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?

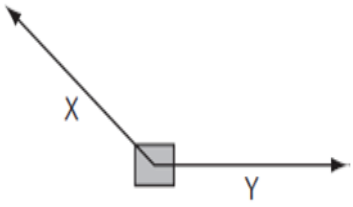
A mass, distance, time

B friction, velocity, electromotive force

C tension, speed, energy

D weight, displacement, electrostatic force

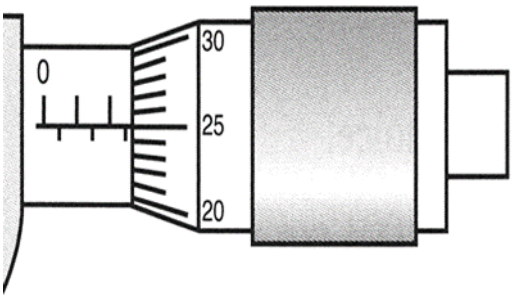
2 The diagram shows two forces X and Y act on an object.



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

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

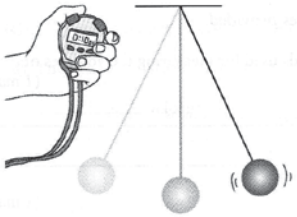
3 The diagram shows a ball bearing being measured using a micrometer screw gauge.



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.

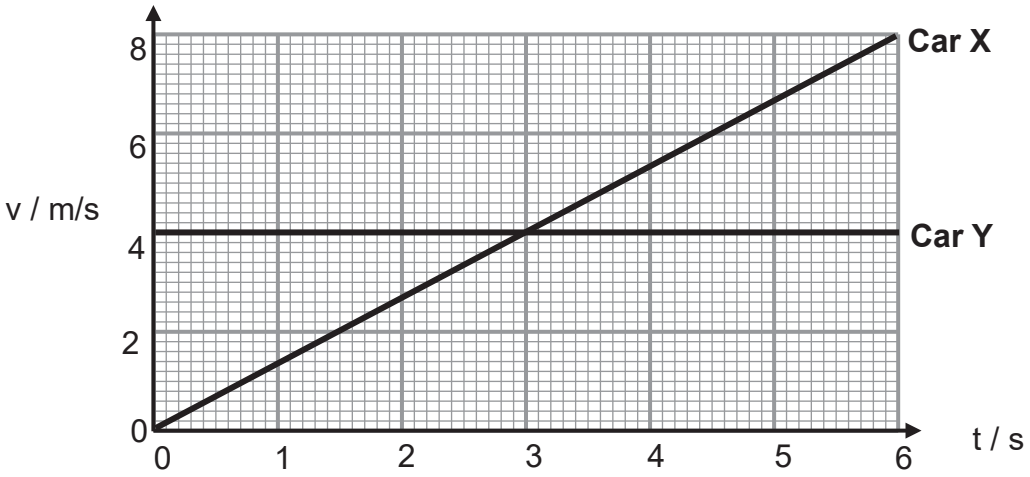


Two readings for 20 oscillations are as follows: 34.98 s and 35.70 s.

What is the average period of the pendulum?

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

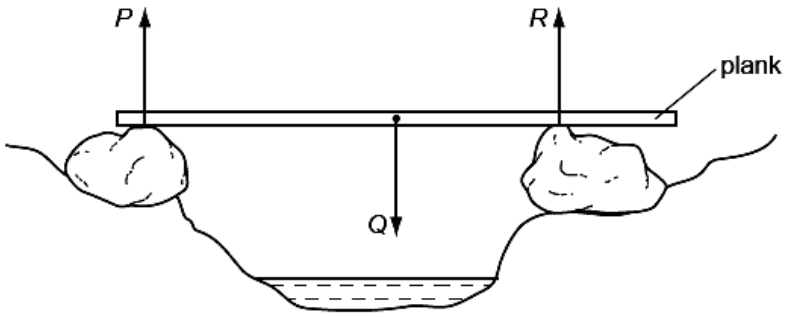
5 The speed-time graphs of car X and car Y are shown below.



