

NAME: MARKIN K. SCHEMG INDEX NO:

CANDIDATE'S SIGN: DATE:

(THEORY)

232/1

PHYSICS

PAPER 1

AUG/SEPT, 2022

TIME: 2 HOURS

LONDIANI SUB-COUNTY JOINT EXAMINATIONS 2022

INSTRUCTIONS TO THE CANDIDATE:

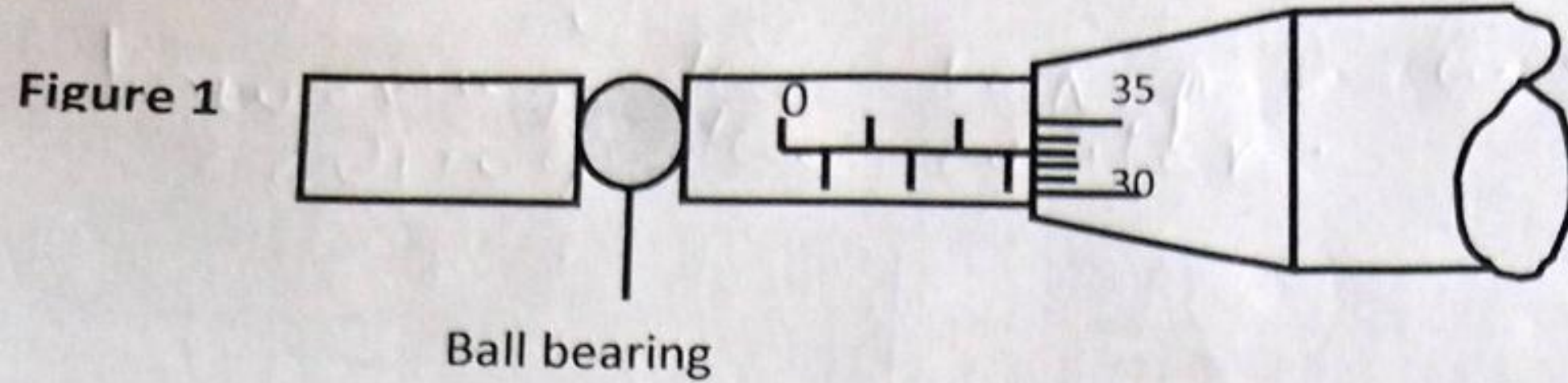
- (a) Write your **name** and **index number** in the spaces provided above.
- (b) **Sign** and write the **date** of examination in the spaces provided above.
- (c) This paper consists of **two** Sections **A** and **B**.
- (d) There are 14 printed pages, with 18 questions check to confirm that your paper is complete.
- (e) Answer **all** the questions in sections **A** and **B** in the spaces provided.
- (f) All working **must** be clearly shown in the spaces provided.
- (g) Mathematical tables and electronic calculators **may be** used.

FOR EXAMINER'S USE ONLY:

Section	Question	Maximum Score	Candidate's Score
A	1 – 12	25	
B	13	08	
	14	10	
	15	09	
	16	07	
	17	12	
	18	09	
Total Score		80	

SECTION A: (25 MARKS)

1. A ball bearing is held between the anvil and spindle of a micrometer screw gauge as shown in the **Figure 1** below.



What is the diameter of the ball bearing?

(1 mark)

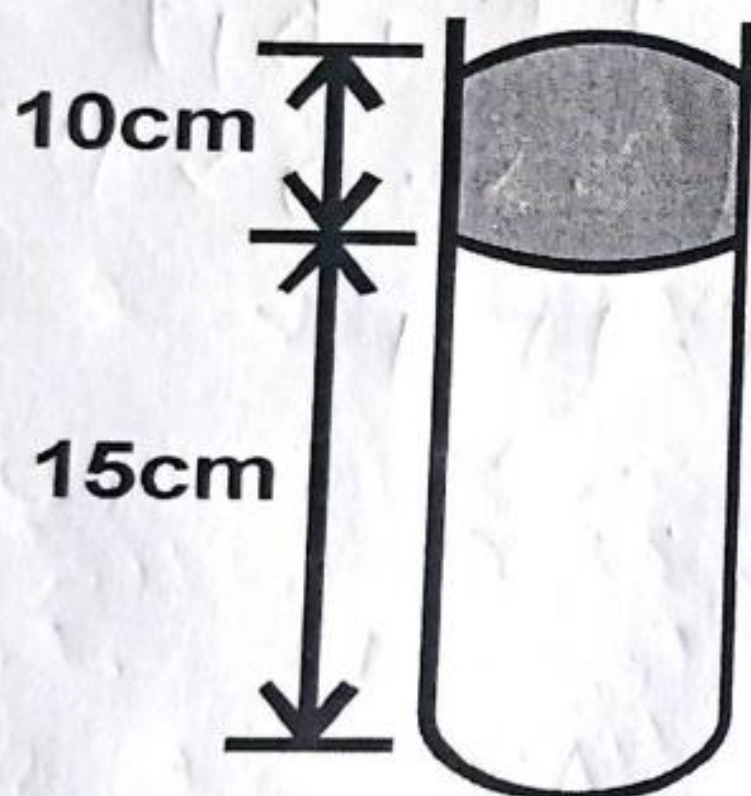
$$\begin{array}{r} 2.50 \\ + 0.33 \\ \hline 2.83 \text{ mm} \end{array}$$

2. State two properties of a liquid that is suitable for use in a thermometer. (2marks)

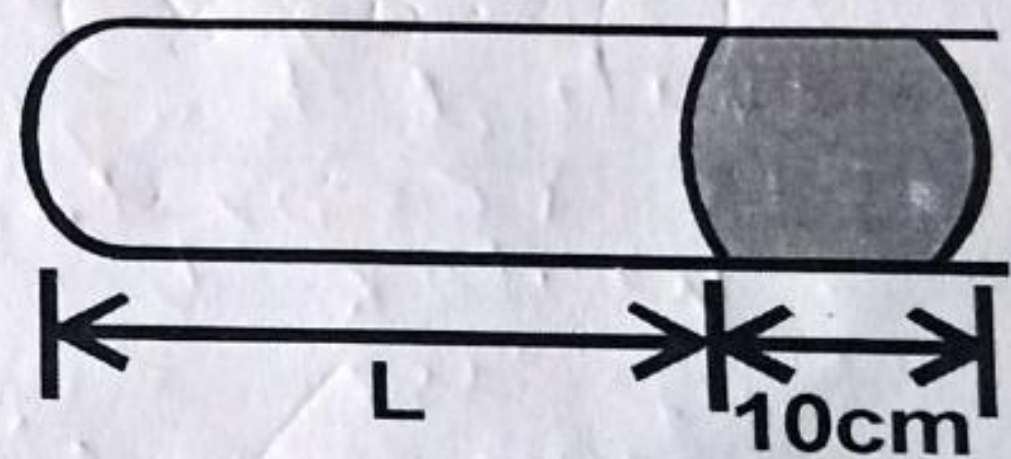
- Does not wet the glass. ✓
 - Has a wide range of temperature
 - Expand and contract uniformly ✓
- any two correct*

3. A column of air 15cm is trapped by mercury thread of 10cm as shown below. Calculate the length of the trapped air when the tube is laid horizontally given that atmospheric pressure is 76cmHg.

