JUNYUAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY FOUR EXPRESS / FIVE NORMAL ACADEMIC

CANDIDATE NAME

CLASS INDEX NUMBER

SCIENCE PHYSICS

5076/01

Paper 1 Multiple Choice

01 Sep 2021

1 hour

Candidates answer on the Multiple Choice answer sheet.

Additional Materials: Multiple Choice answer sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **twenty** 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 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, hand in the Multiple Choice Answer sheet and question paper separately.

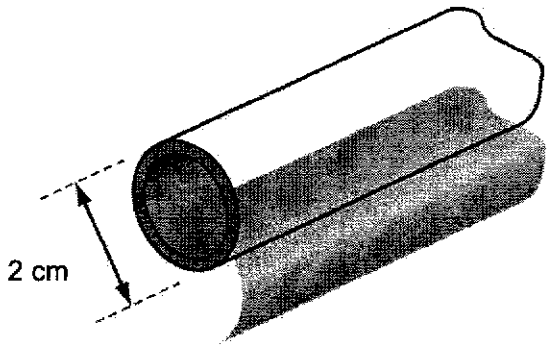
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1 A length of copper pipe, of uniform cross-section and several metres long, carries water to a tap.



Measurements are taken to determine accurately the volume of copper in the pipe.

Which of the instruments are most suitable to be used?

A measuring tape and vernier calipers

B metre rule and micrometer screw gauge

C measuring tape and micrometer screw gauge

D metre rule and vernier calipers

2 When the angle of oscillation of a simple pendulum is 10°, each complete oscillation will take 1.00 s.

If the angle of oscillation of the same pendulum is reduced to 5°, each complete oscillation will take

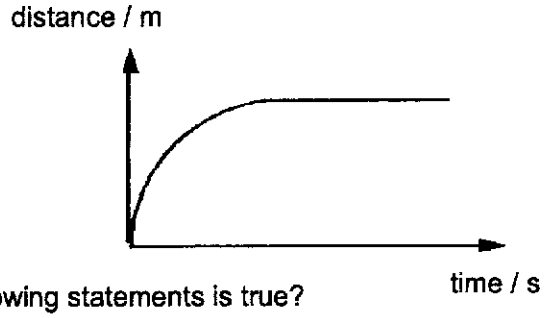
A 0.25 s

B 0.50 s

C 1.00 s

D 2.00 s

3 The graph shows how the distance of a car changes over time.



Which of the following statements is true?

A The car accelerates and then moves with a constant speed.

B The car accelerates at a decreasing rate.

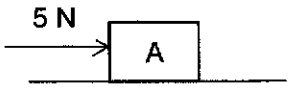
C The car decelerates then moves with a constant speed.

D The car decelerates until it stops.

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4 The diagram shows an object A being pushed along a smooth surface by a constant 5 N force.



If the weight of object A is suddenly increased by 8 N, which of the following correctly describes the change in its motion?

A Object A will maintain its current acceleration.

B Object A will maintain its current speed.

C Object A will slow down.

D Object A will stop moving immediately.

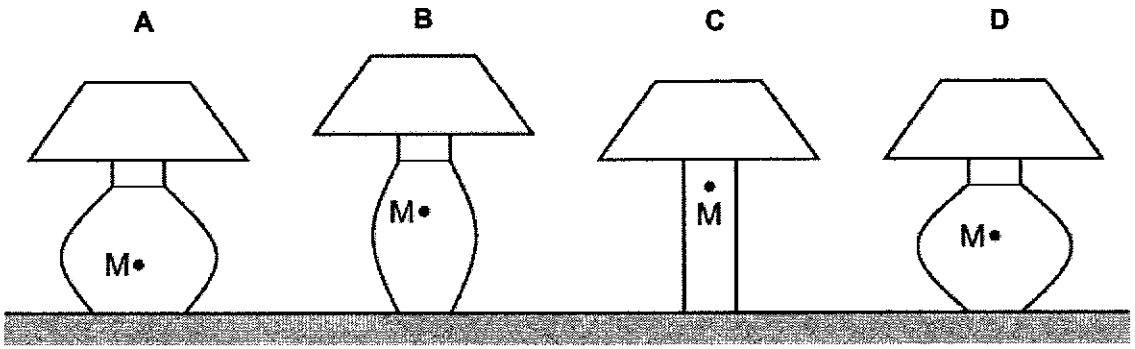
5 The table below shows the mass and weight of some objects on the surface of four different planets.

Which planet has the greatest gravitational field strength?

planet	mass / kg	weight / N
A	0.8	40
B	0.8	80
C	4.0	40
D	4.0	80

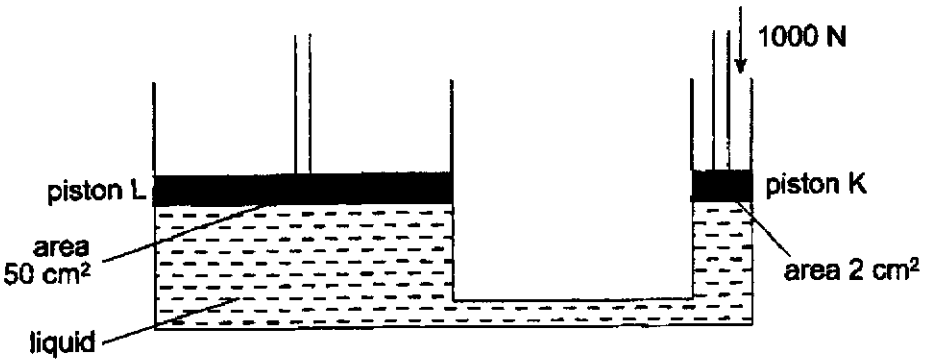
6 Four lamps are shown along with the position M, the centre of mass in each lamp.

Which lamp is the most stable?



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7 The diagram below 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

8 An experiment is conducted to determine the power of a student running up a flight of stairs.

Which of the following information is **not** required?

A the horizontal distance travelled by the student

B the time taken for the student to run up the stairs

C the vertical height of the flight of stairs

D the weight of the student

9 Which statement about solids, liquids and gases is correct?

A In a gas, particles move slowly upwards due to the force of gravity.