When will the two cars meet each other?

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

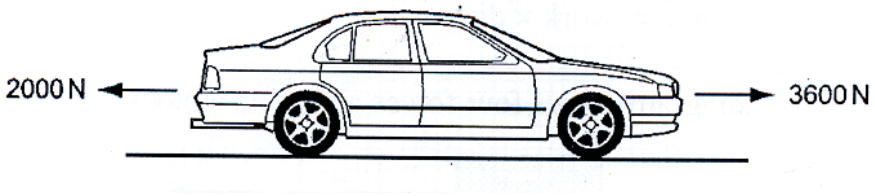
6 A wooden plank rests in equilibrium on two boulders on opposite sides of a narrow stream. Three forces of size *P*, *Q* and *R* act on the plank.



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?

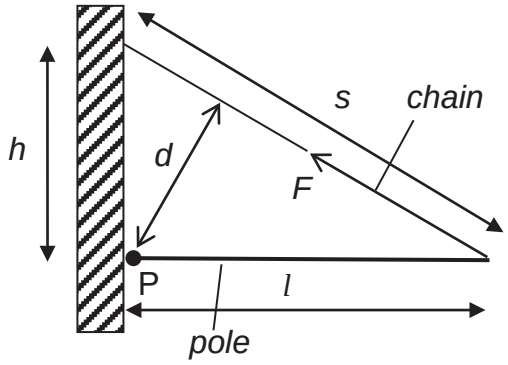


A 2.0 m/s^2 **B** 2.5 m/s^2 **C** 4.5 m/s^2 **D** 7.0 m/s^2

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

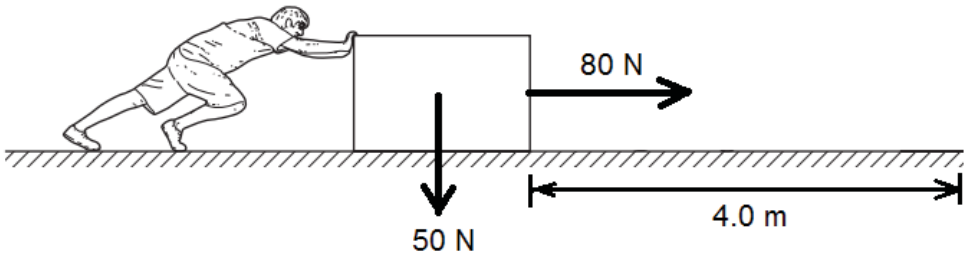
9 A horizontal pole is attached to the side of a building as shown. There is a pivot P at the wall and a chain is connected from the end of the pole higher up the wall. There is a tension F in the chain.



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

A *F* x *d* **B** *F* x *h* **C** *F* x *l* **D** *F* x *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.

150 ^{0}C	30 ^{0}C
block 1	block 2

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

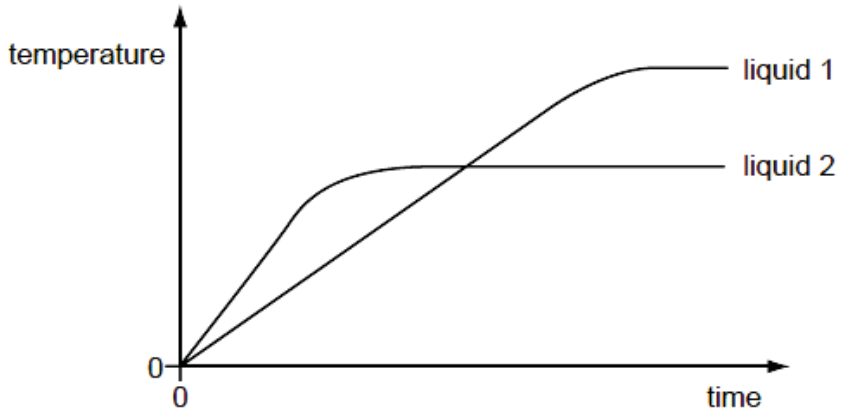
A Thermal energy will be transferred from block 1 to block 2 until they both reach thermal equilibrium at 90 ^{0}C.

