Name: …….. ( ) Class: ……

Bukit Batok Secondary School

GCE 'O' LEVEL PRELIMINARY EXAMINATIONS 2020

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (PHYSICS) 5076 / 02

Paper 2

1 September 2020

0800 − 0915 h

1 hour 15 minutes

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

READ THESE INSTRUCTIONS FIRST

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

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

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

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

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

Section A [45 marks]

Answer **all** the questions in this section.

1 The linear motion of a body is represented by the speed-time graph shown in Fig. 1.1. The mass of the body is 20 kg and its initial speed is 8.0 m/s.

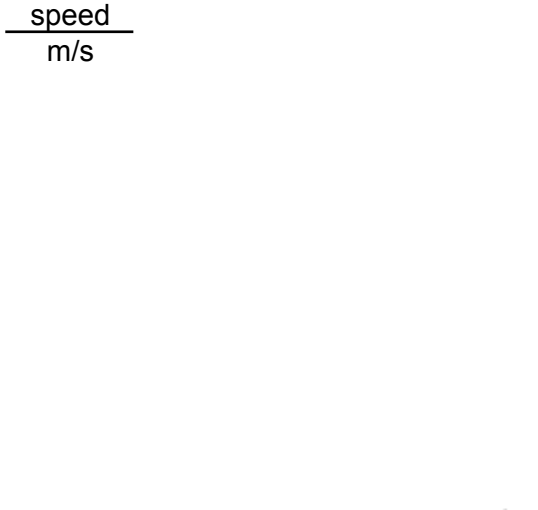


Fig. 1.1

Based on the data present in Fig. 1.1,

(a) show that the distance travelled by the body is 40 m,

[2]

(b) determine the deceleration of the body,

deceleration = …….m/s^2 [2]

Applying past knowledge to new situations 2

(c) determine the retarding force acting on the body,

retarding force = ……. N [2]

(d) show that the work done to bring the body to rest is 640 J.

[2]

2 A stone falls vertically from the top of a cliff into the sea, as shown in Fig. 2.1.
The speed-time graph for the stone is shown in Fig. 2.2.

Between points A and C, the stone was falling through the air.

The stone touches the sea at point C.

Between points C and D, the stone was sinking vertically through the sea water.

Fig. 2.1

Fig. 2.2

(a) Describe how the acceleration of the stone changes between points A and D.

……...

…… [2]

(b) By considering the forces acting on the stone, explain why the acceleration changes between points A and B.

……...

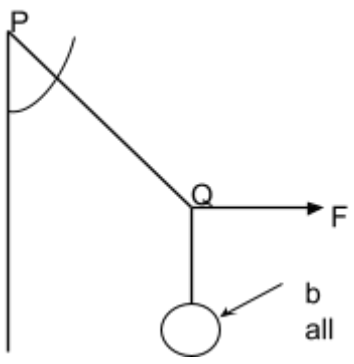
……...

……...

…… [3]

(c) Did the stone fall freely between points B and C? Explain your answer.

…… [1]



3 Fig. 3.1 shows a ball hanging at rest from a string that is pulled to one side by a horizontal force F.

The weight of the ball is 80 N.

The magnitude of force F is 60 N.

(a) In the space below, draw a vector diagram to determine the resultant of F and the weight of the ball.
State clearly the scale that you have used, the magnitude of the resultant force and the angle between the resultant force and the weight of the ball.

scale: …….

magnitude of resultant force: ……..N

angle between resultant force and weight of ball: …….° [3]

(b) Deduce the magnitude of the tension along region PQ of the string.
Give a reason for your deduction.

……..……

……..……

…… [2]

Applying past knowledge to new situations 6

4 **(a)** State what is meant by the ***centre of gravity*** of a body.

……

…… [1]

(b) The stability of a lorry is tested, as shown in Fig. 4.1.

The lorry was left on a tilting ramp, and the ramp tilted.

