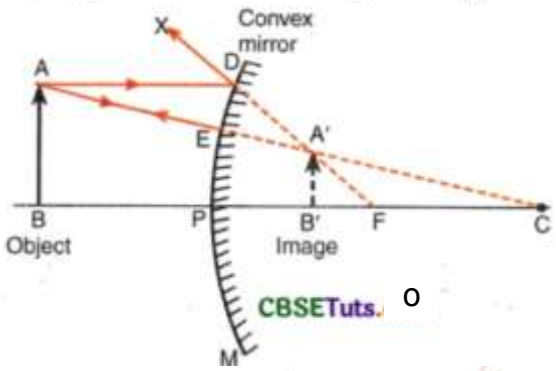
SOLUTIONS 2026

LIGHT AND WAVES

ITEM 1:

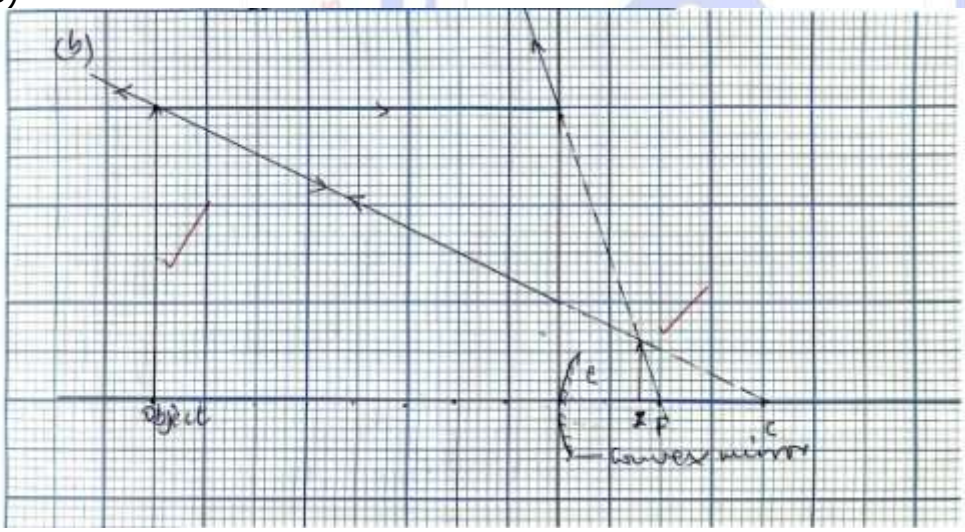
a)They made convex (diverging) mirrors



o

- A ray of light from the object O initially parallel to the principal axis is reflected diverging and it appear as if it is from the principal focus F.
- A ray from the object O through the centre of curvature C is reflected along the same path.
- The point where the above two rays appears to intersect is where the image I is formed as shown above.

b)



h_o = 150 cm

u = 200 cm

f = 50 cm

Let 1 cm represent 25 cm.

(Graph paper)

$$magnification = \frac{hi}{ho}$$

$$= 30 / 150$$

$$= 1/5$$

$$= 0.2$$

OR

= v / u = 40 / 200 = 1/5 = 0.2

- The green uniform appeared green under yellow flood light because the green colour reflects the green in yellow.
- The blue uniform appears black because yellow is absorbed by blue.
- The red sweaters appear red, because the red in yellow is reflected by the red in the sweaters.

d)Convex mirrors are used;

- As driving mirrors. This is because they always form erect image and have a wide field of view.
- In supermarkets to observe the activities of customers -In security check points to inspect under vehicles (security mirrors)

ITEM 2

(a) The road signs and features that should be put at the sharp bend to minimize accidents are:

- Road signs with reflecting colours show the bent road ahead.
- Road signs with glass reflectors like road studs and glasses with reflectors on road barriers/guard rails.
- Convex mirror to work as traffic mirrors.
- Using reflecting colours to write words like "slow down" or zig-zag signs at points near the black spot.

(b) Rain and foggy conditionsbring about a lot of water droplets being suspended in space which scatter the parallel beam of light from the headlamps in all directions giving a glare effect that reflects light back into the driver's eyes instead of illuminating the road ahead.
At night, the lack of natural light leaves only the artificial bulbs to illuminate a narrow section directly in front of the car.