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.

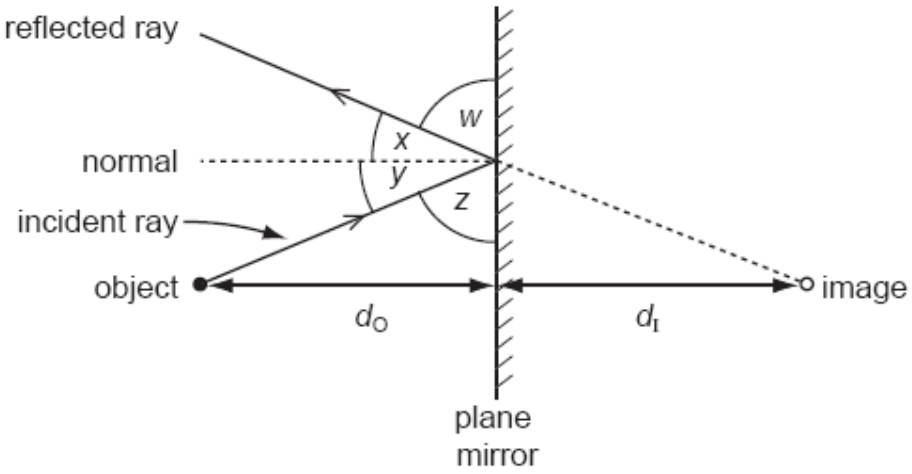
13 Equal masses of two different liquids are heated using the same heater. The graph shows how the temperature of each liquid changes with time.



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.

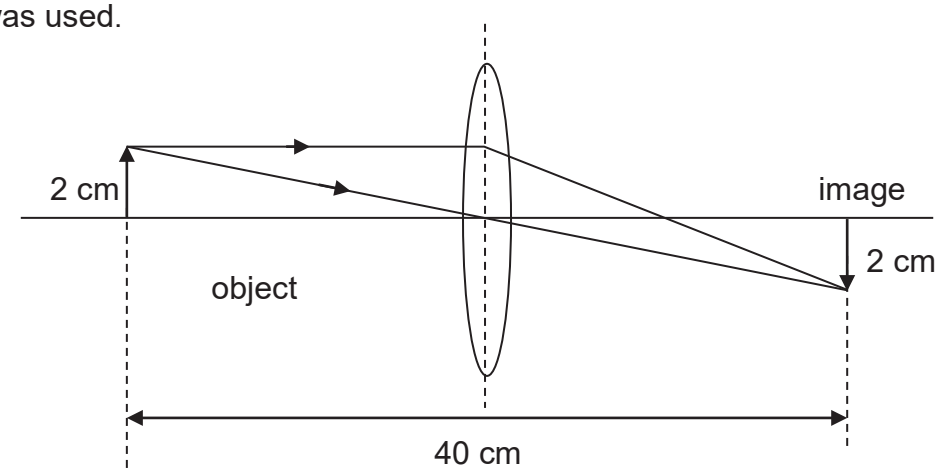
14 An image is formed in a plane mirror.



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?

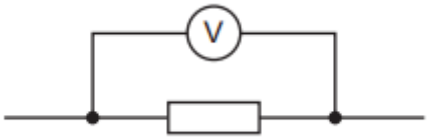
A They are all transverse waves.

B They are all visible to the naked eye.

C They all travel at the same speed of 3.0 x 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?