B In a liquid, particles move rapidly in some directions only.

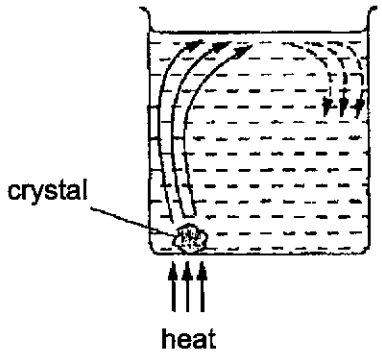
C In a solid, particles vibrate about fixed positions.

D Liquids and gases can be easily compressed.

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10 The diagram below shows a crystal which is being heated in a beaker of water. Parts of the crystal starts to dissolve and acts as a dye to show how the water circulates around the beaker.



What is happening to cause the water above the crystal to rise?

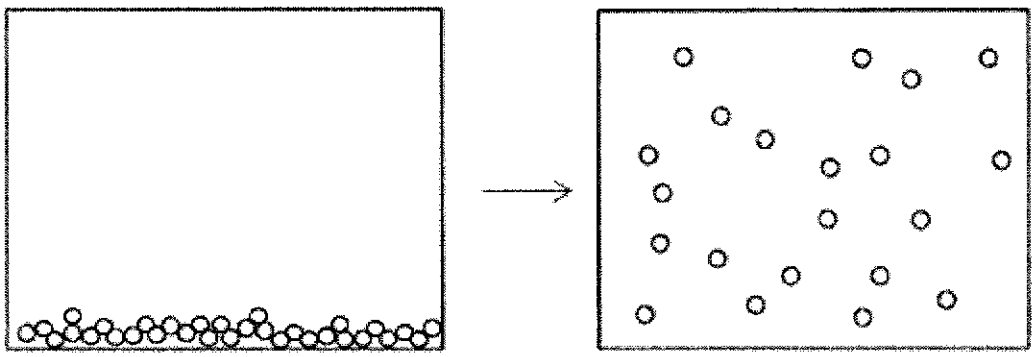
A The water contracts and its density decreases.

B The water contracts and its density increases.

C The water expands and its density decreases.

D The water expands and its density increases.

11 The diagram below shows how the atoms in a substance rearrange themselves during a change of state.



What processing is occurring?

A boiling

B freezing

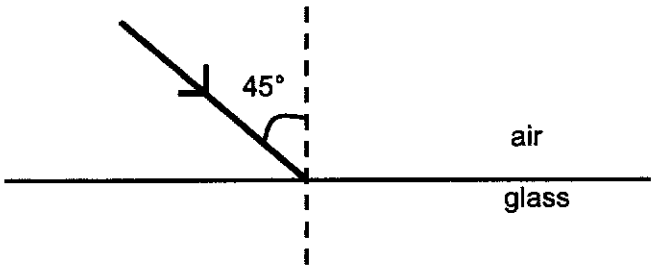
C melting

D sublimation

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12 The diagram shows a ray of light incident to a glass block of refractive index 1.35 at an angle of incidence of 45°.



What will happen to the light ray?

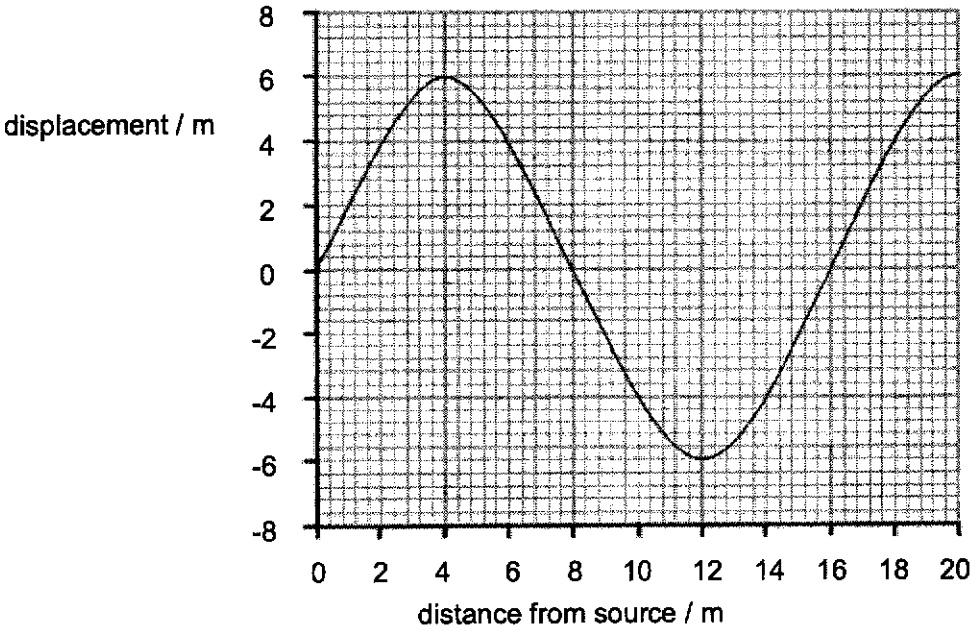
A It will enter the glass block and bend away from the normal.

B It will enter the glass block and bend towards the normal.

C It will refract and travels along the air-glass boundary.

D It will undergo total internal reflection.

13 The diagram below shows how the displacement of particles in a wave varies with distance from the source.



The wave shown has a frequency of 5 Hz.

What is the speed of the wave?

A 0.8 m/s

B 3.2 m/s

C 32 m/s

D 80 m/s

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14 Which of the following is correct?

A Gamma rays have a longer wavelength than ultra-violet waves.

B Infra-red waves have a lower frequency than radio waves.

C Microwaves have a longer wavelength than visible light.

D X-rays have a higher speed in air than visible light.

