

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Answer **all** questions in Section A and any **two** questions in Section B.
Enter the numbers of the Section B questions you have answered on the dotted lines in the grid below.

The number of marks is given in brackets [] at the end of each question or part question.

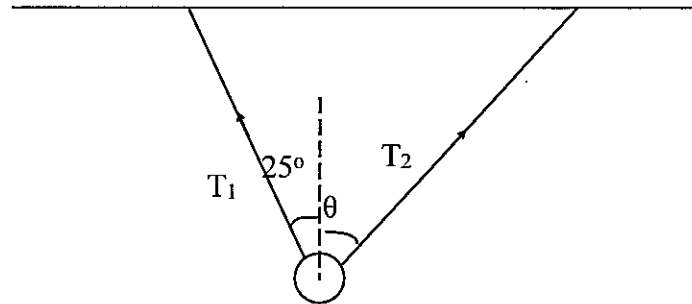
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|-----------|--------------------|
| Section A | |
| Section B | |
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| Total | |

Section A [45 marks]

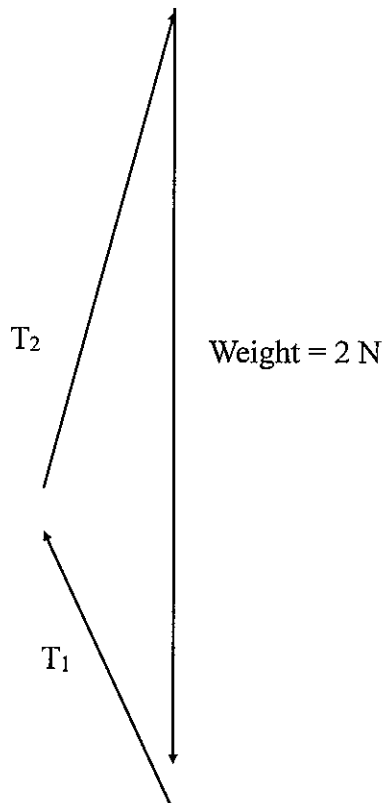
Answer **all** questions.

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

- 1 A 200 g ball is hung stationary by two strings as shown. Assume the acceleration due to gravity to be 10 m/s^2 .



Using an appropriate scale diagram, determine the tension of T_2 and θ if T_1 is 0.8 N
[4]



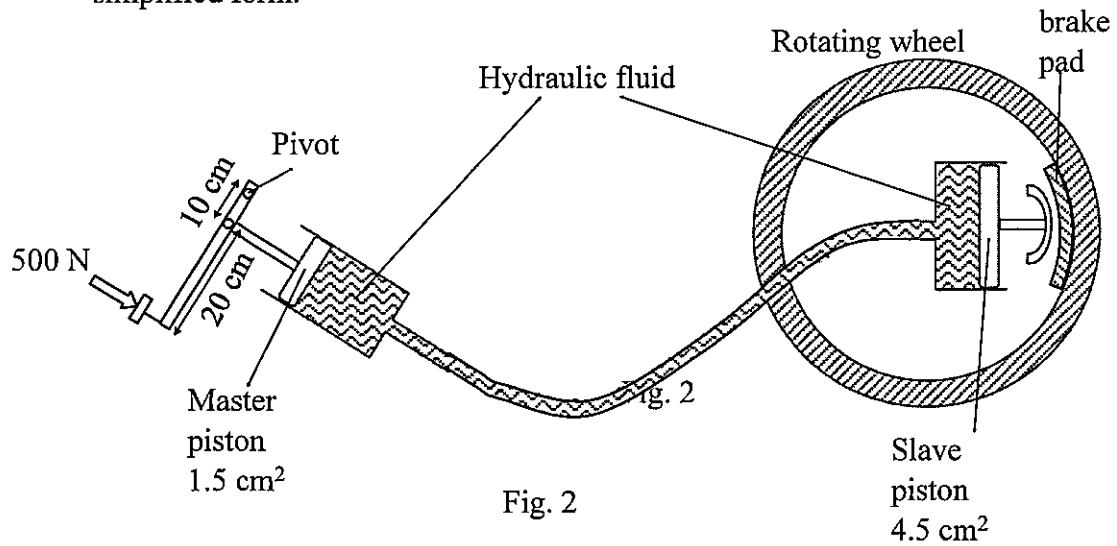
Correct $\theta = 15^\circ$ [1]

Tension = 1.7 N [1]

Correct diagram [1]

Correct scale used [1]

- 2 Fig. 2 shows the essential features of a vehicle's hydraulic braking system but in a simplified form.