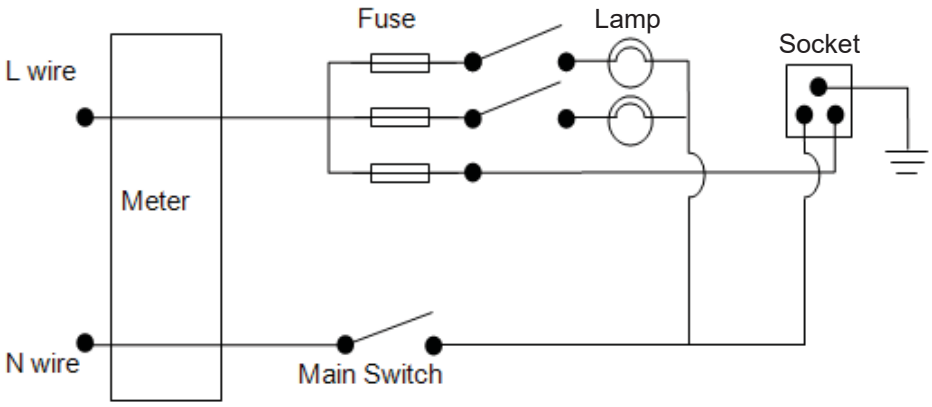
A the work done in driving 1 W of power through the resistor

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.

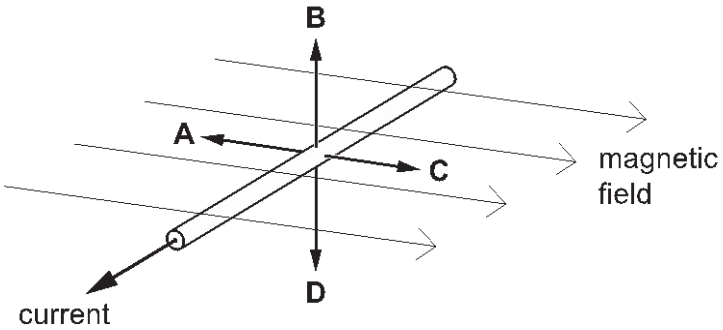
B The position of the earth wire in the socket is wrong.

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
27 Aug 2019

Paper 2 Physics

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

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.

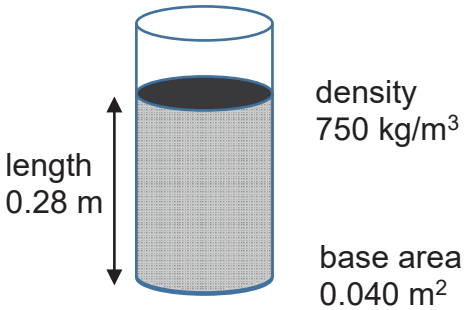


Fig 2.1

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.

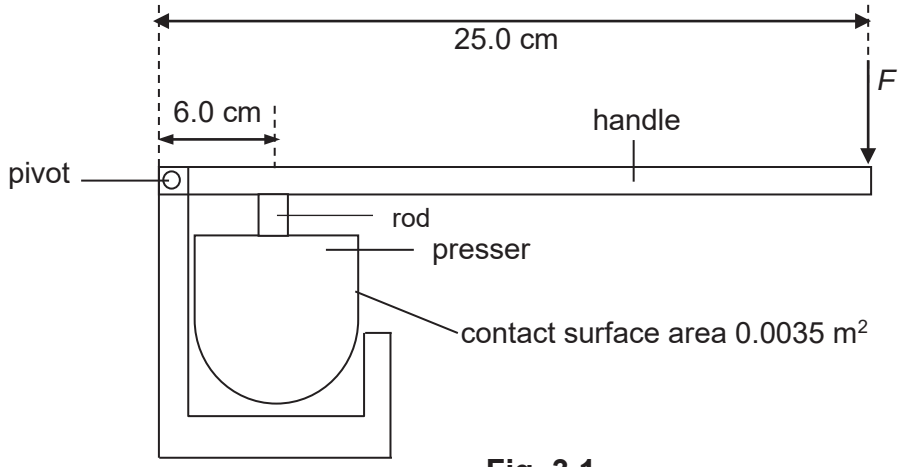


Fig. 3.1

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.

