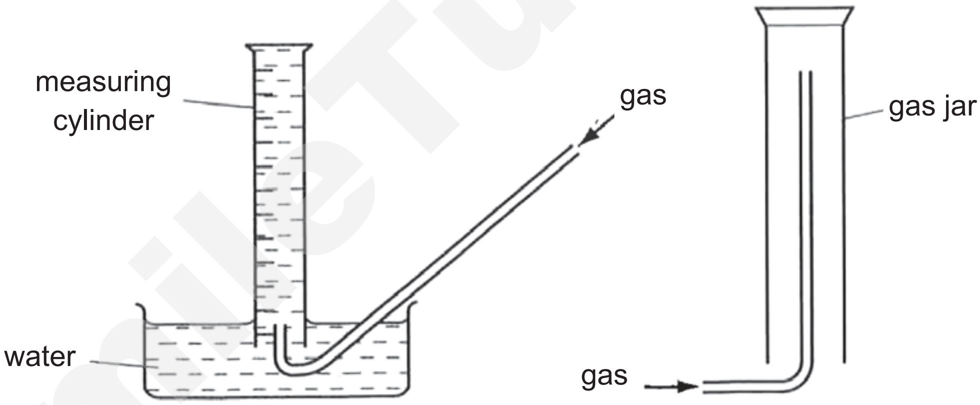
21 The conical flask contains compound **X** which is present in solid, liquid and gaseous states.



Which of the following is **not** correct?

A A gaseous **X** molecule has a lower mass than a liquid **X** molecule.
B Energy is released when **X** changes from gas to liquid.
C Gas **X** molecules occupy a larger space than same number of liquid **X** molecules.
D Solid **X** molecules vibrate about fixed positions.

22 The following diagrams show two methods of gas collection.



Which row gives the properties of a gas which could be collected by both methods?

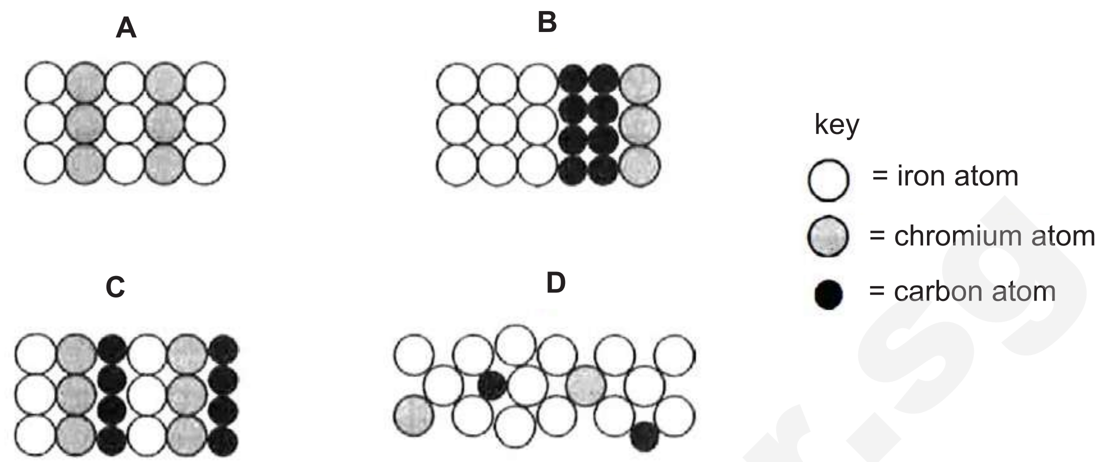
	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

23 Substance **E** melts at -114 °C and boils at 78 °C. It is soluble in water.

Which method can be used to obtain a significant amount of a pure sample of **E** from a mixture of **E** and water?

A crystallisation
B filtration
C fractional distillation
D paper chromatography

24 Which of the following diagrams shows the arrangement of the atoms in stainless steel?



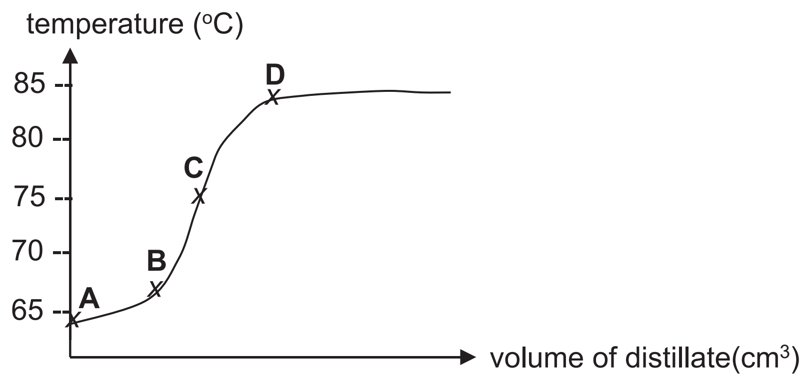
25 The following apparatus can be used in the measurement of volumes of liquids:

I 25 ml beaker
II 50 ml burette
III 25 ml graduated measuring cylinder
IV 25 ml pipette

Which of the following shows the correct order of increasing accuracy of these apparatus?

A **I**, **III**, **IV**, **II**
B **II**, **III**, **IV**, **I**
C **II**, **IV**, **III**, **I**
D **I**, **IV**, **III**, **II**

26 The following graph shows the temperature changes when a 1:1 mixture of methanol (melting point: −97 ºC, boiling point 65 ºC) and propanol (melting point: −89 ºC, boiling point: 82 ºC) was distilled.



If a 3 cm^3 fraction of the distillate was collected at each of the points **A**, **B**, **C** and **D** indicated on the graph, which fraction would contain the highest proportion of propanol?

27 Nitric acid can be decomposed into nitrogen dioxide, water and oxygen as shown in the equation given below.

$$4HNO_3(aq) \rightarrow 4NO_2(g) + 2H_2O(l) + O_2(g)$$

What volume of gas would be produced if 12.6 g of nitric acid was used?

A 1.2 dm^3
B 4.8 dm^3
C 6.0 dm^3
D 8.4 dm^3

28 An element **X** has two isotopes, ^{238}**X** and ^{235}**X**.

How does ^{238}**X** differ from ^{235}**X**?

