Name: ..... M/scheme .....Adm no:.....Class:.....

Index No. .....

Candidate's Sign. .....

Date:.....

232/1
PHYSICS
PAPER 1
TIME: 2 HOURS

KASSU JOINT EXAMINATION

JUNE – 2024

PHYSICS

PAPER 1

INSTRUCTIONS TO THE CANDIDATES:

- Write your **name, admission number and class**.in the spaces provided above.
- Answer ***all*** the questions both in section **A** and **B** in the spaces provided below each question
- All workings ***must*** be clearly shown; marks may be awarded for correct steps even if the answers are wrong.
- Mathematical tables and silent electronic calculators may be used.
- Take *Acceleration due to gravity, g=10m/s²*
  Density of fresh water=1 g/cm³
  Density of sea water=1.2 g/cm³

FOR EXAMINER'S USE ONLY

SECTION	QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 14	25	
B	15	09	
	16	10	
	17	11	
	18	11	
	19	14	
	TOTAL	**80**	

This paper consists of 12 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION A (25mks)

Answer all the questions in this section

1. Under which branch of Physics is the functioning of a refrigerator studied? (1mark)

Thermodynamics ✓1

2. An empty density bottle has a mass of 25g. When full of sea water, its mass is 66.2g and when full of a liquid X, its mass is 65g. Given that density of sea water is 1030kg/m³, find the density of liquid X. (~~3~~marks)

3 (3mks)

Mass of sea water = 66.2 − 25
= 41.6g

Volume of density bottle = $\frac{41.6}{1.03}$
= 40.388cm³

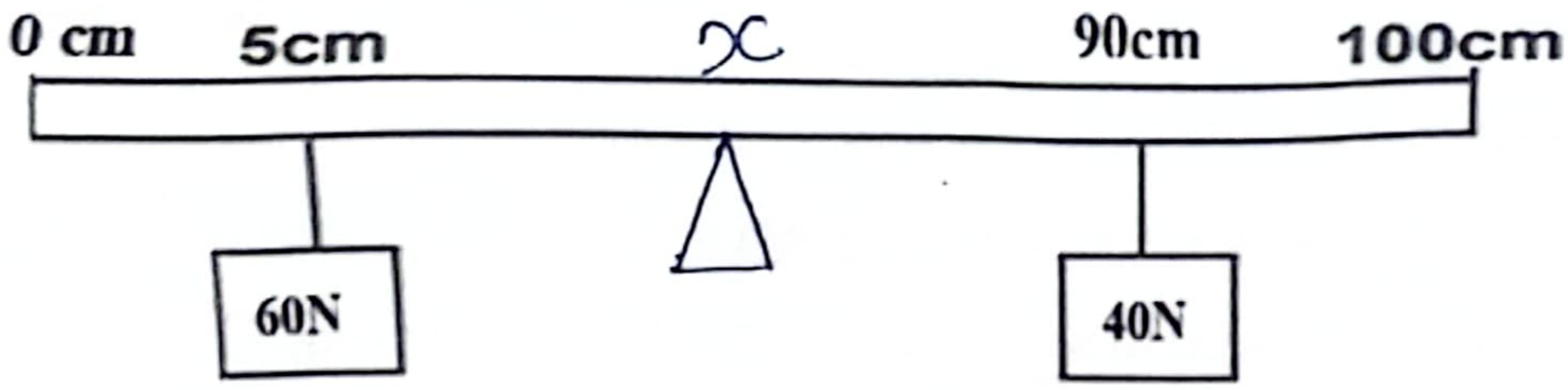
Mass of liquid X = 65 − 25
= 40g. ✓1

Density of liquid X = $\frac{40}{40.388}$ = 0.9904g/cm³ ✓1
990.4kg/m³

3. The rate of heat flow in thermal conductivity increases with increase in cross-section area. Explain this observation. (1MK) (~~2marks~~)

An increase in cross-sectional area increases ✓1
the number of free electrons available for
conductivity hence increases the rate of
heat transfer.

4. *The figure below shows a weightless uniform metre rule supporting two weights. The metre rule is pivoted somewhere such that it is horizontally balanced.* (Pivot not shown).



The 60N weight is at 15cm mark while the 40N weight is at 90cm mark. Determine the position of the pivot from zero cm mark. (3marks)