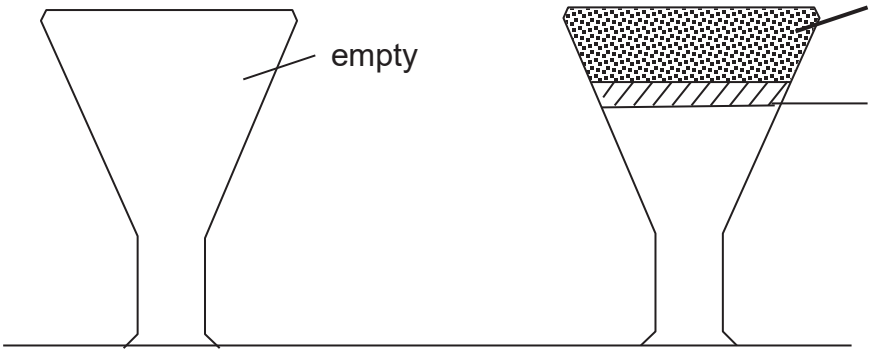


Fig. 4.1

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.

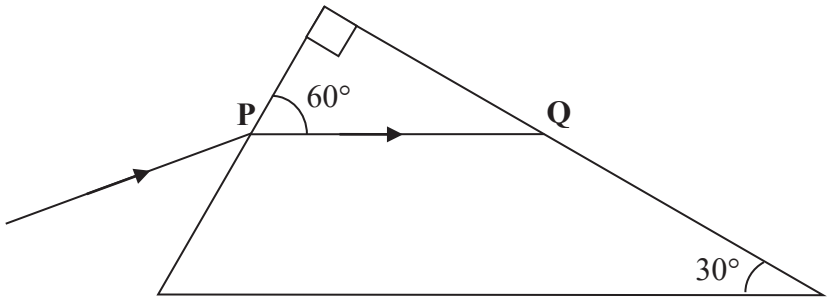


Fig. 5.1

(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.

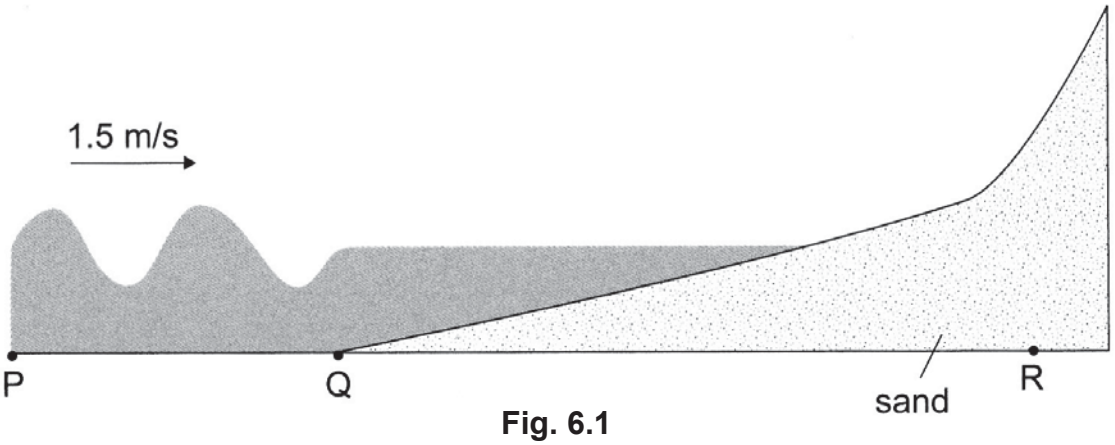


Fig. 6.1

(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.

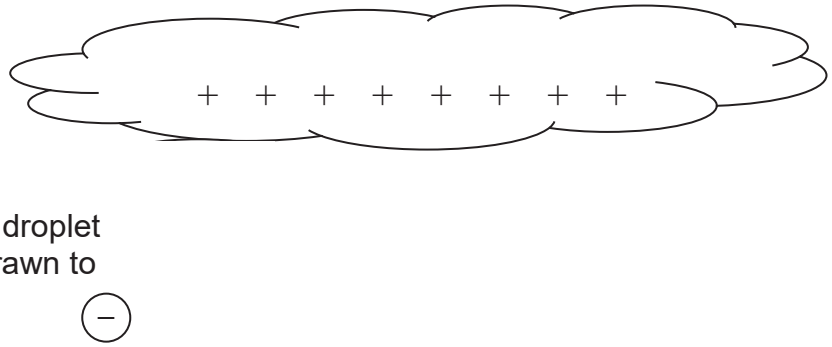


Fig.7.1

(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.