(c) The sound from the presentersis distorted and not clear due to reverberation of sound waves. This is where the original sound interferes with the echo to produce a prolonged sound. During the interference of waves both destructive and constructive wave patterns are formed causing more distortions. This can be minimized by;

✓By covering the walls of the hall with soft absorbent materials
✓Using thick curtains
✓Using cushioned furniture
✓Modifying the shape of the ceiling board

From $V = 2d / t$

Given:

$V = 320\ m\ s^{-1}$
$t = 0.2$ second
$d = ?$

Assuming the distance is the movement of sound in the hall, then $V = 2d / t$
$320 = (2 \times d) / 0.2$
$2d = 0.2 \times 320$
$2d = 64$
$d = 32m$

- ∴ The estimated length of the hall is 32 metres

ATOMIC PHYSICS

ITEM 1:

a)The radiations emitted from the decay process of TC – 99 are dangerous because the cause many health challenges. Therefore, safety precautions can be put in place for the safety of patients, workers and community members like;

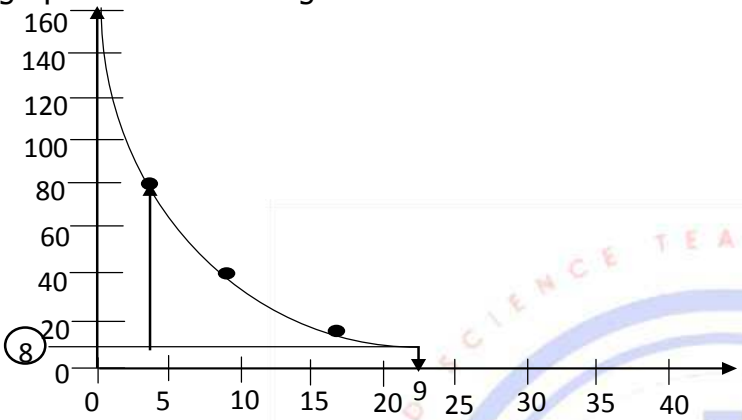
- Constant use of lead shielding

- Minimize exposure time
- Maximize distance from the source (avoid unnecessary exposure) -Wearing protective equipment and radiation badges.
- Display awareness messages like "follow safety rules, respect warning signs".

The accurate answer and maximum score is obtained when a graph is used.

Count rate (Cs^{-1})	160	80	40	20	10	5
Time (hours)	0	6	12	18	24	30

A graph of count rate against time



The time T obtained from the graph is the answer.

NB: (I did not have papers and graph papers)

b) $^{99}_{43}Tc \longrightarrow {}^{99}_{44}Ru + {}^{0}_{-1}e$ + Energy

From the equation; Y is an electron and therefore, a beta particle. Y is a beta particle and it carries a negative charge.

c) Technetium – 99 is used because; -It has a short half-life (6 hours)
- Reduced risks of radiation exposure
- It provides enough time for imaging.

d) Time for settling back is possible when the count rate from the waste reduces from 160 Cs^{-1} to 8 Cs^{-1} (background radiation)

ITEM 2:

a) Uranium is bombarded by a slow neutron, it produces two daughter nuclei and heat then the reaction goes on hence the energy produced is collected, used to heat the water through pipes, the water turns into steam which runs turbines and produce electricity.

b) Retired engineers disagreed with;
- The disposal in the river would lead to radioactive water and radiations are dangerous to humans (leukaemia and other cancers)
- The high density and population will stand a very high risk on passing on of attacks.
- Radio leaker – causing cancers, birth defects and contamination of land, water for decades.
- Health risks during normal operation. During normal conditions, nuclear plants release very low levels of radioactive gases.
- They require large amounts of water for cooling, hence the water returned to river can kill fish.
- Nuclear waste storage (high level radioactive waste remains, hence low to store it.
- A nuclear plant could be attacked, causing a catastrophic release. Residents are unsafe

Isotopes undergo beta decay

c)(i) Neutron in the nucleus converts into a proton, emitting an electron (beta particle) gamma rays are also emitted.

