Name: ......Marking Scheme...... Index No.: ....

School: ....Candidate's Signature: ....Date: ....

232/1
PHYSICS
(THEORY)
PAPER ONE
JULY 2024
TIME: 2 HOURS

Kenya Certificate Of Secondary Education (KCSE)

MOKASA II JOINT EVALUATION EXAMINATION-2024

Instructions to Candidates

- *This paper consists of sections:* ***A*** *and* ***B.***
- *Answer* ***ALL*** *the questions in section* ***A*** *and* ***B*** *in the spaces provided.*
- ***ALL*** *working* ***MUST*** *be clearly shown in the spaces provided.*
- *Mathematical tables and electronic calculators may be used.*

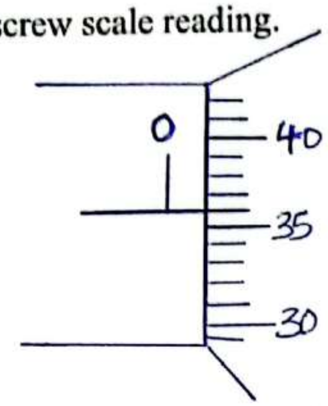
For Examiner's Use Only

SECTION	QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 10	25	
B	11	09	
	12	07	
	13	09	
	14	08	
	15	10	
	16	12	
TOTAL SCORE		**80**	

This paper consists of 14 printed pages. Candidates should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing

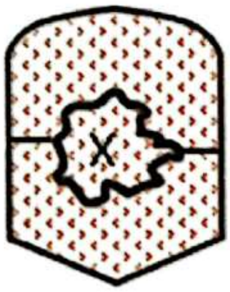
SECTION A (25 Marks)

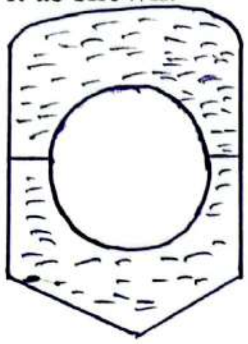
1. A student measured the diameter of a nichrome wire as 0.36mm. On the space provided, draw the micrometer screw scale reading. (2mks)



Marking Points
Sleeve scale ✓ 1
Thimble scale ✓ 1

2. (a) The diagram below shows a wire loop with a thread tied across it. The loop is dipped into a soap solution such that the soap film covers it as shown.





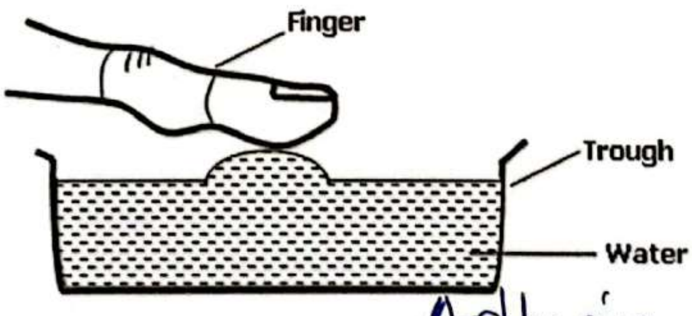
✓

Region **X** is punctured. On the space alongside the diagram sketch the resulting shape of the wire loop. Give a reason for the shape. ✓ 1 (2mks)

Surface tension is greater all round the thread pulling it radially due to outward resultant force. ✓ 1

Reject surface tension is "broken"

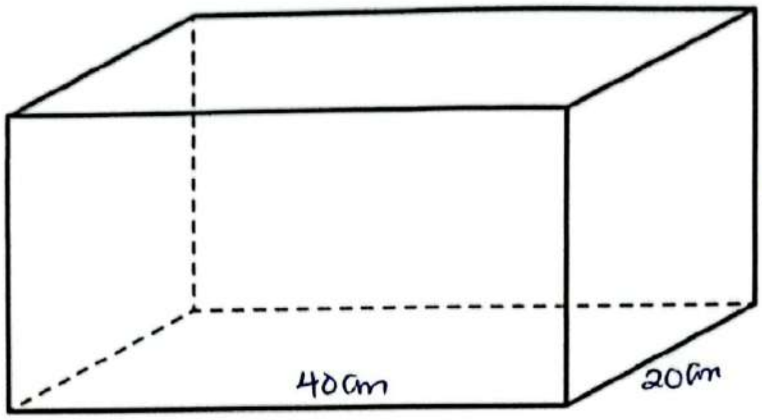
(b) Diana placed her finger on water as shown in the diagram below.



