BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020

SUBJECT : Science Physics **LEVEL : Sec 4E/5N**

PAPER : 5076 / 2 **DURATION : 1 hour 15 minutes**

SETTER : Mrs Seah-Pay Ling Ling **DATE : 27 Aug 2020**

CLASS :	NAME :	REG NO :

READ THESE INSTRUCTIONS FIRST

Write your register number, name and class on the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

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

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

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

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

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

This paper consists of **18** printed pages (including this cover page)

[Turn over]

Examiner's Remark

Section A (45 Marks)

Answer **ALL** questions in the space provided.

1 A positively-charged metal sphere **P** is hung from an insulating string as shown in Fig. 1.1.

Fig. 1.2 shows the effect on **P** when a negatively-charged metal sphere **Q** on an insulated rod is positioned close to it. The string makes an angle θ with the vertical.

Fig. 1.1

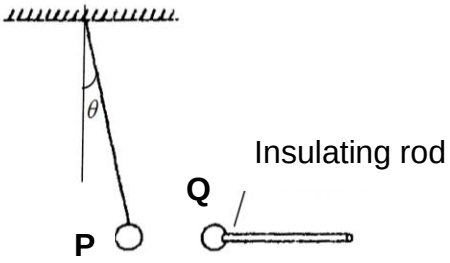

Fig. 1.2

Given that the mass of sphere **P** is 5.0×10^{-3} kg and the attraction force acting on **P** is 1.5×10^{-1} N.

Draw a labeled vector diagram to determine the tension of the string and the angle θ made by the string with the vertical.

scale = ……..……..

tension of string = …….. N

angle, θ = …….. ° [4]

Examiner's Remark

2 Fig. 2.1 shows the speed-time graph of a car and a lorry travelling on a straight road. The lorry is travelling at a uniform speed of 15.0 m/s.

The car is travelling at 10 m/s. It then accelerates uniformly from t = 5.0 s to t = 12.0 s, and continues the rest of the journey with a uniform speed of 18.0 m/s.

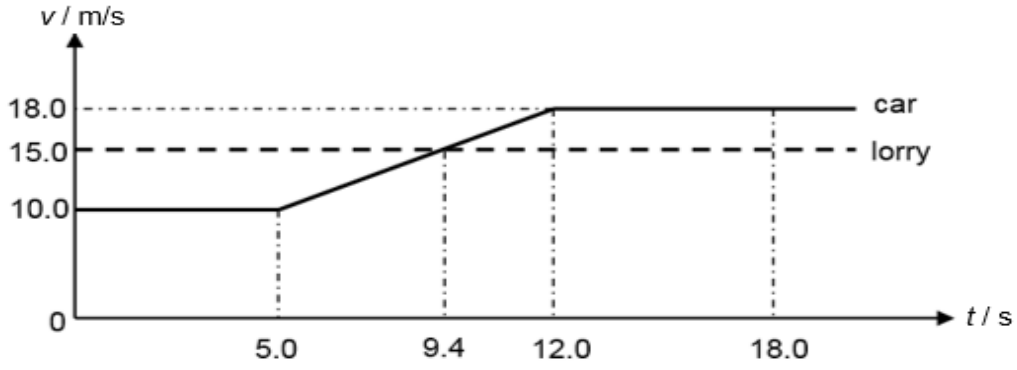

Fig. 2.1

(a) Calculate the acceleration of the car between t = 5.0 s to t = 12.0 s.

acceleration = …….. m/s^2 [2]

(b) Calculate the average speed of the car from t = 0 s to t = 18.0 s.

speed = …….. m/s [2]

(c) State how the distance between the car and the lorry changes during the period of

(i) t = 5.0 s to t = 9.4 s

……

…… [1]

(ii) t = 9.4 s to t = 12.0 s

……

…… [1]

Examiner's Remark

3 Fig. 3.1 below shows part of a boiler in a steam engine. Steam escapes through the valve when the pressure inside the boiler becomes too high.