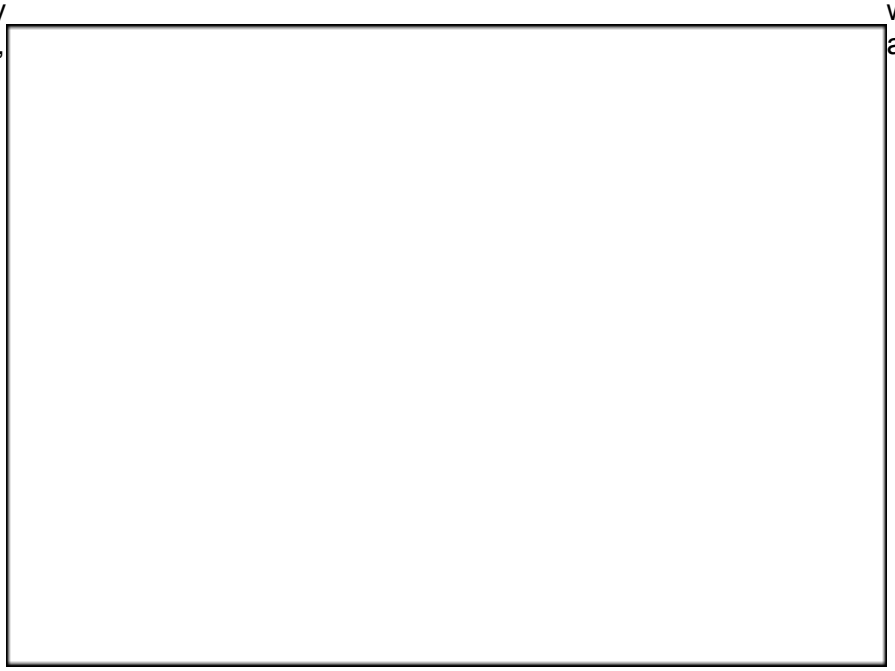


Fig. 4.1

(i) **<u>On Fig. 4.1</u>**, draw the line of action of the weight of the lorry. [1]

(ii) Explain why the lorry falls over if the ramp is tilted any further.

……

……

……

…… [2]

(c) Fig. 4.2 shows a uniform metre rule, of weight 1.0 N, being suspended freely by a thread at the 70 cm mark. It is balanced by an unknown weight W hanging from the 80-cm mark.

Fig. 4.2

(i) Determine the moment due to the weight of the metre rule about the 70 cm mark.

moment = …….Ncm [3]

(ii) Hence, determine the magnitude of the unknown weight W.

magnitude of W = …….N [2]

5 Fig. 5.1 (not to scale) shows a man making a bungee jump.

The man starts his jump from a platform 60 m above a river. From the platform to point A, the man falls freely. At point A, the elastic rope tied to the man's feet becomes taut.
From point A to point B, the man decelerates as he falls.
The lowest point the man reaches is point B, which is 4.0 m above the surface of the river.

The mass of the man is 80 kg.

The gravitational field strength is 10 N/kg.

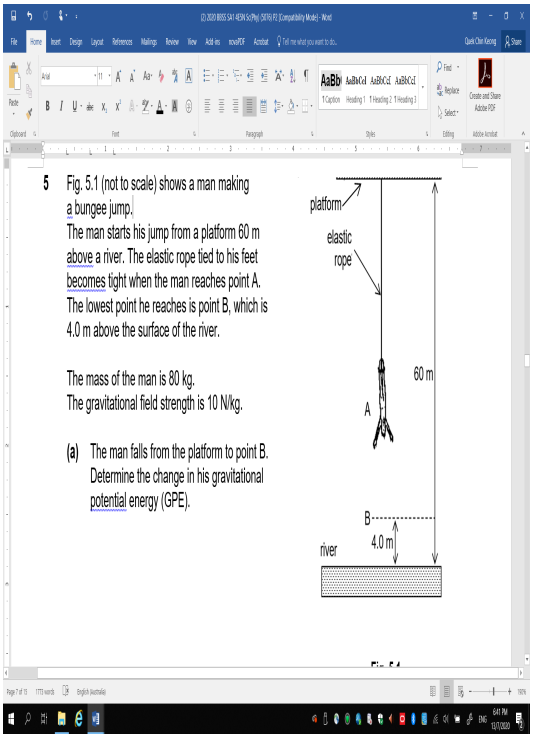


Fig. 5.1

(a) Determine the change in the man's gravitational potential energy (GPE) when he falls from the platform to point B.

change in GPE = ……J [2]

(b) The maximum kinetic energy of the man is 23 kJ.
Calculate his maximum speed.

maximum speed = …….m/s [2]

(c) Describe the energy changes to the man and the rope as the man falls from A to B.