- (a) Calculate the force exerted on the master piston when the driver exerts a force of 500 N on the brake pedal. [2]

By principle of moment,

$$500 (0.3) = F (0.1) \quad [1]$$

$$F = 1500 \text{ N} \quad [1]$$

- (b) If the area of the master piston is 1.5 cm^2 , calculate the pressure exerted on the fluid in Pascal. [2]

$$\text{Pressure} = F / A \quad [1]$$

$$= 1500 / 1.5 \times 0.01 \times 0.01$$

$$= 1\,000\,000 \text{ Pa} \quad [1] \quad \text{with 3 sif.}$$

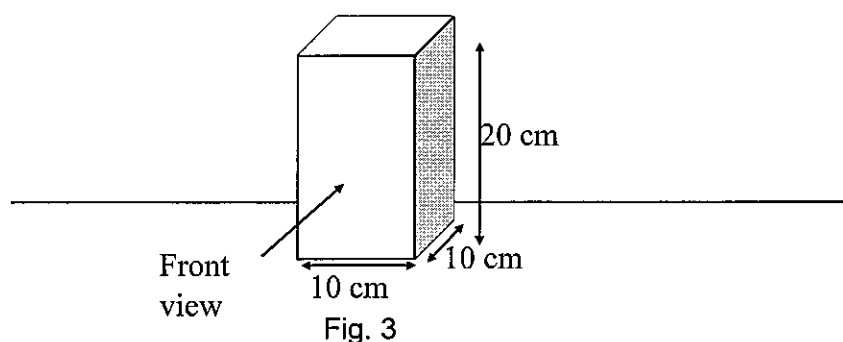
- (c) If the area of the slave piston is 4.5 cm^2 , calculate the force on the brake pad. [2]

$$\text{Pressure at master piston} = \text{Pressure at slave piston} \quad [1]$$

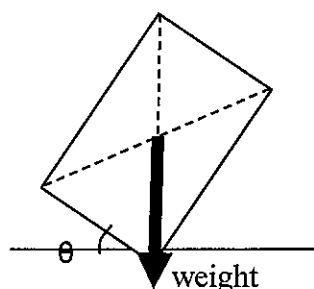
$$1\,000\,000 = F / 4.5 \times 0.01 \times 0.01$$

$$F = 4\,500 \text{ N} \quad [1]$$

- 3 Fig. 3 shows a uniform block of dimensions 10.0 cm x 10.0 cm x 20.0 cm resting on a horizontal surface. The block is tilted about its right edge by a force until it topples.



- (a) In the space provided, draw the front view of the block when it is about to topple. Indicate clearly the line of action of the weight of the block. [2]



- (b) Calculate the minimum angle θ at which the block must be tilted before it topples. [2]

$$\begin{aligned}\tan (90^{\circ} - \theta) &= 20 / 10 \\ \theta &= 26.6^{\circ}\end{aligned}$$

- (c) The block in Fig. 3 is replaced by another uniform block of identical dimensions, but made of a denser material.

Explain why a large moment is now needed to tilt the block. [2]

When the block is made of a denser material and with identical dimensions, the

 location of c.g. does not change. However the magnitude of the weight changes and
 thus it requires a higher moment to topple it

- 4 Fig. 4 shows an object (O) placed in front of a thin converging lens. The positions of the focal points are marked F.