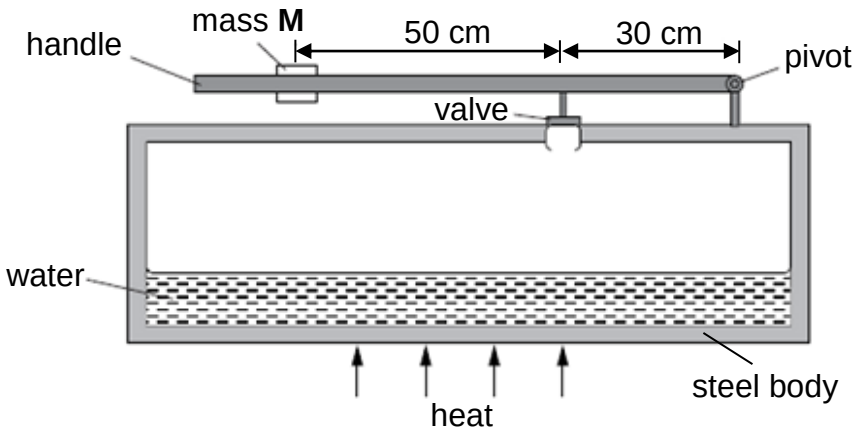

Fig. 3.1

(a) Explain how heat is transferred to the water through the steel body.

……

……

……

…… [2]

(b) When the pressure inside the boiler reaches 4.0×10^5 Pa, the valve opens. The area of the valve in contact with the steam is 2.0×10^{-4} m^2.

(i) Calculate the upward force exerted on the valve for it to open.

upward force = …….. N [2]

Examiner's Remark

(ii) The mass of the handle is 1.25 kg. Calculate the weight of the handle given that gravitational field strength is 10 N/kg.

weight = …….. N [1]

(iii) Given that the handle is 1 m long, calculate the maximum value of mass **M** such that the valve will open when the pressure inside the boiler is 4.0×10^5 Pa.

mass, **M** = …….. kg [2]

4 Explain the following observations using the kinetic theory of matter.

(a) Fig.4.1 shows a beaker of alcohol that is placed on a puddle of water. Air is bubbled into the beaker. The alcohol evaporates quickly and the water on the table freezes into ice. Describe how the evaporation of the alcohol causes a cooling effect on the water.

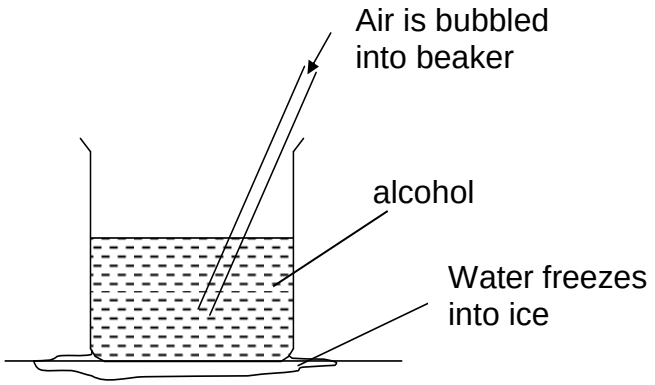

Fig. 4.1

……

……

…… [2]

Examiner's Remark

(b) During freezing, the temperature of water remains constant although heat is being removed.

……

……

……

…… [2]

5 A microwave oven uses microwaves to heat food. The common frequency used is roughly 2500 MHz. Microwaves in this frequency range have the following properties:

- They are absorbed by water, fats and sugars and converted directly into atomic motion.
- They are not absorbed by most plastics, glass or ceramics.
- They are reflected by metals, which is why metal pans do not work well in a microwave oven.

(a) Calculate the wavelength of the microwave used in the microwave oven.

wavelength = …….. m [2]

(b) State one use of microwave in the communication field.

…… [1]

(c) State one other difference between the microwaves and ultrasound wave, without the comparison of their wavelengths and frequencies.

……

…… [1]

Examiner's Remark

6 A clarinet contains a thin strip of material, known as the reed. A musical note is produced when the reed vibrates, causing molecules in the air nearby to vibrate at the same frequency.
Fig. 6.1 shows the clarinetist and audience in a concert room.

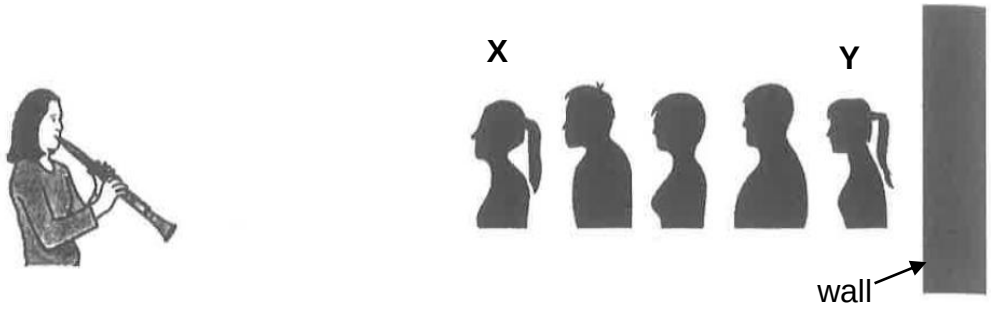

Fig. 6.1

A sound is heard by a listener, **X,** who is 21 m from the clarinet. The clarinet is making a note of frequency 220 Hz.

