SOLUTIONS TO THE ANNUAL NATIONAL LOWER SECONDARY CURRICULUM PHYSICS

SEMINAR HELD ON 29/06/2025 AT SEETA HIGH GREEN CAMPUS

PHYSICS 535/1 AND 535/2

ITEM ONE

(i) Cross sectional area A $A = \pi r^2$

$$= 3.14x\left(\frac{0.35}{1000}\right)^2$$

$$A = 3.85x10^{-7}m^2$$

$$Tensile\ stress\ \delta = \frac{Force}{Area, A}$$

$$For\ iron\ \delta = \frac{6000}{3.85x10^{-7}}$$

$$= 1.56x10^{10}\ Nm^{-2}$$

$$Tensile\ strain\ for\ iron\ \epsilon = \frac{extension}{original\ length}$$

$$\epsilon = \frac{\frac{2}{100}}{10} \qquad \epsilon = 0.002$$

$$Young's modulus\ E = \frac{tensile\ stress}{tensile\ strain}$$

$$= \frac{1.56x10^{10}}{0.002}$$

$$E = 7.8x10^{12}Nm^{-2}$$

$$Tensile\ stress\ for\ wood\ \delta = \frac{Force}{Area, A}$$

$$= \frac{4000}{3.85x10^{-7}}$$

$$= 1.04x10^{10}Nm^{-2}$$

$$Tensile\ strain\ for\ wood\ \epsilon = \frac{extension}{original\ length}$$

$$= \frac{\frac{2.5}{100}}{10}$$

$$= 0.0025$$

$$Young's modulus\ E = \frac{tensile\ stress}{tensile\ strain}$$

$$= \frac{1.04x10^{10}}{0.0025}$$

$$= 4.16x10^{12} Nm^2$$

Since the tensile stress and young's modulus of iron is higher than that of wood, then iron is stronger than wood

(ii) Properties of bricks

- ✓ They have strong compressive strength
- ✓ They are resistant to weathering
- ✓ They have strong thermal insulation
- ✓ They can easily be recycled

Properties of tiles

- They are water proof
- They are strong under compression
- They are chemical resistant
- They are fire resistant

Properties of iron

- ❖ It is ductile
- ❖ It has high tensile and compressive strength
- ❖ It is fire resistant

Properties of wood

- ➢ It has high compressive strength
- ➢ It is easy to work with since it can be shaped or cut into different forms easily
- ➢ It has good thermal insulation

Properties of concrete

- ❖ It very strong under compression
- ❖ It is weather resistant
- ❖ It is fire resistant

- ❖ It can be molded to different shapes when reinforced
- ❖ It is less corrosive

(iii) The walls should be painted white because white is a reflector of heat and will keep the house cool during hot weather, while black is a good absorber of heat and will cause the house to become hot on hot days

The roof should be made of grass because grass is an insulator which will keep e house cool on hot days since it will not absorb heat quickly from the surroundings. It will also enable the house to remain warm on cold days since it will not easily conduct away heat. The iron roof would easily conduct heat since iron is a good conductor of heat this would make the house hot on hot days and cool on cold days.

ITEM TWO

(a) Time taken by the nurse $During\ acceleration\ v = u + at$

$$40 = 0 + 2t$$

$$t = 20s$$

$$time\ taken\ during\ constant\ velocity\ \ s = ut$$

$$8000 = 40t$$

$$t = 200s$$

$$time\ taken\ during\ deceleration\ v = u + at$$

$$0 = 40 - 4t$$

$$t = 10s$$

$$total\ time\ taken = 20 + 200 + 10$$

$$t = 230s$$

$$heat\ gained\ = heat\ gained\ by\ ice\ in\ temperatures\ change + in\ melting + temp\ raise\ for\ water + heat\ gained\ by\ temperature\ raise\ of\ vaccinne$$

$$pxt = mc_1(\theta_1 - \theta_2) + ml_f + mc_2(\theta_2 - \theta_3) + m_2c_2(\theta_1 - \theta_3)$$

$$200X230 = \frac{110}{1000}x2100x(0 - -5) + \frac{110}{1000}x3.36x10^5 + \frac{110}{1000}x4200x(\theta - 0) + \frac{400}{1000}x2000x(\theta - -5)$$

$$46000 = 1155 + 36960 + 462\theta + 800\theta + 4000$$

$$3885 = 1262\theta \qquad \theta = 3.08^0C$$

The vaccine was delivered within the recommended temperature range since the temperature as the nurse reached the destination was below 4^0C