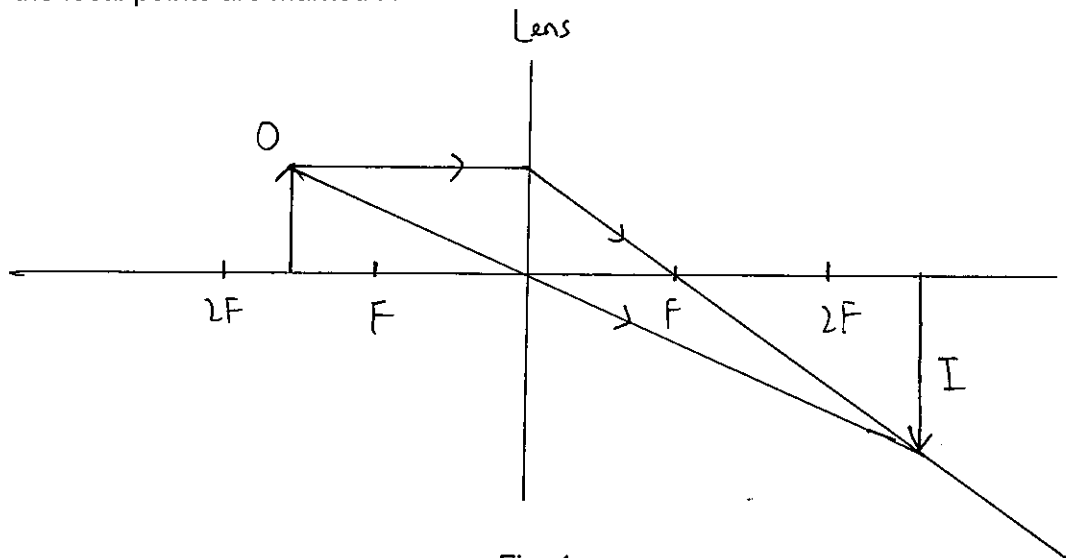


Fig. 4

- (i) On Fig. 4, draw two light rays from the object to obtain the position of the image. Label the image "I". [3]
- (ii) If the distance of the object from the lens is reduced to be less than the focal length, state two characteristics of the image. [2]

It will be virtual / magnified / upright (Any two)

- 5 One end of a copper bar and one end of an iron bar of the same size were placed side by side in a fire.

- (a) The heated end of the iron bar became red hot. The heated end of the copper bar did not become red hot.
What can be deduced from these observations?

Copper bar is a better conductor [1] than iron bar as it enables heat to transmit

through the bar instead of consolidating the heat at the heated end. [1] [2]

- (b) Which rod could be removed by hand with less risk of being burnt? Explain your answer.

Iron bar as it is a poorer conductor [1] than copper bar thus the other end

which is not heated, receive lesser heat than the heated end. [1] [2]

6 State two differences between boiling and evaporation.

[2]

Boiling takes a shorter time, observe bubbles, occurs throughout liq, at fixed temp.

Evaporation slower, no bubbles observed, occurs at surface, any temp. (any 2)

7 Fig. 7.1 shows a part of a device called a gold leaf electroscope. The plate, rod and leaf are all made of metal. Fig. 7.2 shows what happens to the gold leaf when a positively charged strip is held close to the plate.

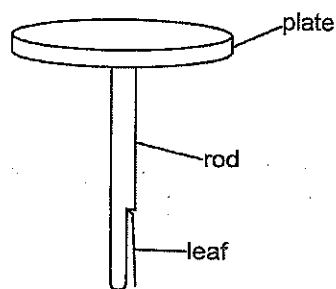


Fig. 7.1

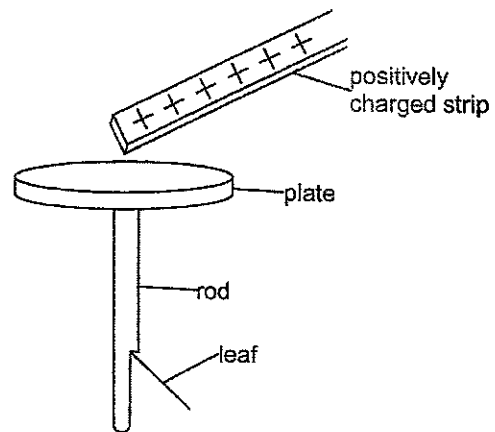


Fig. 7.2

Explain why the leaf moves away from the rod when the positively charged strip is held near the plate. [3]