(3 Marks)



(3marks)



$$P_1 V_1 = P_2 V_2$$

$$10L = 1290$$

$$L = \underline{\underline{129 \text{ cm}}}$$

$$(76 + 10) \times 15 = L \times 10$$

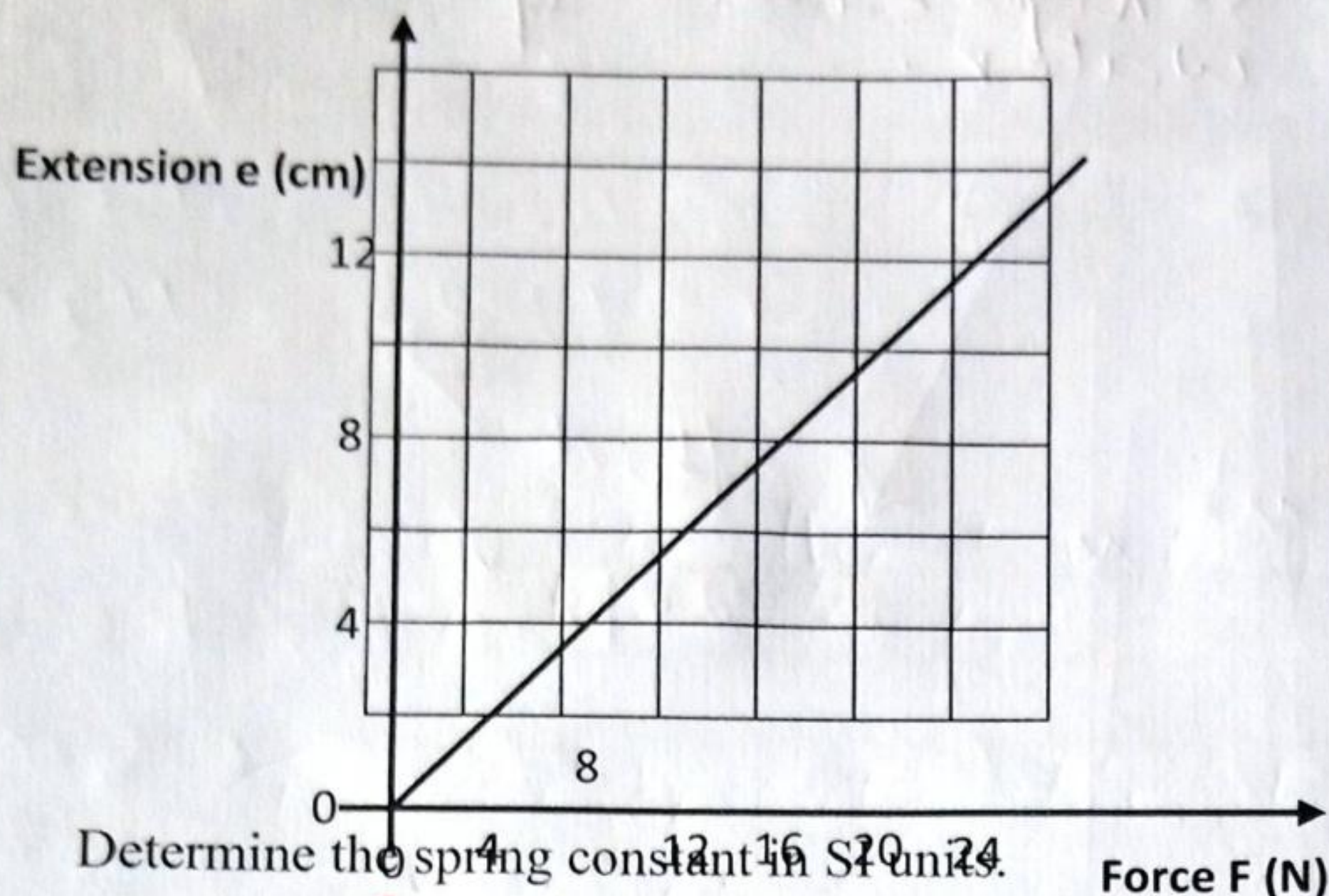
$$86 \times 15 = 10L$$

4. Why are gases more compressible while liquids and solids are almost incompressible?

(1 mark)

Gases has larger intermolecular spaces than liquid and solids

5. The graph shows variation of extension and stretching force F for a spring which obeys Hooke's law.



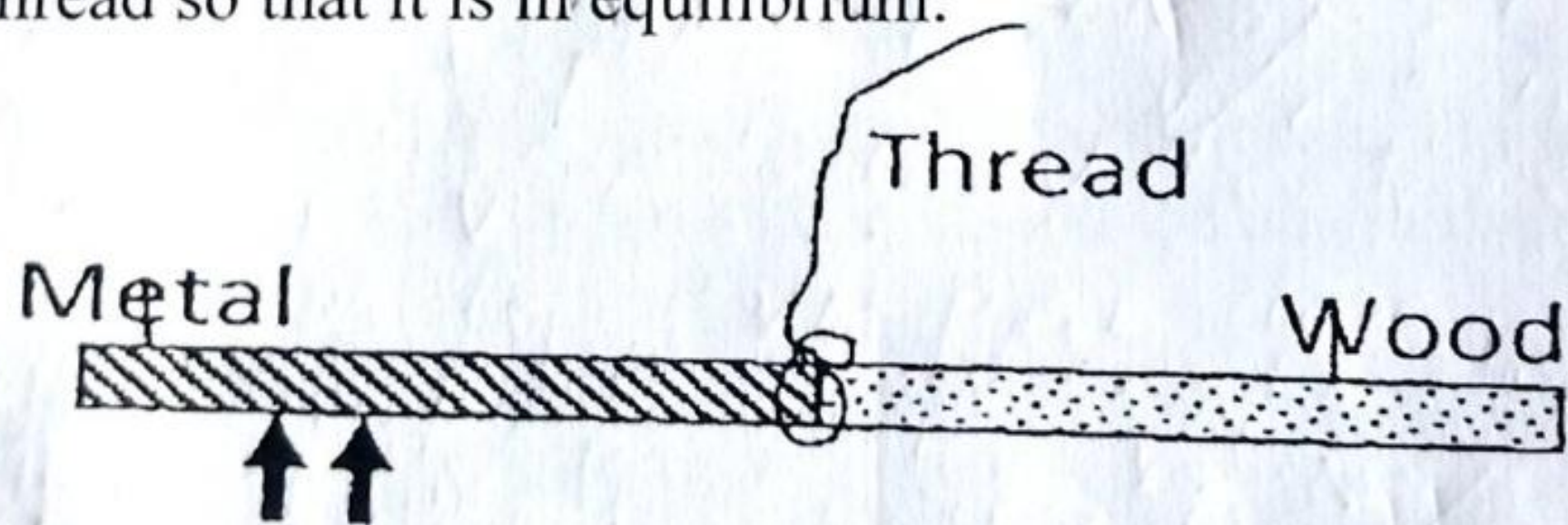
(i) Determine the spring constant in N m^{-1} . (1 mark)

$$k = \frac{F}{e} = \frac{24}{12} = 2 \text{ N/cm} = 200 \text{ N/m}$$

(ii) The energy stored when the extension is 20cm. (2 marks)

$$E = \frac{1}{2} Fe = \frac{1}{2} ke^2 = \frac{1}{2} \times 200 \times 0.2 = 4 \text{ J}$$

6. The figure 2 below shows a rod made of wood on one end and metal on the other end suspended freely with a piece of thread so that it is in equilibrium.