15 Which of the following explains why sound is not heard in the vacuum of outer space?

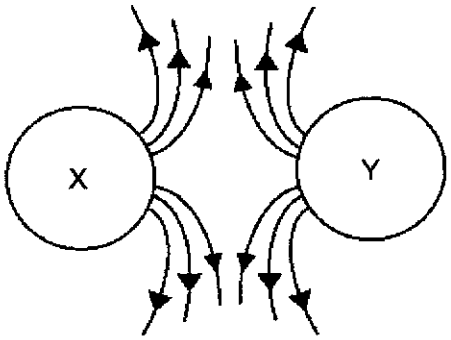
A Objects in space do not make noise.

B Sound waves are longitudinal waves.

C Sound waves do not have the energy needed to travel in space.

D Sound waves require a medium to propagate.

16 The diagram below shows the electric field lines between two isolated electric charges, X and Y.



What are the charges on X and Y?

	charge on X	charge on Y
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

17 A wire of resistance R has length L and cross-sectional area A. The wire is then stretched to twice its length and half its cross-sectional area.

What is the resistance of the wire after it is being stretched?

A 0.25 R

B R

C 2 R

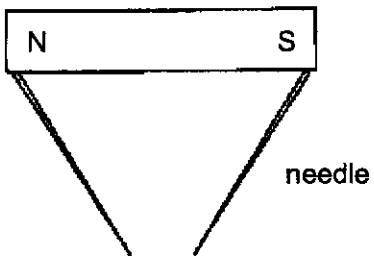
D 4 R

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18 Which of the appliances is likely to melt 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 stove	13 A

19 Two iron needles hanging from the ends of a bar magnet are observed as shown.



Which of the following best explains the observation?

A The ends of the needles are both north poles.

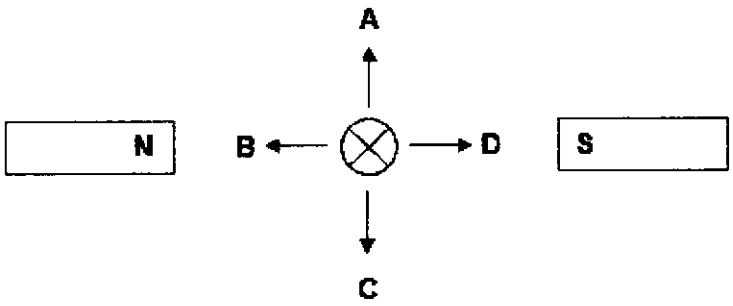
B The ends of the needles are both south poles.

C The needles are induced temporary magnets.

D The needles have become permanently magnetised.

20 The diagram below shows a current-carrying conductor with current flowing into the paper. It is placed between two magnets.

Which arrow correctly indicates the direction of the force acting on the conductor?



End of Paper

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SECONDARY FOUR EXPRESS/FIVE NORMAL (ACADEMIC)

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

SCIENCE PHYSICS

5076/02

Paper 2 Theory

25 Aug 2021

1 hour 15 min

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.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
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 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.

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	/65

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Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

1 Two forces of equal magnitude of 6.0 N act on a small body, **B**. The angle between the directions along which the forces act is 80°, as shown in Fig. 1.1.

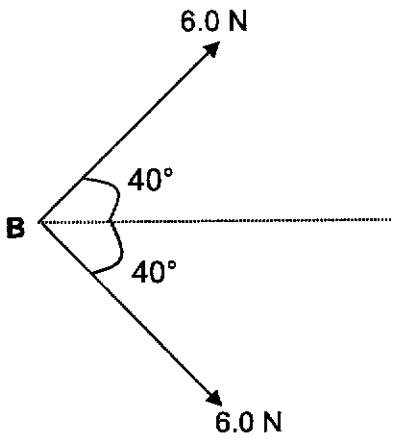


Fig. 1.1

Determine the magnitude of the resultant force on body **B** by drawing a vector diagram in the space below.

State clearly the scale you have used.

scale = ...

resultant force = ... N [4]

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2 Fig. 2.1 below shows an electric scooter used by Peter to travel from home to school. He accelerates uniformly from rest to 2.0 m/s in 3 s. He continues at this speed for 9 s on a straight horizontal path before decelerating uniformly in 5 s.

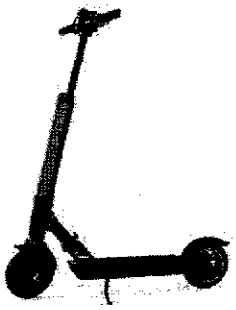


Fig. 2.1

(a) Draw on Fig. 2.2 the variation of speed of the electric scooter with time. [3]