(a) Given that the speed of sound in air is 330 m/s, calculate how many vibrations the reed makes before the sound reaches the listener **X**.

number of vibration = …….. [3]

Examiner's Remark

(b) Another listener **Y** is further away from the clarinet as shown in Fig. 6.1.

Fig. 6.2 shows the pressure-time graph of a particle as the sound wave passes from clarinet to listener **X**.

Sketch on Fig. 6.2, the pressure-time graph of a particle as the sound wave passes from the clarinet to listener **Y**, which is heard as softer and of the same pitch as compared to listener **X**.

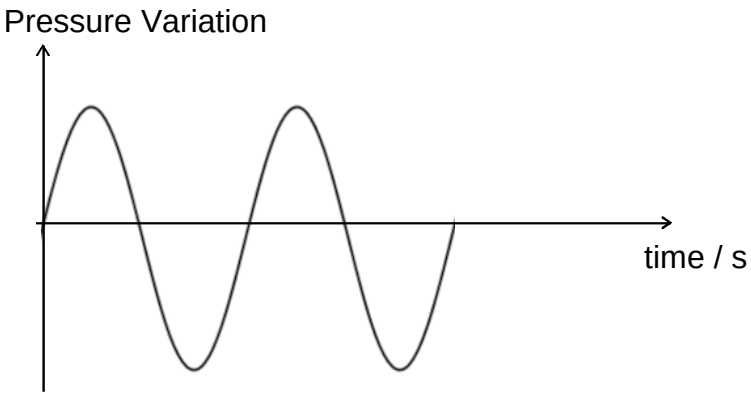

Fig. 6.2 [2]

7 **(a)** A light metallic coated sphere **P** is suspended by an insulating string. Sphere **P** is in contact with an uncharged metal sphere **A** which is fixed on an insulating stand.

A highly positively charged sphere **B** is moved towards sphere **A** as shown in Fig. 7.1.

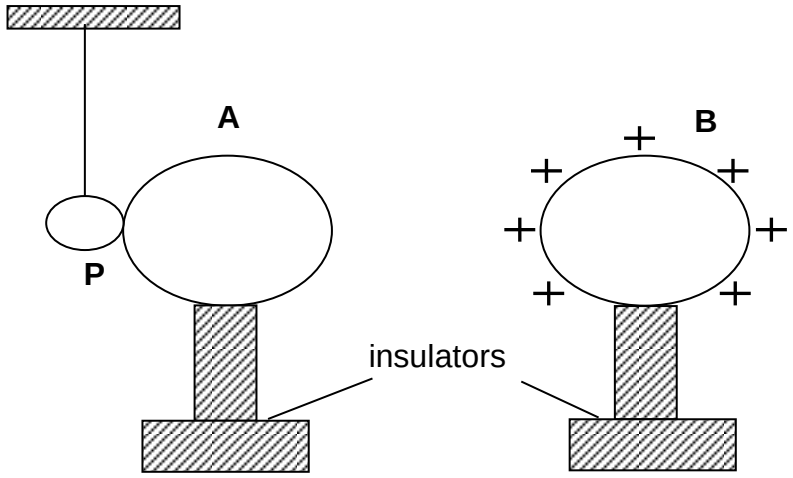

Fig. 7.1

(i) On Fig. 7.1, draw the charge distribution on spheres **P** and **A**. [2]

Examiner's Remark

(ii) Explain how these charges are induced in sphere **A**.

……

……

……

…… [2]

(b) Fig. 7.2 shows a worker topping up the fuel in an aircraft.