Heat

The side made of metal is now heated with a Bunsen flame. State with a reason, the side to which the rod is likely to tilt. (2 marks)

It tilts in anticlockwise direction
 When the metal was heated, it expanded
 hence the position of C.O.G.

7. State one factor that would increase the surface tension of pure water in a beaker of water. (1 mark)

- lowering the temperature of water or cooling the water.

8. The figure below (figure 3) shows a uniform metal rod balanced at its centre by different forces.

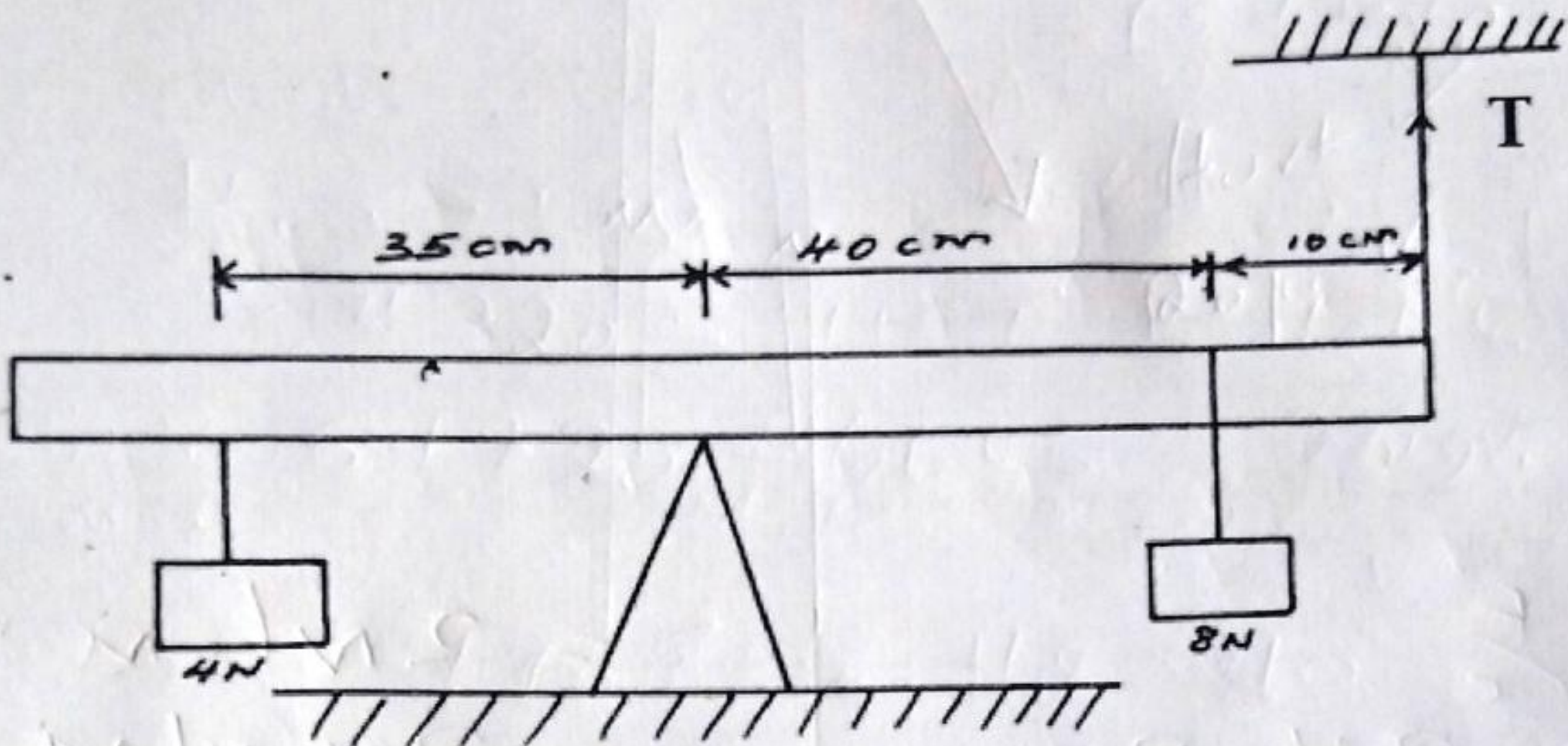


Figure 3

Determine the value of T.

value of

(3 marks)

$$F_1 d_1 + F_2 d_2 = F_3 d_3$$

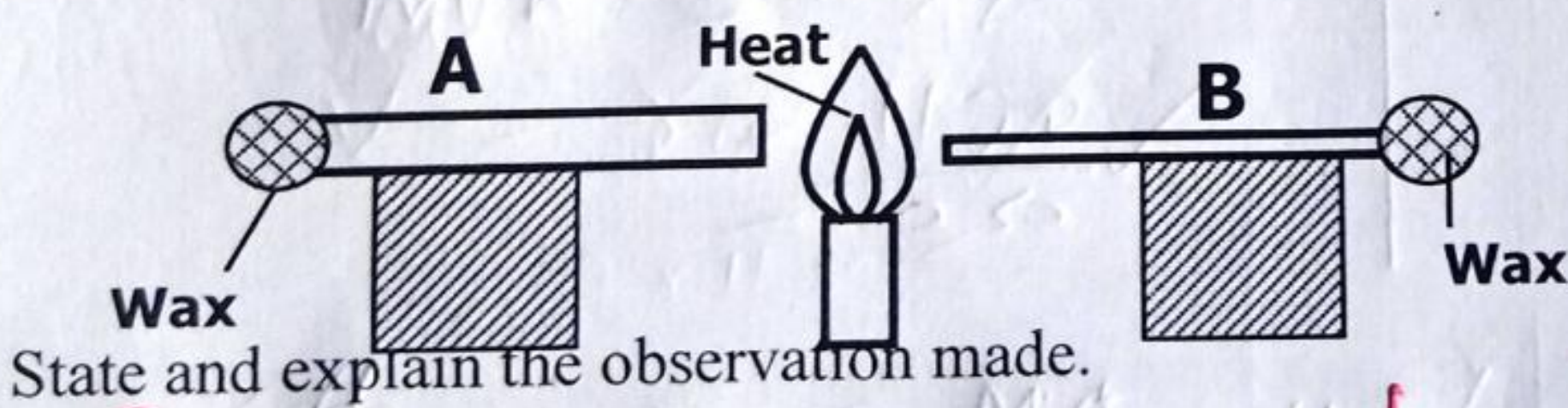
$$(4 \times 0.35) + (T \times 0.5) = (8 \times 0.4)$$

$$1.4 + 0.5T = 3.2$$

$$0.5T = 1.8$$

$$T = 3.6 \text{ N}$$

9. Two rods of copper A and B of the same length but different thickness with candle wax attached to either end are heated as shown below.



State and explain the observation made.

(2 marks)

The wax on rod A falls off first. Then the wax on rod B later. A has a greater cross-sectional area hence conducts heat faster than B.

10. Figure 4 shows a manometer attached to a gas supply. If the atmospheric pressure is $1.0336 \times 10^5 \text{ Pa}$. Calculate the pressure of the gas supply.