Name the force that lifts the water to the finger. Adhesive force ✓ 1 (1mk)

05

3. The diagram below shows a cuboid with dimensions **20cm by 20cm by 40cm** of mass **5kg.**



Reject 'surface area.'

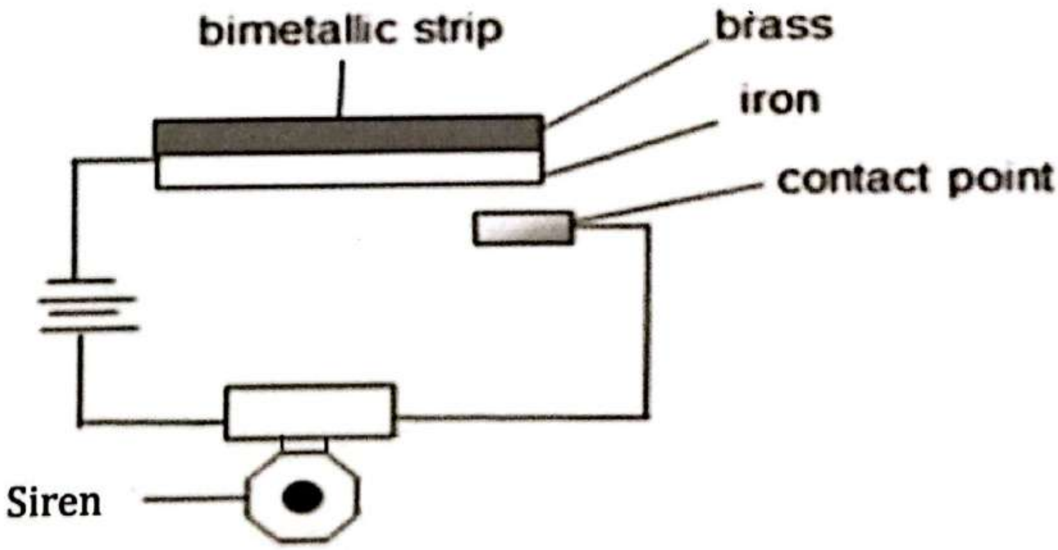
State and explain how it should be placed on a flat surface in order to exert minimum pressure on the surface. (2mks)

- Place the cuboid with the 40cm by 20cm face on the flat surface. ✓ 1

- This is to ensure maximum area of contact. ✓ 1

4. Explain the formation of steam at **100⁰C** using the particulate nature of matter. (2mks)

5. The figure below shows a simple bimetallic strip used for detecting fire.



Describe how the fire alarm works. (3mks)

4. Intermolecular distance between liquid molecules increases. ✓ 1 This leads to weakening of cohesive forces / intermolecular forces of attraction. 1