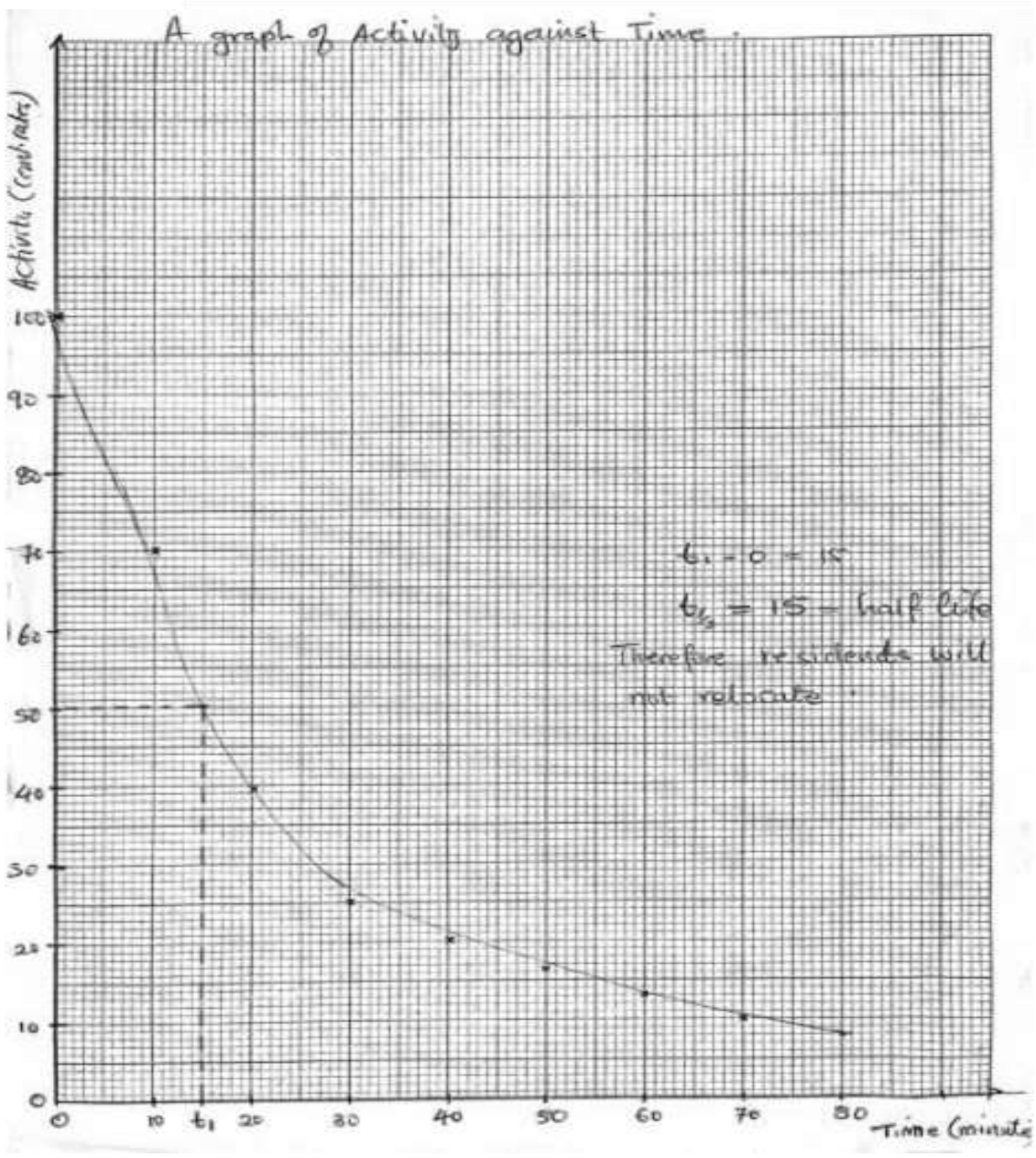
These radiations penetrate human body causing

- Skin burns
- Eye irritations
- Infertility
- Genetic disorders

(ii) **Scale**

	Graph	**Ground**
Horizontal	1 cm	20 cm
Vertical	1 cm	10 cm

Transferred to graph



Since the half-life is less than 20 minutes, then the residents will not relocate because the radiations becomes dangerous when the half-life is greater than 20 minutes.

EARTH AND SPACE

ITEM 1:

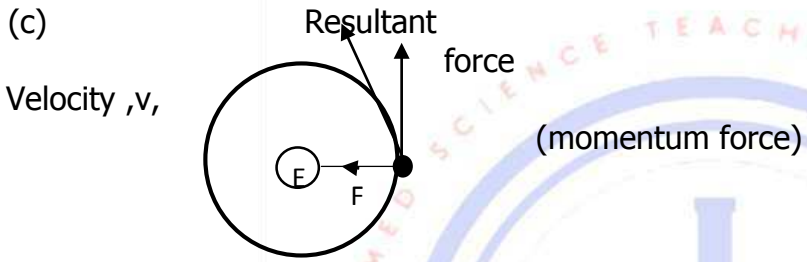
(a)Satellites enable effective and timely communication over a large geographical area including remote areas.

- It provides accurate weather forecasting information to the people.
- It assists in disaster monitoring and management.
- Supports environmental monitoring to avoid or reduce effects of greenhouse gases and other challenges.
- Enhances agricultural planning and improving food security.
- It improves navigation (GPs) and mapping services.

(b)- Geostationary satellites orbit the earth above the equator.

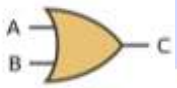
- The satellite completes one cycle after 24 hours. Therefore, it appears stationary relative to a point on earth and ground antennas do not need constant adjustment.
- Continuous communication coverage is provided to a specific region.

(c)



The earth attracts the satellites by a gravitational force F.
The satellite moves with a tangential force to its orbit by a velocity (v) The resultant force of the two forces keep the satellite in a continuous circular motion in orbit

d)The logic gate to be used is OR gate because either one input or both inputs will make the bulb to produce light.



TRUTH TABLE

Let A be a person present in the room.
A = 1
A = O person absent
Let B = 1 be darkness
B = O bright light
C = 1 bulb lights
C = O no light from the bulb

A	B	C
O	O	O
O	1	1
1	1	1

The bulb light when one or both inputs are true.