A It has 3 more neutrons.
B It has 3 more neutrons and 3 more electrons.
C It has 3 more protons.
D It has 3 more protons and 3 more electrons.

29 Which of the following pairs of ions **cannot** be distinguished using aqueous sodium hydroxide?

A Ca^{2+} and Fe^{2+}
B Cu^{2+} and Fe^{3+}
C NH_4^+ and H^+
D Pb^{2+} and Zn^{2+}

30 What are the two reagents that **cannot** be used to prepare a soluble salt of magnesium ethanoate?

A magnesium and ethanoic acid
B magnesium carbonate and ethanoic acid
C magnesium hydroxide and ethanoic acid
D magnesium nitrate solution and potassium ethanoate solution

31 The electrical properties of four substances **W**, **X**, **Y** and **Z** are shown below:

substance	electrical property
W	conducts electricity only in aqueous solution
X	conducts electricity when molten and in solid state
Y	conducts electricity when molten and in aqueous state
Z	does not conduct electricity under any conditions

What could these four substances be?

	W	**X**	**Y**	**Z**
A	$CaCl_2$	HCl	P	Pb
B	HCl	Pb	$CaCl_2$	P
C	P	$CaCl_2$	HCl	Pb
D	Pb	P	$CaCl_2$	HCl

32 Metals **W**, **X**, **Y** and **Z** are placed in salt solutions as shown in the table

	result of placing metal in solution of			
	salt of **W**	salt of **X**	salt of **Y**	salt of **Z**
W	no reaction	**X** displaced	**Y** displaced	no reaction
X	no reaction	no reaction	no reaction	no reaction
Y	no reaction	**X** displaced	no reaction	no reaction
Z	**W** displaced	**X** displaced	**Y** displaced	no reaction

What is the order of reactivity of the metals from most reactive to least reactive?

A **Y → X → W → Z**
B **Y → W → Z → X**
C **Z → W → Y → X**
D **Z → Y → X → W**

33 The figures below show the particles in a substance at two different temperatures but at the same pressure.

-90 ºC　　　　-5 ºC

Which of the following most likely indicates the melting point and boiling point of the substance?

	melting point / ºC	boiling point / ºC
A	180	200
B	23	80
C	-78	13
D	-123	-10

34 Which of the following shows the correct trends down the group for the melting point, density and atomic radius of alkali metals?

	melting point	density	atomic radius
A	increasing	decreasing	increasing
B	decreasing	increasing	increasing
C	increasing	increasing	decreasing
D	decreasing	decreasing	decreasing

35 In which of the reaction is the underlined substance acting as an oxidising agent?

A $Cl_2 + 2\underline{FeCl_2} \rightarrow 2FeCl_3$

B $2HCl + \underline{MgO} \rightarrow MgCl_2 + H_2O$

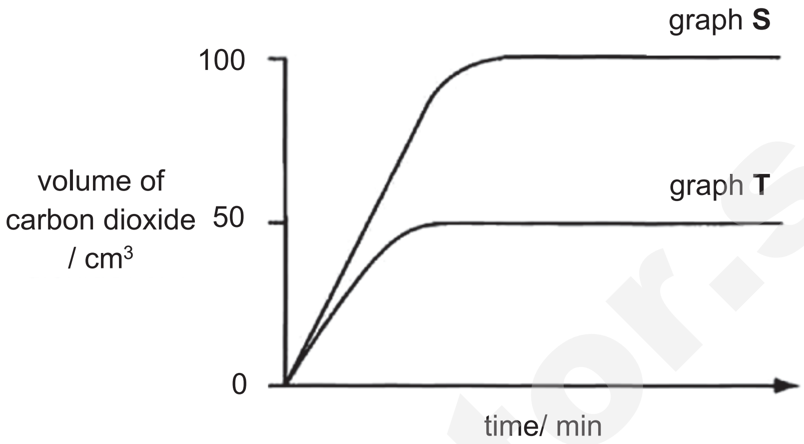
C $\underline{CuO} + H_2 \rightarrow Cu + H_2O$

D $ZnO + \underline{CO} \rightarrow Zn + CO_2$

36 Some crystals of magnesium carbonate were added to an excess of sulfuric acid at room temperature.

The volume of carbon dioxide produced was measured over a period of time. The results are shown in graph **S**.

The experiment was repeated and graph **T** was obtained.



Which change was used to obtain the results shown in graph **T**?

A Acid of the same volume and half the original concertation was used.
B Half the mass of magnesium carbonate was used.
C Larger crystals of magnesium carbonate were used.
D Using a lower temperature.

37 Rice mills face a greater threat of explosion from production of rice flour compared to rice silos which store rice grains.

Below are four statements which can explain why rice mills have a higher possibility of explosion occurring.

I The combustion of rice flour is exothermic.
II Rice flour is less combustible than rice grains.
III Rice flour dust has a larger surface area than rice grains.
IV Rice flour catalyses the combustion of gaseous fuel in the mills.

Which of the above are true?

A **I** and **III** only
B **II** and **IV** only
C **I** and **IV** only
D **I**, **III** and **IV** only

38 A student investigated the reaction of vegetable oils with hydrogen. 100 cm^3 of hydrogen was bubbled through 1 g samples of four vegetable oils containing a suitable catalyst. The volume of hydrogen gas remaining after each experiment was recorded in the table below.

vegetable oil	volume of hydrogen gas remaining/ cm^3
P	**100**
Q	**87**
R	**63**
S	**0**

Which vegetable oils are unsaturated?

A **P**, **Q** and **R**
B **Q** and **R**
C **Q**, **R** and **S**
D **S** only

39 When ethanol is left standing in the air for some time, it becomes acidic.

Which chemical equation represents this change?

A $CH_3CH_2OH + CO \rightarrow CH_3CH_2CO_2H$
B $CH_3CH_2OH + O_2 \rightarrow CH_3CO_2H + H_2O$
C $CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
D $2CH_3CH_2OH + O_2 \rightarrow 2CH_3CO_2H + 2H_2$

40 The table shows the observations made when an organic compound **X** reacts with aqueous bromine and acidified potassium manganate(VII)

reagent	observation
aqueous bromine	no visible reaction
acidified potassium manganate(VII)	purple solution turns colourless

What is compound **X**?

