4E/5NA

Name: _____ ( ) Class: _____

Centre Number: _____ Index Number: _____

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

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

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

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READ THESE INSTRUCTIONS FIRST

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

INSTRUCTIONS TO CANDIDATES

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

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

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

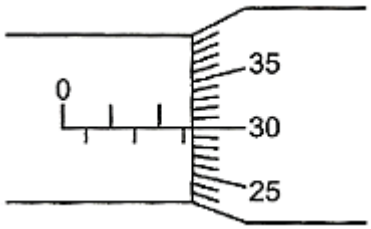
Set by : Mr Guay Hansen / Mr Go Jun Hong

This question paper consists of 15 printed pages.

[Turn over

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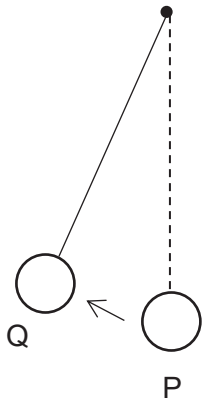
1 A micrometer is used to measure the diameter of a brass rod and its reading is shown in the diagram below.



What is the diameter of the brass rod?

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

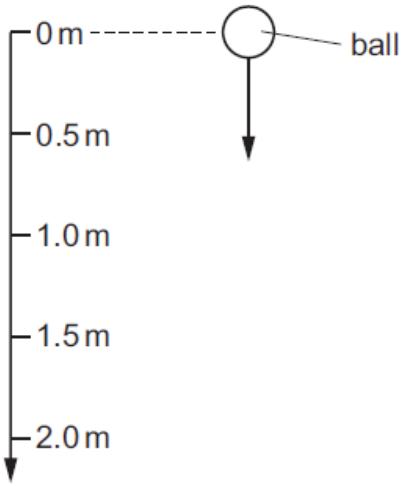
2 The time taken for a pendulum to swing from its lowest position, P, to position Q of its maximum displacement is 0.30 s.



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

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

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



What is the acceleration of the ball at 0.5 m?

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

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

Which statement about the boat is correct?

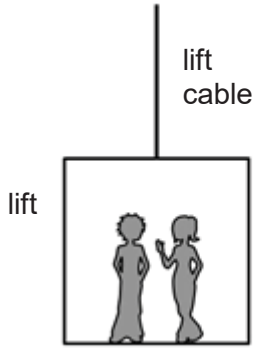
A The resultant force on the boat is in the direction of motion.

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

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

D The resultant force on the boat is zero.

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



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

What is the acceleration of the lift?

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

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

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



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

What happens and why?

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

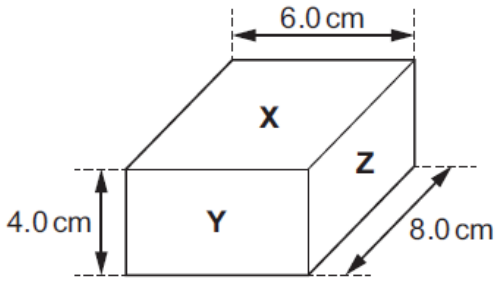
B The liquid cools because faster-moving molecules escape.

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

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

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

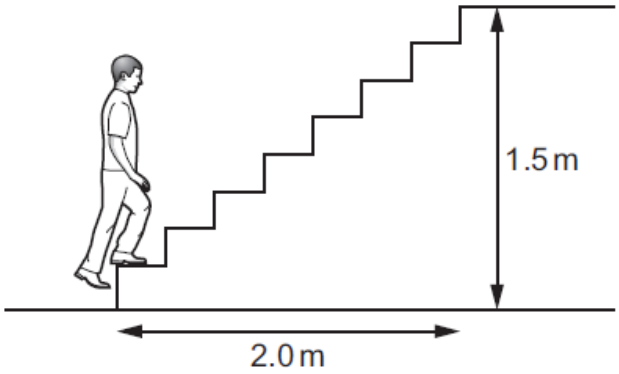


The box rests on a flat horizontal surface.