ITEM 2:

a. The nuclear fusion process that takes place in the sun produces a lot solar that provides energy to power the telescopes.
When heavy hydrogen combines to form isotopes of helium, The process produces solar energy as in the equation below.

$$^{2}1\ H + {}_{1}{}^{2}H \longrightarrow {}^{3}_{2}He + {}^{1}_{0}n + Energy$$

b. The ground station received analogy data from the mobile phones and communication house (TV stations) and it is processed into digital data (Encoded) and sent to the satellite (uplink process).
The signals are processed and amplified by the satellite before it is transmitted to the ground stations all over the country (down link) and information is received by the phones after being decoded. This makes communication possible across the country.

c. The stars observed near the moon are of different brightness and different colours because;
- Some stars are nearer the earth's surface than others.
- Stars are of different sizes.
- Stars are of different ages.
- Different stars have different surfaced temperatures and different energy outputs.
- Dust and gas particles between the earth and stars may reduce their brightness.

d. Two inputs must be correct before the door opens means that the logic gate involved is an AND gate.



TRUTH TABLE

Let A be the valid access card.
B be the correct pass word.
C be the opening of gate.

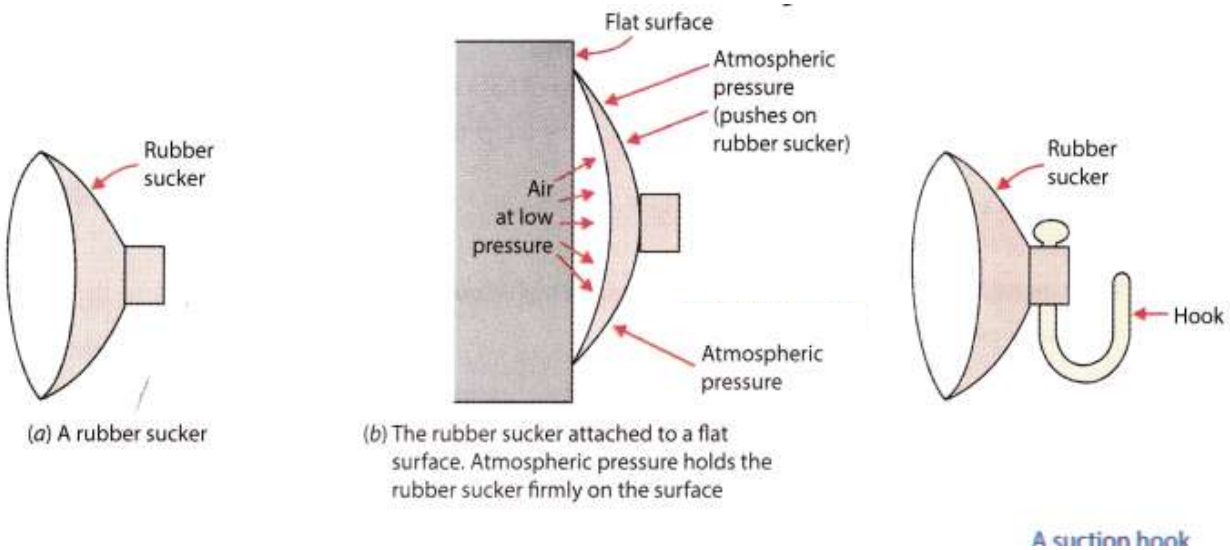
A	B	C
O	O	O
1	O	O
O	1	O
1	1	1

From the truth table the gate only opens when both the card is valid and a correct pass word is punched in.

MECHANICS AND HEAT

Item 1:

a) .



(a) A rubber sucker

(b) The rubber sucker attached to a flat surface. Atmospheric pressure holds the rubber sucker firmly on the surface

A suction hook

The rubber sucker use the principle of atmospheric pressure
When pressed on to the glass, air inside is expelled leaving a semi vacuum, the atmospheric pressure on the outside pressed it hard on a smooth surface since the pressure inside is less than atmospheric pressure it will stick.

b) At the top floor the atmospheric pressure is lower than at the ground floor. This is because as you go up, the concentration of air reduces only the more energetic molecules remain up. Boiling point of water is determined by the atmospheric pressure at that point, hence at the top boiling point is lower, hence less heat to the egg and it takes longer.