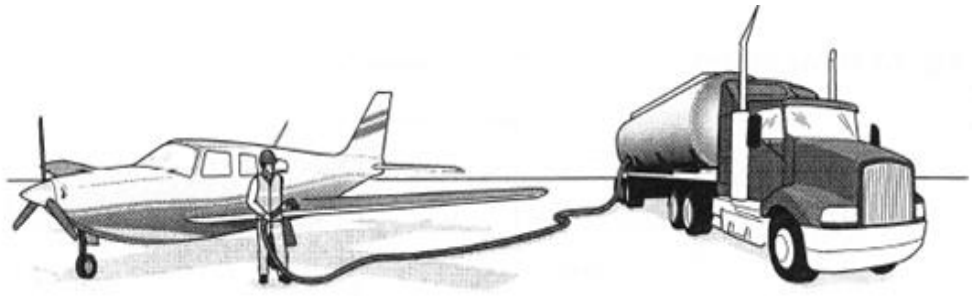

Fig. 7.2

Both the fuel and the hose through which it passes are insulators. The fuel passing into the aircraft becomes positively charged and this causes the aircraft to be positively charged. There is then a danger that the fuel may ignite.

(i) Explain how the fuel becomes charged.

……

…… [1]

(ii) Suggest how the charge may cause the fuel to ignite.

……

…… [1]

(iii) The danger is reduced by connecting a wire from the aircraft to the ground. Explain how this prevents the build-up of positive charge on the aircraft.

……

…… [1]

8 Fig. 8.1 shows an electrical circuit containing three resistors and a light bulb connected to a battery with an electromotive force (e.m.f.) of 12 V.

Examiner's Remark

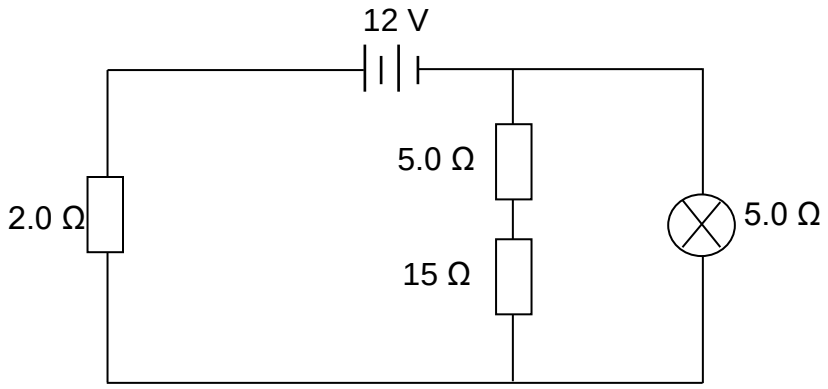

Fig. 8.1

(a) Define what is meant by e.m.f of 12 V.

……

……

……

…… [1]

(b) Calculate the total resistance of the circuit.

total resistance = …….. Ω [2]

(c) Calculate the current in the 2.0 Ω resistor.

current = …….. A [1]

Examiner's Remark

(d) Calculate the charge that flows through the battery in 4.0 min.

charge = …….. C [2]

(e) Calculate the potential difference across the light bulb.

potential difference = …….. V [2]

End of Section A

Section B (20 marks)

Examiner's Remark

Answer any **TWO** questions in the spaces provided.

9 A drop slide is a slide where the first part of the fall is vertical and very smooth. Fig. 9.1 shows Javis with a mass of 80 kg going down a drop slide.

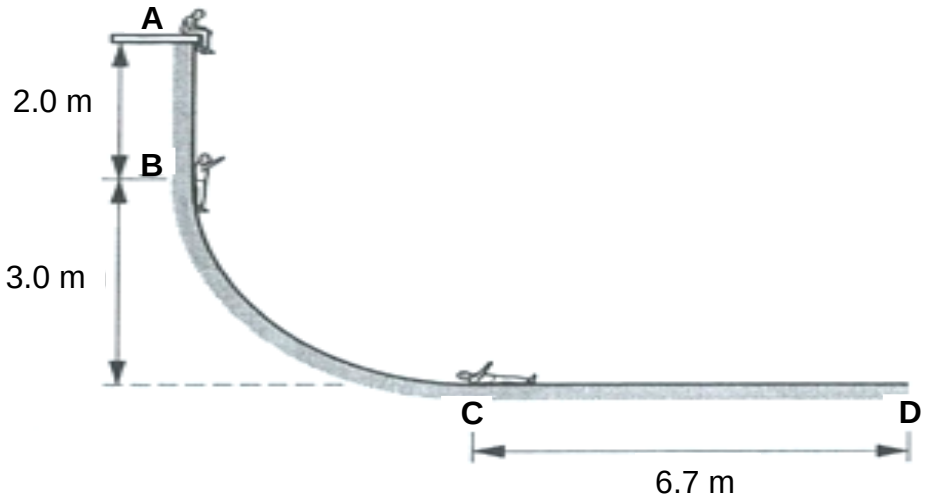

Fig. 9.1

Javis drops a vertical distance of 2.0 m from **A** to **B** before reaching the curved segment at **B**. He then slides a vertical distance of 3.0 m down from **B** to **C** and continues to slide a horizontal distance of 6.7 m before stopping at point **D**.