……..……

……..……

……..……

……..……

……..…….. [3]

6 To investigate a layer of rock underground, an explosion is made on the surface of the Earth. Fig. 6.1 shows the arrangement.

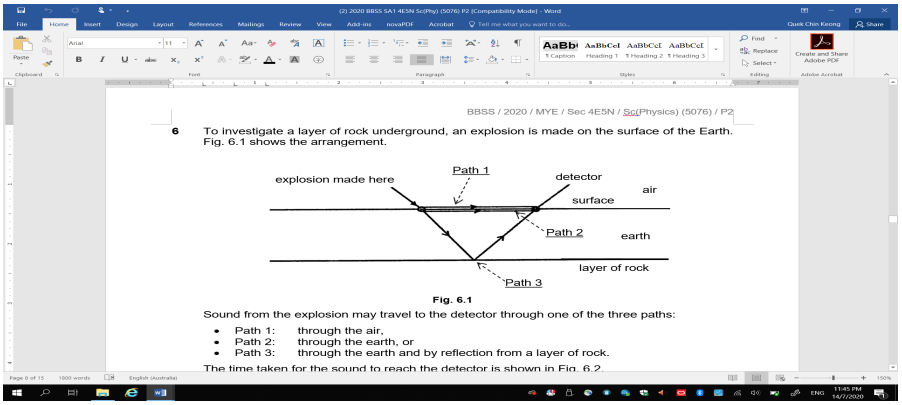


Fig. 6.1

Sound from the explosion may travel to the detector through one of the three paths:

- Path 1: through the air,
- Path 2: through the earth, or
- Path 3: through the earth and by reflection from a layer of rock.

The time taken for the sound to reach the detector is shown in Fig. 6.2.

	Path 1	Path 2	Path 3
time taken for sound to travel from source to detector / s	0.100	0.020	0.300

Fig. 6.2

(a) Explain how sound energy is transferred through the air without transferring matter.

……...

……...

…… [2]

(b) The distance travelled by sound in Paths 1 and 2 is the same. However, sound arrives first at the detector along Path 2. Explain why this is so.

…… [1]

(c) Given that the speed of sound in air is 300 m/s,

(i) calculate the distance between the explosion and the detector.

distance = ……m [2]

(ii) Hence, determine the speed of sound in earth.

speed = …….m/s [1]

7 A plastic ball, initially uncharged, is hung freely by a thread. It is then rubbed with wool and becomes positively charged.

(a) Explain, in terms of movement of charges between the ball and the wool, why the plastic ball becomes positively charged.

……...

…… [1]

(b) A negatively charged ball is brought near, but not touching, the plastic ball, as shown in Fig 7.1 below.
Draw the electric field that exists between the two balls. [3]

Fig. 7.1

Section B

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

8 **(a)** Fig. 8.1 shows the side view of two cans A and B.
Both cans are made from the same type of metal and are identical in size.
However, can A has a shiny silver exterior while can B has a dull black exterior.
Both cans are filled with equal mass of water with the same initial temperature.