(b) The tyres were worn out due to friction, this results into generation of heat and abrasion, causing the tyres to wear off.

(c) The nurse should put on a helmet

The nurse should not drive above the recommended speed limit

The nurse should not over load the motorcycle

The nurse should put-on heavy-duty shoes or gum boots

ITEM THREE

(a) $$^{90}_{38}Sr \rightarrow {}^{90}_{39}Y + {}^{a}_{b}X$$

$$a + 90 = 90 \qquad a = 0$$

$$b + 39 = 38 \qquad b = -1$$

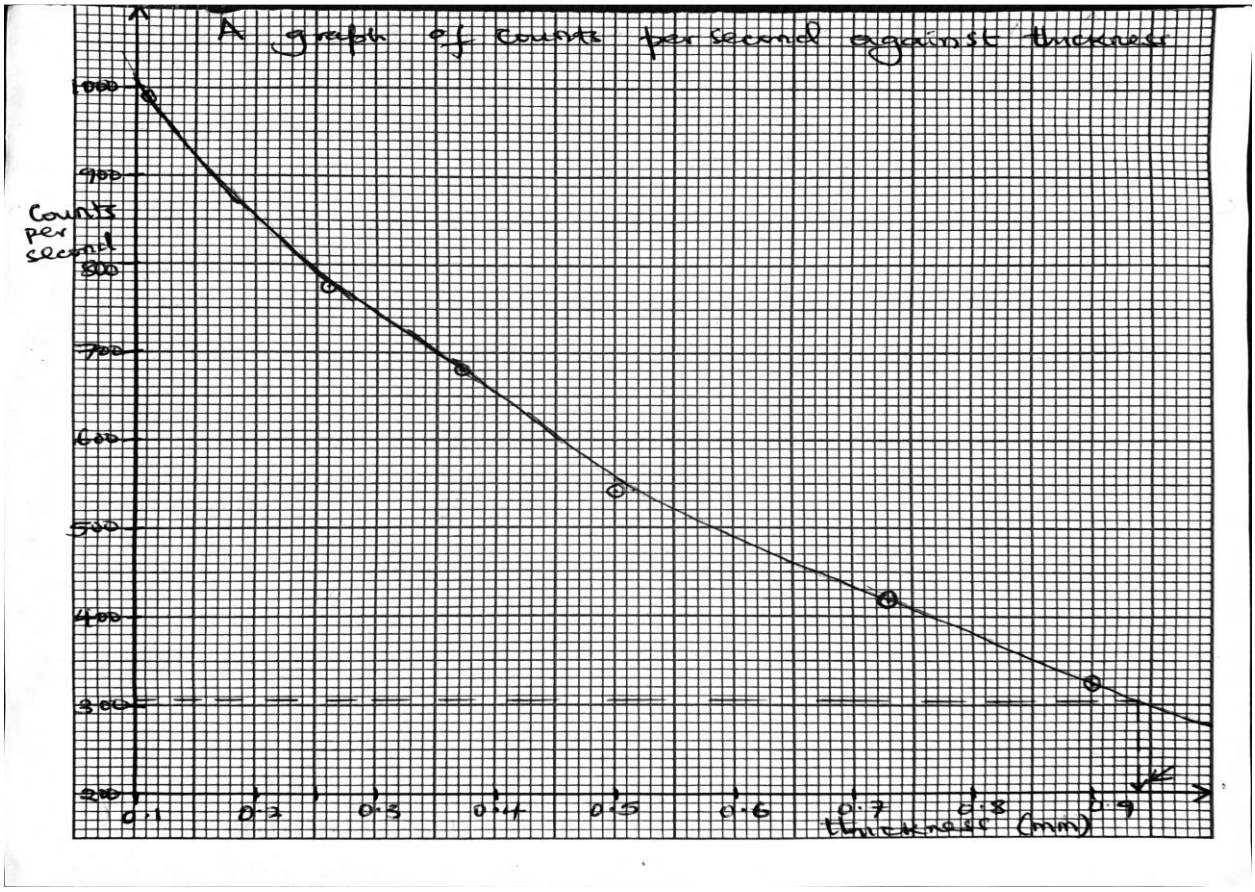
$$Therefore\ X\ is\ {}^{0}_{-1}X\ hence\ an\ beta\ particle.$$