$60 \times (x-5) = 40 \times (90-x)$ ✓1 FSA

$60x - 300 = 360 - 40x$

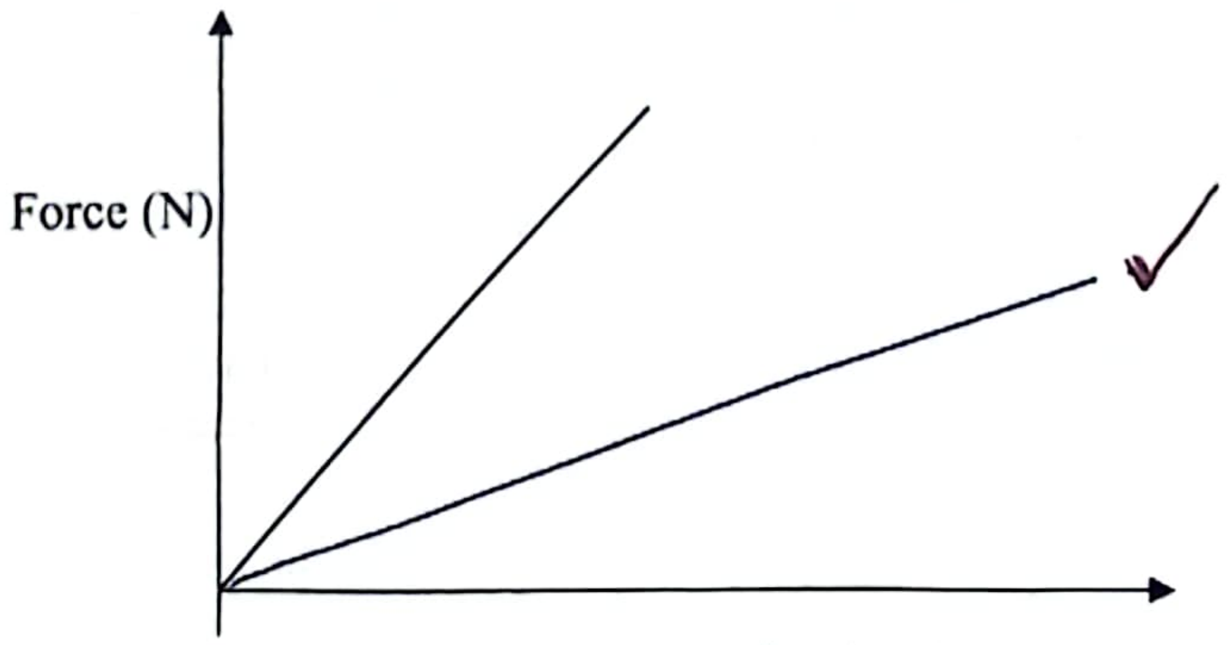
$60x + 40x = 360 + 300$

$100x = 660$

$x = 6.6\text{cm}$. ✓

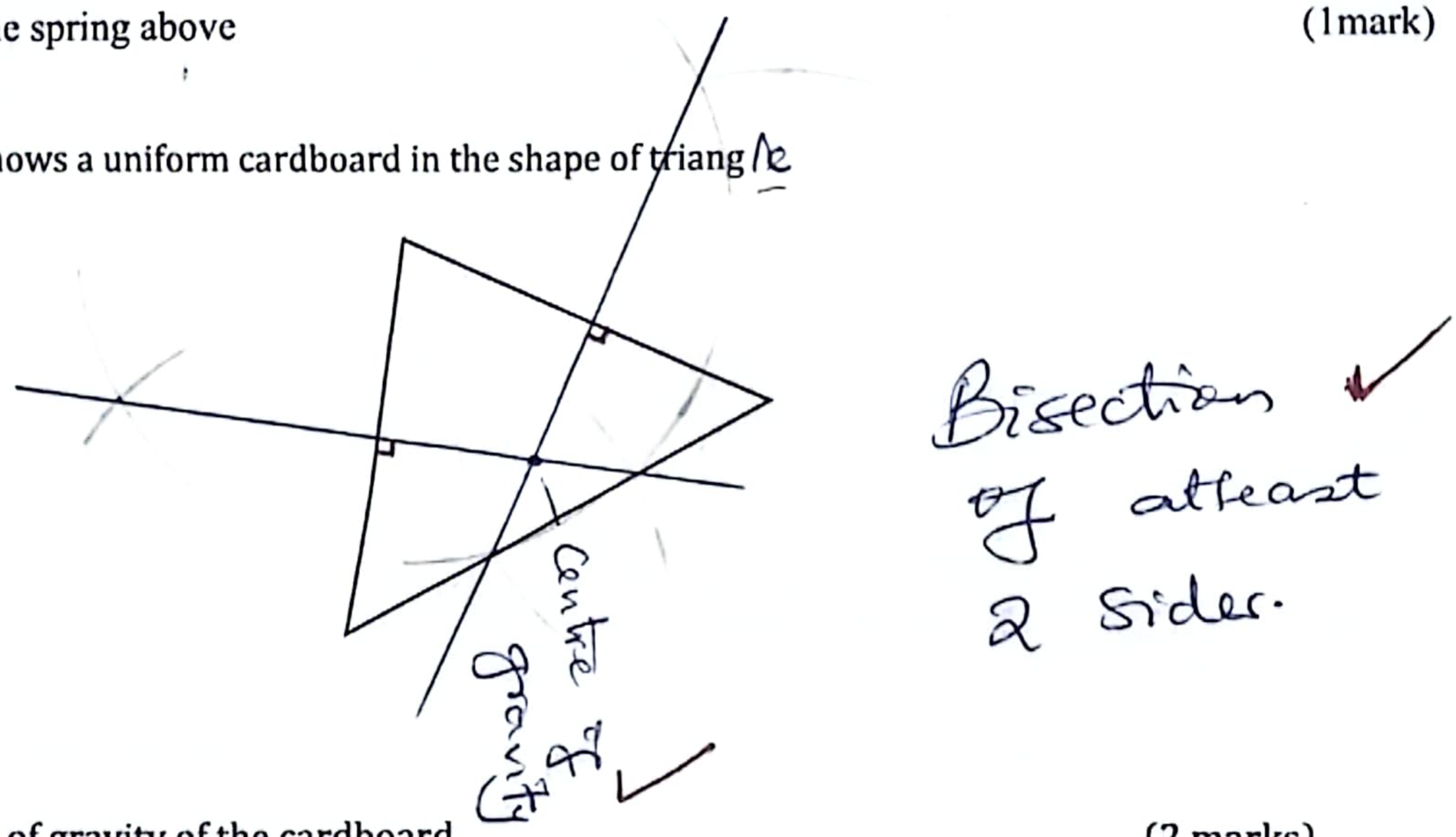
08

5. The following is a graph of force against extension for a spring



On the same axes, sketch a graph of force against extension for a spring double the length, same thickness, same material as the spring above (1mark)

6. The figure below shows a uniform cardboard in the shape of triangle



Locate the centre of gravity of the cardboard. (2 marks)

7. The figure below shows a syringe filled with a liquid. The diameter of section A of the syringe, $D_1 = 1.0$ cm and that of section B, $D_2 = 2$ mm. The length of section A is 8.0 cm.

If the piston travels the length, 8 cm in 2 s, determine the velocity of the liquid in section B. (~~2marks~~)