(a) State the *principle of conservation of energy*.

……

……

……

…… [2]

(b) Calculate the loss in gravitational potential energy of Javis from **A** to **B.**

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

Examiner's Remark

(c) Calculate the speed of Javis at point **B**.

speed = …….. m/s [2]

(d) State an assumption that you have made for part **(b)**.

……

…… [1]

(e) It is observed that the speed of Javis at **C** is half of the speed at **B**, determine the amount of energy converted to thermal energy.

thermal energy = …….. J [3]

Examiner's Remark

10 **(a)** Fig. 10.1, shows a ray of light entering the core of an optical fibre with refractive index of 1.4.

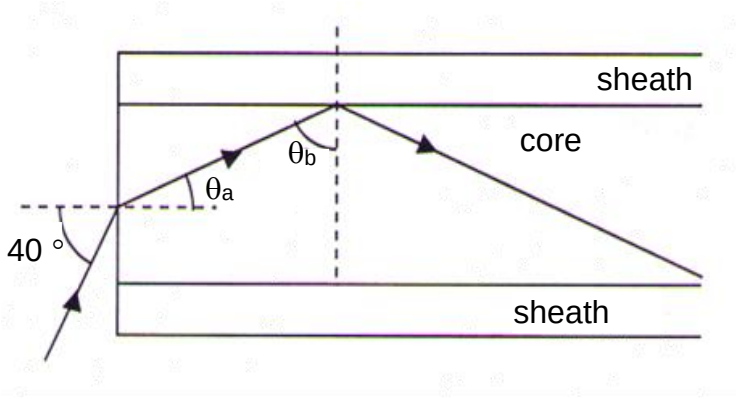

Fig. 10.1

(i) Calculate the value of angle θ_b.

angle θ_b = ……..° [2]

(ii) Explain why it is desirable for the core of the fibre to have a high refractive index

……

……

……

…… [2]

Examiner's Remark

(b) Fig. 10.2 shows an illuminated object L of height 3.0 cm placed in front of a converging lens. A sharp image is formed on the screen on the opposite side of the lens.

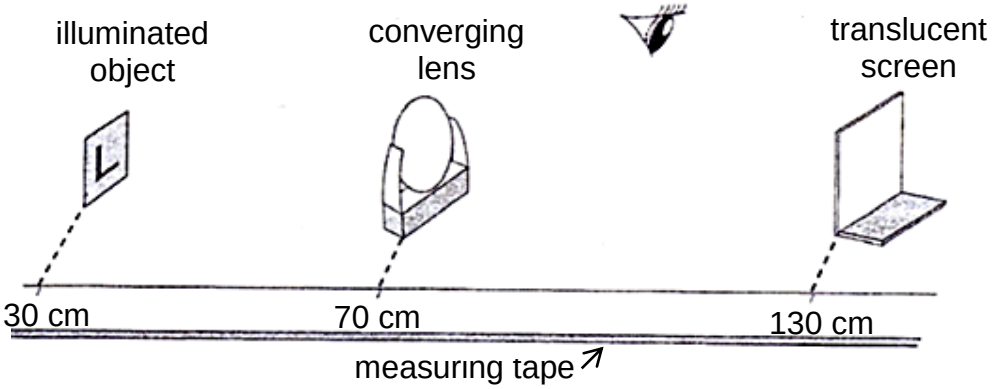

Fig. 10.2

(i) In the box below, draw the image of the illuminated object, "**L**" that is formed on the screen as seen from the eye. You need not draw the image to scale.

[1]

(ii) Using information from Fig. 10.2, construct a ray diagram for the set-up, indicating clearly the position of the lens and the image formed on the screen on Fig. 10.3. The object has been drawn for you.