A ethane
B ethanoic acid
C methanol
D propene

END OF PAPER

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

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
				Key			1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9			proton (atomic) number atomic symbol name relative atomic mass								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.).

YUHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

4E/5N	CANDIDATE NAME			
	CLASS		INDEX NUMBER	

SCIENCE (PHYSICS) **5076/02**

Paper 2

30 Aug 2019
1 hour 15 minutes

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

Setter: Mr Yeh Bao Yaw

READ THESE INSTRUCTIONS FIRST
Write your name, class and index number on all the work you hand in.
Write in dark blue and black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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	
Section B	
……………..	
……………..	
Total	

This document consists of **17** printed pages, inclusive of this page.

Section A

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

1 **Fig. 1.1** shows a catapult used to project an object. Force **F** pulls back the object, creating a tension in the rubber cords.

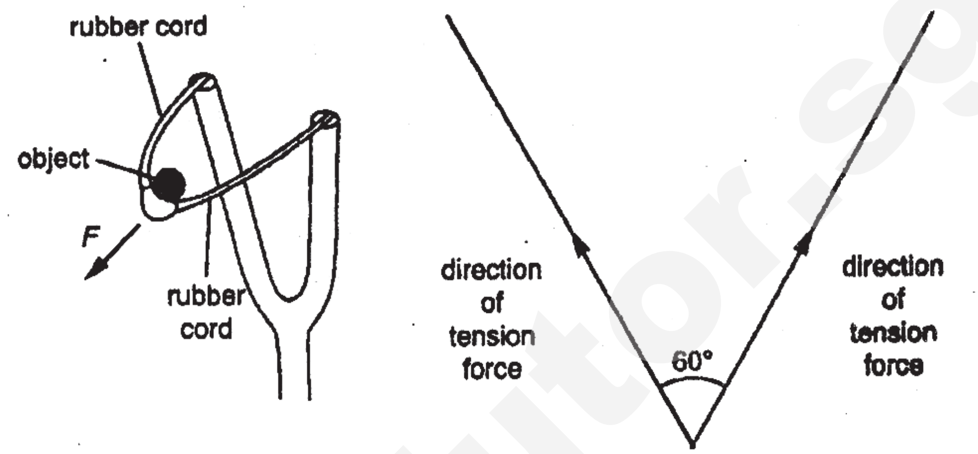


Fig. 1.1

The tension force in each rubber cord is 20 N and the two cords are 60° to each other as shown in **Fig. 1.1**. By making a scale drawing of 1 cm : 4 N, find the resultant of these two tension forces acting on the object.

resultant force = ……………………….. N [3]

2 **Fig. 2** shows a claw hammer being used to pull a nail out of a piece of wood.

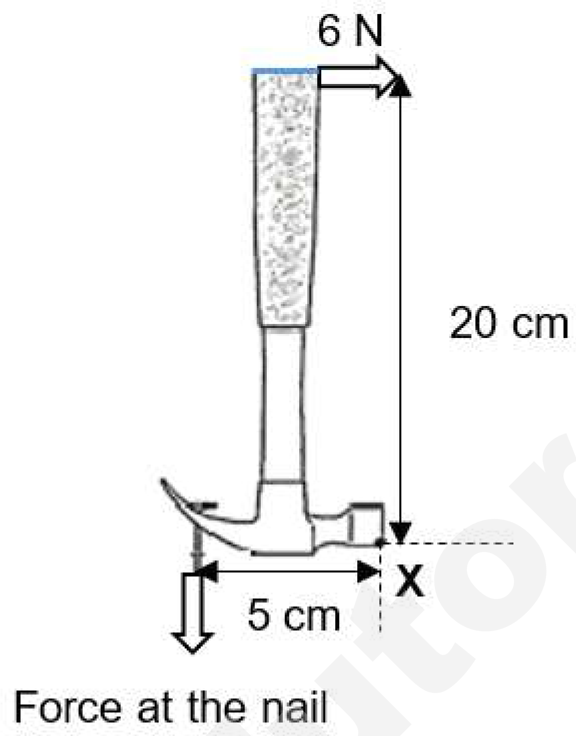


Fig. 2.1

(a) Explain why the force at the nail is greater than the force exerted at the handle of the hammer.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………. [2]

(b) The hammer rotates about the pivot, **X**, when the nail is being pulled out. A force of 6 N is applied at the end of the hammer's handle as shown in **Fig. 2.1**. Calculate the force on the nail.

force at the nail = ……………………….. N [2]

3 **Fig. 3.1** shows a small ball bearing rolling down a hemispherical bowl of radius 14.0 cm. The ball bearing has a mass of 1 kg. The inner surface of the bowl is slightly rough. (g = 10 N/kg)

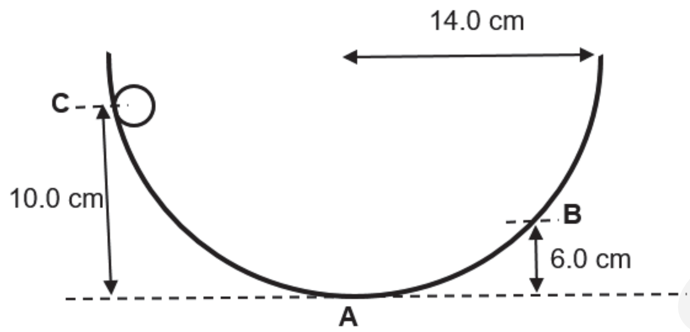


Fig. 3.1

(a) Calculate the gravitational potential energy of the ball bearing when it is released at a vertical distance of 10.0 cm above **A**, which is the bottom of the bowl.

gravitational potential energy = …………….. J [2]

(b) Hence or otherwise, find the maximum possible speed of the ball bearing at **A**.

maximum speed = …………….. m/s [2]

(c) When the ball is released at **C**, explain why the ball bearing is only able to reach **B** using the principle of conservation of energy.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………… [2]

4 **Fig. 4.1** shows a vending machine that can serve a hot cooked ready-to-eat meal. It has a storage space for frozen food at the bottom of the machine. The cooking compartment is separated from the storage space.