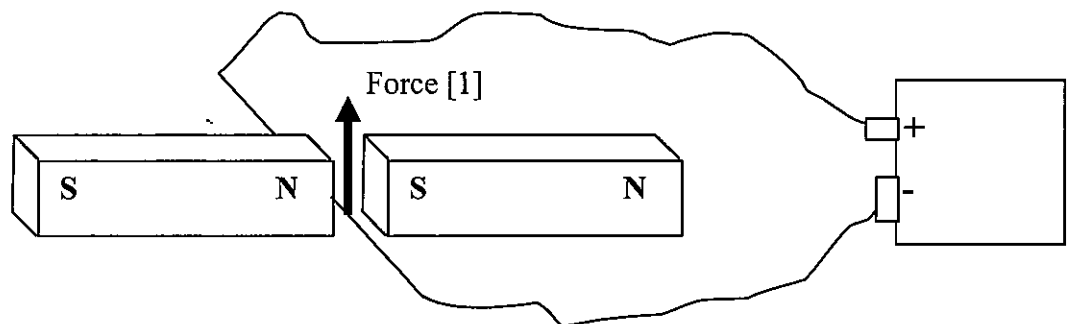
As the strip is brought near the plate, there is a separation of charges in the plate. [1]

Electrons will be attracted to the plate leaving behind the positive charges on the rod [1]

and the leaf. As both the rod and leaf shares the same charges, the rod and leaf repel

repel each other as like charges repel. [1]

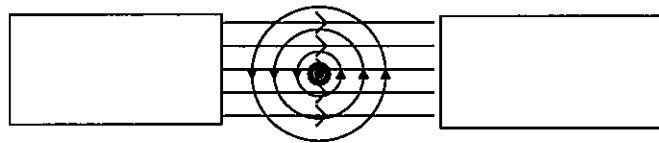
- 8 A current carrying wire is placed between 2 permanent magnets.



- (a) On the diagram above, indicate the direction of force acting on the wire. [1]

- (b) Draw a *separate* diagram of magnetic field lines to explain why the wire experiences the force. [2]

From the front view, both the magnet and the wire carries magnetic field



There's a reinforcement of magnetic field at the bottom of wire while cancel

- (c) The magnet on the left is removed. Does the wire still experience a force? Explain. [2]
 yes,[1] the magnet on the right still provide the magnetic field [1]

- 9 Fig. 9.1 shows three resistors connected to a battery.

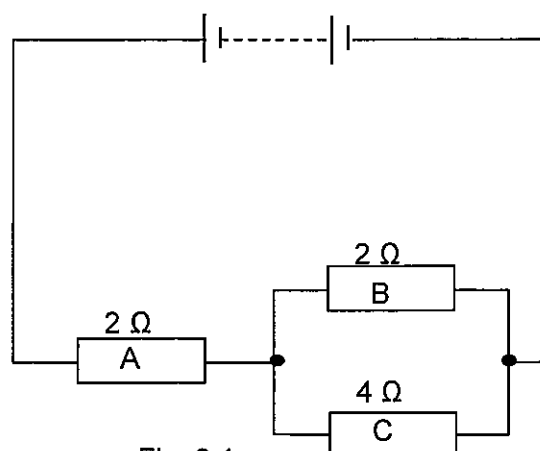


Fig. 9.1

A current of 3A flows through the resistor A.

- (a) Calculate the charge flowing through resistor A in one minute. [2]

$$\begin{aligned} Q &= I \times t \quad [1] \\ &= 3 \times 60 \\ &= 180 \text{ C} \quad [1] \text{ with correct unit} \end{aligned}$$

- (b) Calculate the combined resistance of the parallel connection of B and C. [2]

$$\begin{aligned} 1/R &= 1/R_1 + 1/R_2 \quad [1] \\ 1/R &= 1/4 + 1/2 \\ R &= 1.33 \quad [1] \end{aligned}$$

- (c) Calculate the combined resistance of all the three resistors. [1]

$$\text{Therefore combined resistance} = 3.33 \, \Omega \quad [1]$$

- (d) Calculate the potential difference across the battery. [2]

$$\begin{aligned} V &= I \times R \quad [1] \\ &= 3 \times 3.33 \\ &= 10 \text{ V} \quad [1] \end{aligned}$$

- (e) Determine the current flowing through B. [3]