(Density of mercury = 13600 kg/m^3)

(2 marks)

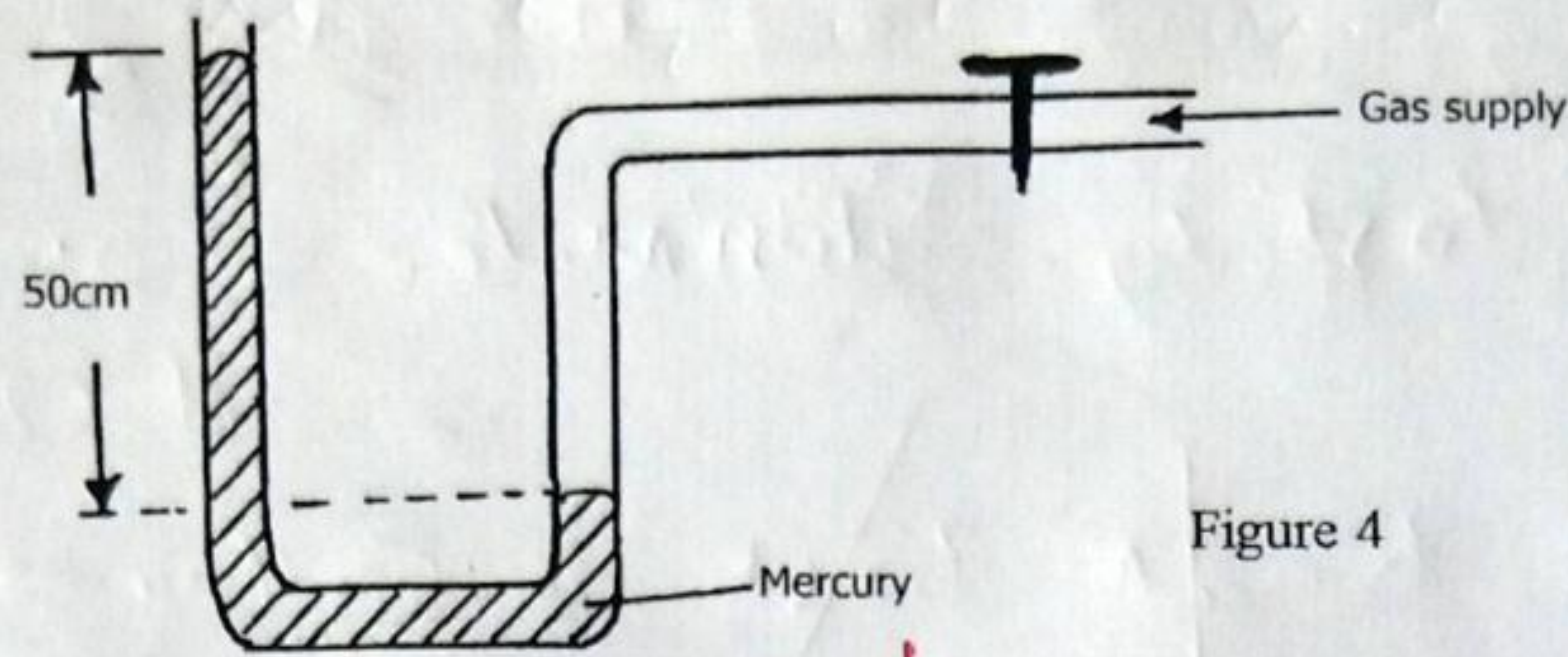


Figure 4

$$P_{atm} + P_{Hg} = P_{gas}$$

$$103360 + (0.5 \times 13600 \times 10) = P_g = \underline{\underline{171360 \text{ Pa}}}$$

$$= 103360 + 68000$$

11. A block of wood measuring 0.8m by 0.5m by 2m floats in water. 1.2m of the block is submerged.

(Density of water = 1000 kg/m^3 , $g=10 \text{ N/kg}$) Determine the weight of the water displaced.

(3 marks)

$$\text{Volume of water displaced} = 0.8 \times 0.5 \times 1.2 = 0.48 \text{ m}^3$$

$$\text{Mass} = \rho v = 1000 \times 0.48 = 480 \text{ kg}$$

$$\text{Weight} = Mg = 480 \times 10 = \underline{\underline{4800 \text{ N}}}$$

12. The figure 5 below shows two light sheets of paper arranged as shown.

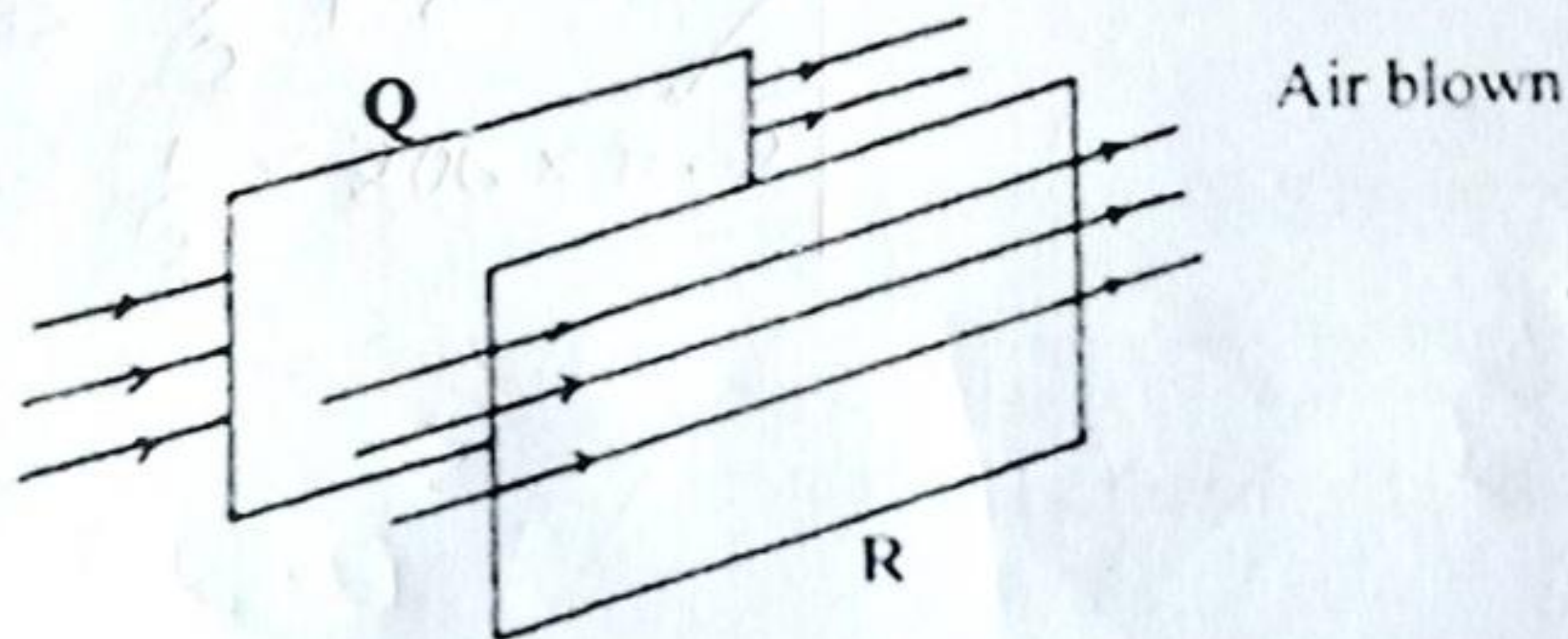


Fig. 5

It is observed that the papers move away from each other when strong air is blown at the same time behind paper Q and in front of paper R as shown. Explain (2 marks)

When air is blown, it moves at high velocity on the outer sides of the paper producing a low pressure zone. The higher atmospheric pressure between them pushes them out.