$A_1V_1 = A_2V_2$

$\pi \times 0.5^2 \times \frac{8cm}{2s} = \pi \times 0.1^2 \times V_2$

$0.5^2 \times 4 = 0.1^2 \times V_2$

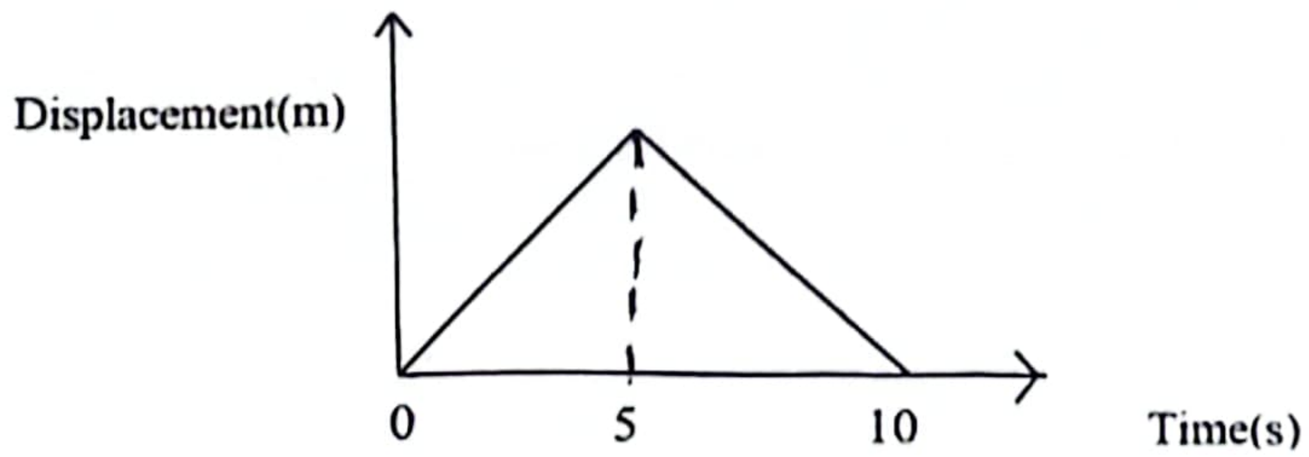
$V_2 = 100\ cm/s$ or $1\ m/s$ (3 marks)

OR $\frac{\text{Volume A}}{\text{time}} = \frac{8 \times \pi \times (0.5)^2}{2} = 3.14159\ cm^3/s$

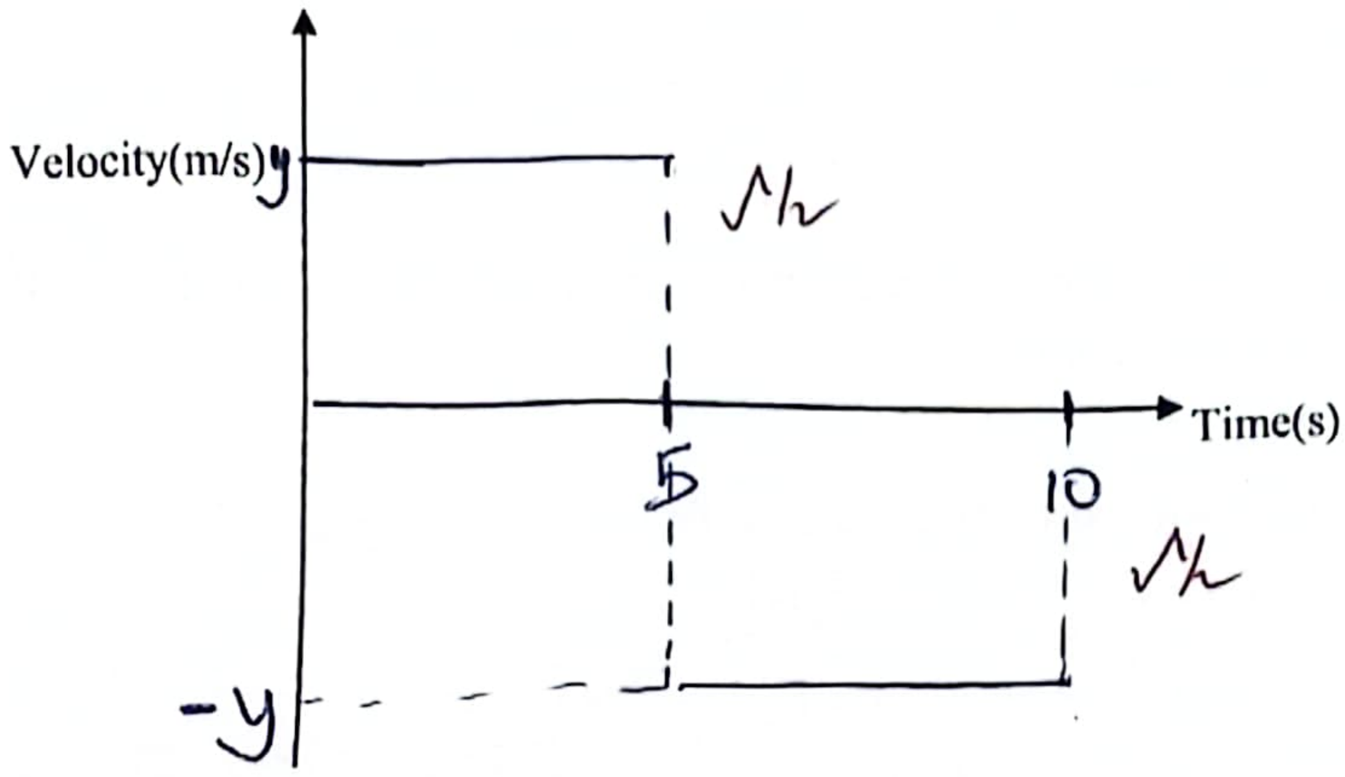
$V_B = \frac{3.14159}{\pi \times 0.1^2} = 100\ cm/s$ or $1\ m/s$

6 marks

8. The figure below shows the displacement time graph for the motion of an object.



Sketch the velocity time graph for the object. (1 mark) (~~2marks~~)



9. State the law of conservation of energy (1mark)

Energy can neither be created nor destroyed but can be changed from one ~~form~~ to another.

10. State one factor that determines the critical speed with which a car can negotiate a bend on a level ground. (1mark)

- radius of the bend
- nature of the road surface.
- ~~Nature~~ condition of car tyres.

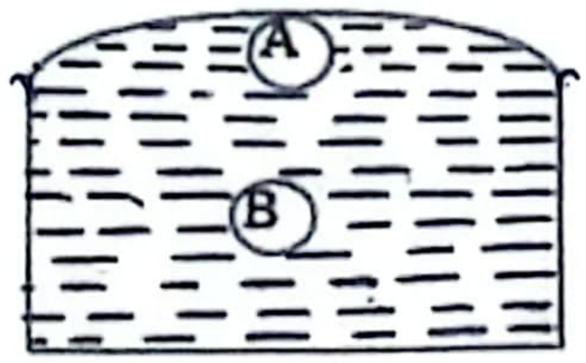
any one

11. A 100ml solution of water and potassium permanganate is mixed with 900ml of water. It is observed that the total volume is 990ml.Explain. (2marks)

The potassium permanganate particles filled into the spaces between the water particles ~~and to which there was no increase in volume.~~ The particles of potassium permanganate and water pack more closely reducing the volume. Due to the difference in sizes of the molecules.