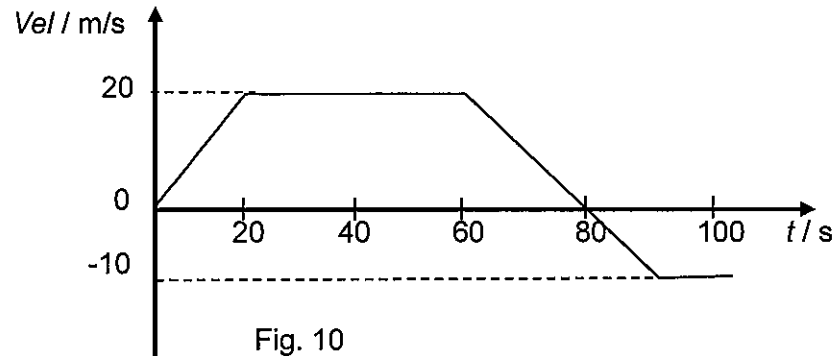
$$\begin{aligned} \text{Voltage across } 2\Omega &= 3 \times 2 = 6 \text{ V} \quad [1] \\ \text{Therefore voltage across B is } &10 - 6 = 4 \text{ V} \quad [1] \\ \text{Current through B} &= 4/2 = 2 \text{ A} \quad [1] \end{aligned}$$

Section B [20 marks]

Answer **TWO** questions.

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

- 10 A car starts from rest and travels along a straight line. Fig. 10 below shows the velocity time graph of the car from 0 s to 90 s.



- (a) Describe the motion of the car from 0 s to 90 s. [3]

In the first 20s, the car is traveling at an acceleration of 1m/s^2 . [1]

The car remains at 20m/s for the next 40 s (20 s to 60s). [1]

The car then decelerate at 1m/s^2 for the next 30 s [1]

.....

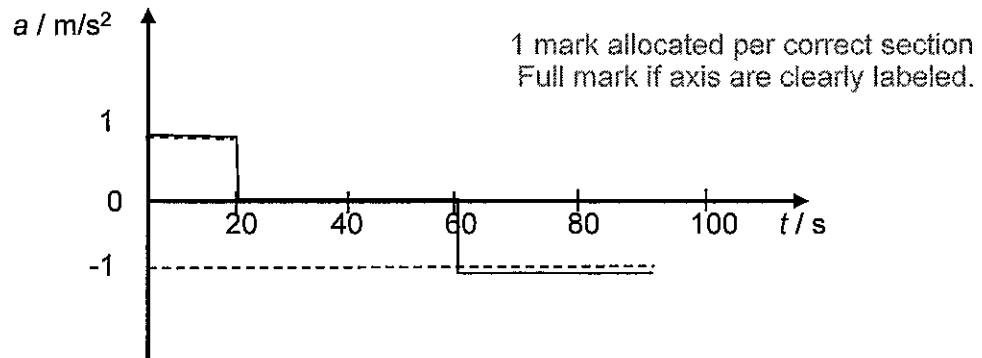
- (b) Find the average velocity of the car in the first 70 s. [2]

Average velocity = Total Dist/ Total Time

$$\text{Total dist.} = \frac{1}{2} (40+80) (20) - \frac{1}{2} (10) (10) = 1150 \text{ m [1]}$$