SECTION B (55 MARKS)

13. A block and tackle is made up of three pulley wheels on top and two pulley wheels at the bottom in figure 6

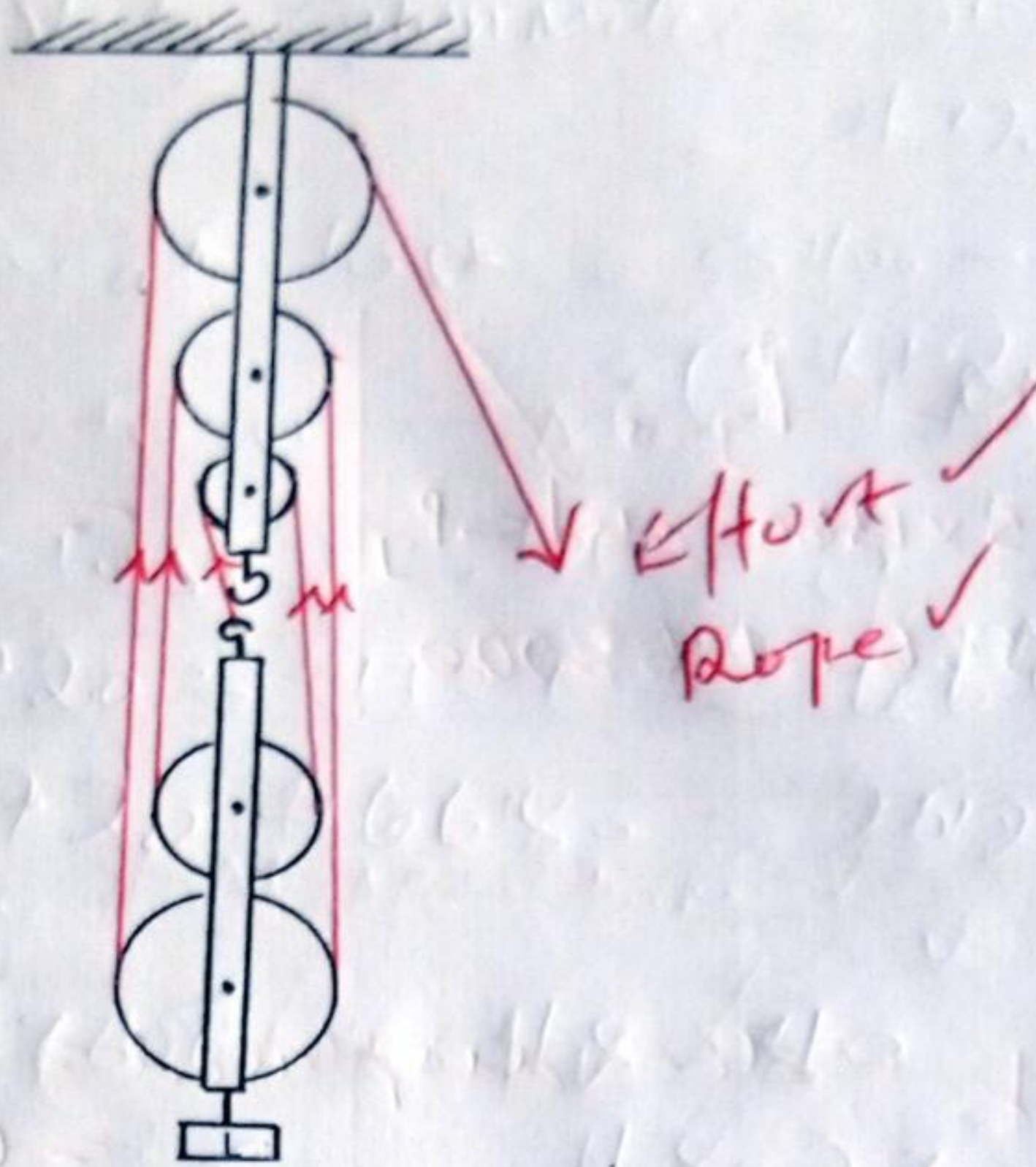


Figure 6

(a) Complete the diagram by drawing the chain which passes over the wheels and indicate where the effort is applied (2 marks)

(b) What is the velocity ratio (V.R) of the machine (1 mark)

5.

(c) A load of 1120N is lifted by an effort of 250N

Determine

(i) The mechanical advantage (M.A) of the system (2 mark)

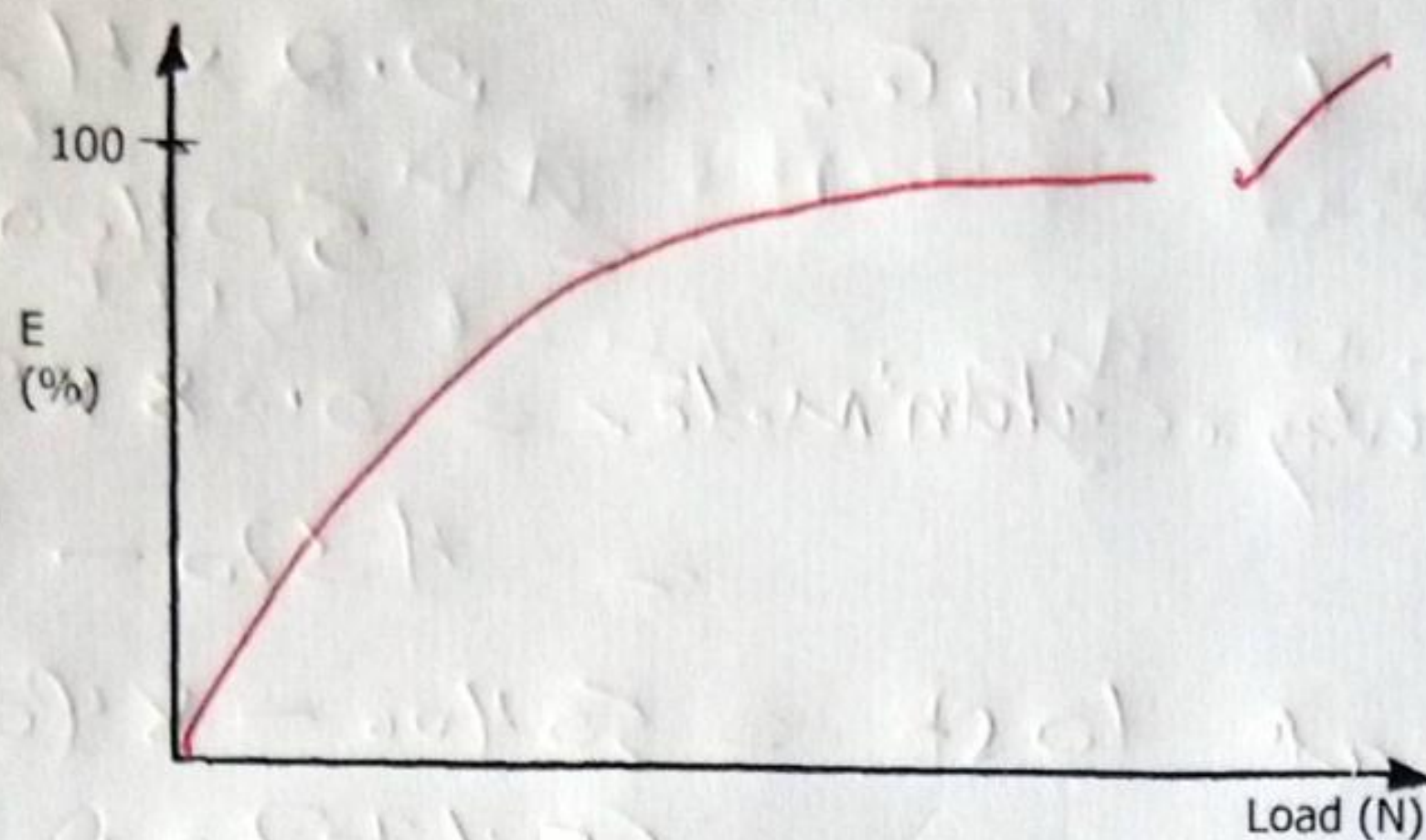
$$M.A = \frac{L}{E} = \frac{1120}{250} = 4.48$$