05

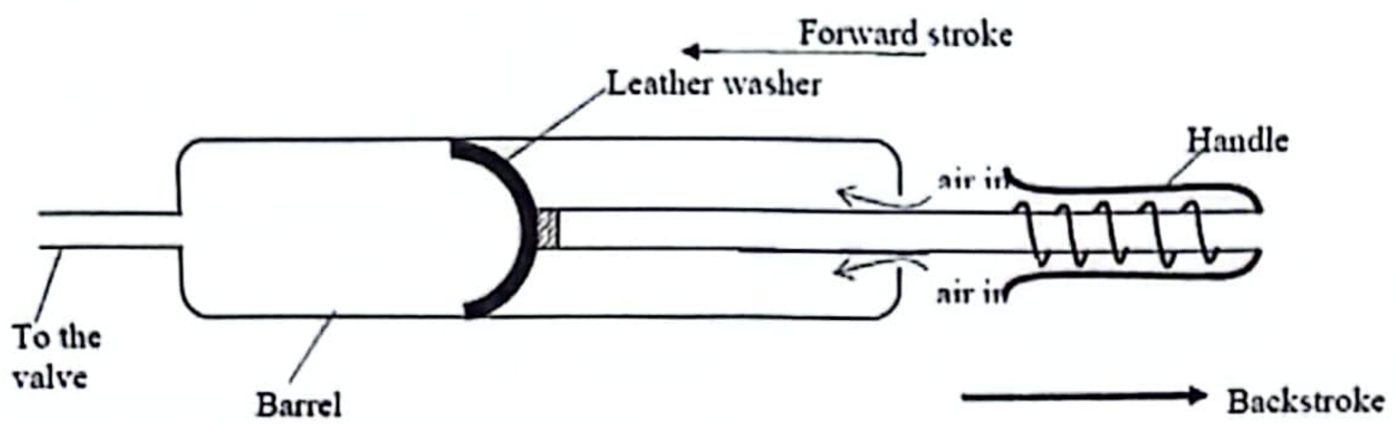
12. The diagram below shows the force acting on two water molecules, molecule A on the surface of the water and molecule B below the surface of water. (2 marks)



Explain why molecule A experiences surface tension while molecule B does not (2marks)

Molecule A has more water molecules below it than on the vapour side, thus it experiences a net force downwards ✓
Molecule B is surrounded by water molecules and hence no resultant force/net force is zero ✓

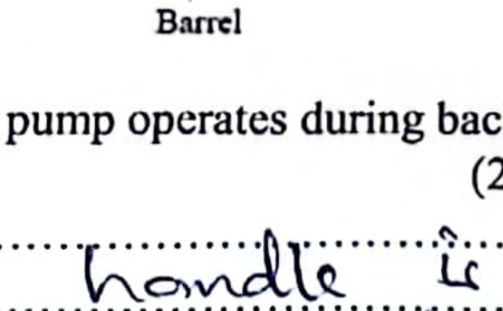
13. The bicycle pump shown below is one of the applications of pressure in gases.



Explain how the pump operates during backstroke (2marks)

When the handle is pulled the volume ~~air enters the bar~~ between the barrel and the valve increases, pressure reduces and atmospheric pressure pushes air into the barrel. ✓

14. The figure below shows part of the scales of a micrometer screw gauge whose jaws are completely closed.



A student used the same micrometer screw gauge to measure the diameter of a test tube of actual diameter 2.15mm. What was the reading shown by the micrometer screw gauge. (2marks)

Error = − 0.03 mm ✓

Reading = 2.15 + 0.03

= 2.12 mm ✓

06

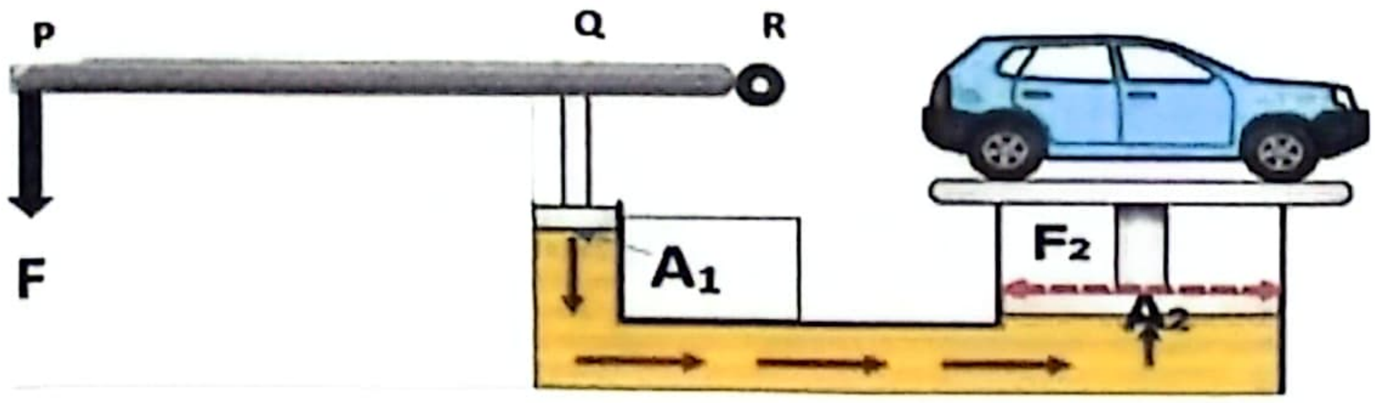
SECTION B (25mks)

Answer all the questions in this section

15. (a) Define Load as used in machines. (1mark)

This is the force exerted overcome by the machine ✓

(b) The diagram below shows a simple hydraulic lift used to lift a car in a garage. Use the diagram to answer the questions that follows



Given that PQ = 1.2m, QR = 0.2m, $A_1 = 0.006m^2$, $A_2 = 3m^2$ and F =150N; determine:

i. Force acting on the Effort Piston of the hydraulic lift (2marks)

$(150 \times 1.4) = F \times 0.2$ ✓

$210 = 0.2F$

$F = 1050N$. ✓

ii. The maximum weight of the car that can be lifted by the machine (2marks)

$P = \frac{1050}{0.006}$

$= 175000 N/m_2$ ✓

$F = P \times A$

$= 175000 \times 3$

$= 525\,000N$. ✓

iii. Determine the velocity ratio of the system (2 marks)

$V.R = \frac{3}{0.006} \times \frac{1.4}{0.2}$ ✓

$= 500 \times 7 = 3500$ ✓

iv. Calculate the efficiency of the system (2 marks)