Beta particles are preferred for use in monitoring process during production of plastic sheets because they are partially absorbed depending on thickness. When the sheet is thick more of the beta particles are absorbed and a few penetrate through while if it is thin most beta particles pass through and detected, therefore control system can be adjusted according to produce the sheet of required thickness.

The alpha particles are completely absorbed by the sheet, irrespective of thickness and thus can't be used

The gamma rays have high penetrating power and are almost not absorbed even at higher thickness so can not be used

(b)



From the graph the thickness of 6 sheets=0.94mm

Thickness of one sheet = 0.156mm

C) Precautions

People working with strontium should put on protective clothing lined with lead

People working with strontium should handle it using long tongs

People working with strontium cover any open wounds

People working with strontium should avoid over exposure to the radiations emitted

People working with strontium should not eat or drink while working with it

ITEM FOUR

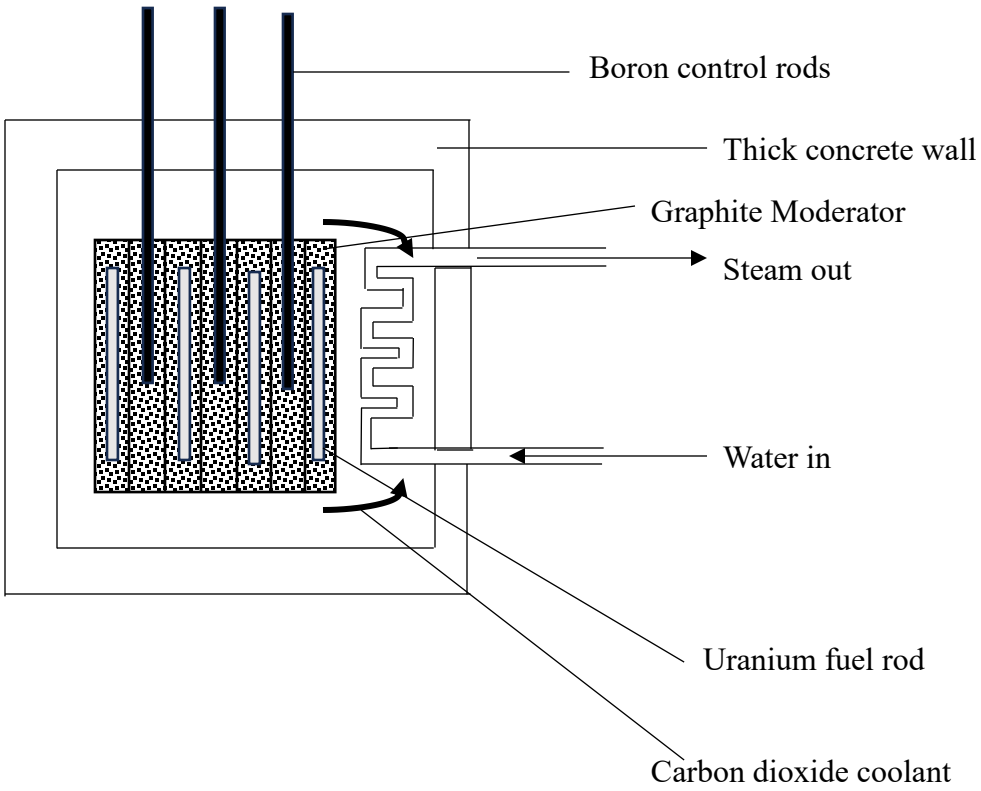
(a) ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + X \ {}^{1}_{0}n$