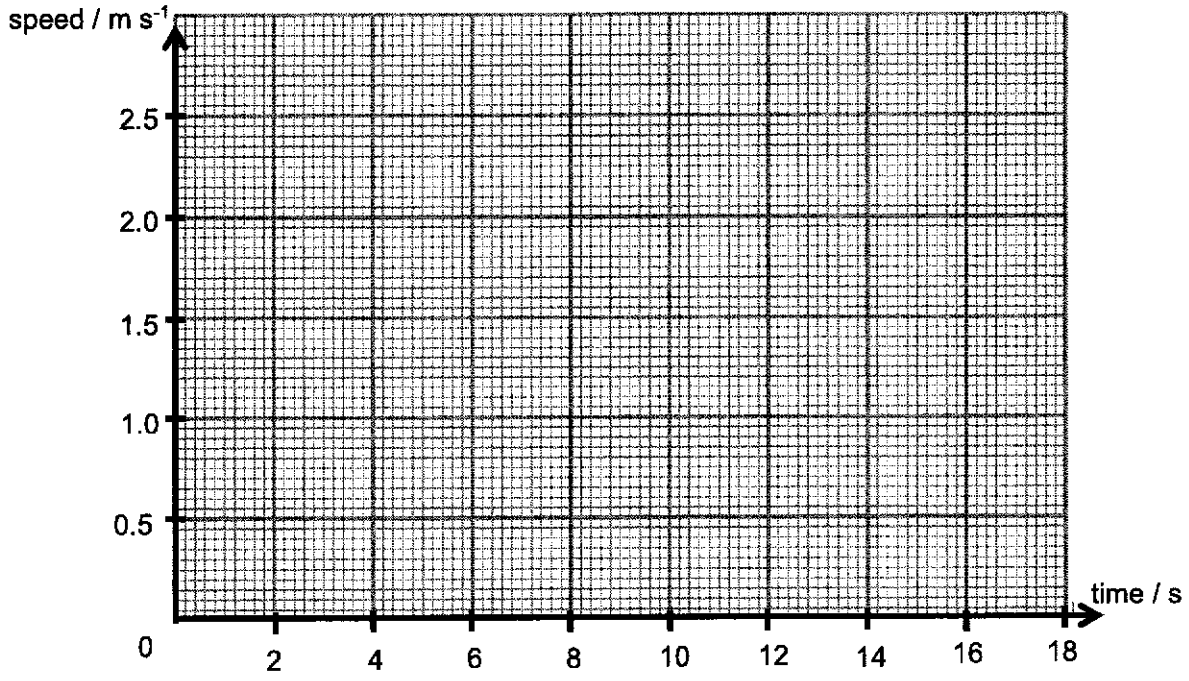


Fig. 2.2

(b) Calculate the average speed of the electric scooter for the journey.

average speed = ... m/s [3]

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3 A hovercraft is a vehicle that glides over ground by hovering on a cushion of air. Fig. 3.1 shows a hovercraft of mass 3 000 kg hovering at a constant height above the ground. It has a base area of 120 m^2 in contact with the cushion of air.

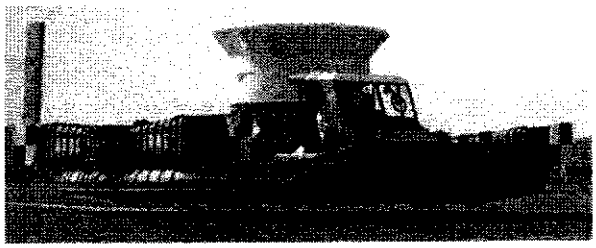


Fig. 3.1

(a) Taking the gravitational field strength on Earth, *g* to be 10 N/kg, calculate the weight of the hovercraft.

weight = ... N [1]

(b) **(i)** State the magnitude of the upward force exerted by the air cushion on the hovercraft.

upward force = ... N [1]

(ii) Explain how you derived at your answer in part **(b)(i)**.

.....

..... [1]

(c) Calculate the pressure exerted by the hovercraft on the cushion of air.

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

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4 A girl of weight 500 N is playing on a see-saw with her brother. Fig. 4.1 shows her brother, of weight *W*, sitting 1.2 m to the right of the pivot.

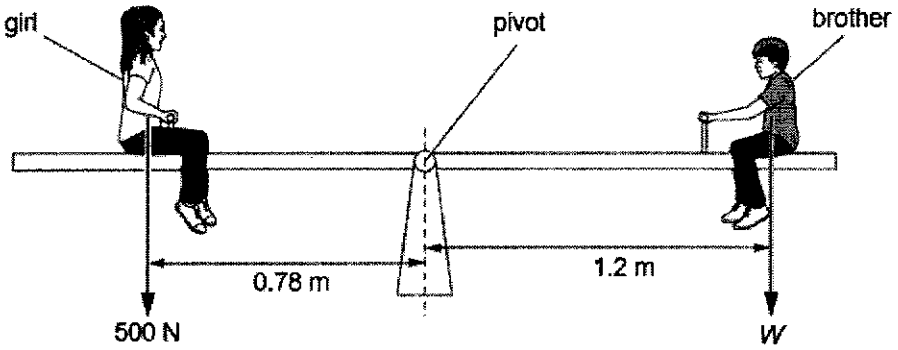


Fig. 4.1

The see-saw is balanced when the girls sits 0.78 m to the left of the pivot.

(a) State the principle of moments.

.....

.....

..... [1]

(b) Calculate the value of *W*.

W = ... N [2]

(c) The girl slides 0.20 m towards the pivot of the see-saw, while her brother slides 0.10 m away from the pivot.

State how the see-saw will rotate and explain why.

.....

.....

.....

..... [2]

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5 Fig. 5.1 shows an electric immersion heater being used to heat up water in a cup.

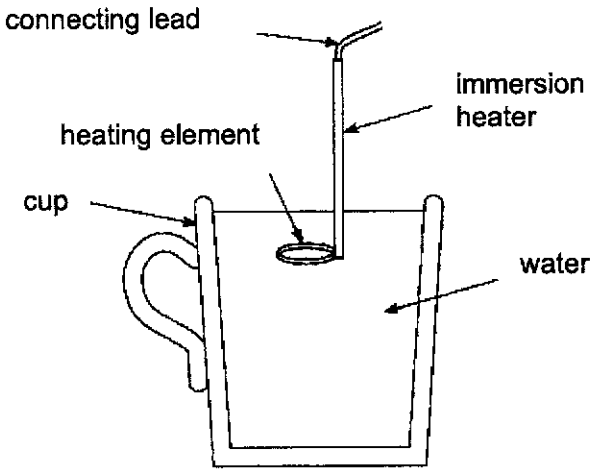


Fig. 5.1

(a) With the heating element in the position shown, the water at the bottom of the cup remains cold even after some time. Explain why it is so.

.....

..... [2]

(b) The heating element is now placed at the bottom of the cup.

Describe how all the water in the cup is heated with the heating element in its new position.

.....

.....

.....

..... [2]

(c) Suggest a way to reduce heat loss to the surroundings by the hot water. Explain your choice.

.....

..... [2]

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6 Fig. 6.1 shows a ray of light **ABC** passing along a simple optical fibre glass to its end at **C**.

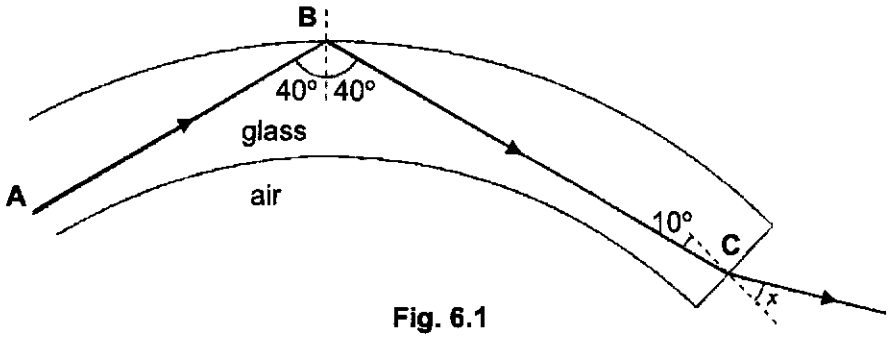


Fig. 6.1

(a) The refractive index of glass is 1.8.