$\eta = \frac{\frac{525\,000}{150} = MA}{3500} \times 100 = \frac{3500}{3500} \times 100$ ✓

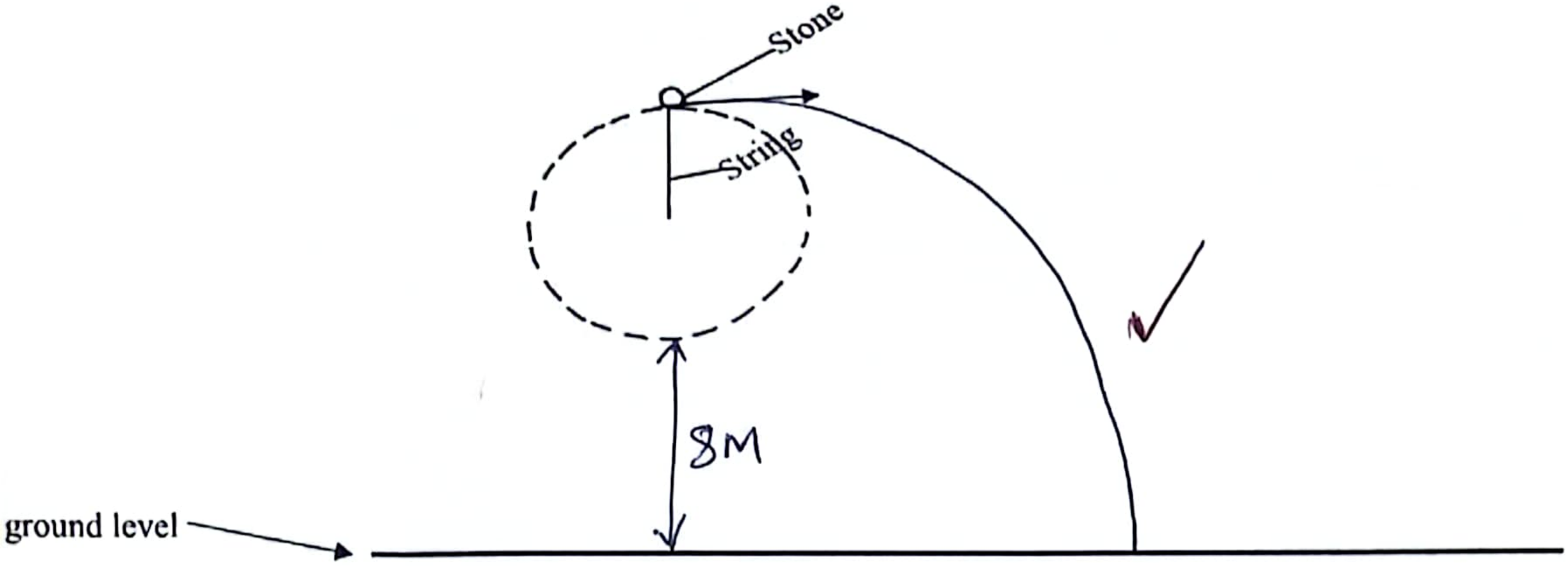
$= 100\%$. ✓

09

16. (a)Define the term radian (1mark)

Angle subtended at the centre of a circle by any arc length equal to the radius ✓

(b)The diagram below shows an stone of mass 0.5kg whirled in a vertical circle of radius 2.0m at a uniform speed and makes 120 revolutions per minute.



Determine;

i) Angular velocity. (2marks)

$\omega = 2\pi f$

$= 2 \times \pi \times 1$ ✓ SA

$= 6.284 \text{ rad/s}$ ✓

ii) Linear velocity (2marks)

$V = r\omega$

$= 2 \times 6.284$ ✓ | $V = 12.568 \text{ M/s}$ ✓ SA

(c) If the stone was whirled with the centre of the path10m from the ground and released at the point as shown above;

i. sketch the path on the diagram which the stone takes as it falls to the ground (1mark)

ii. determine the time of flight the stone takes to the ground (2 marks)

$S = ut + \frac{1}{2}gt^2$ | $S = 12 \text{ M}$

$12 = \frac{1}{2} \times 10 t^2$ ✓ | $u = 0$

$12 = 5t^2$ | $g = 10$

$t^2 = 2.4$

$t = 1.549 \text{ s}$ ✓ SA

$v^2 = u^2 + 2gs$

$v^2 = 2 \times 10 \times 12$

$v = \sqrt{240}$

$= 15$

iii. what is the total horizontal distance travelled by the body from the release point? (2marks)