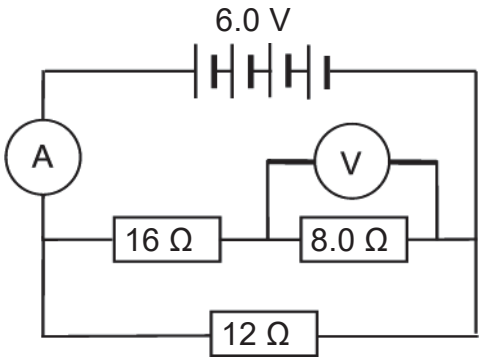


Fig. 8.1

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**.

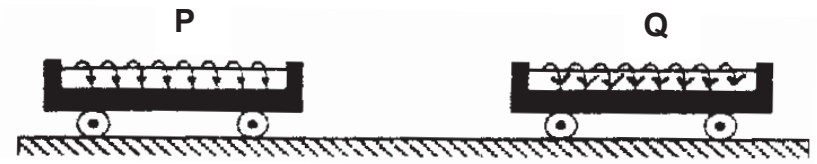


Fig. 9.1

(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.

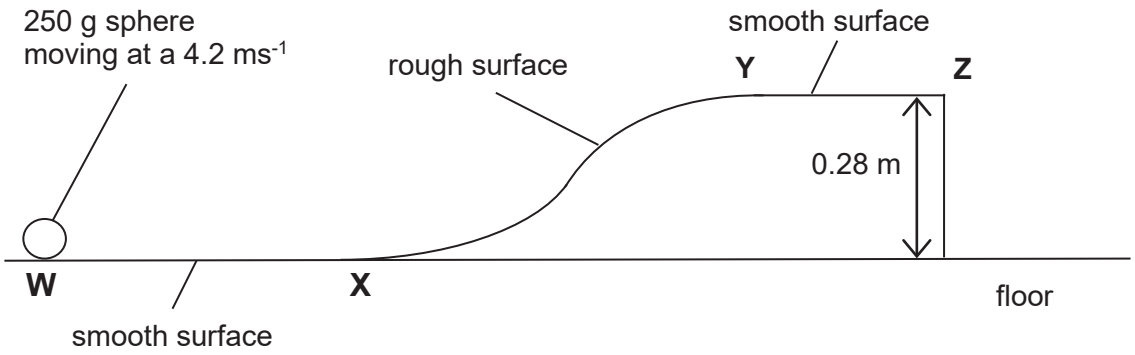


Fig. 10.1

(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]

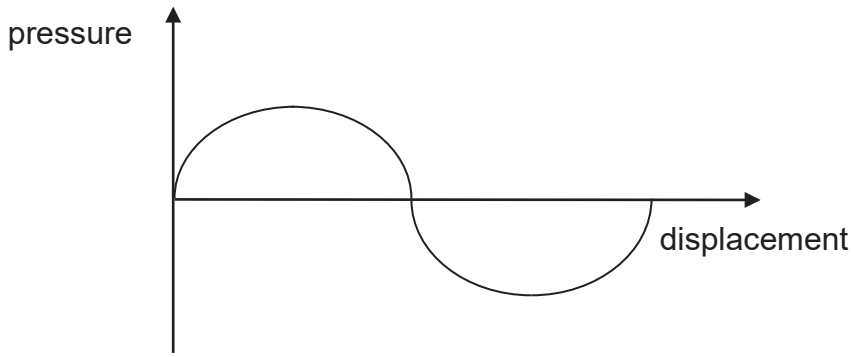


Fig. 10.2

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.