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

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

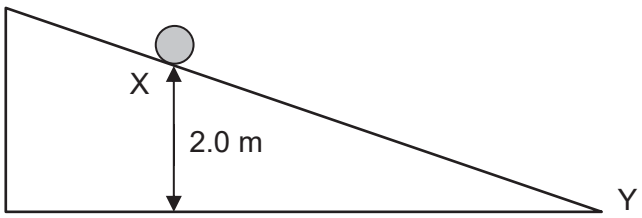
9 A student of mass 60 kg climbs some steps. He travels a horizontal distance of 2.0 m and a vertical distance of 1.5 m. The gravitational field strength g is 10 N/kg.



What is the work done against the force of gravity?

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

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



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

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

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

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11 A student stands 240 m in front of a vertical, flat cliff and bangs together two pieces of wood to make a short, loud sound.

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

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

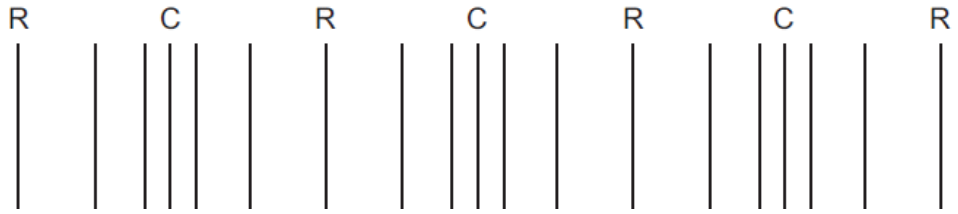
A 160 m/s **B** 320 m/s **C** 360 m/s **D** 720 m/s

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

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

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

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



Which of the following statements is true?

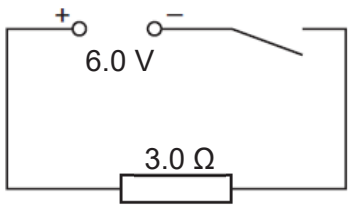
A All particles on one line move in the same direction at the same time.

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

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

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

14 The circuit shown is switched on for 1.0 minute.

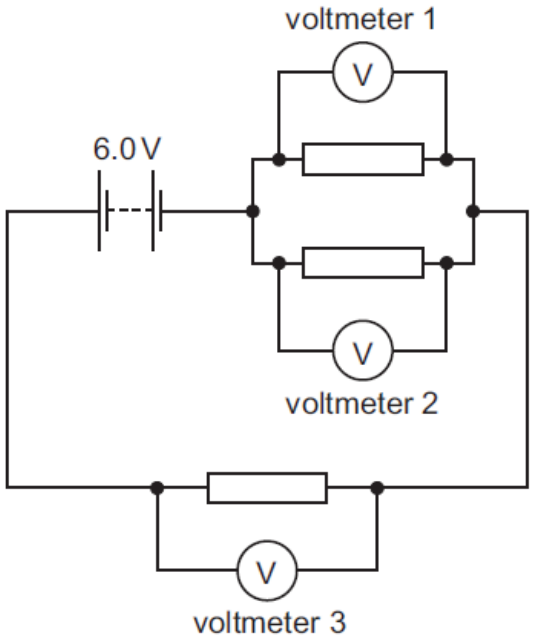


How much charge passes through the 3.0 Ω resistor?

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

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



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

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

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

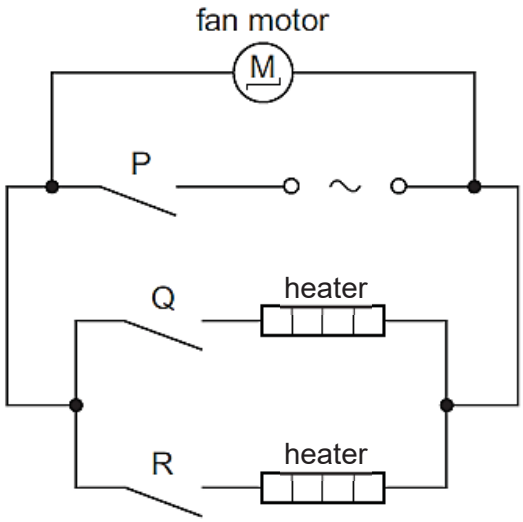
The wire is 20 cm long and has a cross-sectional area of 2.0 mm^2.