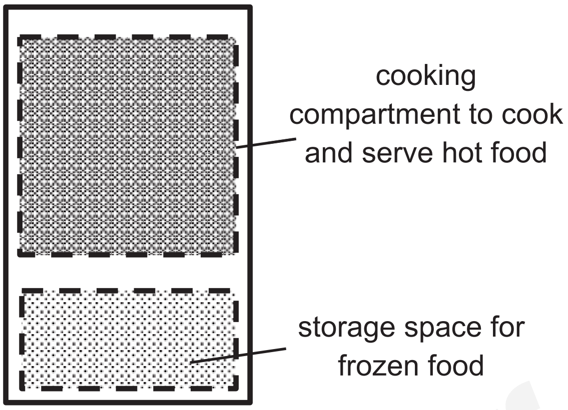


Fig. 4.1

(a) In terms of thermal energy transfer, explain why the cooking compartment is at the top while the storage space for frozen food is located at the bottom of the vending machine.

....

....

....

.... [2]

(b) Suggest one way to reduce thermal energy transfer between the cooking compartment and the storage space for frozen food.

....

.... [1]

(c) What colour should the vending machine be in order to reduce heat gain to the storage space for frozen food? Explain your answer.

....

....

....

.... [2]

5 **Fig. 5.1** shows the wave crests viewed on the surface of a ripple tank (not drawn to scale).

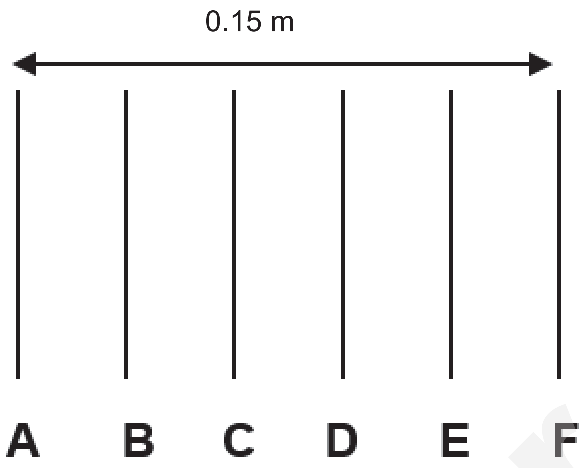


Fig. 5.1

(a) State what is meant by a wavefront.

....

.... [1]

(b) The wavefront shown at position **A** in **Fig. 5.1** takes 5.0 s to travel to position **F**. Determine

(i) the wavelength of the wave,

wavelength = ... m [1]

(ii) the speed of the wave,

speed = ... m/s [1]

(iii) the frequency of the wave.

frequency = ... Hz [1]

6 **Fig. 6.1** shows the position of an object **O** and a thin converging lens with its focal points, **F**.

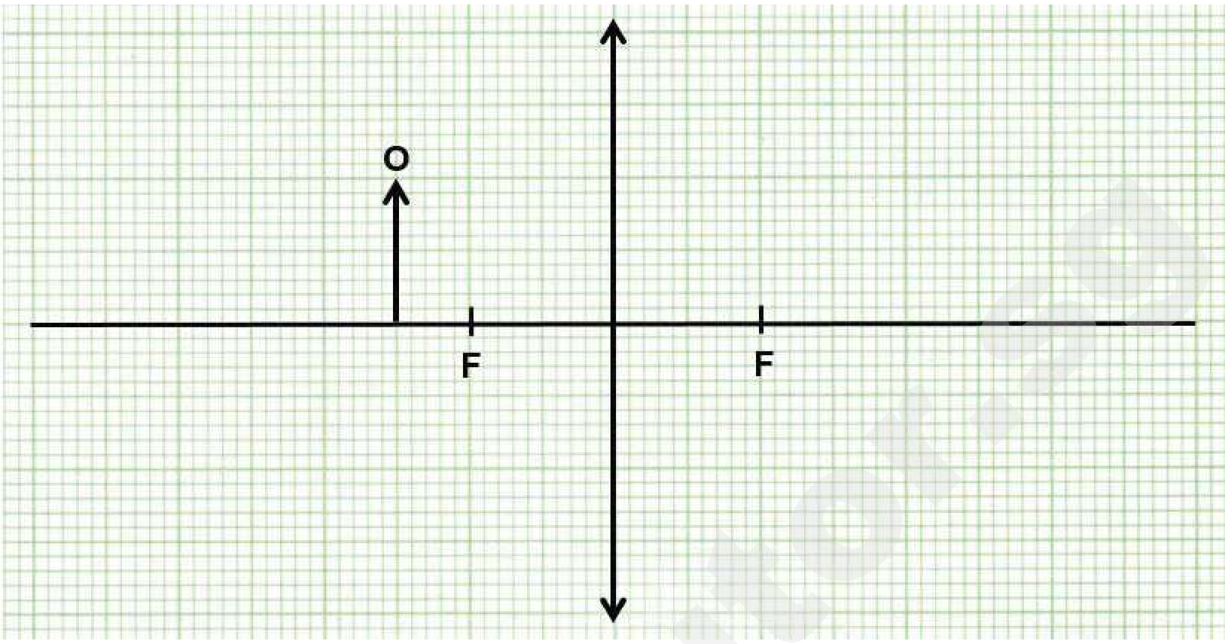


Fig. 6.1

(a) On **Fig. 6.1**, draw two rays from the top of **O** to locate the top of the image. Draw in the whole of the image. [2]

(b) State the characteristics of the image produced.

.... [1]

(c) State an application for this arrangement of object and lens.

.... [1]

7 **Fig. 7.1** shows the base of a large thundercloud which is negatively charged above a tall building. A lightning flash occurs as the thundercloud loses some of its charge to the ground.