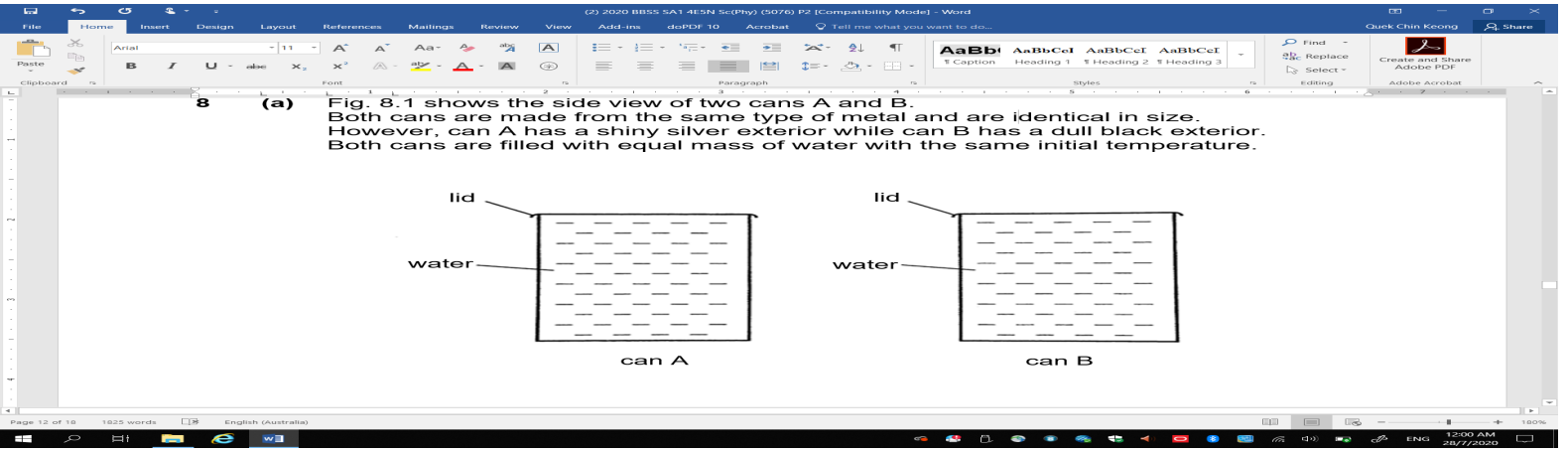


Fig. 8.1

(i) Fig. 8.2 shows the graph of temperature against time for the volume of water in can A.

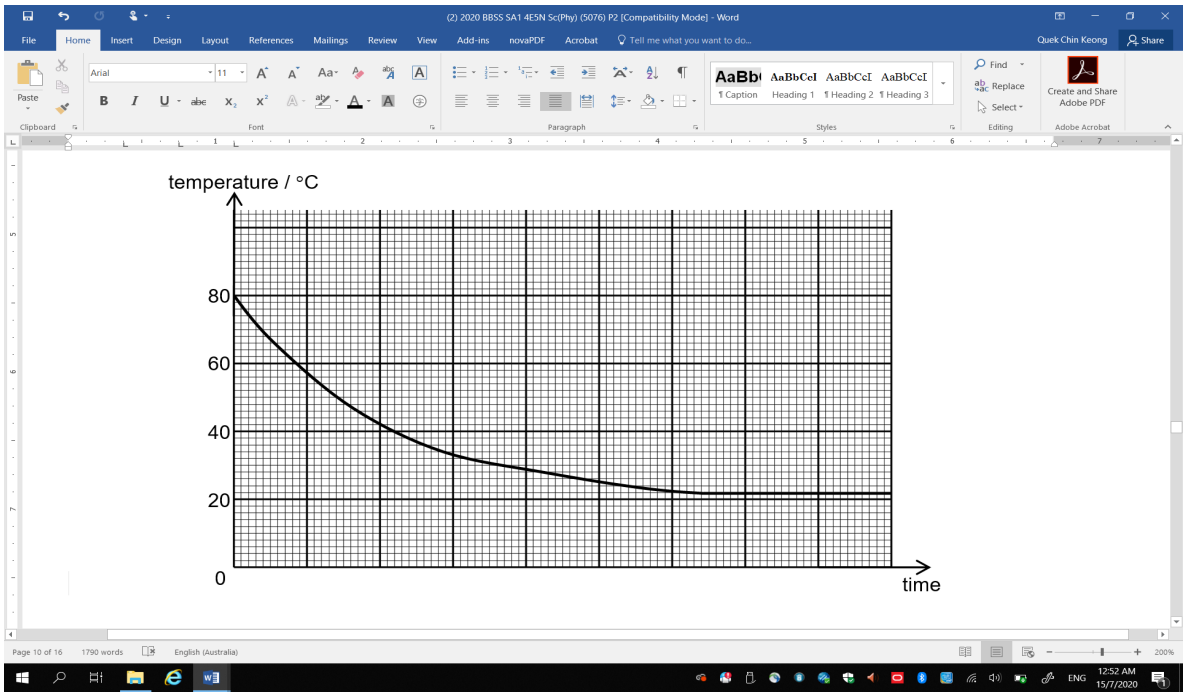


Fig. 8.2

1 State the initial temperature of the water in can B.

initial temperature = ... [1]

2 On Fig. 8.2, sketch the graph of temperature against time for the volume of water in can B. [2]

(ii) Infra-red radiation is a component of the electromagnetic spectrum.