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

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

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

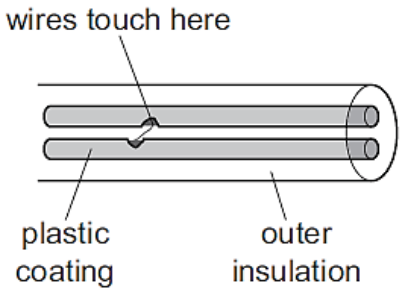


The fan motor has a power rating of 0.10 kW and the heaters each have a rating of 0.40 kW. The cost of electricity is 8.0 cents per kWh.

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

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

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



What could happen because of this?

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

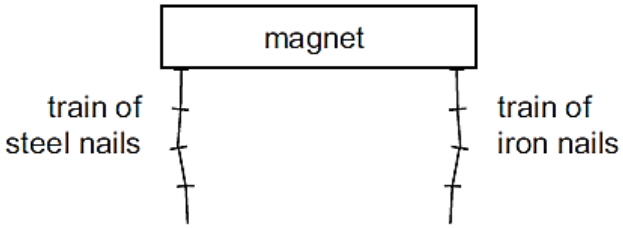
B The hairdryer plugged into the socket could be damaged.

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

D The circuit breaker could trip.

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



The trains are then carefully removed from the magnet.

What happens to the trains?

A Both trains fall apart.

B Both trains stay together.

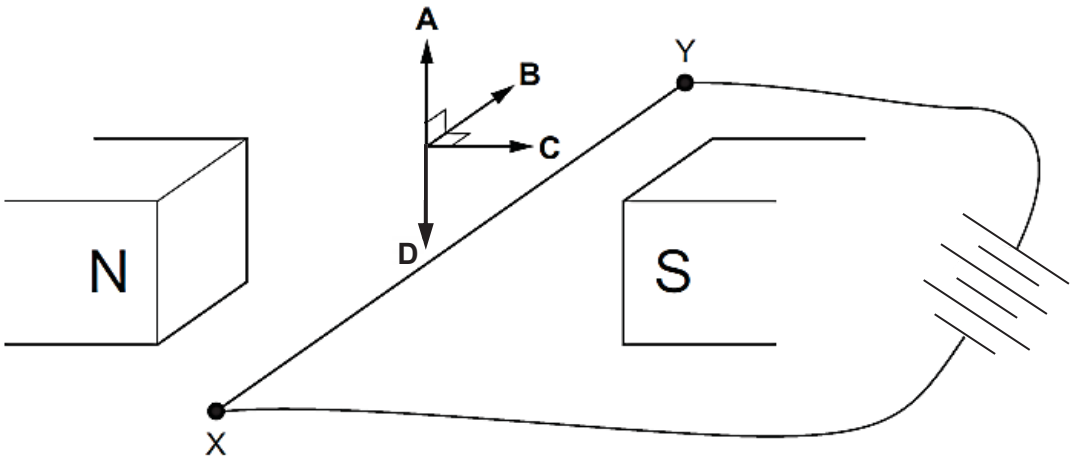
C Only the train of iron nails falls apart.

D Only the train of steel nails falls apart.

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

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

In which direction does the wire move?



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

SCIENCE (PHYSICS)
Paper 2

5076/02

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

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READ THESE INSTRUCTIONS FIRST

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

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

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

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

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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

FOR EXAMINER'S USE	
TOTAL	65

Set by: Ms Felicia Mah

This question paper consists of 17 printed pages.

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Section A [45 marks]

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

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

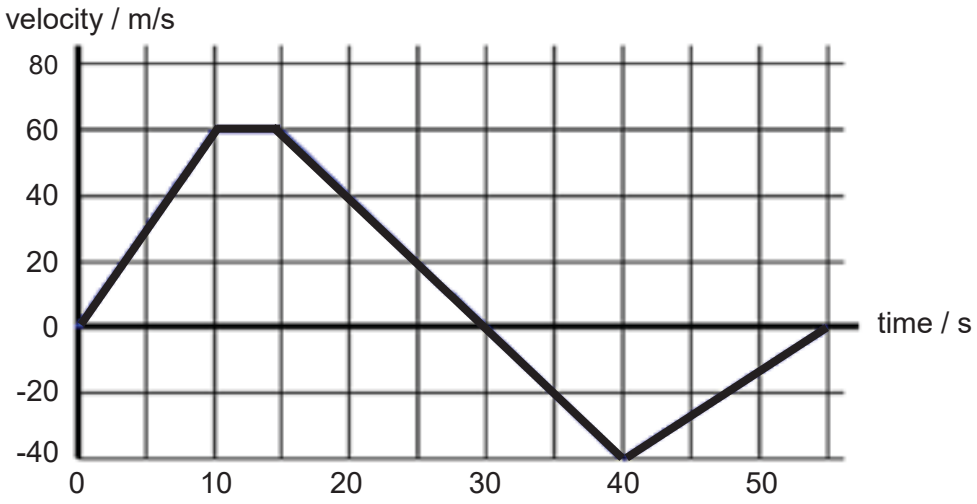


Fig. 1.1

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

……

…….. [1]