Calculate the critical angle of the glass.

critical angle = ... ° [2]

(b) Explain why the light ray **AB** does not emerge from the optical fibre.

.....

.....

.....

..... [2]

(c) The ray **BC** makes an angle of 10° with the normal to the glass surface at **C**.

Calculate the angle *x*, as shown in Fig. 6.1.

x = ... ° [2]

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7 Fig. 7.1 shows a student standing in between a bell tower and a steep mountainside.

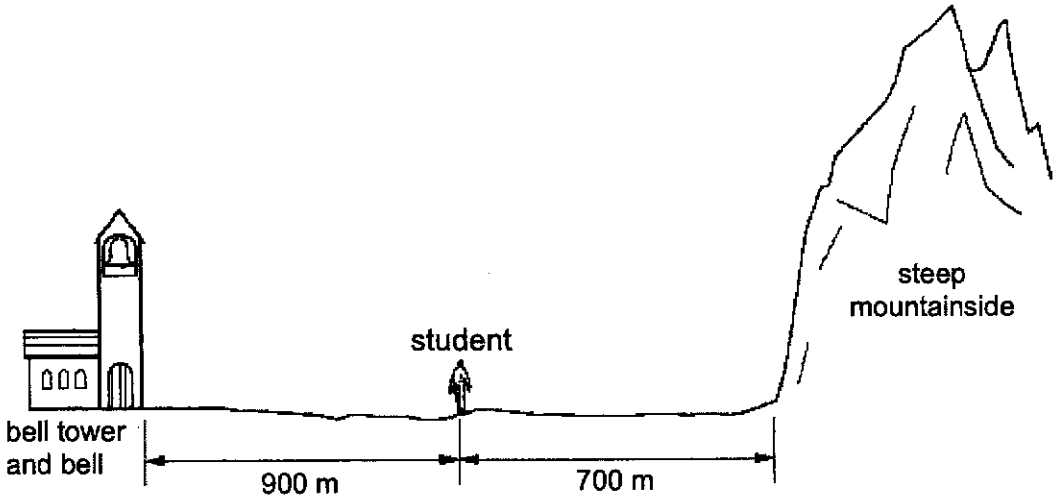


Fig. 7.1

(a) The bell rings once, but the student hears two rings separated by a short time interval.

Explain why the student hears two rings.

.....

.....

..... [2]

(b) Given that sound travels at 300 m/s in air.

Calculate the time interval between the two sounds.

time interval = ... s [3]

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8 Fig. 8.1 shows two small plastic spheres **P** and **Q** made from different materials.



Fig. 8.1

Sphere **P** is negatively charged while sphere **Q** is neutral. After rubbing sphere **Q** with a cloth, the two spheres are found to repel each other.

(a) Suggest why the two plastic spheres repel each other.

.....

..... [2]

(b) In Fig 8.2, draw the electric field pattern set up by sphere **P**.



[2]

Fig. 8.2

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9 Fig. 9.1 shows a wire **AB** connected to a switch **S** and a low voltage battery. The wire **AB** is placed between the poles of a magnet.

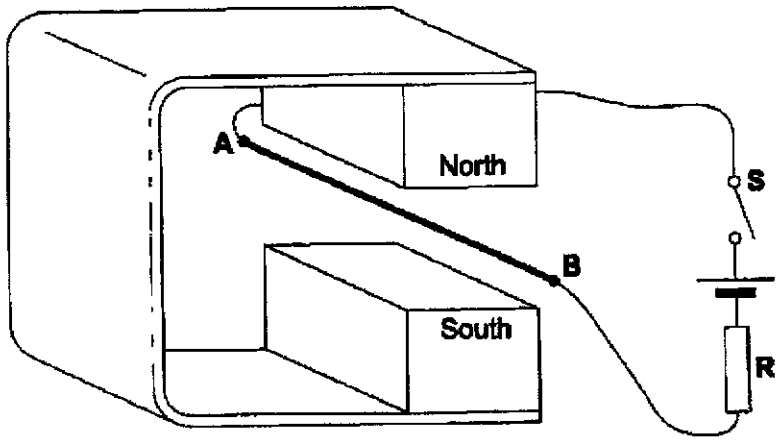


Fig. 9.1

(a) Describe what happen to wire **AB** when switch **S** is closed. Use your understanding of magnetic fields to explain your answer.

.....

.....

.....

..... [2]

(b) Describe the effect on **AB** if

(i) the poles of the magnet are reversed,

..... [1]

(ii) the resistor **R** is replaced by one with lower resistance.

..... [1]

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Section B (20 marks)

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

Write your answers in the spaces provided.

10 Fig. 10.1 shows the set-up by a student to investigate the speed of impact when a glass ball is dropped from a known height onto a large container of sand.

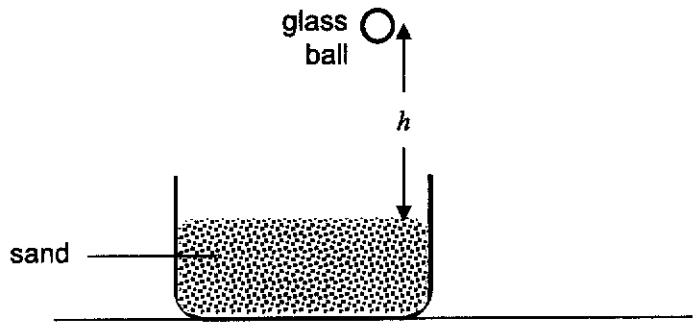


Fig. 10.1

The height *h* is varied. Table 10.2 shows the results of the investigation, where the speed of impact is the speed of the glass ball just before it touches the sand. Take *g* to be 10 N/kg.