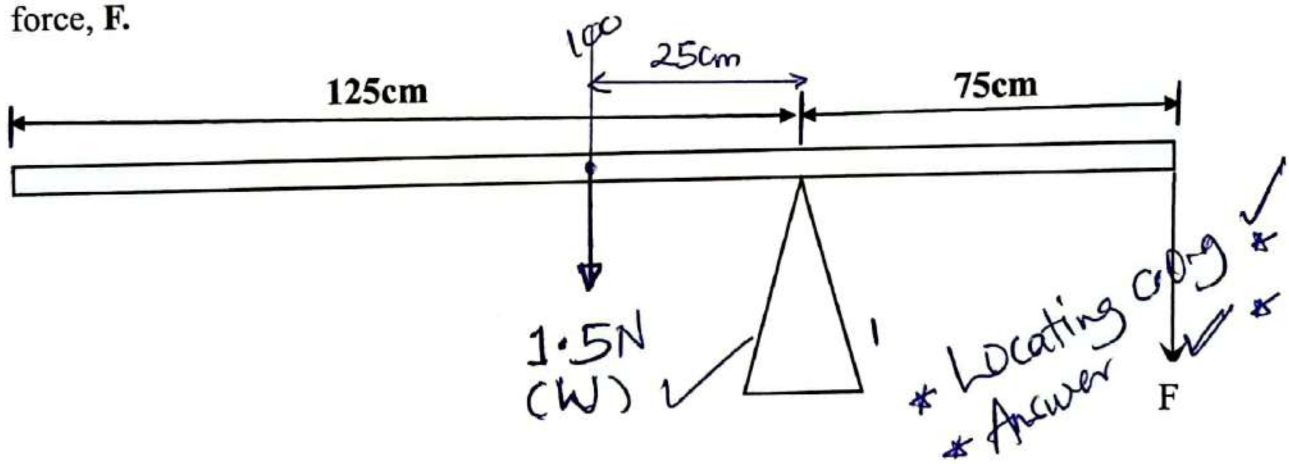
04

- When temperature rises, the metals expand at different rates. Brass expands more than iron causing the strip to bend downwards making the contact.
Accept curves downwards making the contact.

6. Jane stirred hot tea using a metal spoon and observed that the handle of the spoon soon becomes warm. State two ways through which the heat is conducted to reach the hand. (2mks)

- Use of free electrons | mobile electrons | delocalised
- Vibrating atoms

7. The diagram below shows a uniform metal bar of mass 150g balanced horizontally by a force, **F**.



(i) Determine the value of the force, **F**. (2mks)

$F_1 d_1 = F_2 d_2$

$1.5N \times 25cm = F \times 75cm$

$F = \frac{1.5N \times 25cm}{75cm}$

$= 0.5N$

(ii) Calculate the reaction force on the pivot. (1mk)

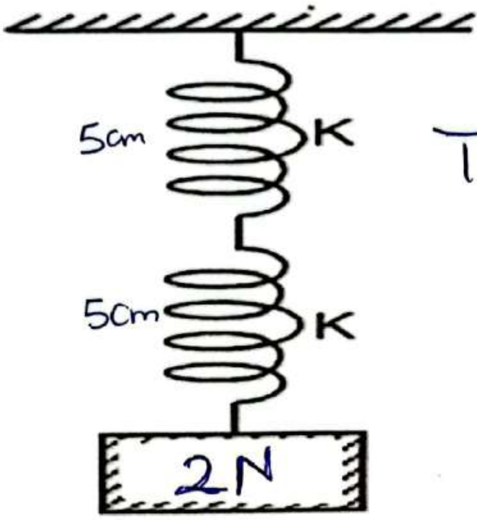
Reaction upward force (sum) = Sum of downward forces

Reaction = 1.5N + 0.5N

= 2.0N

08

8. The diagram below shows an arrangement of two identical light springs. Each spring has a length of **5cm** when unstretched. The total length of the two springs is **15cm** when supporting a load of **2N.**



Total extension = 15 − 10 = 5cm

Calculate:

(i) The extension on each spring (1mk)

ext = 5/2 = 2.5cm ✓ 1

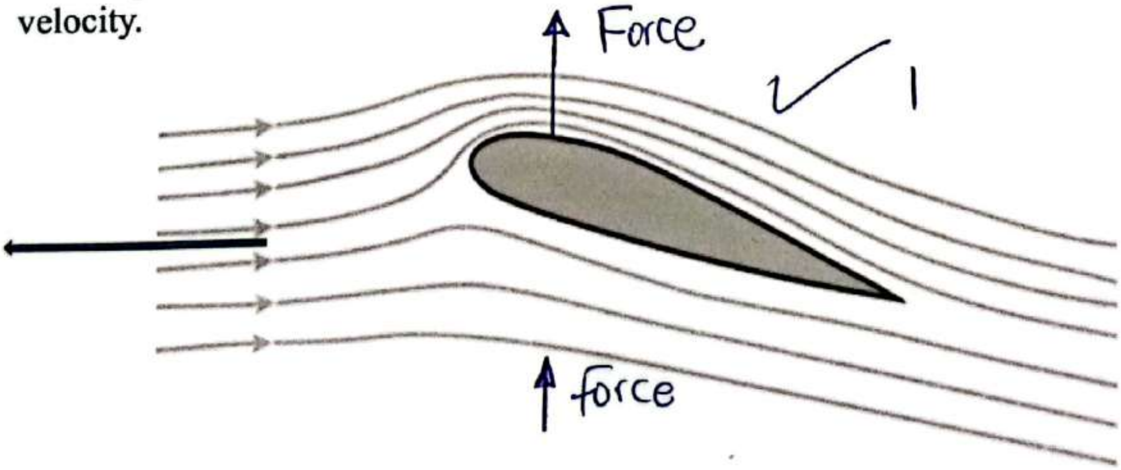
(ii) The combined spring constant (2mks)