$$235 + 1 = 141 + 92 + X$$

X =3

Therefore three neutrons are produced

(b)



The atoms of uranium in the fuel rods capture a neutron and undergo a fission reaction producing barium, krypton, three neutrons and energy in form of heat according to the equation below

$$^{235}_{92}U + ^{1}_{0}\cap \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3\ {}^{1}_{0}\cap + energy$$

The heat produced is absorbed by the carbon dioxide circulating in the reactor which heats up the water in the heat exchanger producing steam which is used to drive the turbines to produce electricity.

The neutrons produce further fusion reaction resulting in a chain reaction.

The control rods made of boron capture the excess neutrons keeping the fission reaction at the required rate

(c) The moderator slows down the neutrons produced so that they can cause fission of uranium -235 other than the other isotopes

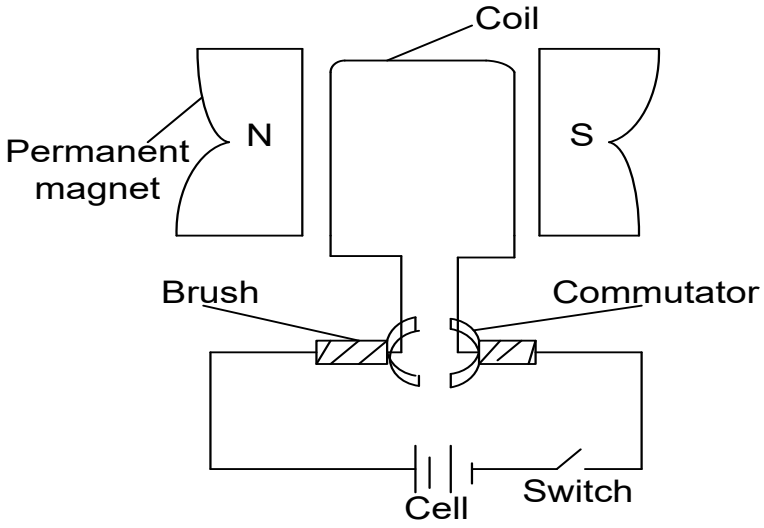
The control rods capture excess neutrons keeping the fission level to the required rate and prevent the reaction from growing out of control.

(d) The people working in the plant should take precautions because the radiations emitted in the uranium fission are highly dangerous and can cause severe harm to human life.

ITEM FIVE

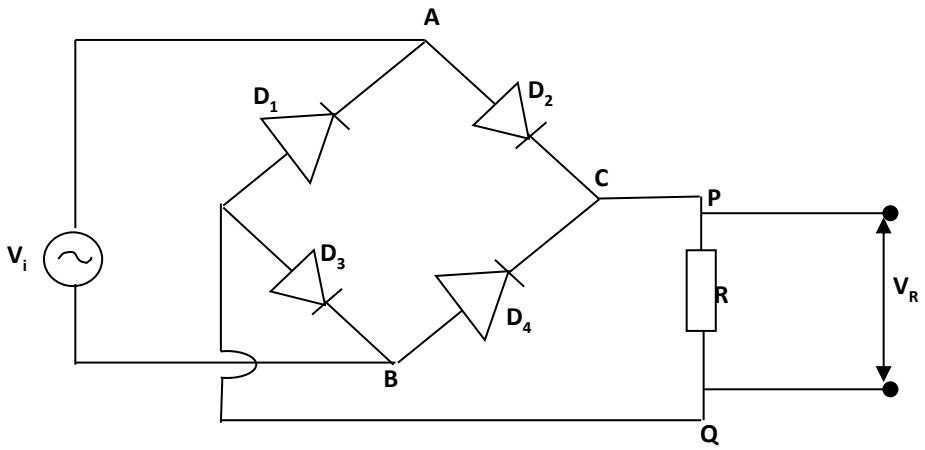
(a) The fan is able to rotate due to an electric motor.