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

acceleration = ……..... [2]

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

total distance = ……..... [2]

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

……

……

……

…….. [2]

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

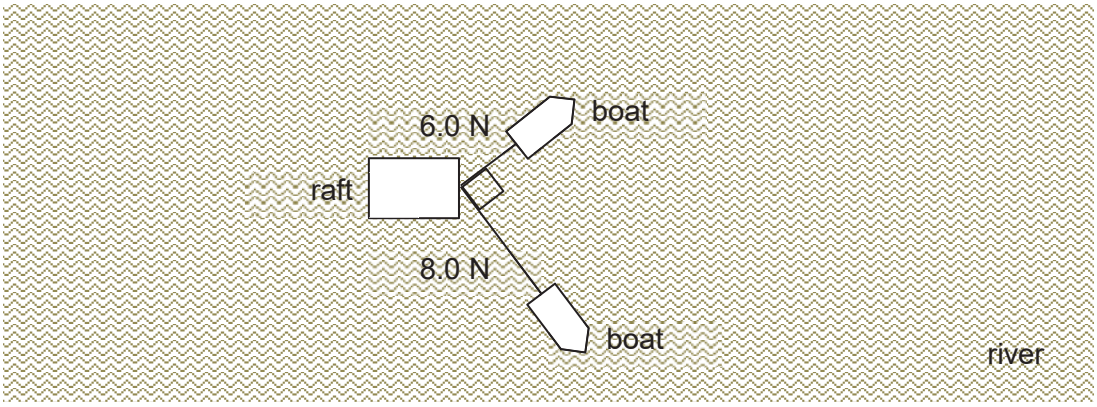


Fig. 2.1

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

scale = …….. : …….. [1]

resultant force = ……..... [3]

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

acceleration = ……..... [1]

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

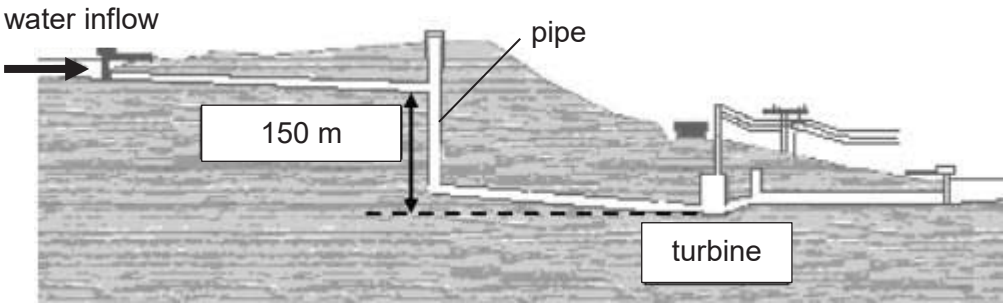


Fig. 3.1

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

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

mass = …….. [1]

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

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

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

maximum speed = ……..... [2]

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

…… [1]