K = F/e = 2N/2.5 = 0.8N/cm S.A

K_c = K/2 = 0.8N/cm / 2 ✓

= 0.4N/cm OR 40N/m ✓ 2

9. The diagram below shows an aerofoil moving in the direction shown in air at a high velocity.



✓ 1

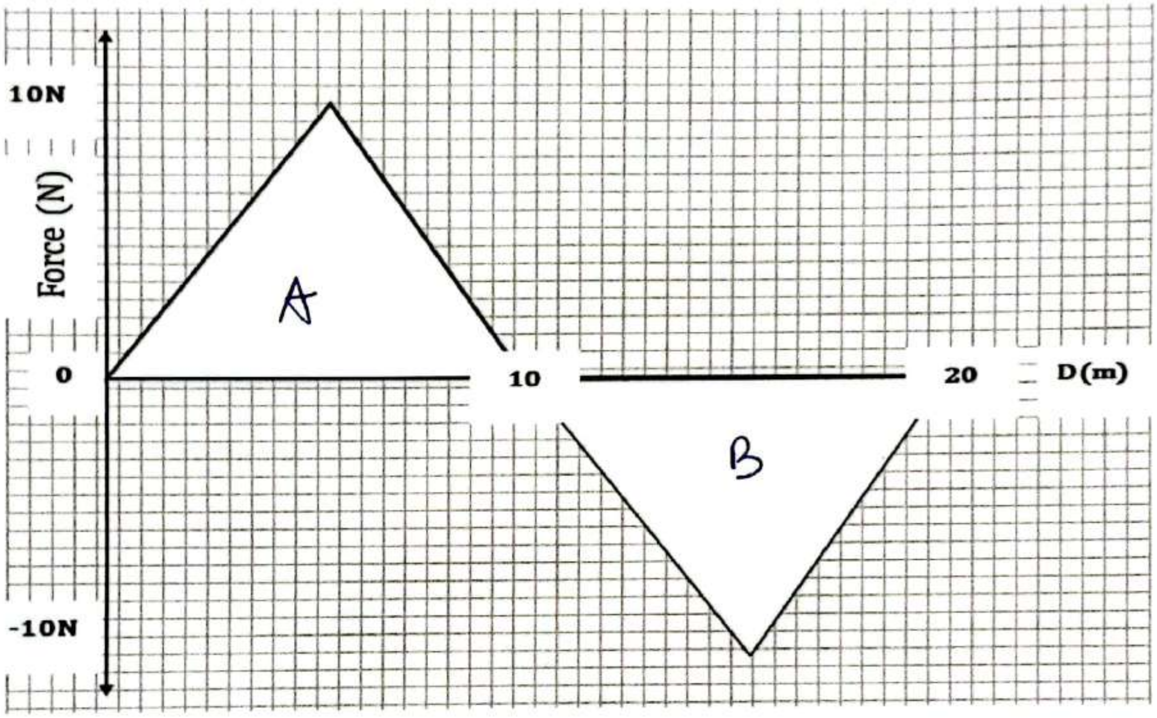
State and explain the direction of the force acting on the aerofoil. (2mks)

04

Velocity of air is higher above the aerofoil creating a region of lower pressure, velocity below is lower hence greater pressure. The pressure difference causes the dynamic lift.

Watch comparative language

10. The diagram below shows a variation of force acting on an object.



Find the total work done on the object. (3mks)

Total work done = Total area of under the graph.