An electric motor is made of a rectangular coil wound on soft iron and placed between concave poles of a permanent magnet.



When the switch is closed current flows through the coil, side AB experiences a downward force and CD experience an upward force according to Fleming's lefthand rule. The two forces are equal but opposite which constitute a couple. This couple causes the coil to rotate, when the coil reaches vertical position, the commutators lose contact with the carbon brushes and the current is cut off. However, the coil is driven past this position due to the momentum. The commutators then change contact with the carbon brushes, current reverses direction in the coil but it continues to rotate in the same direction.

(b) The a.c is converted to direct current through a process called rectification. This achieved by use four diodes



- During the first half cycle when A is positive diodes D_2 and D_3 conduct because they are forward biased while the diodes D_1 and D_4 do not conduct because they are reverse biased.
- In the second half cycle diodes D_1 and D_4 conduct while the diodes D_2 and D_3 do not conduct.
- During both half cycles current flows through the load in the same direction hence full wave rectification.

(c) $P = \frac{v^2}{R}$ $\quad 1000 = \frac{240^2}{R}$

$$R = \frac{57600}{1000}$$

R=57.6Ω

The manager was wrong since the resistance of the speaker is 57.6Ω and not 60Ω

ITEM SEVEN

(a)

ITEM	NUMBER OF UNITS	COST
BULBS	$\frac{4 \times 2 \times 100 \times 15 \times 30}{1000} = 360$	360 X 900 = 324000
FLAT IRON	$\frac{2500 \times 20 \times 30}{1000 \times 60} = 25$	25 X 900 = 22500
LOUD SPEAKER	$\frac{2 \times 1800 \times 5 \times 30}{1000} = 540$	540 X 900 = 486000
REFRIGERATOR	$\frac{1000 \times 1 \times 30}{1000} = 30$	30 X 900 =27000
	TOTAL	=859500

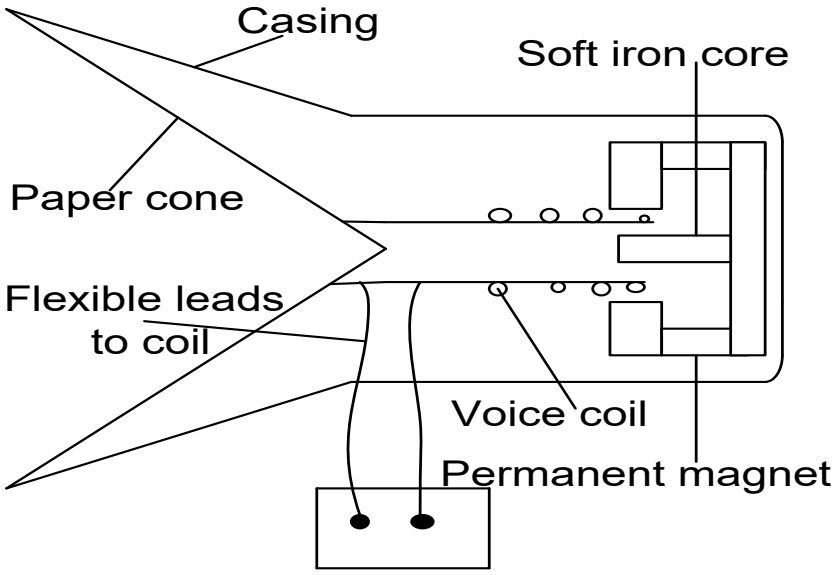
The cost of the monthly electricity bill is shs 859500 which is means they are over charged by shs 500 by the land lord.