Table 10.2

h / cm	initial gravitational potential energy in J	speed of impact in m/s
2.5	0.025	0.707
5.0	0.050	1.00
10.0	0.100	1.40
20.0	0.200	1.89
30.0	0.300	2.36
60.0	0.600	3.31

(a) State the principle of conservation of energy.

.....

.....

..... [2]

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(b) Calculate the mass of the ball.

mass = ... [2]

(c) State the expected amount of kinetic energy of the ball just before it touches the sand when it is released from a height of 60.0 cm.

..... [1]

(d) Based on the results from Table 10.2, calculate the kinetic energy of the ball just before it touches the sand when it is released from a height of 60.0 cm.

kinetic energy = ... [2]

(e) State the reason for the difference (if any) between the value stated in **(c)** and the value calculated in **(d)**.

.....

..... [1]

(f) Describe the energy conversion of the ball when it is dropped from a certain height to the point when the ball hits the sand.

.....

..... [2]

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11 Fig. 11.1 shows an air conditioner and a television connected to the same electrical circuit with a 240 V a.c. power supply.

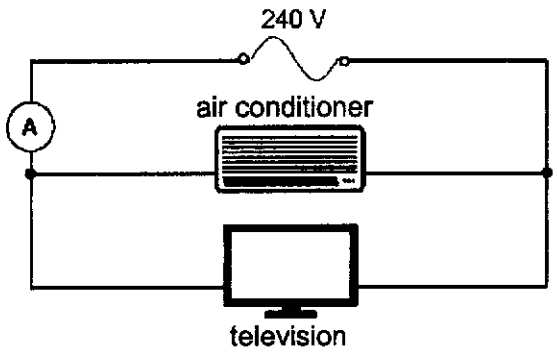


Fig. 11.1

Table 11.2 gives the normal rating and daily usage for the two electrical appliances.

Table 11.2

	normal rating		daily usage
electrical appliance	power	voltage	
air conditioner	2300 W	240 V	8 hours
television	280 W	240 V	4 hours

(a) Calculate the total current through the ammeter.

total current = ... [2]

(b) Fuses are normally rated at 1 A, 2 A, 5 A, 10 A, and 13 A. Suggest a suitable rating for the fuse to be fitted to the main branch of the electrical circuit. Explain your choice.

.....

..... [1]

(c) Describe how a fuse in a circuit can prevent a possible electrical hazard.

.....

.....

..... [2]

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(d) Given that one kWh of electrical energy is charged at \$0.36, calculate the cost incurred by the two electrical appliances when they are both switched on for 12 hours.

cost = ... [2]

(e) An earth wire is connected to the metal base of the television. Describe how the earth wire works to prevent a possible electrical hazard.

.....

.....

.....

..... [2]

(f) State the circumstance when the earth wire is not necessary in an electrical appliance.

.....

..... [1]

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12 The resistance of component **X** changes with temperature. It is connected in series with a light bulb **Y** of resistance 10 Ω and a 1.5 V battery, as shown in Fig. 12.1.

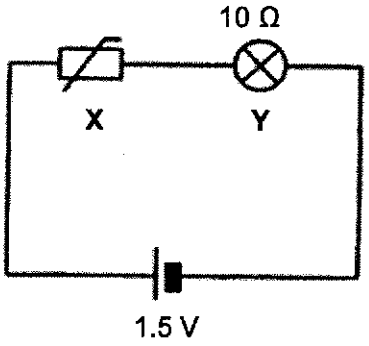


Fig. 12.1

(a) Fig. 12.2 shows how the resistance of **X** varies with temperature.

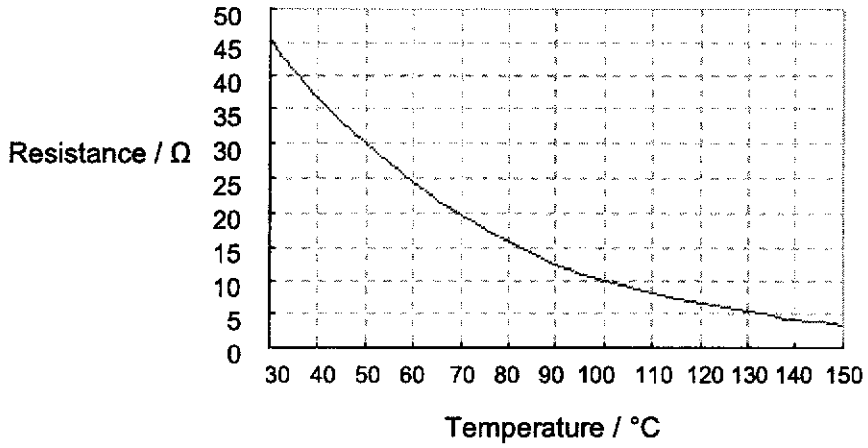


Fig. 12.2

At a temperature of 50 °C,

(i) state the value of the resistance of component **X**,

resistance = ... [1]

(ii) calculate the current in the circuit,

current = ... [2]

(iii) calculate the charge flow in the circuit if the circuit is operating for 2 minutes.

charge = ... [2]

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(b) As the temperature increases, state and explain what happens to the current flow in the circuit.

.....

.....

..... [2]

(c) At 160 °C, component **X** melts.

State how the arrangement and movement of the particles changes as the temperature of component **X** increases from 140 °C to 160 °C.

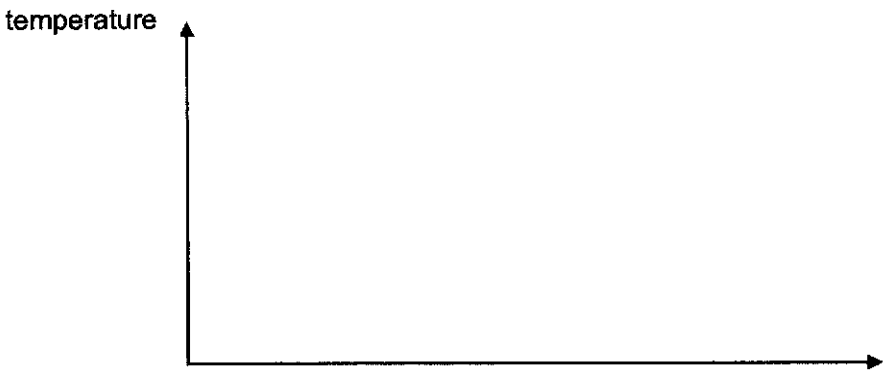
arrangement: .....