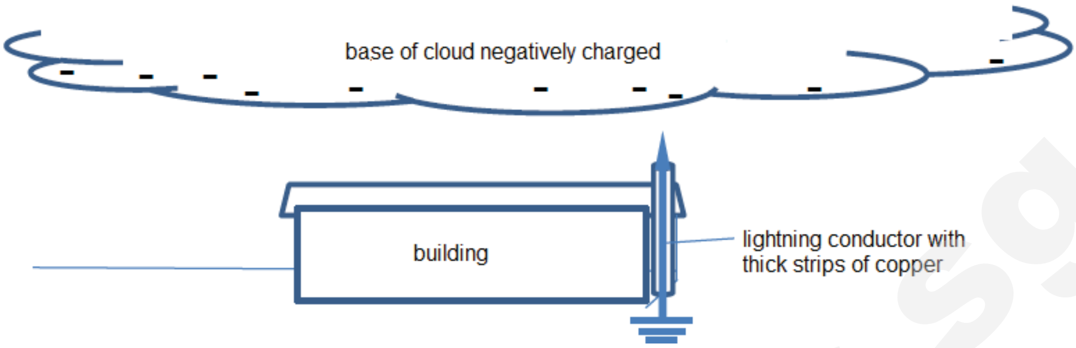


Fig. 7.1

(a) **(i)** State if the tip of the lightning conductor is positively or negatively charged.

.... [1]

(ii) Explain how the tip of the lightning conductor becomes charged, as stated in **(a)(i)**.

....

.... [2]

(b) **(i)** One lightning flash delivers an average current of 10 000 A to the ground for a duration of 0.0002 s.
Calculate the amount of charge that is transferred during this flash.

charge = ... C [1]

(ii) Assuming that there is a potential difference of 4 MV between the cloud and the ground, calculate the energy dissipated during the flash.

energy = ... J [2]

8 **Fig. 8.1** below shows a circuit containing two lamps connected in parallel to a 12 V battery. Each lamp is rated 12 V, 2.0 A.

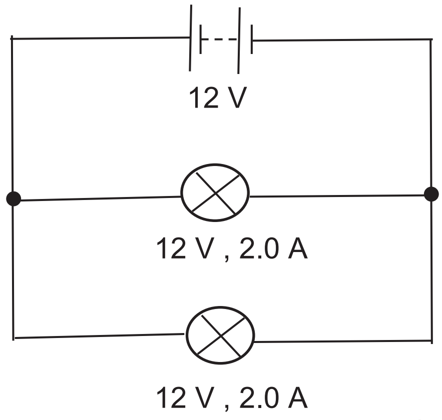


Fig. 8.1

(a) State the current passing through the battery.

current = ………………. A [1]

(b) Calculate the resistance of each lamp.

resistance of each lamp = ………………. Ω [2]

(c) Hence, calculate the total resistance in the circuit.

total resistance = ………………. Ω [2]

9 **Fig. 9.1** below shows the wiring inside an electric iron.

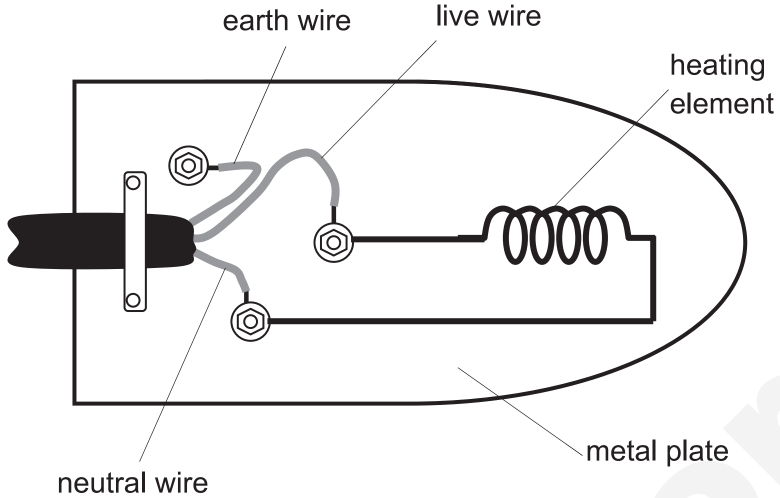


Fig. 9.1

(a) Describe the fault that occurs that causes current to flow in the earth wire.

……………………………………………………………………………………………..

…………………………………………………………………………………… [1]

(b) The iron has a power rating of 1500 W and is connected to a 240 V mains supply.

(i) Calculate the current passing through the iron when in use.

current = …………………. A [1]

(ii) If electricity costs 15 ¢ per kWh, what is the cost of using the iron for 10 hrs?

cost = ……………… ¢ [2]

10 A coil is wound on an iron core. It is placed near a permanent magnet, as shown in **Fig. 10.1**.

Fig. 10.1

(a) The current is switched on. Explain why the permanent magnet moves away from the iron core.

....

....

.... [2]

(b) The current is switched off and the permanent magnet is replaced by an iron rod. State and explain what will happen to the iron rod when the current is now switched on.

....

....

.... [2]

Section B
Answer any **two** questions in this section.
Write your answers in the spaces provided.

11 A train as shown in **Fig. 11.1** travels from one station to the next. It starts from rest at time t = 0 and accelerates uniformly for the first 20 s. It accelerates uniformly for the first 20 s. At t = 20 s it reaches its top speed of 30 m/s. It then travels at this speed for a further 30 s before decelerating uniformly to rest. The total time for the journey is 60 s.

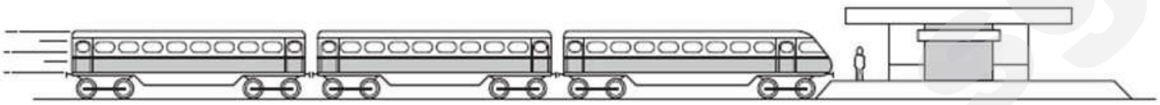


Fig. 11.1

(a) On **Fig 11.2** below, plot a speed-time graph for the motion of the train.