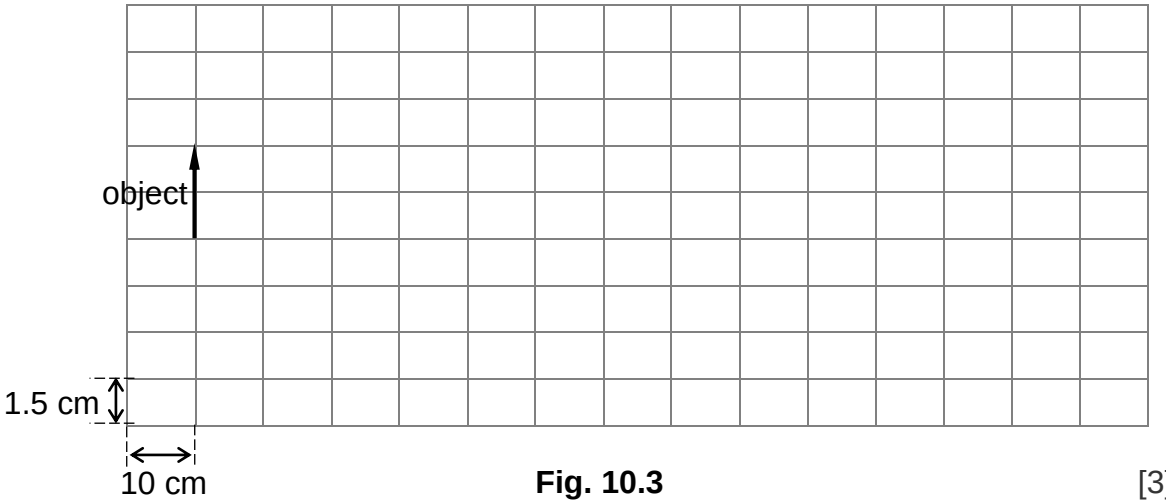

Fig. 10.3

[3]

Examiner's Remark

(iii) Without shifting the position of the object and the screen, describe how you can obtain another real image using the same lens.

……

…… [1]

(iv) State how the size of this image would have changed from **(b) (ii)**.

……

…… [1]

Examiner's Remark

11 Fig. 11.1 shows a room heater and Fig. 11.2 shows the electric circuit of this room heater.

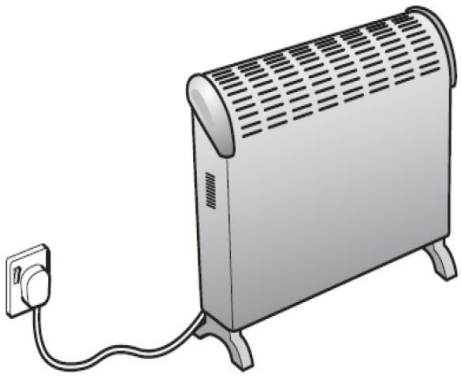

Fig. 11.1

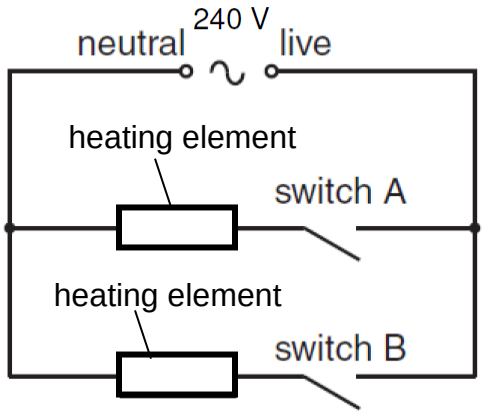

Fig. 11.2

(a) The fuse has not been drawn on the circuit diagram in Fig. 11.2.
On Fig. 11.2, draw the symbol for a fuse in the correct position. [1]

(b) State the part of the room heater to which the earth wire is connected.

…… [1]

(c) The earth wire reduces the chance of an electric shock if a fault develops in the room heater.

(i) State one fault that causes an electric shock when a person uses the room heater without an earth connection.

……

…… [1]

(ii) Explain how using an earth connection prevents an electric shock.

……

……

……

…… [2]

Examiner's Remark

(d) Fig. 11.3 shows the power output of the room heater when each switch is closed.

	power / W
Only switch A closed	600
Only switch B closed	1500
Both switches closed	2100

Fig. 11.3

(i) Determine the suitable fuse to be used if fuses of 1 A, 3 A, 5 A, 13 A and 30 A are available.

suitable fuse = …….. A [2]

(ii) The room heater is used with both switches closed for 2.5 hours every day. Calculate the cost of using this room heater for 30 days. The cost of 1 kWh is $0.25.

cost = $ …….. [3]

- End of Paper -