(b) They should switch of the lights during day time and when not in use

They should low power consuming and efficient appliances

They should use energy saving bulbs

(c) The loud speaker



A varying electric current passes through the speech coils. The speech coils experience a varying force due to the magnetic field which causes them to move to and fro together with the paper cone attached to it. The paper cone sets the air into vibration causing the air to vibrate at the same frequency as the current flowing through the speech coils reproducing the original sound.

ITEM EIGHT

(a) The government used the monitoring satellites to locate the position of the locusts

The monitoring satellites have cameras, thermometer and other instruments for capturing data. The data collected is sent to the ground station where it is analysed by experts and the right action is chosen.

With precision after the location of locust they were sprayed hence solving the problem in a short time.

(b) Speed of the satellite.

In a single rotation the satellite covers a circle, and the period is 24 hours

$$Average\ speed = \frac{distance\ moved\ by\ satellite}{time}$$

$$average\ speed = \frac{2\pi R}{T}$$

$$= \frac{2\,\pi\,[(35000 + 6300)x1000]}{24 \times 3600}$$

$= 3.00 \times 10^3 ms^{-1}$ /1.08x10^{4}kmh^{-1}

$$speed\ of\ the\ island = \frac{distance\ covered}{time}$$

In one rotation the island covers a distance equal to the circumference of the earth and takes time to make one revolution equal to 24 hours

$$speed\ of\ island = \frac{2\pi r}{T}$$

$$= \frac{2 \times \pi \times 6300 \times 1000}{24 \times 3600}$$

$= 4.58 \times 10^2 ms^{-1}$/1.65x10^{3}kmh^{-1}

Relative speed of the satellite =3.00x10^3—4.58x10^2

=2.542x10^{3}ms^{-1}

(c) They will use the AND gate

Truth table for the gate

INPUT			**OUT PUT**
A	**B**	**C**	**D**
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

ITEM NINE

(a) Energy in the sun is produced by nuclear fusion.

The hydrogen atoms in the fuse together to form helium and energy in form of heat. This results in very high temperatures causing further fission to occur.

(b) The sun is the support of life in our solar system because;

It is the primary source of energy used by plants to produce carbohydrates in the process of photosynthesis

The sun provides heat energy which enables some organisms to die because of extreme heat.

Due to the heat the sun helps in the rain formation which essential for plant growth.

(c) Surface temperature of the sun =6000K

Difference in temperature between sun and Earth's surface $= 6000 - (273 + 27)$

$$= 5700K$$

$$Time\ taken\ for\ the\ heat\ to\ reach\ the\ Earth = \frac{distance}{speed}$$

$$= \frac{149600000 \times 1000}{3.0 \times 10^8}$$

$$= 498.69\ s$$

$$average\ rate\ of\ temperature\ loss = \frac{5700}{498.6} = 11.43Ks^{-1}$$

(d) $power\ consumption = 4 \times 15\ + 60$

Power consumption = 120W

Rating for the solar =Pxt

= 120 x5

=600Wh

ITEM TEN

(a) The lab technician should install a convex mirror which has a wide field of view and can be used to monitor a wider area. In addition, it forms upright virtual images which can be clearly identified

(b) The mirror is used for security to check under neath cars. The mirror is moved below the car and since it has a wide field of view all the parts below the car can be seen clearly

The mirror can be used in reflecting telescopes

The mirror can be used as a driving mirror.

(c) $v = \frac{2d}{t}$ $\quad 340 = \frac{2d}{0.5}$

$$d = \frac{340 \times 0.5}{2}$$

d =85m

The width of river Nile at that part is 85m

ITEM 11

(a) The old woman is suffering from presbyopia. This occurs when the center of the lens hardens due to old age and the eye can not focus nearby and far objects. There is gradual thickening and loss of flexibility of the lens. A person suffering presbyopia experiences eye strain and headaches.