State another component of the electromagnetic spectrum that has a lower frequency than infra-red radiation.

..... [1]

8 **(b)** Amy purchased a hot-water tank with an electric heater, as shown in Fig. 8.3.
At this moment, no water enters or leaves the tank.

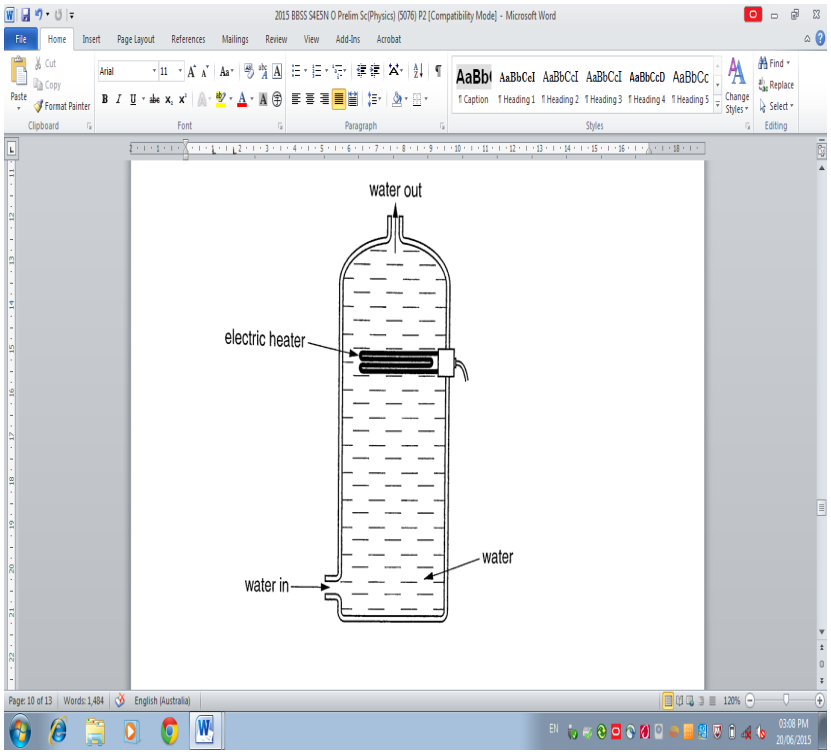


Fig. 8.3

(i) Describe the main process by which the water above the heater becomes warm.

.....

.....

.....

.....

.....

..... [3]

(ii) Will the water below the heater be heated up?
Explain your choice of answer in terms of the arrangement and motion of water molecules.

……

……

……

…… [2]

(iii) John has a similar hot-water tank as Amy's but the heater of his tank is at the bottom of the tank.
Suggest one disadvantage of this arrangement.

……

…… [1]

9 **(a)** Fig. 9.1 (not to scale) shows a ray of light travelling from air into glass. The incident ray makes an angle of 50° with the air-glass boundary. Some of the light is reflected at the glass surface but mostly passes into the glass and is refracted. The refracted ray makes an angle of 65° with the air-glass boundary.

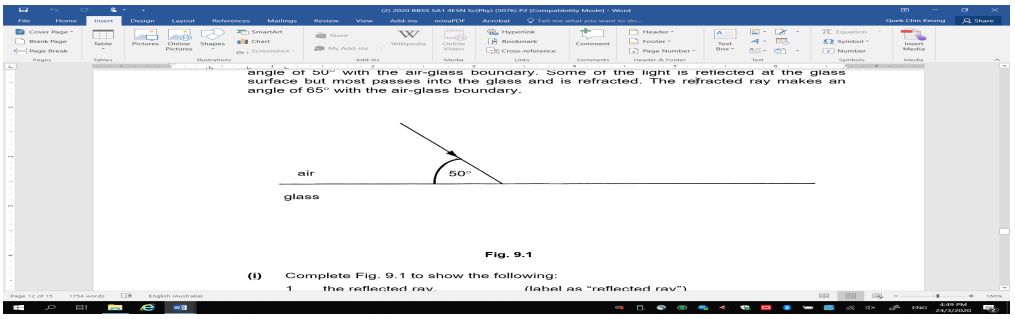


Fig. 9.1 (not to scale)