c) $v = 2x\ 1000 = 2000\ cm^3$

$$\rho = 1200\ kgm^{-3} = 1.2\ gcm^{-3}$$

$$\rho = \frac{m}{v}$$

$$1.2 = \frac{m}{20000}$$

$$m = 2400\ g$$

$$m = 2.4\ kg$$

$$Quantity\ of\ heat, Q = mc\Delta\theta$$

$$but\ Q = p\ X\ t$$

$$2000\ X\ t = 2.4\ X\ 4000\ X\ (87 - 25)$$

$$2000t = 2.4\ X\ 4000\ X\ 72$$

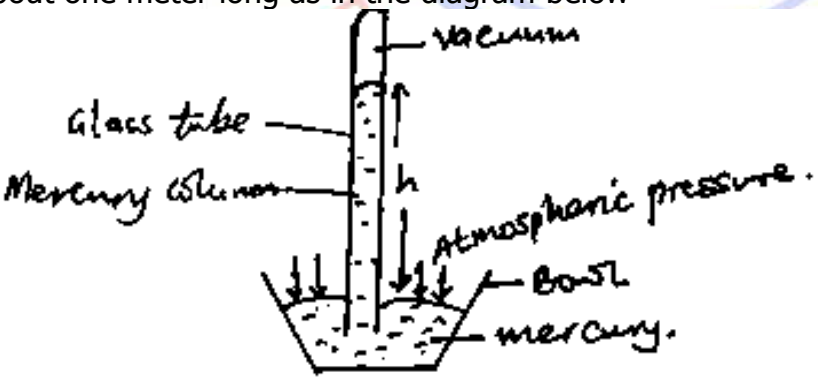
$$t = 5.76\ minutes$$

Basing on the above calculations the time taken is 5.76 minutes which is approximately 5 minutes

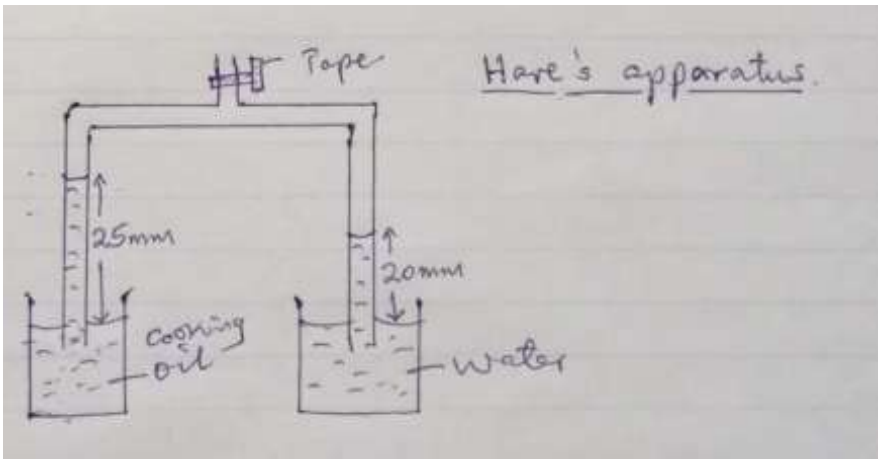
d) Application of a rubber sucker
Sucking a liquid using a straw.
Siphons
Pumps.

ITEM 2

a) The instrument to be used is a simple <u>mercury barometer.</u>
A simple mercury barometer consider of q bowl containing mercury and an inverted closed glass tube about one meter long as in the diagram below



Using the mercury barometer, the pressures both at the bottom and at position of the classroom at measured and recorder.
The pressure difference p = hρg
Where p is the pressure difference
h is the height of the classroom from the ground
ρ Is the density of mercury.
Is acceleration due to gravity
From the above expression, the height of the classroom, h, from the ground can be determined.



b)

When a partial vacuum is created in the tube, the forces due to atmospheric pressure push both water and oil into the different limbs of the tube.

The height of the liquid column depends mostly on the density of the liquid.

Pressure due to oil column = pressure due to water column

$$h_0\rho_0 g_0 = h_w\rho_w g_w$$

$$\frac{25}{1000}\times\rho_0\times 10 = \frac{20}{1000}\times 1000\times 10$$

$$\rho_0 = \frac{200\times 1000}{25\times 10}$$

Density of oil ρ_0 = 800 kgm^{-3}

Basing on the above calculation, the density of cooking is 800 kgm^{-3} which is similar to the standard density, therefore, the cooking oil is pure.

c) Water in a pot percolates through the pores of the pot to the outside and evaporates causing cooling of the remaining water in the pot.

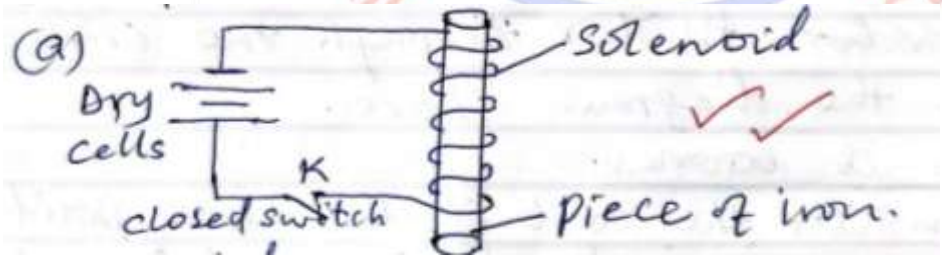
"Evaporation causes cooling"

The jerycan has no pores and no evaporation, therefore, water in the jerrycan remains worn.