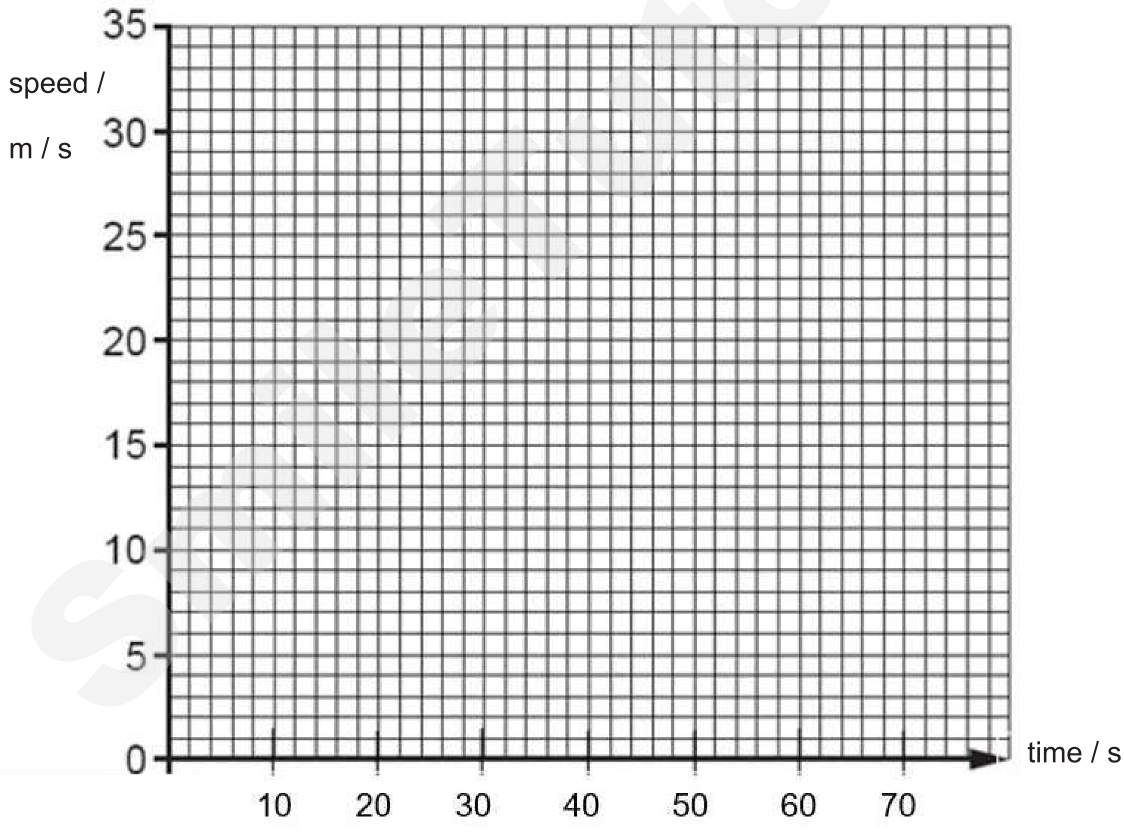


Fig. 11.2 [3]

(b) Explain what is meant by *uniform acceleration*.

……………………………………………………………………………………………………..

………………………………………………………………………………………… [1]

(c) By using your graph in **Fig. 11.2**, calculate

(i) the acceleration of the train.

acceleration = ………………… m / s^2 [2]

(ii) the total distance between the two stations.

total distance = …………………… m [2]

(d) The train is stopped by applying the brakes. Various factors can affect the braking distance of the train. State and explain how the braking distance of the train is affected by carrying more passengers.

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………..

…………………………………………………………………………………… [2]

12 **(a)** **Fig. 12.1** shows what happens to three rays of light as they enter an optical fibre glass of uniform refractive index

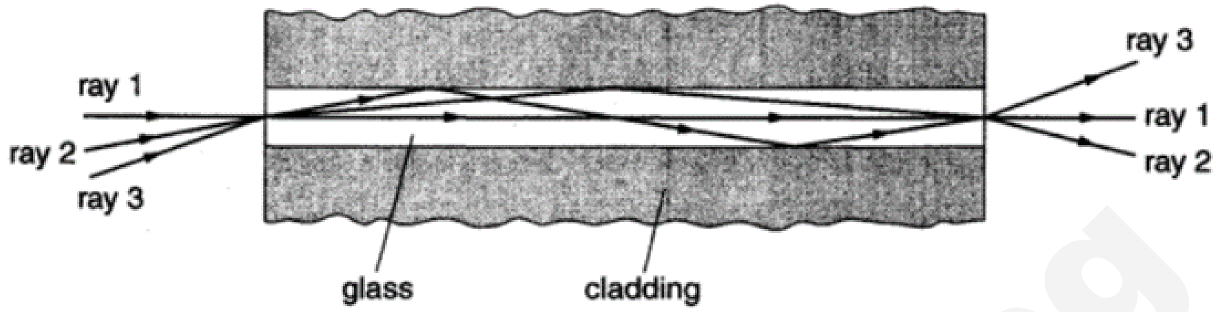


Fig. 12.1

Fig. 12.2 gives information about the three rays as it passes through the fibre.

	angle of incidence on entry / °	angle of refraction on entry / °
ray 1	0	0
ray 2	20	13
ray 3	35	**X**

Fig. 12.2

(i) Using data for ray 2 from **Fig. 12.2**, calculate the refractive index of the glass.

refractive index = …………………….. [2]

(ii) Calculate the angle of refraction **X** for ray 3.

angle of refraction **X** = ……………………..° [2]

(iii) Using information calculated from **(i)**, calculate the critical angle of the light in the fibre glass.

critical angle = ……………………..° [2]

(iv) Explain why the light does not escape from the sides of the optical fibre.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………… [2]

(b) Explain why ray 1 does not bend when entering the optical fibre glass from air, but rays 2 and 3 bends.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………… [2]

13 Some melted crystals are allowed to cool. A student records the temperature of the melted crystals at regular intervals in **Table 13.1**, until there was no further change in temperature. The temperature of the room was at 25 °C.

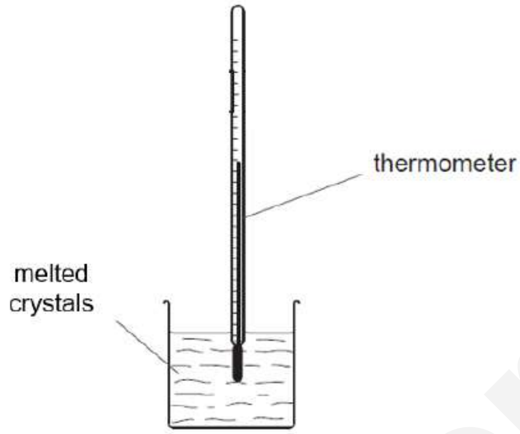


Fig 13.1

time **t** /mins	0	2	4	6	8	10	12	14
temperature /°C	78	59	52	52	52	40	38	25

Table 13.1

(a) **(i)** Plot the cooling curve for the substance on **Fig. 13.2** from t = 0 s to t = 16 s.