$$\text{Average velocity} = 1150 / 70 = 16.4 \text{ m/s [1]}$$

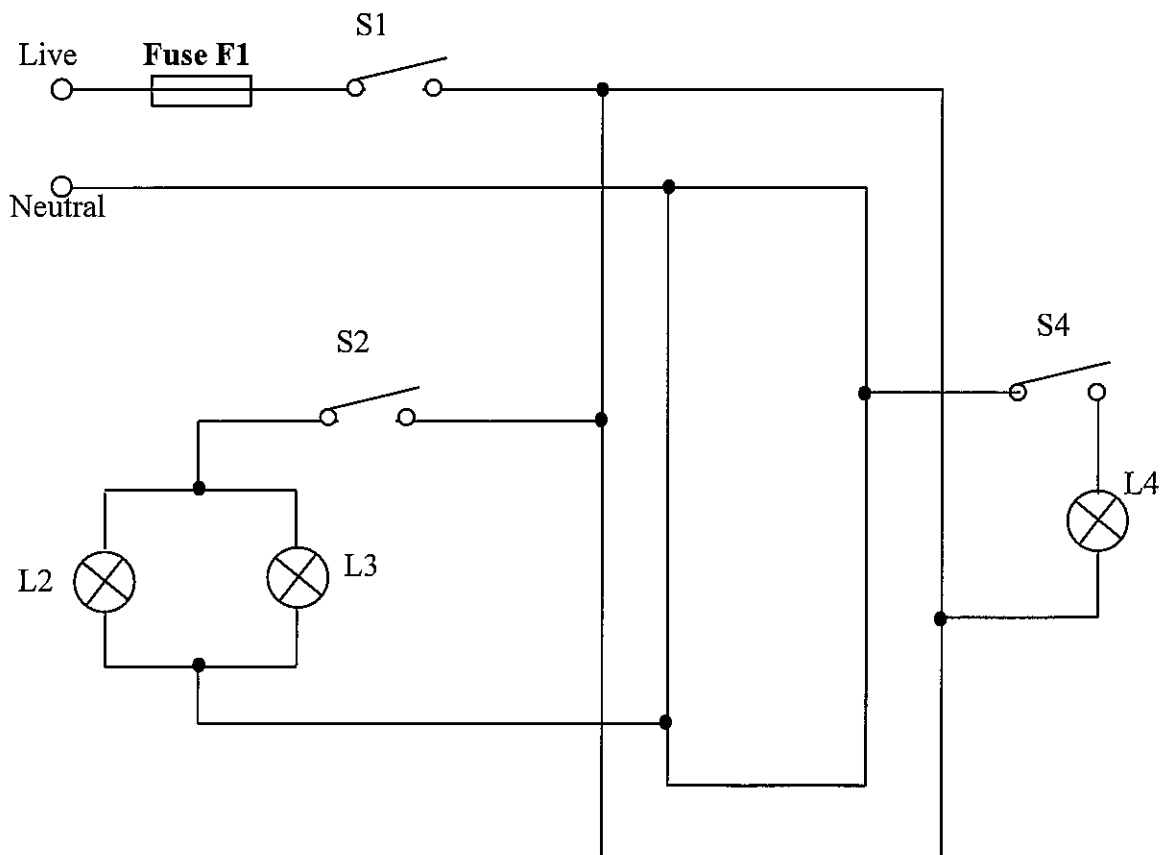
- (c) Draw the acceleration time graph of the car from 0 s to 90 s.
[3]



- (d) Find the work done by the car from the starting point to the position at 70 s if the force provided by the engine is 100 N. [2]

$$\text{Work done} = \text{Force} \times \text{distance} = 100 \times 1150 = 115\,000 \text{ J} \quad [2]$$

- 11 A diagram of electrical wiring of a house is as shown.



- (a) State why lamp L4 is wrongly connected. [1]

The switch is wrongly connected to the neutral wire.

... It should be connected to the live wire. [1]

- (b) The potential difference between the Live wire and Neutral wires is 240V. All lamps are rated 240V, 50 W. Calculate the current through the fuse when [3]

- (i) only S1 is closed

0 A

- (ii) only S1 and S4 are closed

$$I = P / V = 50 / 240 = 0.208 \text{ A}$$

- (iii) all switches are closed

$$3 \times 0.208 = 0.625 \text{ A}$$

- (c) What is the purpose of the fuse? How does the fuse ensure safety? [2]

The fuse is to prevent supply of current that exceed allowable.[1] It allows to
do so as it breaks the circuit when the current exceed by melting its thin wire
inside the fuse thus prevent fire and damage to device. [1]

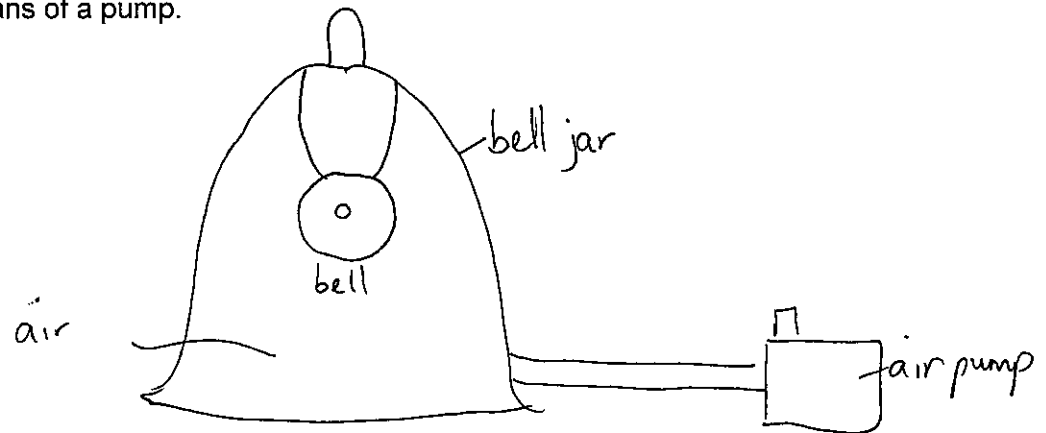
- (d) Explain why switch and fuse should not be placed on the Neutral Wire. [2]

Neutral wire is at 0 V ; LIVE Wire is at 240 V . In order to safely isolate the device
from High voltage, switch and fuse must be at the LIVE wire.