Area A $= \frac{1}{2} \times 10 \times 10$

$= 50Nm$

Area B $= \frac{1}{2} \times 10 \times 10$

$= 50Nm$

Total area

$= 50Nm + 50Nm$

$= 100Nm$

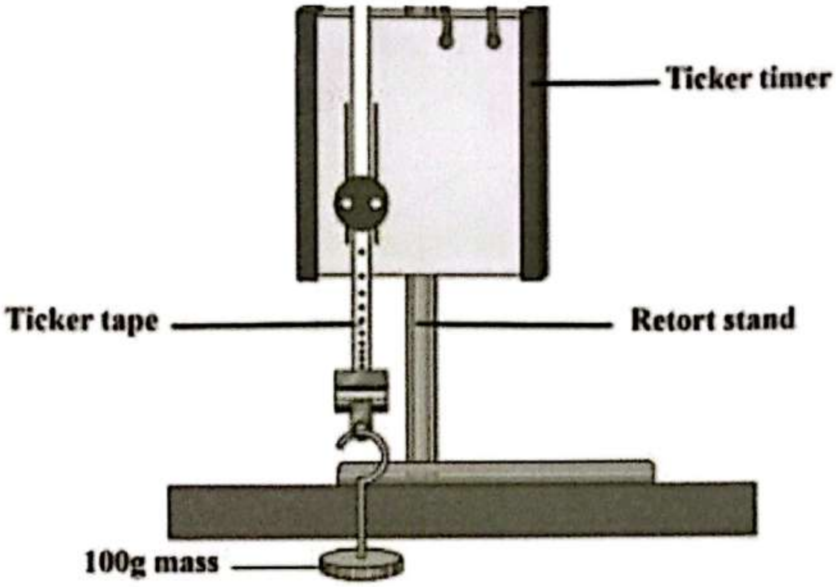
Total Work = 100J

FSA

04

SECTION B (55 Marks)

11.(a) The set up below shows a ticker timer used to determine acceleration due to gravity at a St. Mathews Academy in Karatina, Kenya.



Briefly describe how the set up can be used to determine the value of acceleration due to gravity at the school. (3mks)

- Switch on the ticker timer and let the mass fall freely ✓ 1
- Remove the ~~strip~~ / ~~and~~ paper tape and cut it into appropriate number of ticks. ✓ 1
- Determine the initial and final velocity.
- Using the expression $\frac{v-u}{t}$, determine the value of gravitational acceleration g. ✓ 1

03

(b) A block of wood of mass **40kg** is pulled along a horizontal rough surface with a force of **150N.** Given that the coefficient of friction between the block and the horizontal rough surface is **0.2.** Calculate:

(i) The frictional force between the block and the surface. (3mks)

$F_r = \mu Mg$ ✓ 1

$= 0.2 \times 40 \times 10$ ✓ 1 FSA

$= 80N$ ✓ 1

(ii) The acceleration of the block. (2mks) S.A

$a = \frac{\text{Resultant force}}{\text{Mass}}$

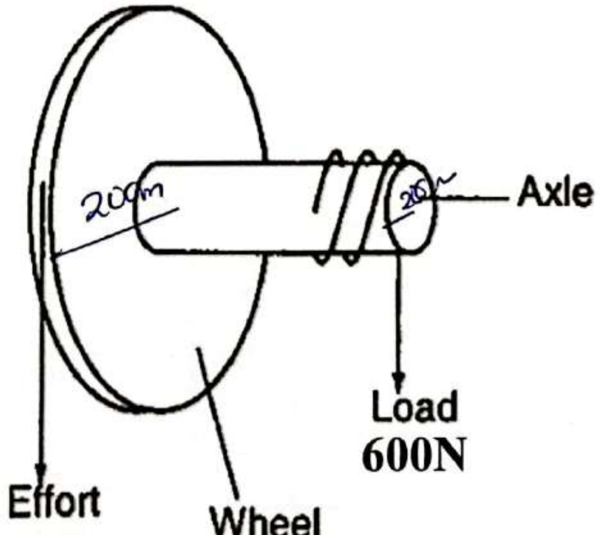
$= \frac{150N - 80N}{40kg}$

$a = \frac{70N}{40kg}$ ✓ $= 1.75 N/kg // m/s^2$ ✓

12. (a) Define work and state it's SI Unit. (2mks)

Product of force and the distance moved in the direction of force. ✓ 1 SI unit is joule (J). ✓ 1

(b) The diagram below shows a wheel and axle as a machine used to lift a load of **600N** using an effort of **60N.**



If the radius of the wheel is **20cm** and that of axle is **2cm**, determine the machine's:

(i) Mechanical advantage (1mk)

$MA = \frac{Load}{Effort} = \frac{600N}{60N} = 10$ ✓ 1

(ii) Velocity Ratio (2mks)