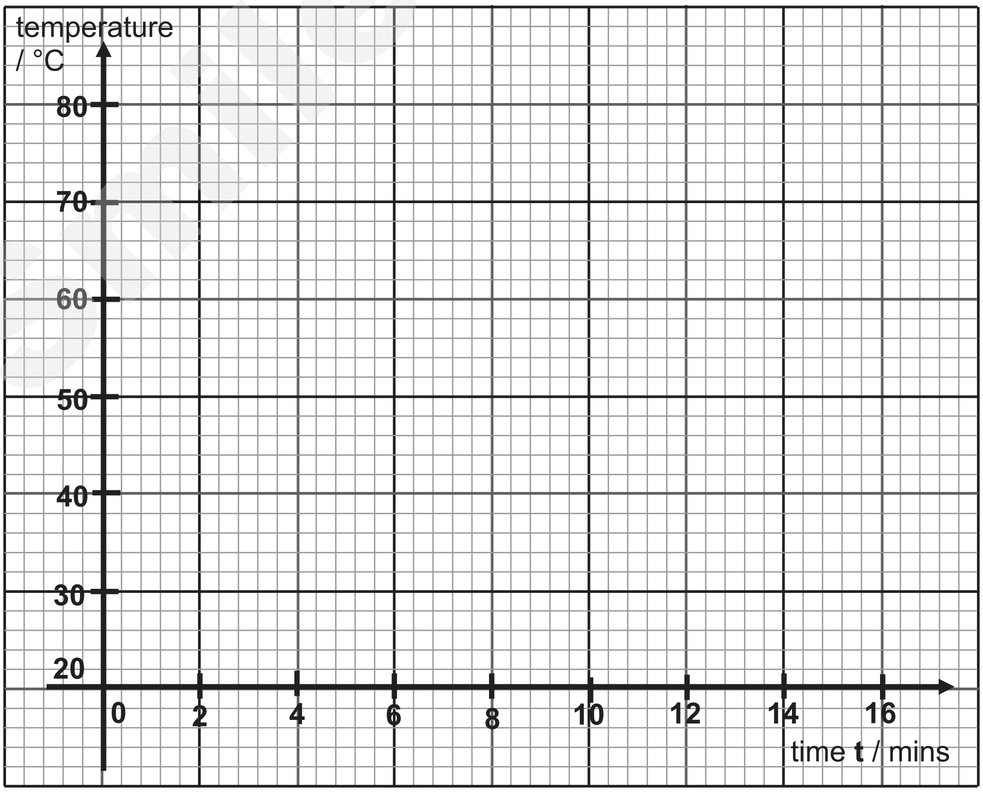


Fig 13.2

[2]

(ii) Explain the shape of the graph that you had drawn in **(a)(i)**.
(Note: You may label segments of the graph with alphabets to assist with your explanation)

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

………………………………………………………………………………………….. [2]

(iii) Describe, in terms of the movement and arrangement of particles, what is happening during solidification.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

………………………………………………………………………………………….. [2]

(iv) Complete the following sentence:

As the substance cools, its ……………….. energy decreases. [1]

(b) **Fig 13.3** shows the process by which molecules near the surface of water escape.

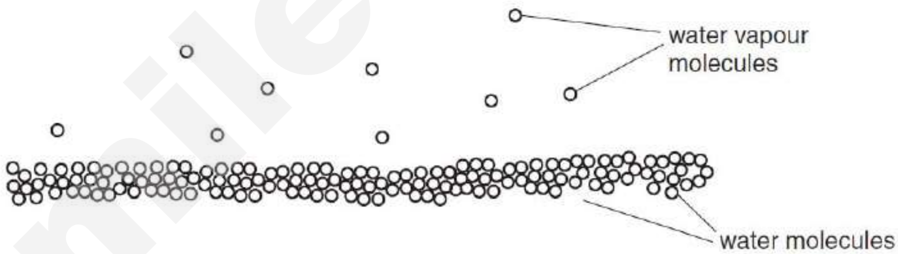


Fig 13.3

(i) What is the name of the process seen in **Fig 13.3**?

………………………………………………………………………………………….. [1]

(ii) What effect does this process named in **(b)(i)** have on the temperature of the water?

……………………………………………………………………………………………

………………………………………………………………………………………….. [1]

(iii) When the temperature is increased, describe and explain any change in the process named in **(b)(i)**.

……………………………………………………………………………………………

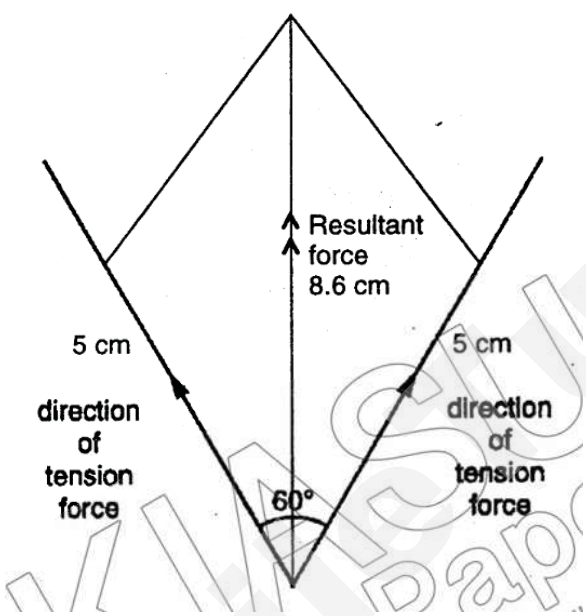
………………………………………………………………………………………….. [1]