ELECTRICITY AND MAGNETISM

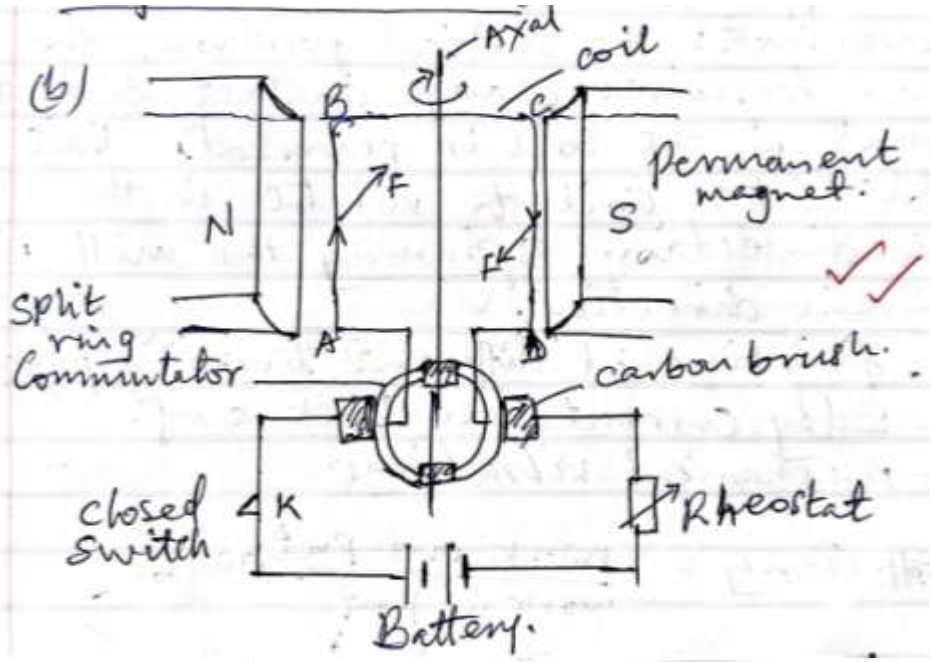
ITEM 1:

(a) electromagnet



(a)

- Enameled (insulated) copper is wound around a pieceofiron to make a solenoid.
- The free ends of the coil are connected to the terminals of a d.c source (Battery).
- When switch K is closed, the piece of iron gets magnetized to form an electromagnet.
- With the switch closed, the electromagnet attracts (picks) the sharp rusty metal pieces from the compound.
- The electromagnet cannot attract glass pieces because glass is a non-ferromagnetic material.



A motor consists of a rectangular coil ABCD placed between two poles of a permanent magnet. The free ends of the coil are connected to a Split ring commutator against which carbon brushes press.

The external circuit is connected to the generator motor through the carbon brushes as in the diagram above.

How it works:

- Consider the coil in the above position, with the switch closed, current flows from A to B and from C to D.
- By applying Fleming's left-hand rule, side AB experiences a force, F, into the paper and side CD experiences a force out of the paper.
- The two equal but opposite forces form a couple of forces which cause rotation of the coil.
- At the vertical position, the carbon brushes press against insulators in the split ring commutator and no current flows in the coil.
- Due to inertia and momentum of the coil, it overshoots the vertical position, the carbon brushes change contact and the direction of current in the coil is reversed,
- this enables the coil to rotate in the same direction, spinning the mill in the same direction.

(i) - Friction at different turning points.
- Eddy currents and back e.m.f.
- Mechanical vibrations.

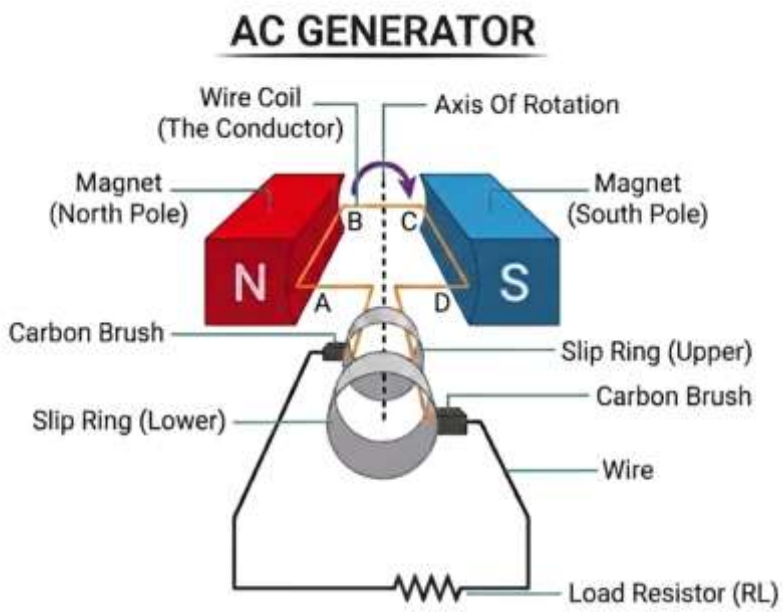
(ii) $Efficiency = (\frac{work\ output}{work\ input})\ x\ 100\%$