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

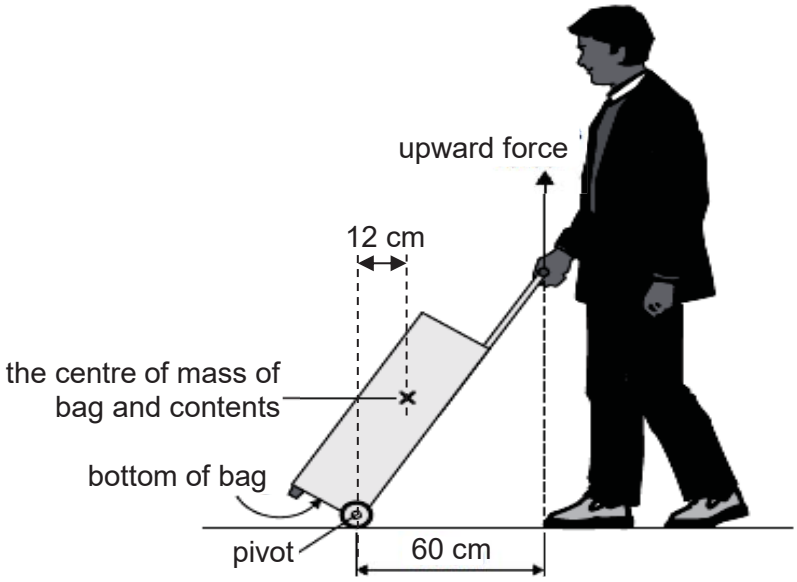


Fig. 4.1

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

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

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

upward force = ……..... [2]

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

……

……

…….. [2]

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

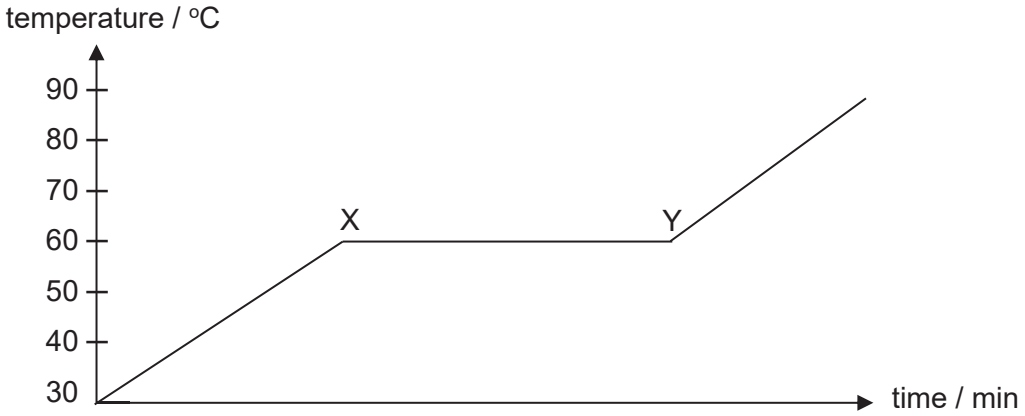


Fig. 5.1

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

……

……

……

……

…….. [2]

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

……

……

…….. [2]

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

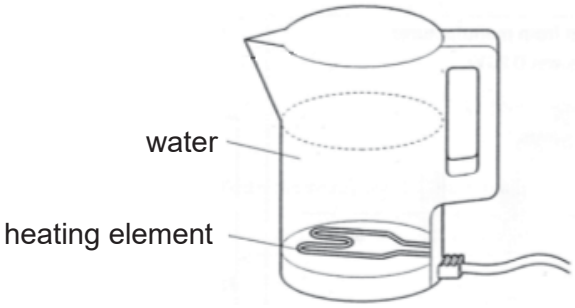


Fig. 6.1

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

……

……

……

……

…….. [2]

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

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

……

……

……

……

…….. [2]

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

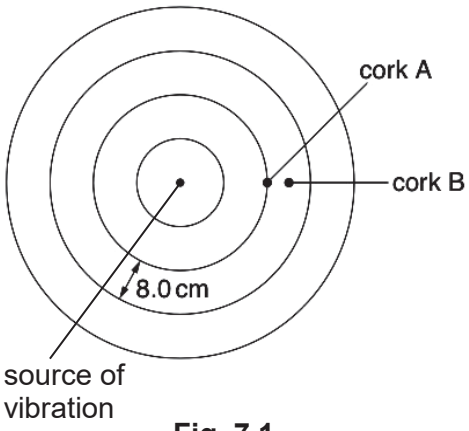


Fig. 7.1

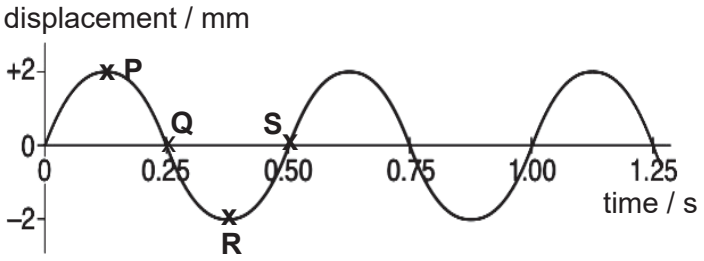


Fig. 7.2

(a) Define the term *wavefront*.