$V.R = \frac{\text{Distance moved by effort}}{\text{Distance moved by load}} = \frac{R}{r} = \frac{20}{2} = 10$ ✓ 1

(iii) Efficiency (2mks)

$\eta = \frac{M.A}{V.R} \times 100$ | $\frac{10}{10} \times 100$ ✓ 1

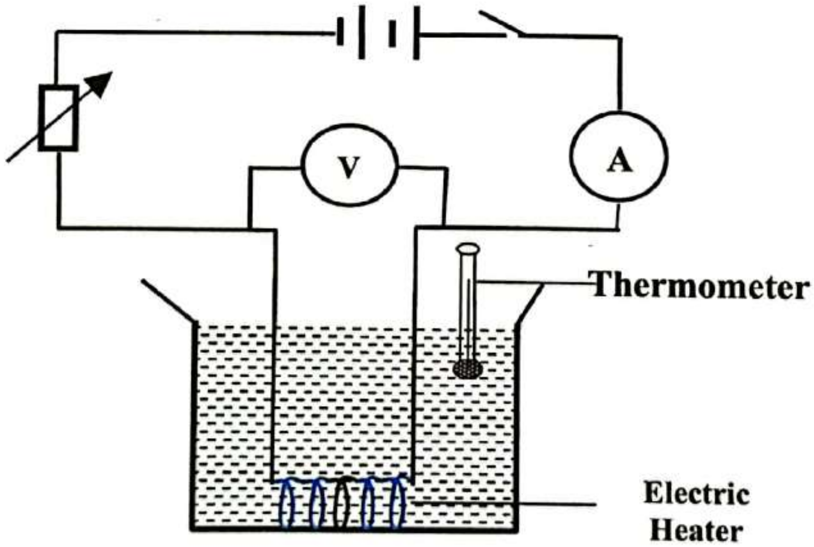
$= 100\%$ ✓ 1

SA

13. (a) Define specific heat capacity (1mk)

The quantity of heat required to raise the temperature of a unit mass of a substance by one Kelvin. ✓ 1

(b) Figure below shows a set up in an experiment to determine specific heat capacity of water.



The data below was obtained from the experiment.

05

± Voltage (V) across the heater =**12V**
± Current (I) in the circuit = **1.4A**
± Time (t) of heating = **600s**
± Mass (m) of water = **0.4kg**
± Change in temperature ΔT = **6°C**

Determine:

(i) The electrical heat energy (2mks)

Electrical Energy = VIt
= 12 x 1.4 x 600 ✓1 S.A
= 10,080J ✓1

(ii) Use the above results to determine the specific heat capacity of water. (3mks) F.S.A

Heat gained by water (MCΔθ) = Heat given by the heater (VIt) ✓

$c = \frac{VIt}{M\Delta T}$ ✓ | $c = \left(\frac{10080}{0.4 \times 6}\right)$ ✓ = 4,200J/kg/K

(iii) The power of the electrical heater. (2mks)

Power = VI
= 12 x 1.4 ✓1 S.A
= 16.8W ✓1

14. (a) If the volume of a fixed mass of a gas is tripled at constant temperature, what happens to its pressure. (1mk)

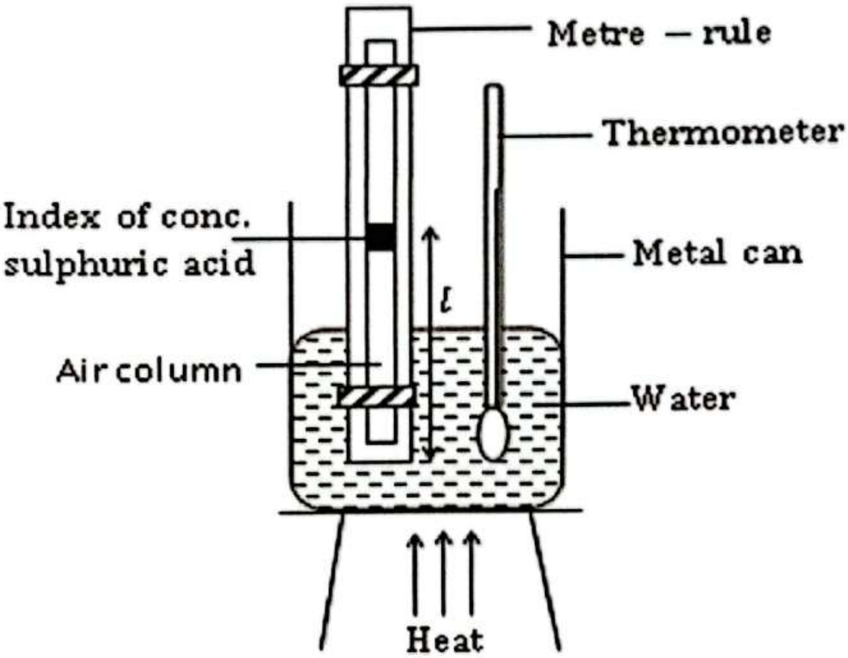
The ~~volume~~ reduces to a third (1/3) its original. ✓1