$= \frac{(2.7\ x\ 106\ )}{(240\ x\ 30\ x\ 5\ x\ 60)}\ x\ 100\%$

$= 125\%$

(d) - Fans to turn air
- CD drives
- Drives of conveyor belts/elevators.
- Pumps (water supply and irrigation)
- Farms
- Compressors
- Industrial machines
- Household appliances

Item 2



Mode of operation.

An A.C generator consists of a rectangular coil ABCD placed between two poles of a permanent magnet. The free ends of the coil are connected to slip rings against which carbon brushes press. Through the carbon, current flows out into the external circuit and back through the carbon brush.

How it works.

- When the coil ABCD is rotated mechanically, sides AB and CD cut through the magnetic field lines
- As the coil cuts the magnetic field, a changing magnetic flux links the coil.
- According to faraday's law of electromagnetic induction, an electromotive force (emf) is induced in the coil.
- The induced emf causes an electric current to flow through the external circuit through slip rings and brushes.
- After one half-turn, the sides of the coil move in opposite directions relative to the magnetic field the direction of the induced emf (current) reverses

according to Fleming's right hand rule, therefore the current also reverses direction and the continuous reversal of current direction produces A.C.

(b) (i)

$$Efficiency = \frac{Power\ out\ put}{Power\ in\ put}\ x\ 100\ \%$$

$$= \frac{\text{Energy out put}}{\text{Energy in put}} \text{x } 100\ \%$$

$$= \frac{[\,(20 \text{ x } 10) + (10 \text{ x } 4 \text{ x } 5)\,] \text{ x } 11 \text{ x } 60 \text{ x } 60}{10 \text{ x } 1760{,}000} \text{X} 100\%$$

$$\frac{15840{,}000}{1760000\ x\ 10} x\ 100\ \%$$

$$= 90\ \%$$

(ii)

- Friction between the moving parts.

This can be minimized by lubricating the system.

- Eddy currents which can be minimized by laminating the core.
- weak magnetic flux which can be improved by replacing the magnet by a stronger permanent or an electromagnet.

(c) Cost = P (kW) x t (hrs) x cost per unit.

$$= \frac{(20x10) + (10x4x5)\ x\ 11\ x\ 1000\ x\ 7}{1000}$$

= Shs. 4,4000 x 7

The cost of electricity in one week = 30800.

Shs. 30,800=.

(d)

- Turbines at electro power stations,
- Bicycle dynamos
- Car alternators
- Dynamic microphones

Item 3

a)

A – step down transformer; used to step down AC voltage from 240V to 12V AC

B – Diode; used to prevent reverse flow of voltage

C – Thermistor; monitor temperature / Used for temperature change detection, control i.e. by changing its electrical resistance in response to temperature variation.

D – Resistor; controls the flow of current.

E – Transistor; used as an automatic digital switch on or off the system using its base current.

F – Rectifier; converts the alternating current to direct current

b) The two prong plugs lacks the Earth pin and wire which is used to open the part in the socket and also provide a safe passage for fault current to the ground protecting users from electric shocks in case there is current leakage since the system is High power appliance.
Fuse is used prevent overloading and short circuit by melting and breaking the circuit when the current goes beyond a certain value.

C) It works as an automatic temperature controlled heater switch.
Since the system is connected to 240V AC mains supply, The transformer steps down this voltage to 12V AC.
The bridge rectifier performs a full wave rectification; converting the alternating current to direct current to power the electronic components.
When the temperature drops (cold) the resistance of the thermistor increases, which causes a large voltage to drop across the divider. This raises the base voltage of the transistor above 0.7V and the transistor switches ON, allowing current to flow through the infrared bulb which turns on and warms the environment.
When the temperature rises, the resistance of the thermistor decreases, which lowers resistance means there less voltage the divider. This decrease the base voltage of the transistor below 0.7 V, the transistor switches off, thence no current through the bulb.

d)

Electrical energy for one month = 0.2 KW × 100

= 20 kwh

Total amount of units for 60 months = 20 kwh × 2

= 40*kwh*

Total cost for electricity for 2 month

Since 1 unit cost ugx 900

Then for 40 kwh, total cost = 40 × 900

= ug.Shs 36,000

SOLUTION TO PRACTICALS

- **Aim**

  An experiment *to determine the force constant of the spring* provided so as to determine if the spring bought is suitable for replacement in the damaged shock absorber of the sports bike.