- (e) Calculate the amount of heat generated in a $10.0\ \Omega$ resistor when 2.00 A current passes through it for 2.00 minute. [2]

$$\begin{aligned}
 E &= P \times t \\
 &= I V \times t \\
 &= I^2 \times R \times t \quad [1] \\
 &= (2 \times 2) \times 10 \times 2 \times 60 \\
 &= 4800\ \text{J} \quad [1]
 \end{aligned}$$

- 12 (a) An electric bell is suspended by thin connecting wires inside a bell jar, as shown. The bell is set ringing, and air is then extracted from the bell jar by means of a pump.



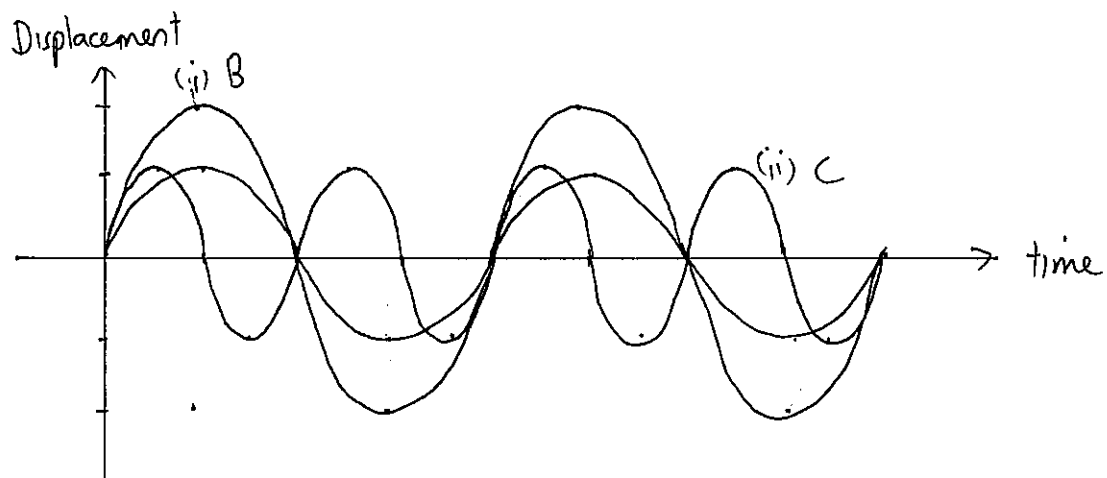
- (i) What would be observed as the air is gradually removed? [2]

The bell ringing gets softer until there is no more sound when all the air has been removed.

- (ii) What can be deduced from this experiment? [1]

Sound needs a medium, in this case air particles to transmit energy.

- (b) The pressure variations in a sound wave are illustrated in the diagram below.



- (i) Add a second wave that shows the pressure variations of a louder sound of the same pitch. Label this wave B.
 (ii) Add a third wave that shows the pressure variations of a sound of higher pitch but of the same loudness. Label this curve C.

- 12 (c) A rectangular block, A, has mass 12 kg and dimensions measuring 0.5m by 0.2m by 1.2m.

The pressure that block A exerts on the ground will vary depending on how it is placed on the ground.

- (i) Calculate the maximum pressure that the block exerts on the ground. [2]

$$P = F/A = 120 / (0.2 \times 0.5) = 1200 \text{ Pa}$$

- (ii) Calculate the minimum pressure that the block exerts on the ground. [1]

$$P = F/A = 120 / (1.2 \times 0.5) = 200 \text{ Pa}$$

- (d) Explain in terms of pressure why the teeth of the lion is sharper than that of the goat. [2]

The area of contact for the lion's teeth with food is lesser, thus allowing it to chew and eat with greater pressure on the food with the same force applied.

~~~ END OF PAPER ~~~