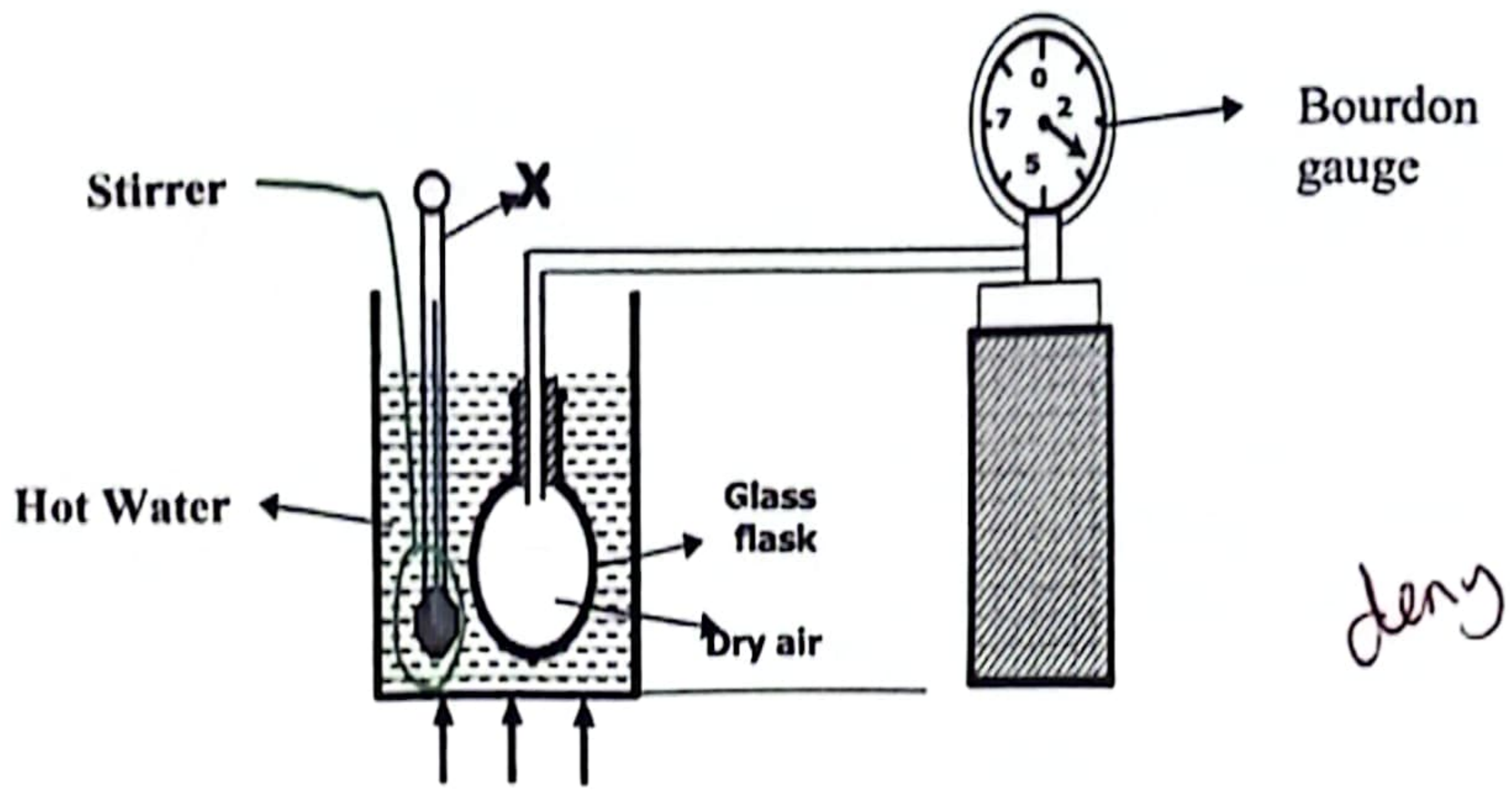
$S = ut$

$= 12.568 \times 1.549$ ✓

$= 19.4678 \text{ M}$ ✓ SA

10

17. a) The diagram below shows a set up that a student used to investigate a law.



deny naming the Law.

i) State the law being investigated (1mark)

Charles/Boyles/Pressure law — The Pressure/volume of a fixed mass of gas is directly proportional to its absolute temperature at constant Pressure/volume. ✓

ii) State the measurements that need to be taken in the experiment (2marks)

- Temperature ✓
- pressure ✓

iii) Describe how the law is verified using the measurements named (ii) above. (3marks)

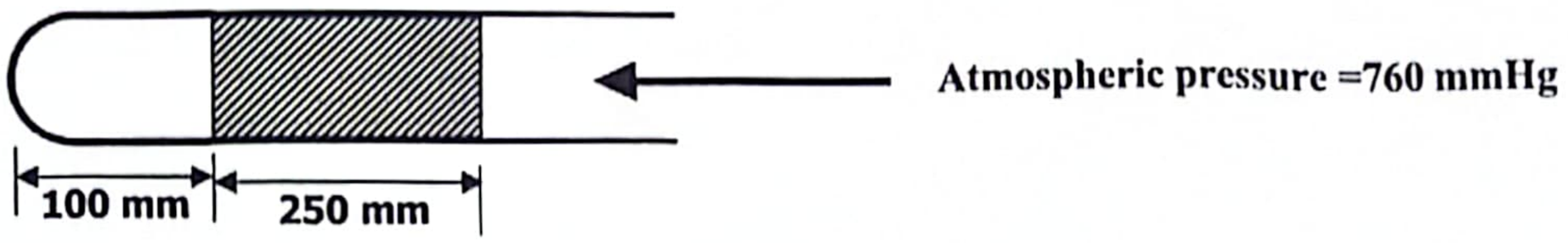
- The water is heated slightly and the values of temp and pressure recorded. ✓
- The temp of the water bath is raised and values of temp and corresponding pressure values recorded at regular intervals ✓
- A graph of pressure against absolute temp values is draw for the values in the table ✓
- A straight line through the origin is obtained, (pressure is directly proportional to absolute temp at constant volume)

06

iv) Using kinetic theory of gases, explain why a bicycle tyre explodes when it stands out in the sun for long (2marks)

The temperature of the air in the tube increases increasing the kinetic energy of the particles; the rate of collision of the particles with the walls of the container increased the rate of change of momentum of the particles

b) Air is trapped inside a glass tube by a thread of mercury 250mm long. When the tube is held horizontally, the length of the air column is 100mm.