……

…… [1]

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

cork **A** : ……

cork **B** : …….. [1]

(c) Calculate the speed of the wave produced.

speed = …… [2]

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

……

…… [2]

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



Fig. 8.1

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

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

……..……..

……[1]

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

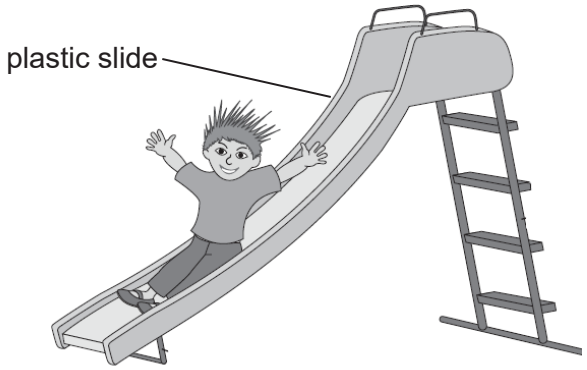


Fig. 8.2

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

Explain how this happens.

……..……..

……..……..

……[2]

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

……..……..

……[1]

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



Fig. 9.1

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

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

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

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

……

…… [1]

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Section B [20 marks]

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

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

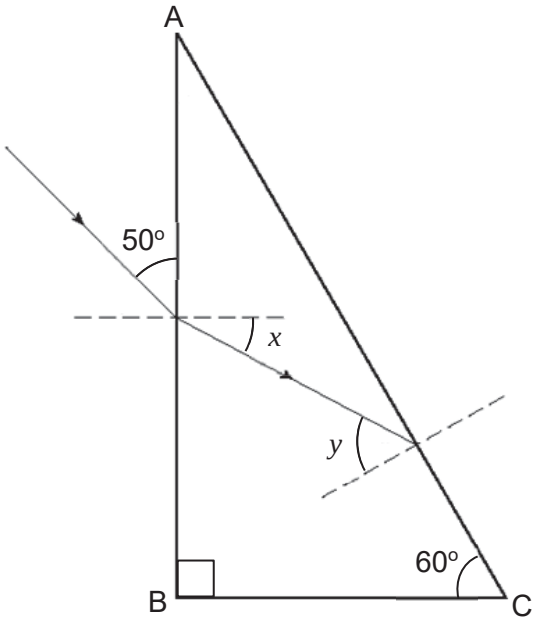


Fig. 10.1 (not to scale)

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

……..

…… [2]

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

angle of refraction x = …….. [1]

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

critical angle = …….. [1]

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

1. ……..

…….. [1]

2. ……...

…….. [1]

(v) The value of angle y is 55.6 ° .

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

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



Fig. 10.2

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

Explain clearly the function of the earth wire.

……..

……..

……..

……..

…… [2]

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

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

cost = …….. cents [1]

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

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

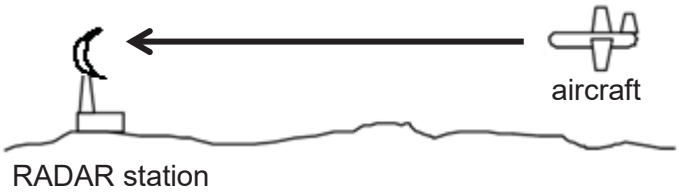


Fig. 11.1

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

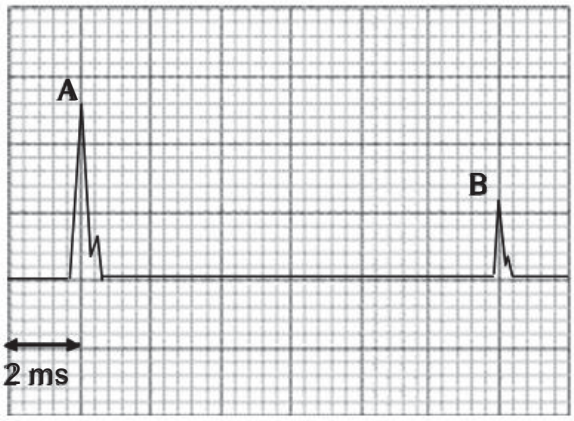


Fig. 11.2

(i) State the speed of radiowaves in vacuum.

speed = …….. [1]

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

distance = …….. [2]

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

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

speed = ……..m/s [2]

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

……..