....

Look out for factor of 3

08

(b) The diagram below shows apparatus used to verify Charles' Law.



(i) State the measurements to be taken from the apparatus (2mks) 1

- Temperature of water / Air collumn ✓ (2)
- Height / Length of air Collumn. ✓ 1

(ii) Describe how apparatus can be used to verify the law (3mks)

- Record room temperature and the corresponding height of the air collumn. ✓ 1 (3)
- Heat the bath and ~~record~~ tabulate the temperature and the corresponding height of the air collumn at ~~corresponding~~ suitable intervals. ✓
- Plot a graph of height / volume against absolute temperature ✓
- It produces a straight line through the origin showing that volume is directly proportional to absolute temperature ✓

05

(c) A gas has a volume of **20cm³** at **27⁰C** and at normal atmospheric pressure. Calculate the new volume of the gas if it is heated to **54⁰C** at the same pressure. (2mks)

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V_1 = 20cm^3$

$T_1 = 27°c = 300K$

$T_2 = 54°c = 327K$ S.A

$V_2 = ?$

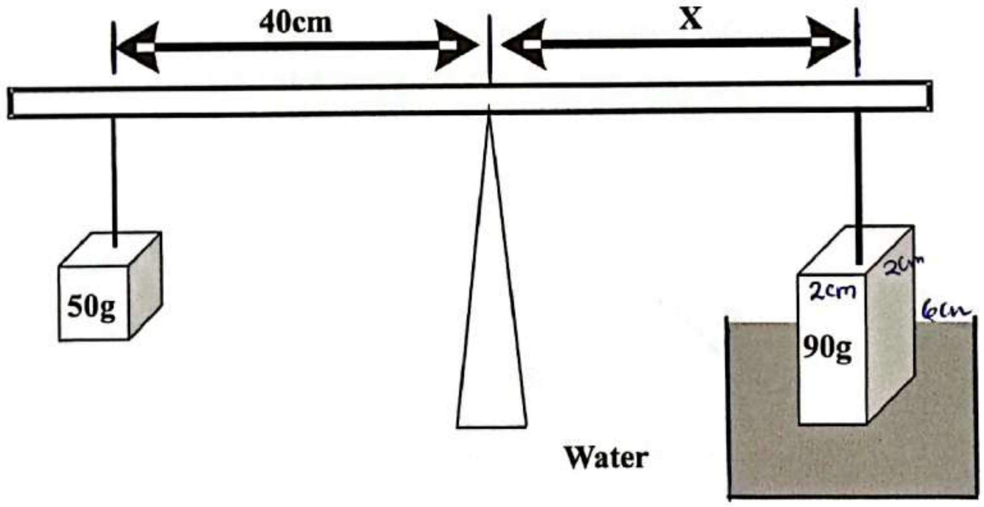
$V_2 = \frac{T_2 V_1}{T_1} = \frac{327 \times 20}{300}$ ✓1

$= 21.8cm^3$ ✓1

15.(a) State Archimedes Principle (1mk)

When a body is partially or totally immersed in a fluid, it experiences an upthrust equal to the weight of the fluid displaced. ✓1

(b) The system below is in equilibrium and balanced at the centre of gravity.



(i) When the temperature of the water is raised, the system is observed to tilt to the right. State the reason for this observation. (2mks)

Water expands, it's density reduces ✓1 and the upthrust reduces ✓1, the block thus sinks more.