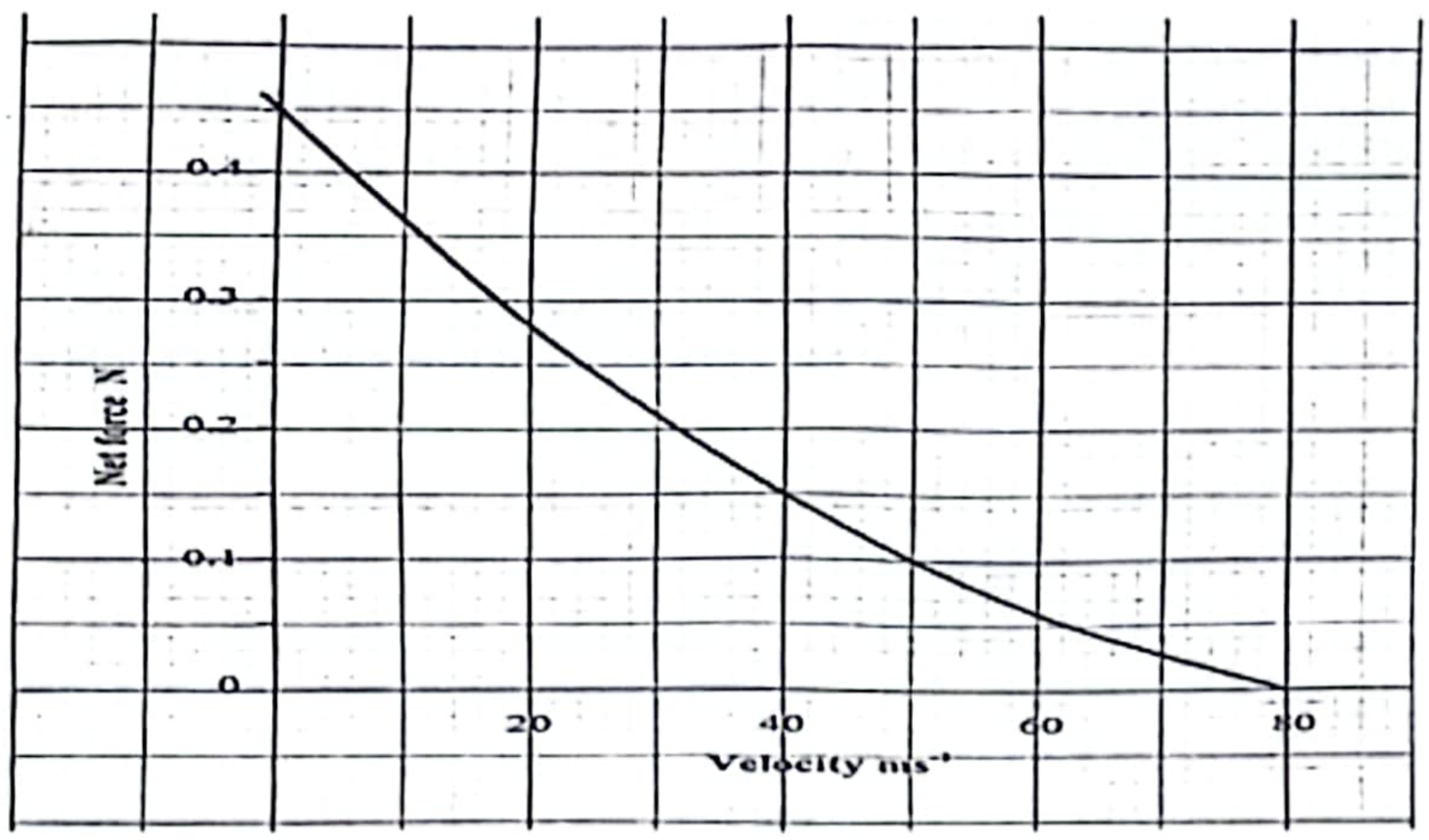


Given that the atmospheric pressure is 760mmHg and the temperature is kept constant, calculate the length of air column when the tube is held vertical with the open end down. (3marks)

$P = 760 - 250$
$= 510mm$ ✓

$P_1V_1 = P_2V_2$
$760 \times 100 = 510 \times V_2$ ✓
$V_2 = \frac{760 \times 100}{510} =$ 149.0196mm ✓

18. (a)The figure below shows a graph of net force on a body against its velocity as it falls through a liquid.



Determine the terminal velocity of the body. (1 mark)

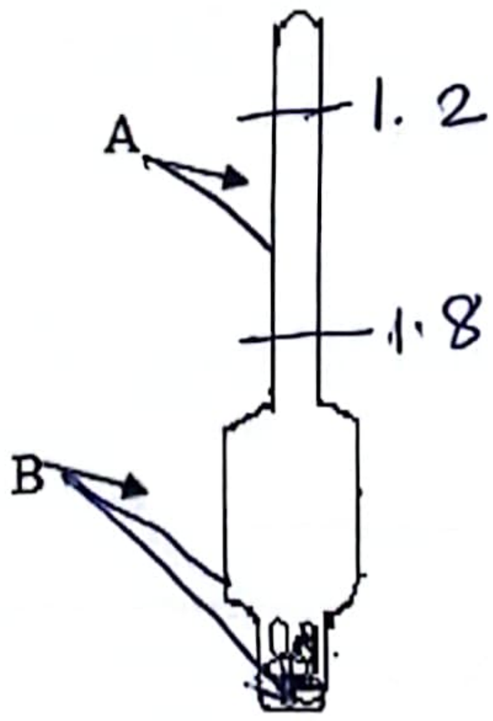
$V_t = 80 m/s$. ✓

06

(b) State the law of flotation (1 mar

A floating body displaces it's own weight of the fluid in which it floats ✓

(c)The diagram below shows a hydrometer



Tied ✓

i. The hydrometer above is placed on liquids of densities 1.2 g/cm^3 and 1.8 g/cm^3. Mark the readings on the hydrometer. (1 mark)

ii. What would be the effect of reducing the cross-sectional area of the part labelled A (1mark)

The sensitivity of the hydrometer will be increased ✓

iii. What is the function of the part labelled B (1 mark)

Keeps the hydrometer upright ✓

(d) A solid floating on water displaces 16cm^3 of water. When the same solid floats on liquid P,it displaces 20cm^3 (take density of water =1000kg/m^3)

Determine;

(i) The weight of the solid. (2marks)

Upthrust = Weight

Mass = 1.0×16

= 16g ✓

Weight = $\frac{16}{1000} \times 10$

= 0.16N ✓

06

(ii) Density of liquid P. (2marks)

Mass of P displaced = 16g.
Volume = 20cm³ SA.
$\rho = \frac{16}{20} = 0.8 g/cm^3$ ✓ ✓

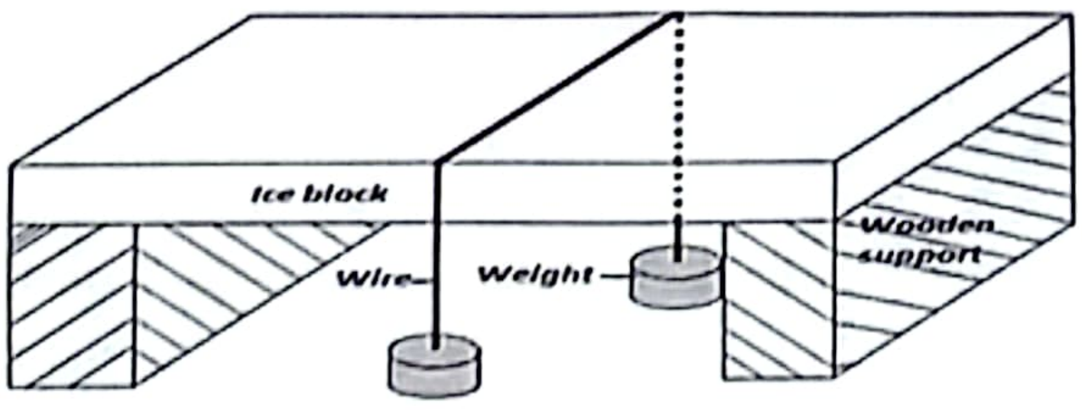
(iii) Volume displaced when placed in a liquid of density ~~0.8 g/cm³~~ 1.25 g/cm³ (2marks) ✓