…… [1]

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

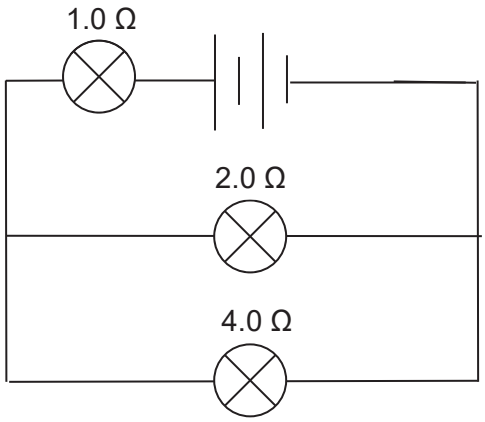


Fig. 11.3

(i) Calculate the effective resistance of the circuit.

effective resistance = …….. [1]

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

current = …….. [1]

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

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

……..

…… [2]

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

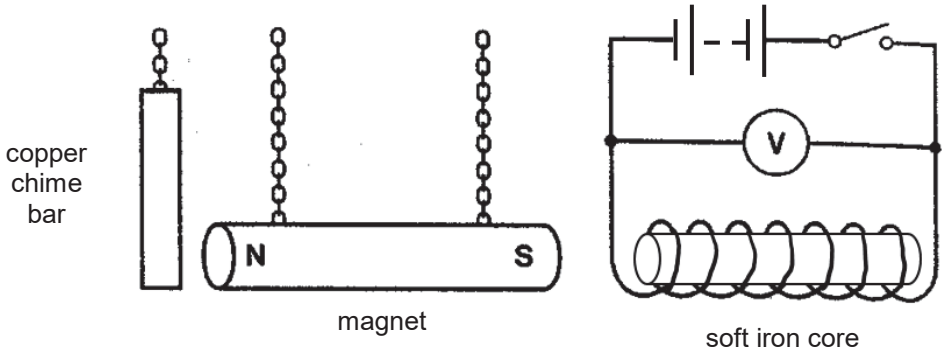


Fig. 12.1

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

……..

……..

…… [2]

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

……..

……..

…… [2]

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

……..

……..

……..

…… [2]

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

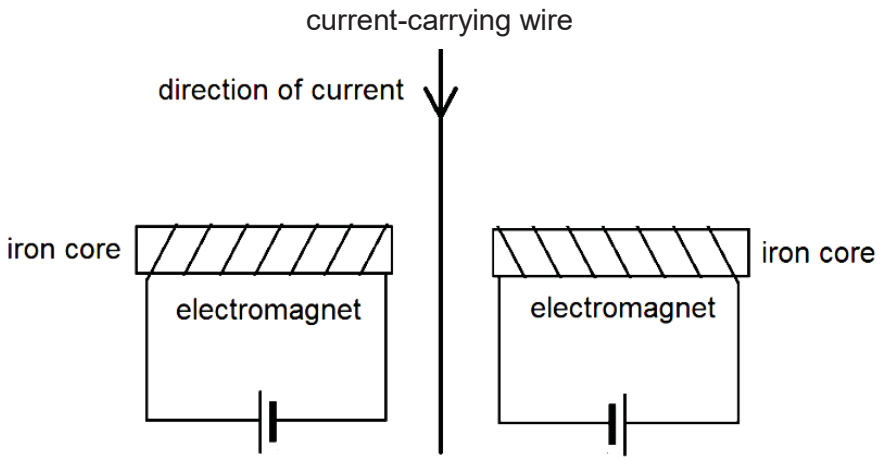


Fig. 12.2

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

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

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

……..

……..