(ii) The efficiency, E, of the system (2 marks)

$$\text{Efficiency} = \frac{M.A}{V.R} \times 100\% = \frac{4.48}{5} \times 100\% = 89.6\%$$

(e) Using the axes given below, sketch a graph of efficiency, E, against load

(1 mark)



14. (a) What is meant by the term specific latent heat of fusion of a substance? (1 mark)

This is the quantity of heat required to change a unit mass of a substance from solid to liquid completely at a constant temperature.

(b) Water of mass 200g at a temperature of 60°C is put in a well lagged copper calorimeter of mass 80g. A piece of ice at 0°C and mass 20g is placed in the calorimeter and the mixture stirred gently until all the ice melts. The final temperature of the mixture is then measured (Latent heat of fusion of ice = 334000Jkg^{-1} , specific heat capacity of water = $4200\text{Jkg}^{-1}\text{K}^{-1}$)

Determine:

(i) The heat absorbed by the melting ice at 0°C (2 marks)

$$Q = mL_f$$
$$= 0.02 \times 334000$$
$$= \underline{\underline{6680\text{J}}}$$

(ii) The heat absorbed by the melted ice (water) to rise to temperature T (2 marks)

$$Q = mC\theta$$
$$= 0.02 \times 4200 \times T$$
$$= \underline{\underline{84T\text{J}}}$$

(iii) The heat lost by the warm water and the calorimeter (Specific heat capacity of the calorimeter = $900 \text{ J kg}^{-1} \text{ K}^{-1}$) (2 marks)

$$\text{Heat lost by water} = 0.2 \times 4200 \times (60 - T)$$

$$= 50400 - 840T$$

$$\text{Heat lost by calorimeter} = 0.08 \times 900 \times (60 - T)$$

$$= 4320 - 72T$$

$$\text{Total heat lost} = 50400 - 840T + 4320 - 72T$$

$$= (54720 - 912T) \text{ J}$$

(iv) The final temperature T of the mixture (2 marks)

$$\text{Heat lost} = \text{Heat gained}$$

$$54720 - 912T = 6680 + 84T$$

$$54720 - 6680 = 912T + 84T$$

$$996T = 48040$$

$$T = \underline{\underline{48.23^\circ \text{C}}}$$

15. A lead shot of mass 40g is tied to a string of length 70cm. It is swung vertically at 5 revolutions per second. (Take $g=10 \text{ m/s}^2$)

(a) Determine:

(i) Periodic time, (1 mark)

$$T = \frac{1}{f}$$

$$= \frac{1}{5}$$

$$= \underline{\underline{0.2 \text{ s}}}$$

(ii) Angular velocity (2 marks)

$$\omega = 2\pi f$$

$$= 2 \times \pi \times 5$$

$$= \underline{\underline{31.42 \text{ rad/s}}}$$

(iii) Linear velocity (2 marks)

$$v = \omega r$$

$$= 31.42 \times 0.7$$

$$= 21.99 \text{ m/s}$$

(iv) Maximum tension in the string.

(2 marks)

$$T_{\text{Max}} = \frac{Mv^2}{r} + Mg$$

$$= 27.64 + 0.4$$

$$= \frac{0.04 \times 21.99^2}{0.7} + 0.04 \times 10$$

$$= 28.04 \text{ N}$$

- (b) The figure 7 below shows a container with small holes at the bottom in which wet clothes have been put. When the container is whirled in air at high speed as shown, it is observed that the clothes dry faster. Explain how the rotation of the container causes the clothes to dry faster.

(2 marks)