Upthrust = 0.16 N
Mass = 16g
$V = \frac{16}{1.25} = 12.8 cm^3$ ✓ SA
~~$\frac{0.8}{1.25}$~~ ~~20cm³~~

19. (a) Distinguish between heat capacity and specific heat capacity. (2marks)

Heat capacity is the quantity of heat energy required to raise the temp of a given mass of a material by one degree celsius or k. ✓
Specific heat capacity is the quantity of heat required to raise the temp of a unit mass of a substance by one kelvin. ✓

(b) In an experiment to determine the effect of pressure on the melting point of ice, the following set-up was used



i) It is observed that the wire cuts its way through the ice block, but leaves it as one piece. Explain this observation (2 marks)

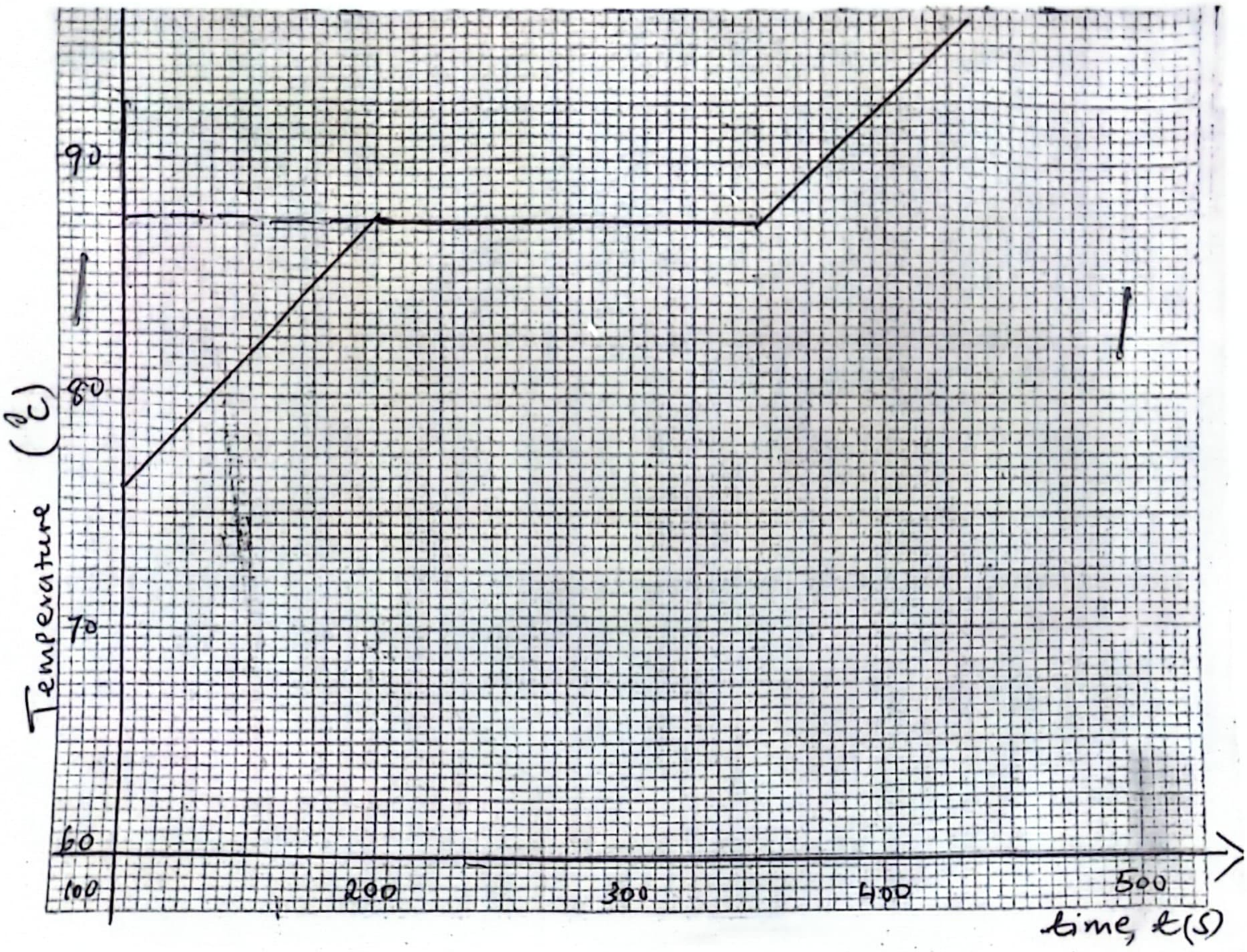
The wire exerts pressure on the ice below it making it to melt at a temp lower than its melting point. The water flows over the wire and immediately solidifies since the pressure has been removed, the latent heat is conducted by the wire and used to melt the ice below ✓ ✓

ii) State what would be observed if the copper wire was replaced with a cotton string. (1 mark)

The string will not cut through the ice ✓

09

c) A solid of mass 120g was heated in a container by an electric heater rated 100W for some time. The graph below shows the variation of temperature of the solid with time.



i) From the graph, determine the melting point of the solid. (1mark)

87.5°C ✓

ii) Explain what happens between the times t=350 seconds and t=450 seconds. (1mark)

The temperature of the melted solid (liquid) rises. ✓

iii) Determine the specific latent heat of fusion of the solid. (3marks)

350 − 200 = 150, ✓

$Pt = ML_f$

$100 \times 150 = 0.12 L_f$ ✓

$L_f = \frac{15000}{0.12}$

$= 125000 J/kg$ ✓

05

iv) Determine the specific heat capacity of the solid. (3marks)

$\Delta\theta = 87.5 - 76$

$= 11.5°c$ ✓

$E = pt \Rightarrow 200 \times 100$

$= 20000J$

$E = Mc\Delta\theta$

$20000 = 0.12 \times c \times 11.5$ ✓

$c = \frac{20000}{0.12 \times 11.5}$ (1mark) ✓

$= 14,492.75 J/kgK$

(c)Explain why a pressure cooker is preferred in high altitude areas

At high altitude the atmospheric pressure is low, a pressure raises the pressure of cooking ✓ hence the cooking temperature is raised.

04