This is corrected by use of a bifocal lens which has two parts to cater for both long and shortsightedness or by refractive surgery

(b) $V = \frac{2d}{t}$ $\quad 330 = \frac{2d}{0365}$

$$d = \frac{330 \times 0.365}{2}$$

$$d = 60.225m$$

Cost =distance X cost per metre = 60.225 X 5000

= Shs 301125

The old woman will pay shs 301125 to the employees

ITEM ONE

535/2 Physics Expected Responses

AIM:

An investigation to determine the density of the material of the rubber bung in the school laboratory to confirm whether it can be used as bottle covers.

VARIABLES:

Independent variable; distance x of rubber bung from pivot

Dependent variable; distance y of standard mass from pivot.

Fixed variable; position of pivot/centre of gravity, material of the metre rule

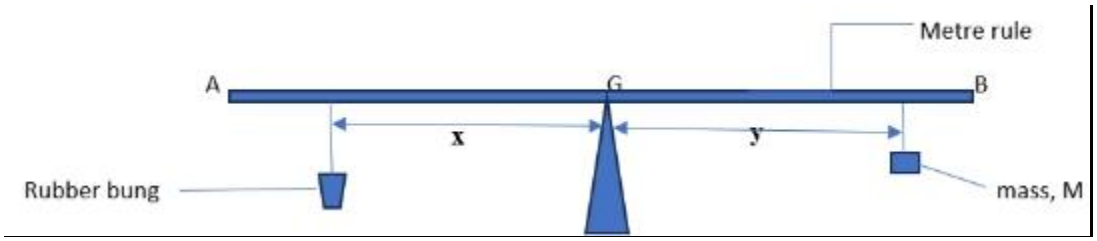
HYPOTHESIS:

Density of rubber bung lies in the range 0.9 gcm^{-3} – 1.1 gcm^{-3}

LIST OF APPARATUS;

Rubber bung, 100g mass, pieces of thread, metre rule, knife edge, wooden block

DIAGRAM



(a) The metre rule AB was balanced on a knife edge and its balance point G noted.

(b) Rubber bung was suspended from end A of the metre rule such that it is at distance x = 45.0 cm from the pivot

(c) Mass M = 100g was hung from end B of the metre rule and its position adjusted until the metre rule balances again horizontally.

(d) Distance y of M from pivot G was measured and recorded

(e) Steps (b) and (e) were repeated for values of x =40 .0, 35.0, 30.0, 25.0 and 20.0cm

(f) Results were recorded in a table

(g) A graph of y against x was plotted

(h) Slope S of the graph was then calculated

(i) The mass m of the rubber bung was calculated from the expression;

$m = 100S$.

(j) Water was poured into a beaker up to a level $V_1 = 200cm^3$ mark

(k) Rubber bung was completely immersed in water such that water rises to a level V_2

(l) The volume of the rubber bung $V = V_2 - V_1$

(m) The density of the rubber bung was calculated from the expression $\rho = \frac{m}{v}$

POSSIBLE SOURCES OF ERRORS

- Parallax error in reading balance lengths, x and y
- Error in locating position G of the Centre of gravity
- Air resistance/wind
- Working surface not flat.

PRECAUTIONS

- Reading scale of the metre rule at a point directly in front of it to avoid parallax error.
- By ensuring that the windows were closed
- By ensuring that working surface was flat.