…… [1]

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

…… [1]

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

…… [1]

End of Paper

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

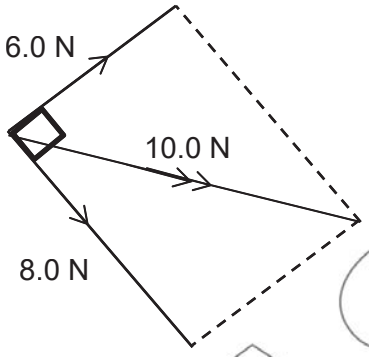
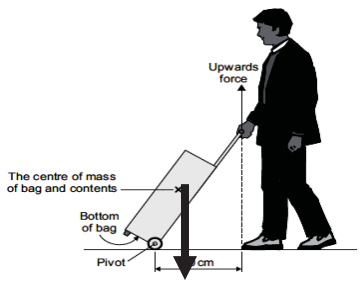
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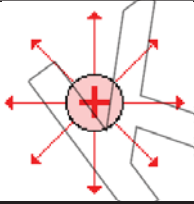
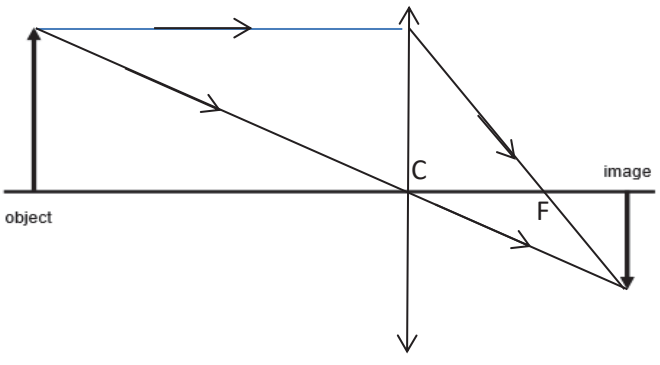
No formula -1m
Wrong/missing unit -1m
No 2/3 sf -1m

Section A [45 marks]

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

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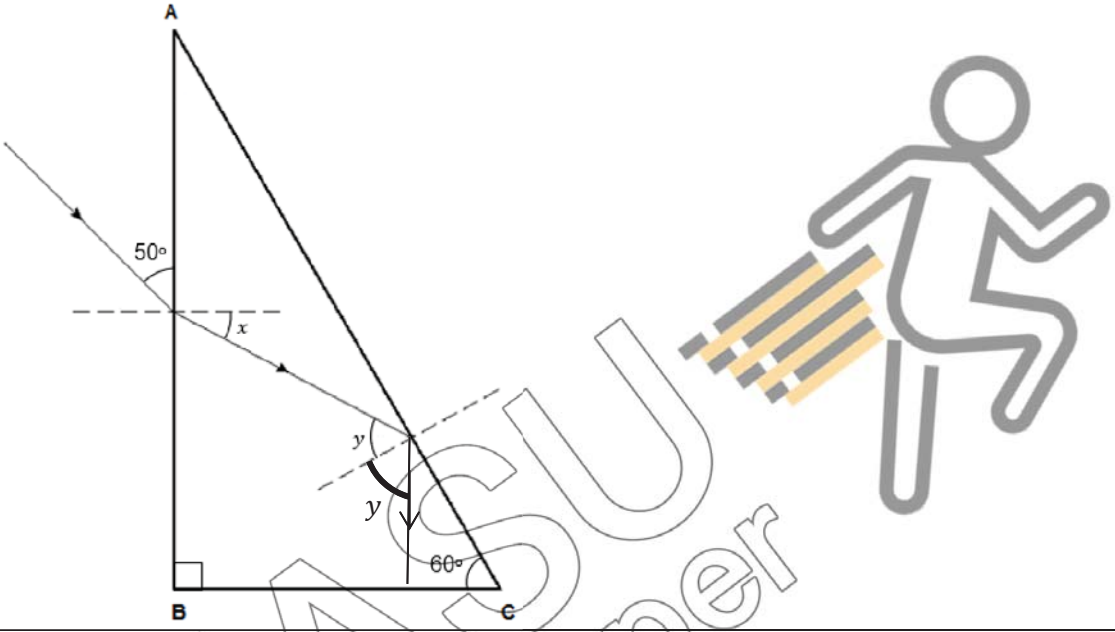
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4c	The **line of action of weight of the bag lies to the right of the pivot / outside the base area (bottom of bag)**, which **produces a clockwise moment** about the pivot, hence the bag will fall and hit the ground.	1 1
5a	At 40^{O}C, the substance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

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Section B [20 out of 30 marks]

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

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

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