END OF PAPER

2019 Yuhua 4E/5NA Science Physics Prelimin Paper 1 Answer Scheme

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

2019 Yuhua 4E/5NA Science Physics Prelimin Paper 2 Answer Scheme

<table>
<tr><td>1</td><td>

Construction of parallelogram [1]
Resultant force = 34.4 N [1]
Direction of resultant force correctly indicated [1]</td></tr>
</table>

2	(a)	The distance from the nail to the pivot is nearer than the distance from the handle to the pivot. [1] By principle of moment, a small force exerted at the handle will create a larger force at the nail. [1]
	(b)	By principle of moments Total clockwise moment = total anti-clockwise moment 6 N x 0.2 m = f x 0.05 m [1] F = 24 N [1]

3	(a)	Ep = mgh = 1 x 10 x 0.1 = 1 J [2]
	(b)	Gain in K.E = Loss in G.P.E = 1 J [1] $1 = \frac{1}{2} mv^2$ $2 = v^2$, v = 1.414 = **1.41 m/s** [1]
	(c)	Some of the energy is converted to thermal energy. [1] The remaining of the energy is converted to GPE at B. [1]

4	(a)	This is because cold air in the frozen food storage is denser and will remain at the bottom [1] while hot air in the cooking compartment is less dense and will remain at the top in the cooking compartment / will not sink to the storage space [1]
	(b)	There should be an insulating material between the cooking compartment and storage space. This would reduce thermal energy transfer by conduction. OR The exterior of the cooking compartment should be light-coloured to reduce the loss of thermal energy by radiation.[1]
	(c)	The exterior should be painted in white. [1] The white exterior is a bad absorber, so heat gain from the hot oven is reduced. [1]

5	(a)	Imaginary line joining up points with the same phase of neighbouring transverse waves together. [1]	
	(b)	(i)	0.15 / 5 = 0.03 m [1]
		(ii)	s = D / t = 0.15 /5 = 0.03 m/s [1]
		(iii)	f = v /λ = 0.03 / 0.03 = 1 Hz [1]

6	(a)	Two correct rays [1] Draws correct image from two rays.[1]
	(b)	Real, inverted and magnified [1]
	(c)	Projector or photographer enlarger [1]

7	(a)	Positive charges [1]	
	(b)	As the base of the thunder clouds are filled with negatively charged particles, the electrons / negatively charged particles in the copper strip will move from the tip to earth [1] since like charges repel [1].	
	(c)	(i)	Q = It = 10 000 x 0.0002 = 2 C [1]
		(ii)	W =VQ = 4.0 x 106 x 2 OR 4.0 x 2 [1] = 8.0 x 10^6 J [1]

8	(a)	Current = 2 + 2 = 4 A [1]
	(b)	Resistance of each lamp = $\frac{12}{2}$ [1] = 6 Ω [1]
	(c)	$\frac{1}{R_{total}} = \frac{1}{6} + \frac{1}{6}$ [1] R_{total} = 3Ω [1]

9	(a)	The earth wire touches the metal plate of the iron. [1]	
	(b)	(i)	use of I = P/V = 1500/240 = 6.25 A [1]
		(ii)	use of E = Pt

			= 1.5 x 10 = 15 kWh [1] use of Cost = E x unit cost = 15 x 15 = 225 ¢ or $2.25 [1] allow e.c.f for cost, if working shown

10	(a)	When the current is switched on, the iron core becomes an electromagnet. By applying the right-hand grip rule, we find that the right side of the iron core becomes the N-pole of the electromagnet. [1] As like poles repel, the permanent magnet moves away from the iron core. [1]
	(b)	When the current is switched on, the iron core still becomes an electromagnet with the right side as the N-pole. Due to the magnetic field created by the electromagnet, the iron rod becomes an induced magnet with the left side of the iron rod becoming an induced S-pole.[1] As unlike poles attract, the iron rod will be attracted to the iron core.[1]

11	(a)		Straight line graph with a positive slope from (0,0) to (20,30).[1] Horizontal graph from (20,30) to (50,30). [1] Straight line graph and going downhill from (50,30) to (60,0). [1]
	(b)		Rate of change of velocity is constant OR Change of velocity per unit time is constant [1]
	(c)	(i)	acceleration = (v-u)/t = (30 ms^{-1} – 0 ms^{-1}) /20s [1] = 1.5 ms^{-2} [1]
		(ii)	Area under speed-time graph = total distance = ½ (30 + 60)(30) m [1] = 1350 m (allow e.c.f if wrong graph is plotted) [1]
	(d)		Train has higher inertia due to larger mass. [1] Braking distance of train increases. [1]

12	(a)	(i)	n = sin i / sin r	
			= sin 20 / sin 13	[1]
			= 1.52	[1]
		(ii)	n = sin i / sin r	
			1.52 = sin 35 / sin X	[1]
			X = 22.2°	[1]
		(iii)	n = 1 / sin c	
			c = $\sin^{-1}$ (1 / 1.52) [1]	
			c = 41.1°	
		(iv)	light makes an incidence angle greater than the critical angle in the optically denser medium [1] Light undergoes total internal reflection where angle of incidence is equal to the angle of reflection [1]	
	(b)		Rays 2 and 3 bend away from the normal as they pass from glass into air. Rays 2 and 3 travel in air (optically less dense medium) faster thus they bend away from the normal. [1] Ray 1 does not bend because its angle of incidence is zero.[1]	

13	(a)	(i)	1m for flat part of curve at 52°C 1m for flat part of curve at 25°C Minus one mark if there is any point that is incorrectly plotted.
		(ii)	At 60°C, solidification occurs. There is no change in temperature as the energy released is used to form/strengthen the intermolecular bonds.[1] The temperature of the substance does not go below 30°C, as it has reached thermal equilibrium with the room.[1]
		(iii)	The particles are initially slipping and sliding over each other and then starts to vibrate about a fixed position.[1] The arrangement of the particles are initially disorderly, and then become in an orderly arrangement.[1]
		(iv)	Thermal / Kinetic / Internal energy [1]
	(b)	(i)	Evaporation [1]
		(ii)	The temperature decreases as a result of evaporation, as the more energetic molecules escape, leaving the less energetic molecules behind.[1]
		(iii)	Rate of evaporation increases. There are more particles with sufficient energy to escape the surface of the liquid.[1]