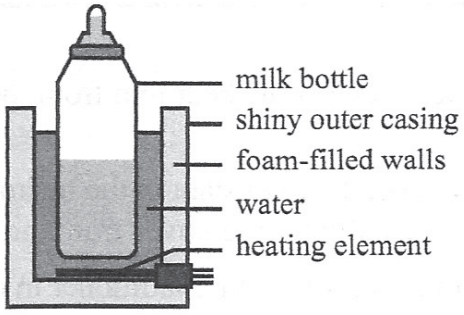


Fig. 11.1

(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.

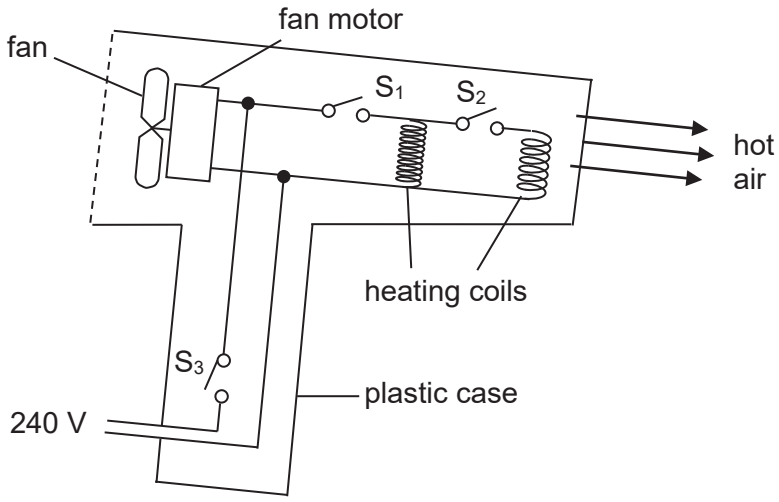


Fig. 12.1

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.

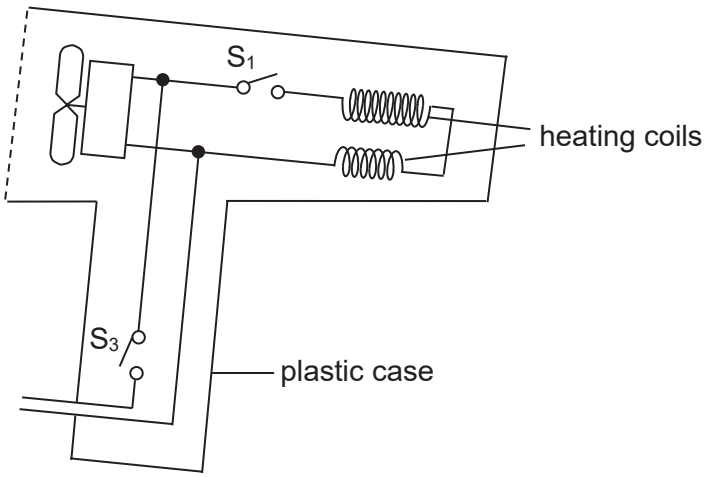


Fig. 12.2

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

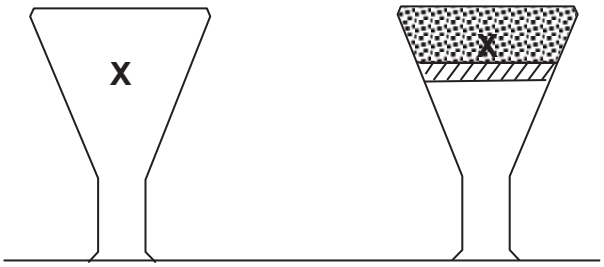
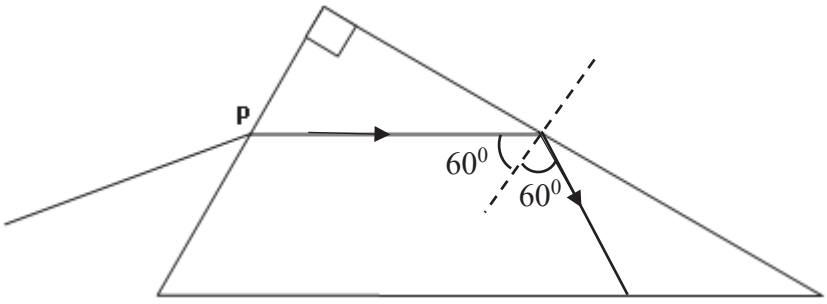
Paper 1