.....

movement: .....

..... [2]

(d) Sketch a temperature-time graph as the temperature of component **X** increases from 30 °C to 180 °C.



[1]

End of Paper

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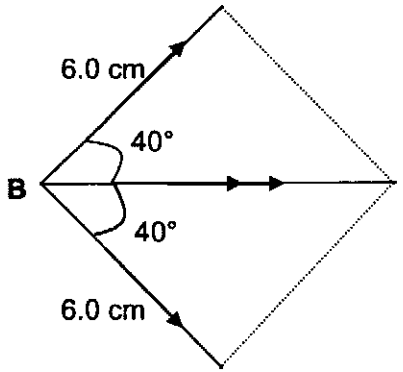
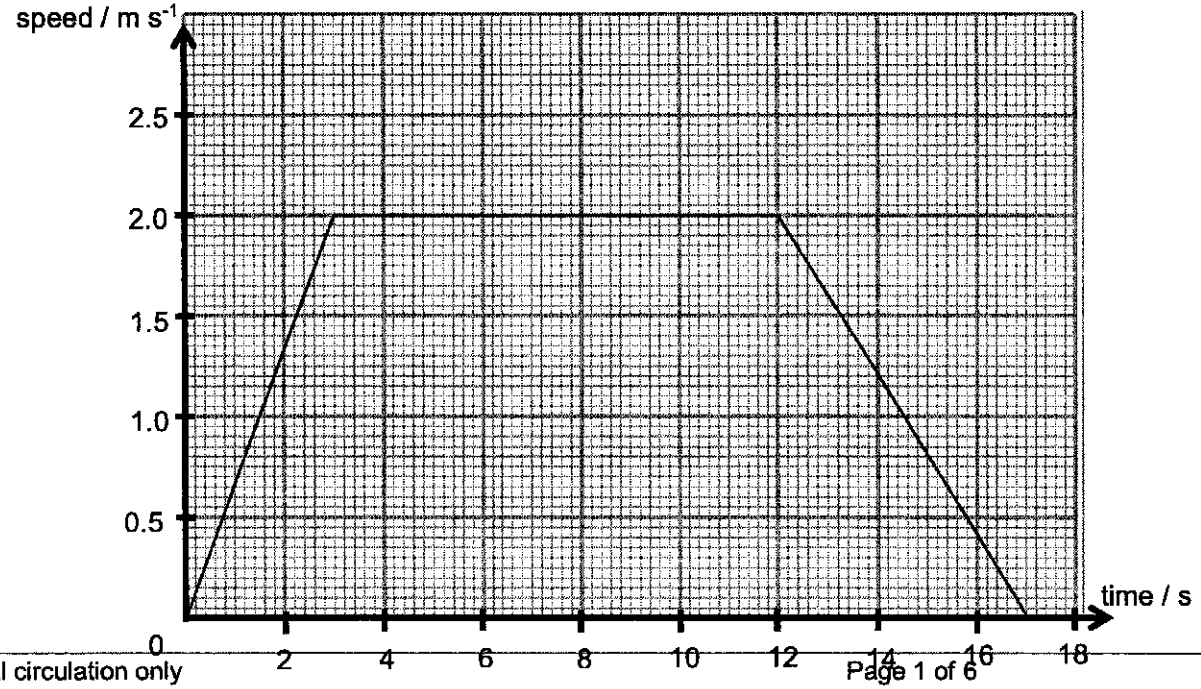
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Paper 1

1-5	ACDCB	**6-10**	ACACC	11-15	ABDCD	16-20	DDCCC

Paper 2

No	Marking Scheme	Marks	Common Mistakes
A1	 1 mark for appropriate scale (1 cm : 1 N) and drawing of the two 6 N forces to scale 1 mark for forming the parallelogram to obtain the resultant force 1 mark for drawing the resultant force accurately 1 mark for getting the value of resultant force as 9.2 ± 0.1 N	4	
2a		3 1 mark for each section of the graph (allow ecf)	

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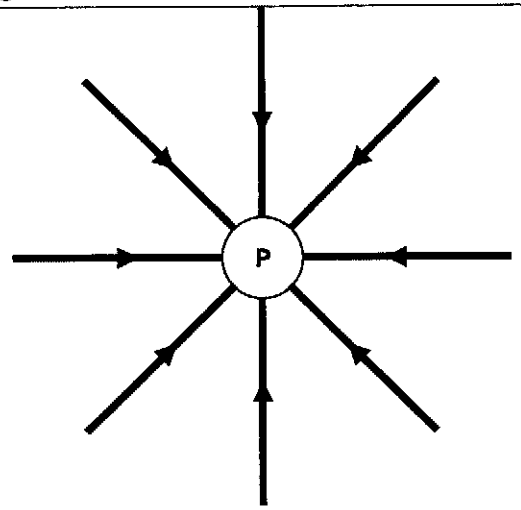
No	Marking Scheme	Marks	Common Mistakes
2b	Area under graph = 0.5 x (9 + 17) x 2 [1] = 26 m average speed = 26 ÷ 17 [1] = 1.53 m/s [1]	1 1 1	
3a	W = mg = 3 000 x 10 = 30 000 N	 1	
3bi	30 000 N	1	
3bii	Since the hovercraft hovers at a constant height above the ground, there must be **balanced forces** acting on it OR **resultant force** acting on the hovercraft is **zero**. Hence, the upward force exerted by the air cushion must be equal to the downward force exerted by its weight.	1	
3c	P = F / A = 30 000 / 120 = 250 N/m^2	 1 1	
4a	For a body in equilibrium, the sum of clockwise moments about any pivot is equal to the sum of anticlockwise moments about the same pivot.	1	
4b	Taking moment about pivot, Sum of clockwise moments = sum of anticlockwise moments W × 1.2 = 500 × 0.78 F = 325 N	 1 1	
4c	The see-saw will rotate clockwise. Since the **brother moves away from the pivot**, the **clockwise moment** generated **by the brother will be larger** than the **anticlockwise moment** generated **by the girl who moves nearer to the pivot**.	1 1	