(i) Complete Fig. 9.1 to show the following:

1	the reflected ray,	(label as “reflected ray”)
2	the refracted ray,	(label as “refracted ray”)
3	angle of incidence, and	(label as “angle i”)
4	angle of refraction.	(label as “angle r”) [2]

(ii) Determine a value for the refractive index of the glass.
Express your answer to 2 significant figures.

refractive index = ... [2]

(iii) Hence, determine the speed of light in glass. You may assume that the speed of light in air to be equal to the speed of light in vacuum.

speed of light in glass = ……. [2]

(b) In the arrangement shown in Fig. 9.1, it is not possible for total internal reflection to occur, whatever the angle of incidence.

(i) Explain why total internal reflection cannot occur.

……

…….. [1]

(ii) Define what is meant by critical angle.

……

……

……

…….. [1]

(iii) Determine a value of the critical angle of the glass.
Express your answer to 2 significant figures.

critical angle = ……. [2]

10 Fig. 10.1 below shows an electrical circuit containing two resistors, a switch S and a 240 V d.c. power supply.

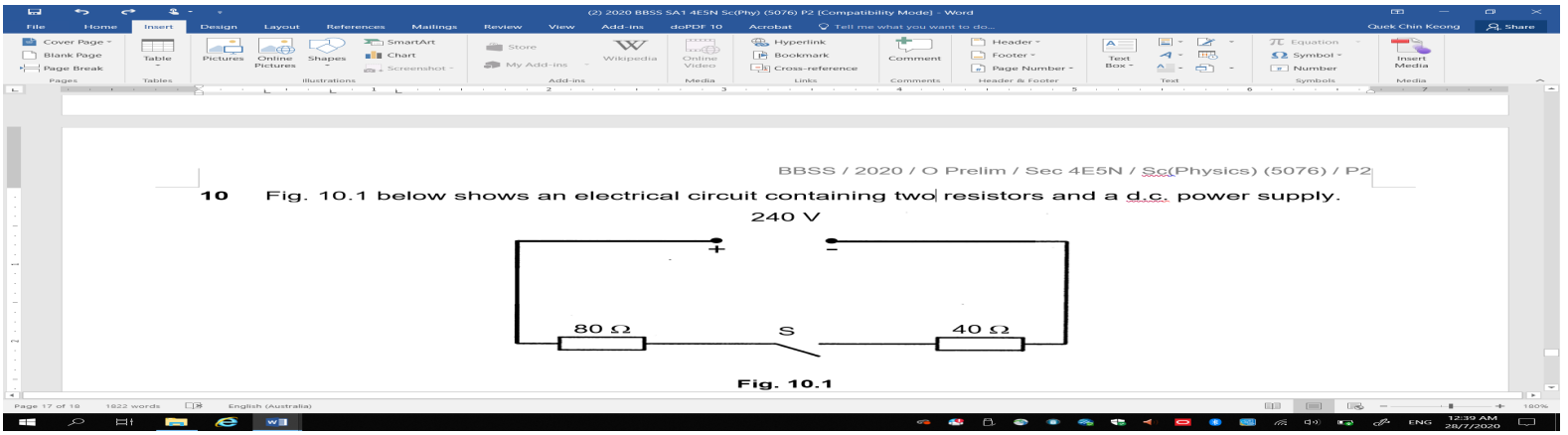


Fig. 10.1

(a) What is meant by the statement "the electromotive force of the power supply is 240 V"?

……...

…… [2]

(b) When switch S is open, the ammeter reading is zero.

State the value of the potential difference across switch S.

potential difference = …… [1]

(c) Switch S is now closed.

(i) Determine the current through the 40 Ω resistor.

current = …… [2]

(ii) Determine the potential difference across the 80 Ω resistor.

potential difference = …… [1]

(iii) What is the power dissipated by the power supply?

power dissipated = ……. [2]

(d) The 80 Ω resistor needs to be replaced and switch S is opened before the replacement is done.

(i) Explain why it is still dangerous to replace the resistor even though the circuit is now opened.

……

…….. [1]

(ii) Mark with an **X** on Fig. 10.1 a safe position for switch S so that both resistors could be replaced safely. [1]

*** END OF PAPER ***