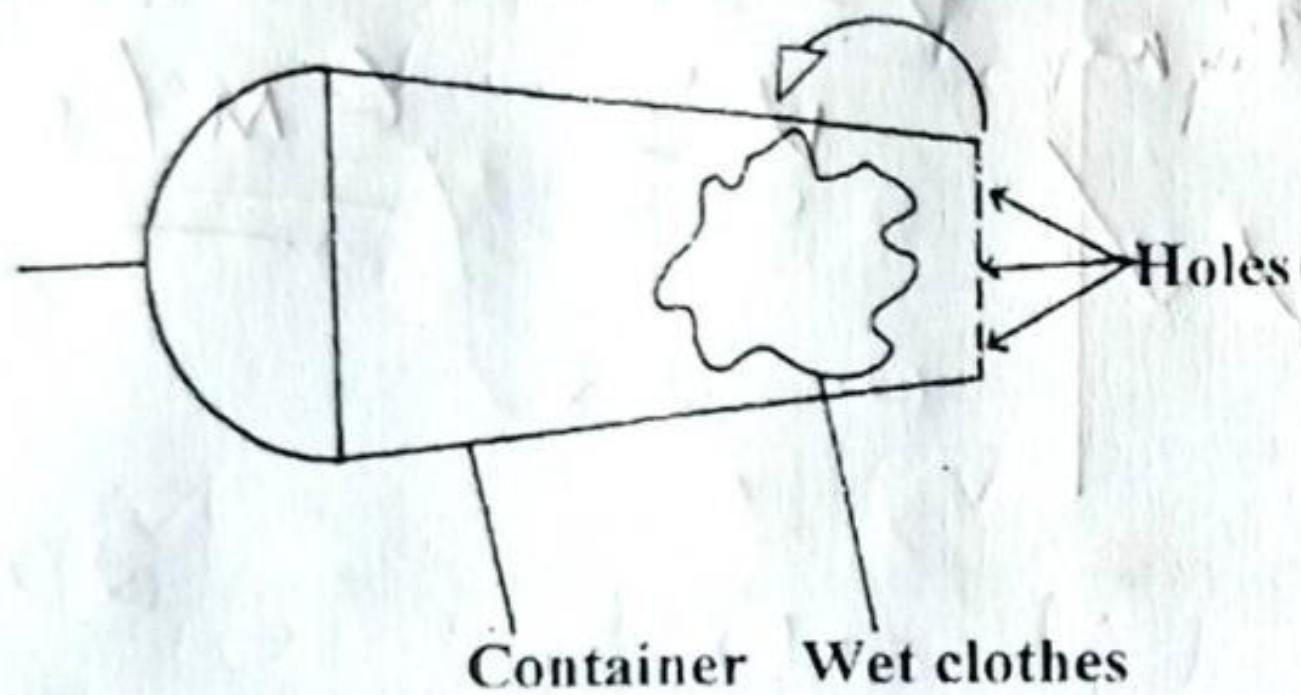


Fig 7

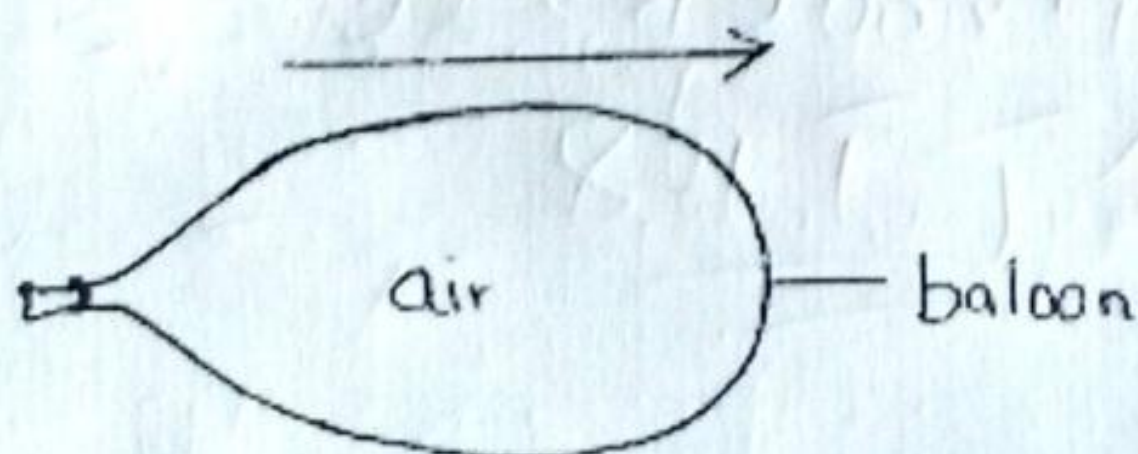
Water being denser and massive, the clothes occupy the furthest end of the container hence spilling out through the holes.

16. (a) Give a reason why the inside of a helmet is lined with sponge.

(1 mark)

It increases the time of impact hence reducing the impulsive force produced during an accident.

- (b) The figure below shows a balloon filled with air.



When the mouth is suddenly opened, the balloon moves in the direction shown above by the arrow. Explain that observation. (2 marks)

Leaving air exerts an action force which produce an equal but opposite reaction force ✓

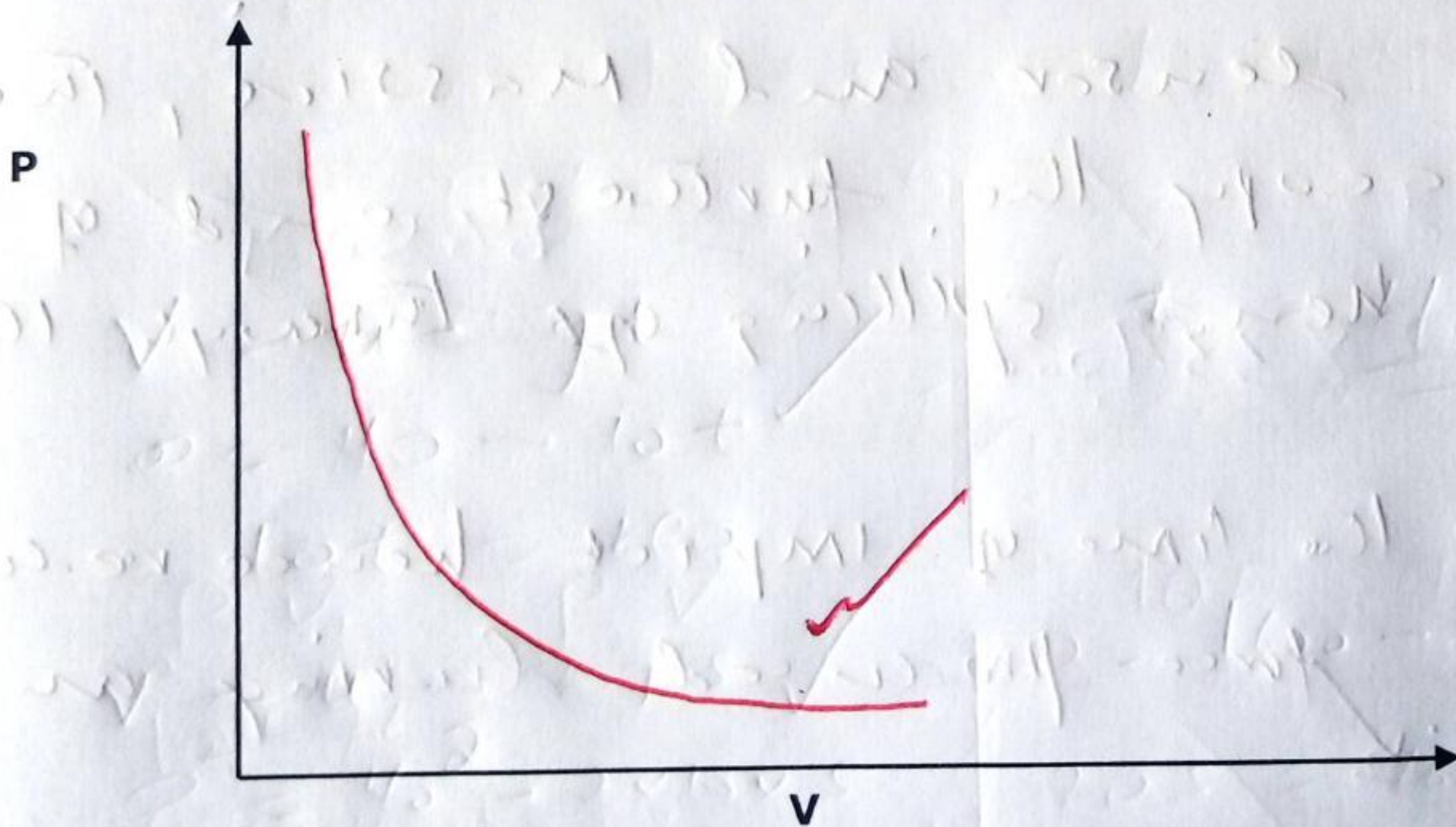
- (c) A rock of mass 150kg moving at 10m/s collides with a stationary rock of mass 100kg. They fuse after collision. Determine the (2 marks)
- (i) Total momentum before collision.

$$\begin{aligned} \text{Momentum} &= M_1 u_1 + M_2 u_2 \\ &= 150 \times 10 + 100 \times 0 \\ &= 1500 \text{ kg m/s} \end{aligned}$$