05

Given that the block is half immersed

(ii) Calculate the volume of the water displaced. (Dimensions of the block are 2cm by 2cm by 6cm) (2mks)

Volume of block under water = volume of water displaced ✓

$= \frac{1}{2} \times 2 \times 2 \times 6 = 12\,cm^3$ ✓ S.A (2)

(iii) Calculate Upthrust and hence the apparent weight of the block. ***(Given the density of water is 1000kg/m³)*** $g = 10\,N/kg$ (2mks) S.A

Upthrust = Weight of water displaced

$= 1000\,\frac{kg}{m^3} \times 12 \times 10^{-6}\,m^3 \times 10\,N/kg$

$= 0.12\,N$ ✓ 1

Apparent wt = wt in air − U

$= 0.9 - 0.12$

$= 0.78\,N$ ✓ 1

(iv) Determine the value of distance X. (3mks)

$F_1 d_1 = F_2 d_2$ ✓ 1

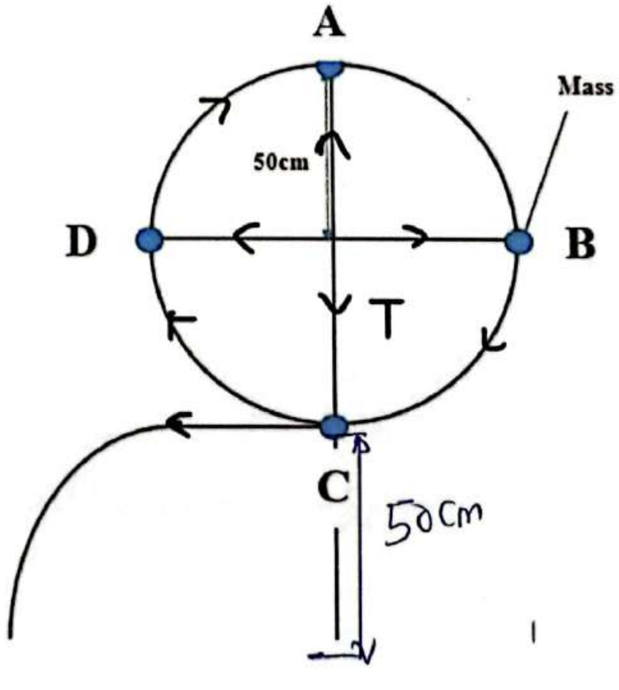
$0.5 \times 0.4 = 0.78 \times x_2$

$x_2 = \left(\frac{0.5 \times 0.4}{0.78}\right)$ ✓ 1

$X = 0.256\,m$

$= 25.6\,cm$ ✓ 1 F.S.A

16. A mass of **100g** is whirled in a vertical plane using a string of radius **50cm** as shown below in the clockwise at a speed of **2m/s.**



(a) Determine:

(i) The angular velocity. (2mks)

Angular Velocity $(\omega) = \frac{V}{r} = \frac{2m/s}{0.5m} = 4 rad/s$ ✓ 1 S.A

(ii) The tension, **T** on the string at point C. (3mks)

$T = m\omega^2 r + mg$ ✓ 1

$= \left(\frac{100}{1000} \times 4^2 \times 0.5\right) + \left(\frac{100}{1000} \times 10\right)$

$T = 0.8 + 1$ 1

$= 1.8N$ ✓ 1 F.S.A

(b) If the string snaps at point C, **50cm** above the ground. Determine:

(i) The time taken for the mass to hit the ground. (2mks)

$H = \frac{1}{2}gt^2$

$0.5 = \frac{1}{2} \times 10 \times t^2$

$t^2 = \frac{0.5}{5}$ ✓ 1

$t = \sqrt{0.1}$

$t = 0.316$ seconds. ✓ 1 S.A

(ii) The horizontal distance travelled before heating the ground. (2mks)

$R = ut$

$= 2m/s \times 0.316s$ ✓ S.A

$= 0.632m$ ✓

(c) Explain how a centrifuge may be used to separate cream from milk. (2mks)

Pressure difference created at a distance from the centre of rotation exerts a force which provides centripetal force. ✓ 1

Centripetal force is greater for cream (lighter particle) pulling it closer to the centre leaving milk at the bottom of the test tubes. ✓ 1

11