TABLE RESULTS;

G = 50.0cm

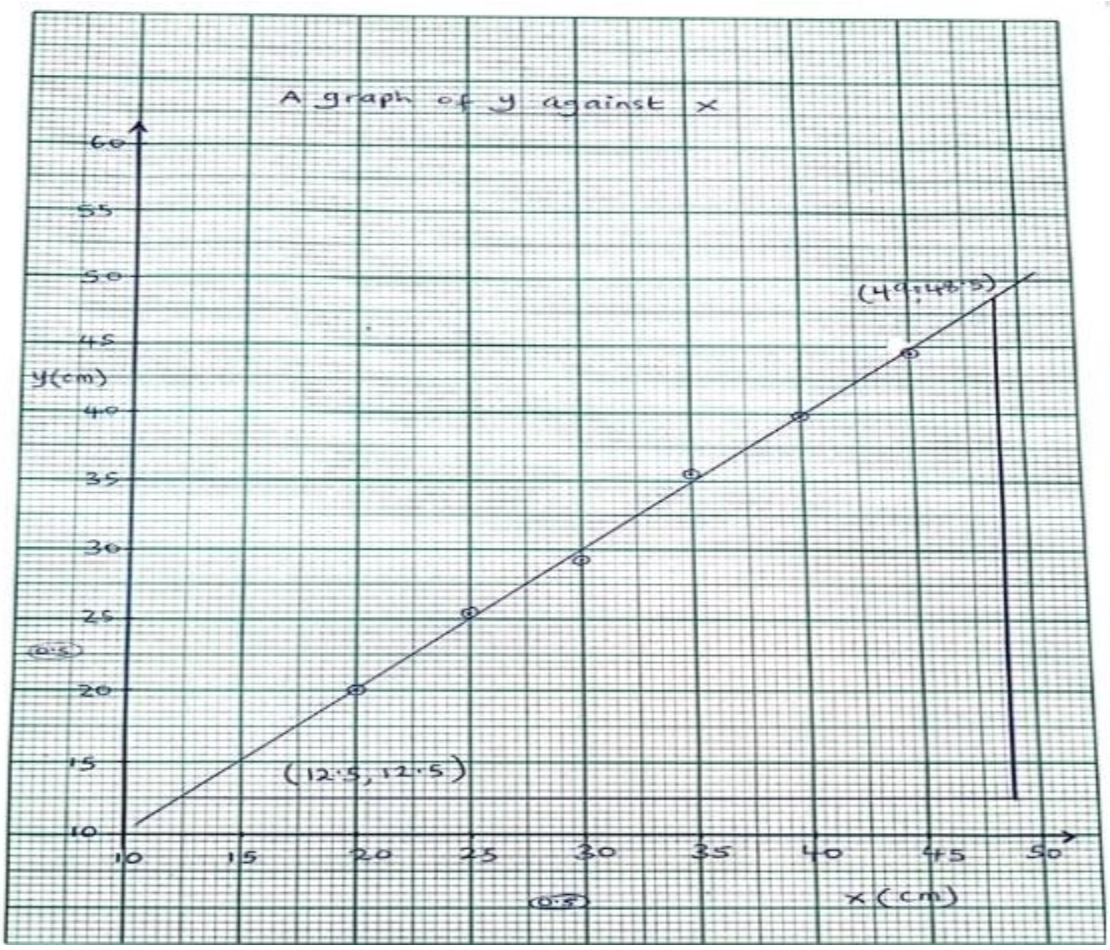
x(cm)	y(cm)
45.0	44.5
40.0	39.8
35.0	35.5
30.0	29.2
25.0	25.4
20.0	20.0

$$\text{Sope S} = \frac{change\ in\ y}{change\ in\ x}$$

$$= \frac{48.5-12.5}{49.0-12.5}$$

$$= \frac{36.0}{36.5}$$

$$= 0.986$$



The mass of rubber bung is calculated from formula m= 100S

= 100 x 0.986

= 98.6g

Initial volume V_1 = 200 cm^3

Final volume V_2 = 249 cm^3

Volume of the rubber bung $v = 249 - 200$ = 49 cm^3

Density of the rubber bung $\rho = \frac{m}{v} = \frac{98.6}{49}$ = 2.0 gcm^{-3}

Conclusion

The density of the rubber bung does not lie within the accepted range; therefore, the material of the rubber bung cannot be used as bottle covers.