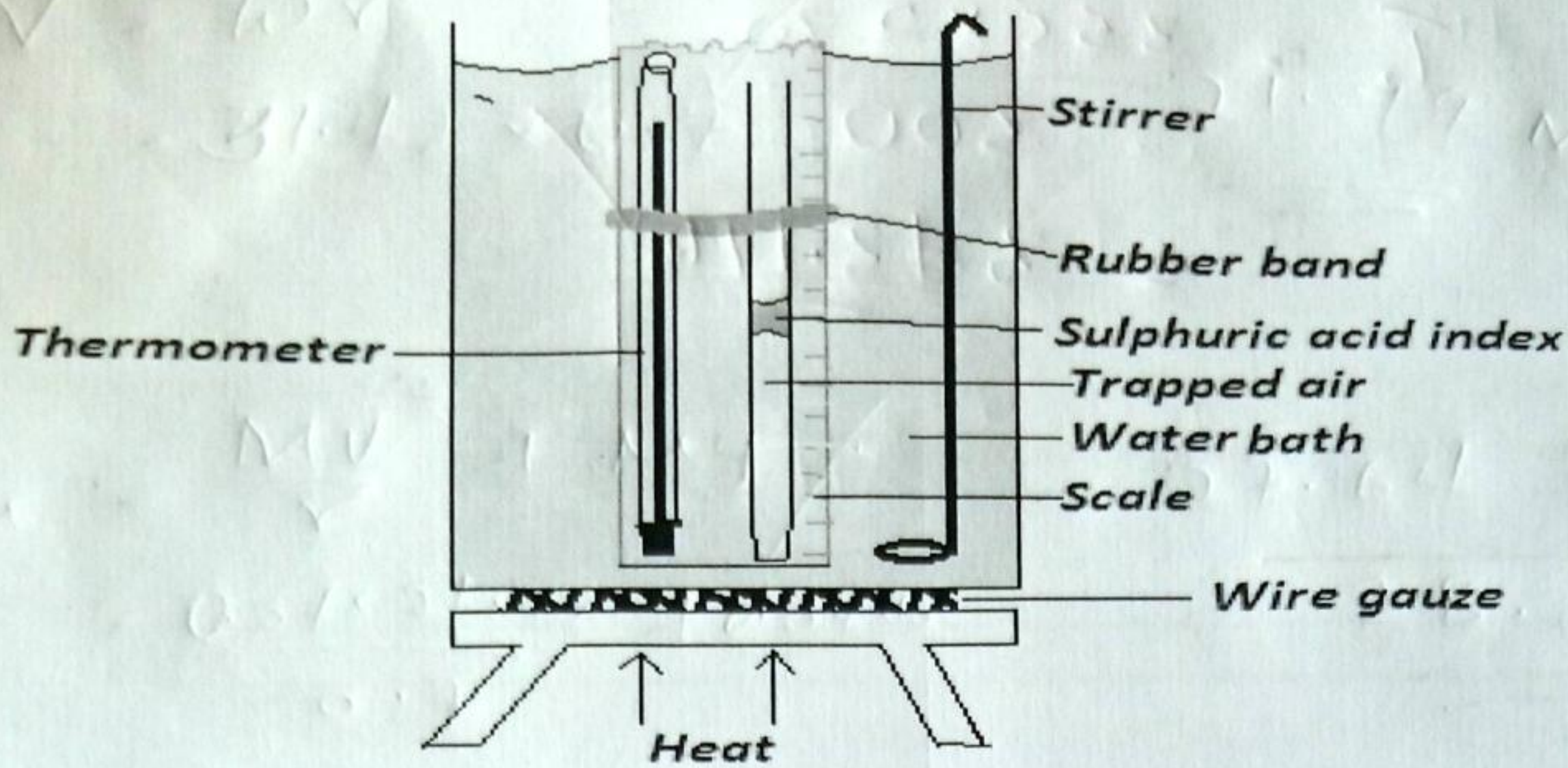
- (ii) Their common velocity after collision. (2 marks)

$$\begin{aligned} \text{Initial Momentum} &= \text{Final Momentum} \\ 1500 &= (100 + 150) v \\ 250v &= 1500 \\ v &= 6 \text{ m/s} \end{aligned}$$

17. (a) On the axis below, sketch a graph to show how the pressure of a fixed mass of a gas varies with volume at constant temperature. (1 mark)



- (b) The set-up below shows an arrangement that can be used to Verify Charles' law.



(i) State any one use of sulphuric acid index in the above set up. (1 mark)

Indicate the level of trapped air or dry the trapped air.

(ii) What is the use of the stirrer? (1 mark)

To distribute the heat in the water evenly.

(iii) State two measurements that should be taken in this experiment. (2 marks)

Temperature of water!
- Height of trapped air!

(iv) Describe how the set up can be used to verify Charles' law. (4 marks)

Initial length of gas column and Temp. is recorded
- water bath is heated and new height of air column is recorded with the corresponding thermometer reading
- This is repeated several times at suitable temperature intervals to obtain several pairs of values.
- A graph of Volume (height) against absolute temperature is plotted.
The graph is a straight line with positive gradient. This shows that the volume is directly proportional to absolute temperature.

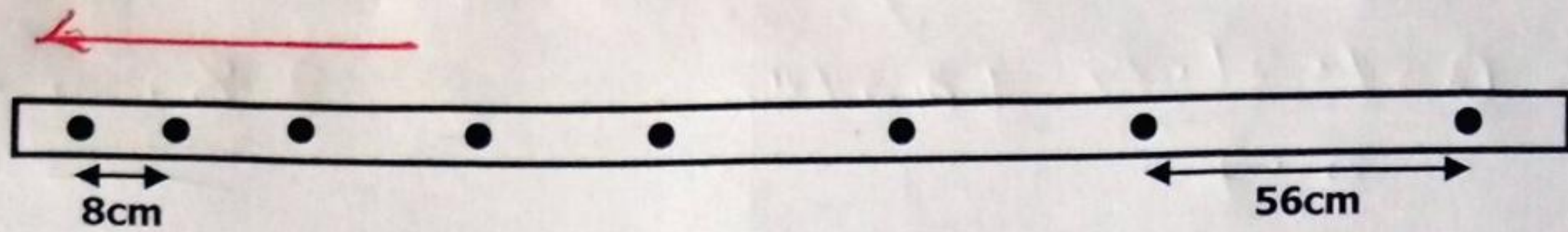
(c) The volume of a gas enclosed with a movable piston is 300 cm^3 when the temperature is 290 K . Determine the temperature at which the volume of the gas increases to 355 cm^3 (Assume pressure does not change) (3 marks)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \left| \quad \frac{300}{290} = \frac{355}{T_2} \right.$$

$$T_2 = \frac{355 \times 290}{300}$$

$$= 343.17 \text{ W}$$

18. (a). The section of the tape shown below was produced when a tape running down an incline plane was attached to a **ticker-tape timer** of frequency **50Hz**.



- i) Indicate above the tape the direction in which the trolley was moving. (1 mark)
 ii) What type of current was used to operate the ticker timer? (1 mark)

Alternating current

- iii) Find the acceleration of the trolley in SI units. (3 marks)

$$u = \frac{8}{0.02} = 400 \text{ cm/s} = 4 \text{ m/s}$$

$$a = \frac{v - u}{t} = \frac{28 - 4}{0.02 \times 6} = 200 \text{ m/s}^2$$

$$v = \frac{56}{0.02 \times 1} = 2800 \text{ cm/s} = 28 \text{ m/s}$$

- (b). A stone is projected vertically upwards with initial velocity of 40m/s from the ground.

Calculate:

- i) Time taken to reach maximum height (2 marks)

$$v = u - gt$$

$$0 = 40 - 10t$$

$$10t = 40$$

$$t = 4 \text{ s}$$

- ii) Maximum height reached (2 marks)

$$v^2 = u^2 - 2gs$$

$$0^2 = 40^2 - 2 \times 10 \times s$$

$$0 = 1600 - 20s$$

$$20s = 1600$$

$$s = 80 \text{ m}$$

THIS IS THE LAST PRINTED PAGE. BEST OF LUCK.