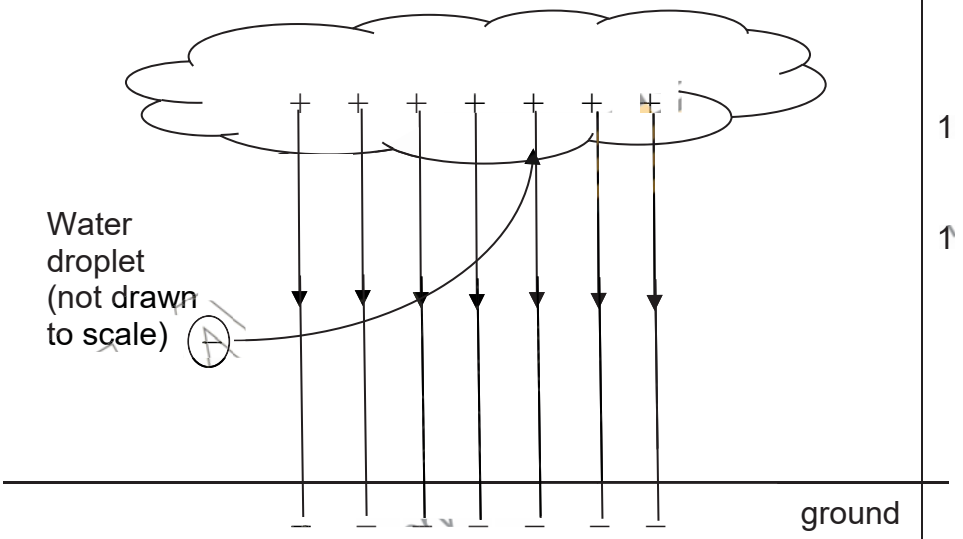
1. D	2. C	3. C	4. B	5. D
6. B	7. A	8. A	9. A	10. B
11. D	12. A	13. C	14. B	15. C
16. B	17. A	18. D	19. C	20. B

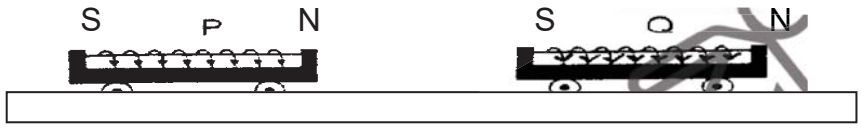
Paper 2

Section A

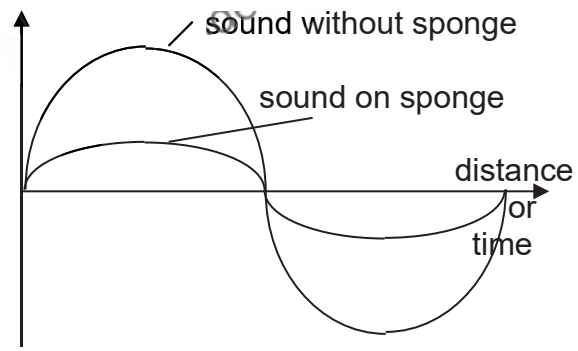
No.	Answers	Marks
1a	Acceleration is the rate of change of velocity or acceleration refers to the change in velocity per unit time.	1
b	Lorry Z	1
c	Lorry X The increase in the value if the speed per unit time is constant.	1 1
d	$a = \Delta v / \Delta t$ $= 8 / 10$ $= 0.80\ m/s^2$ $F = ma$ $= 20000 \times 0.80$ $= 16\,000\ N$	 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
	displacement  	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