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No	Marking Scheme	Marks	Common Mistakes
5a	**Convection currents cannot be set up effectively and** **water** is a **poor conductor** of heat.	1 1	
5b	When the water at the bottom gets heated up, the water **expands** and **becomes less dense and rise**. The water at the upper part **being denser sinks** and convection currents are formed to heat up all the water.	1 1	
5c	**Place a cover** on the cup to **reduce heat loss by convection**. OR include **insulating material around the cup** to **reduce heat loss by conduction.** (any other suitable answers)	2	
6a	$1.8 = 1 \div \sin c$ $c = 33.7°$	1 1	
6b	The **angle of incidence** at B is 40 °, which is **larger than the critical angle of 33.7 °.** Therefore, **total internal reflection** occurs.	1 1	
6c	$n = \sin r \div \sin i$ $1.8 = \sin x \div \sin 10°$ $x = 18.2°$	1 1	
7a	One ring is heard directly from the bell tower. The second ring is the echo of the first ring when it is reflected by the mountains.	1 1	
7b	time to hear 1st sound = d / v = 900 / 300 = 3 s time to hear 2nd sound = d / v = (900 + 700 + 700) / 300 = 7.67 s time interval = 7.67 – 3 = 4.67 s OR difference in dist = 2300 - 900 = 1400 m [1] time = d / v = 1400 / 300 [1] = 4.67 s [1]	 1 1 1	
8a	Electrons from the cloth are transferred to Q. Q is negatively charged. Since like charges repel, P and Q repel.	1 1	

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No	Marking Scheme	Marks	Common Mistakes
8b		2 (1m for the drawing 1 m for the arrows)	
9a	The wire **AB** will move to the right. When two magnetic fields act in the same direction, they combine to give a stronger magnetic field, but when the two fields are opposing each other, they combine to give a weaker field. Hence, **the unbalanced fields on both sides produce a force that exerts on the wire to make it move to the right.**	1 1	
9bi	The wire **AB** will move to the left instead, (move in the opposite direction as before)	1	
9bii	The wire **AB** will move to the right with a larger amplitude as the current flowing through **AB** increases. OR a larger force will act on wire **AB** causing it to move to the right.	1	

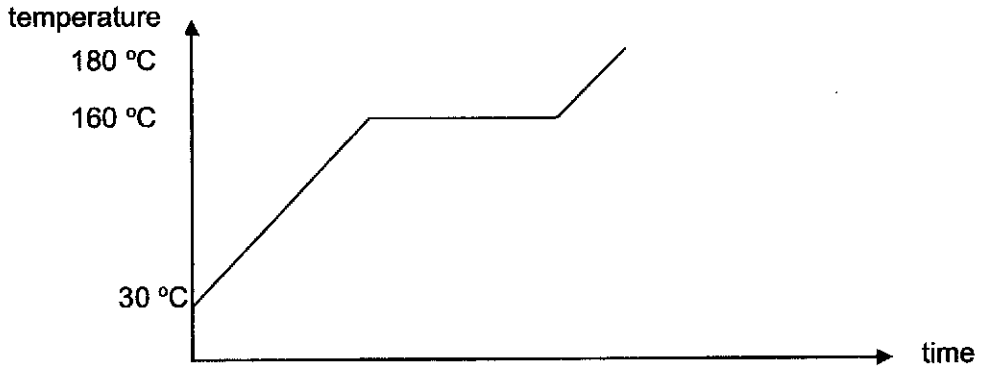
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No	Marking Scheme	Marks	Common Mistakes
B10a	Energy **cannot be created nor destroyed** but can **be converted from one form to another form** or **transferred from one body to another body**. The total energy remains constant.	1 1	
10b	GPE = mgh 0.600 = m x 10 x (60.0 / 100) m = 0.100 kg	 1 1	
10c	0.600 J	1	
10d	KE = ½ mv^2 = ½ x 0.100 x 3.31^2 = 0.548 J	 1 1	
10e	The **difference could be due to work done against air resistance** as the ball falls.	1	
10f	Gravitational potential energy ⟶ kinetic energy ⟶ heat and sound energy (every missing key point, minus 1 mark)	2	
B11a	Total current = P ÷ V = (2300 + 280) W ÷ 240 V = 10.8 A	 1 1	
11b	A suitable rating is 13 A. The chosen fuse rating of 13 A is slightly higher than the operating current of 10.8 A of the circuit.	 1	
11c	When **an unusually large current flow through the circuit**, the **fuse** will **melt and break the circuit**. This will **prevent overheating of the wires which may cause an electrical fire**.	1 1	
11d	$E = Pt$ E = (2300 + 280) ÷ 1000 × 12 = 30.96 kWh Cost = 30.96 × 36 = $11.15	 1 1	
11e	During **an electrical fault**, the **current from the metal base will be directed to the ground**. This will help to **protect the user from an electric shock when the user touches the metal base.**	1 1	
11f	When the casing is made of **plastic (non-conductor of electricity)** OR the **wiring** is **double-insulated (double insulation)**, an earth wire is not necessary,	1	

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No	Marking Scheme	Marks	Common Mistakes
12ai	30 Ω	1	
12aii	I = V ÷ R I = 1.5 ÷ (30 + 10) = 0.0375 A	1 1	
12aiii	Q = It = 0.0375 × (2 × 60) = 4.5 C	1 1	
12b	As the temperature increases, the effective **resistance of the circuit will decrease**. Hence by V = IR, the current in the circuit will **increase**.	1 1	
12c	arrangement: the particles will remain closely packed but will be **arranged randomly instead of orderly.** movement: the particles will **start to slide past each other within the liquid** instead of **vibrating about their fixed positions.**	1 1	
12d		1	

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