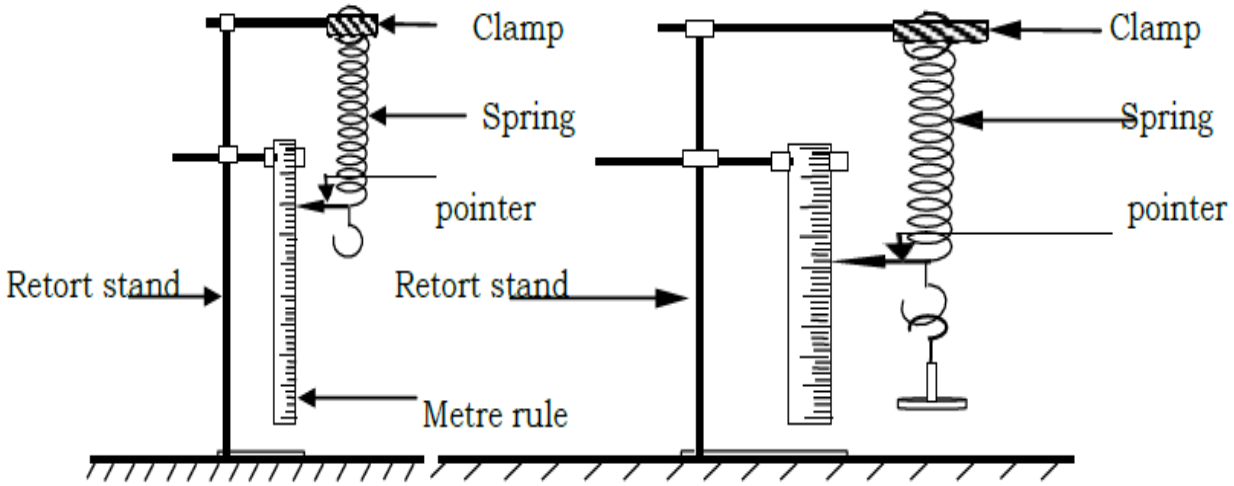
- **Hypothesis**

  The *force constant* of the spring required for replacement in the shock absorber ranges from *60,000Nm^{-1}* to *120,000Nm^{-1}.*

- **Variables**
  - Independent Variable
  - Dependent variable
  - Controlled/fixed/constant variable
  - Standard masses, M, Force, F.
  - New position of the pointer, P_1, Extension, e.
  - Initial position of the pointer, P_0, mass of the spring.

- **Procedures**

  a) The apparatus were arranged as shown below:



b) The initial position, P_0, of the pointer was read and recorded.
c) A mass of 0.001kg was suspended at the lower end of the spring
d) The new position, P_1 of the pointer was read and recorded.
e) The extension, e, is determined from, $e = P_1 - P_0$.
f) Procedures (c) to (e) were repeated for more values of mass, M = 0.002kg, 0.003kg, 0.004kg, 0.005kg and 0.006kg.
g) The results were tabulated in a suitable table including values of F(N) and e(m).
h) A graph of F against e was plotted and its slope, S was determined.
i) The force constant, k of the spring provided is determined from k = S.
j) The force constant of the required spring for the shock absorber is determined from $K_1 = 3000k$.

- **Possible sources of errors**
  - Parallax error while taking readings from the metre rule
  - Over stretched springs
  - Unstable/checking retort stand
  -

- **Precautions to the identified errors**
  - Positioning the eyes at right angles to the scale of the metre rule being read.
  - Using springs in good conditions and avoid overloading masses in the springs and also removing masses from the springs immediately after taking the reading.
  - Using stable retort stands and ensuring that the working table is flat.

- **Table of results.**

P_0 = 52.0cm

M(kg)	P_1(cm)	e(cm)	e(m)	F(N)
0.001	55.6	3.6	0.036	1.00
0.002	59.3	7.3	0.073	2.00
0.003	63.2	11.2	0.112	3.00
0.004	67.1	15.1	0.151	4.00
0.005	71.1	19.1	0.191	5.00
0.006	75.0	23.0	0.230	6.00

- **Data analysis using a graph**

Slope, S = $\frac{\Delta F}{\Delta e}$

S = $\frac{(6.15-0.85)\,(N)}{0.2500-0.0225)(m)}$

S = $\frac{5.30N}{0.2275m}$

S = 23.3 Nm^{-1}

k = S.

K_1 = 3000 × 23.3Nm^{-1}

K_1 = 69,900Nm^{-1}.

- **Conclusion and advice.**

Since the force constant of the spring bought is 69,900Nm^{-1} which is between 60,000Nm^{-1} to 120,000Nm^{-1}, there the spring is suitable for replacement of the damaged spring in the sports bike.

UGANDA NATIONAL EXAMINATIONS BOARD

(to be fastened together with other answers to paper)

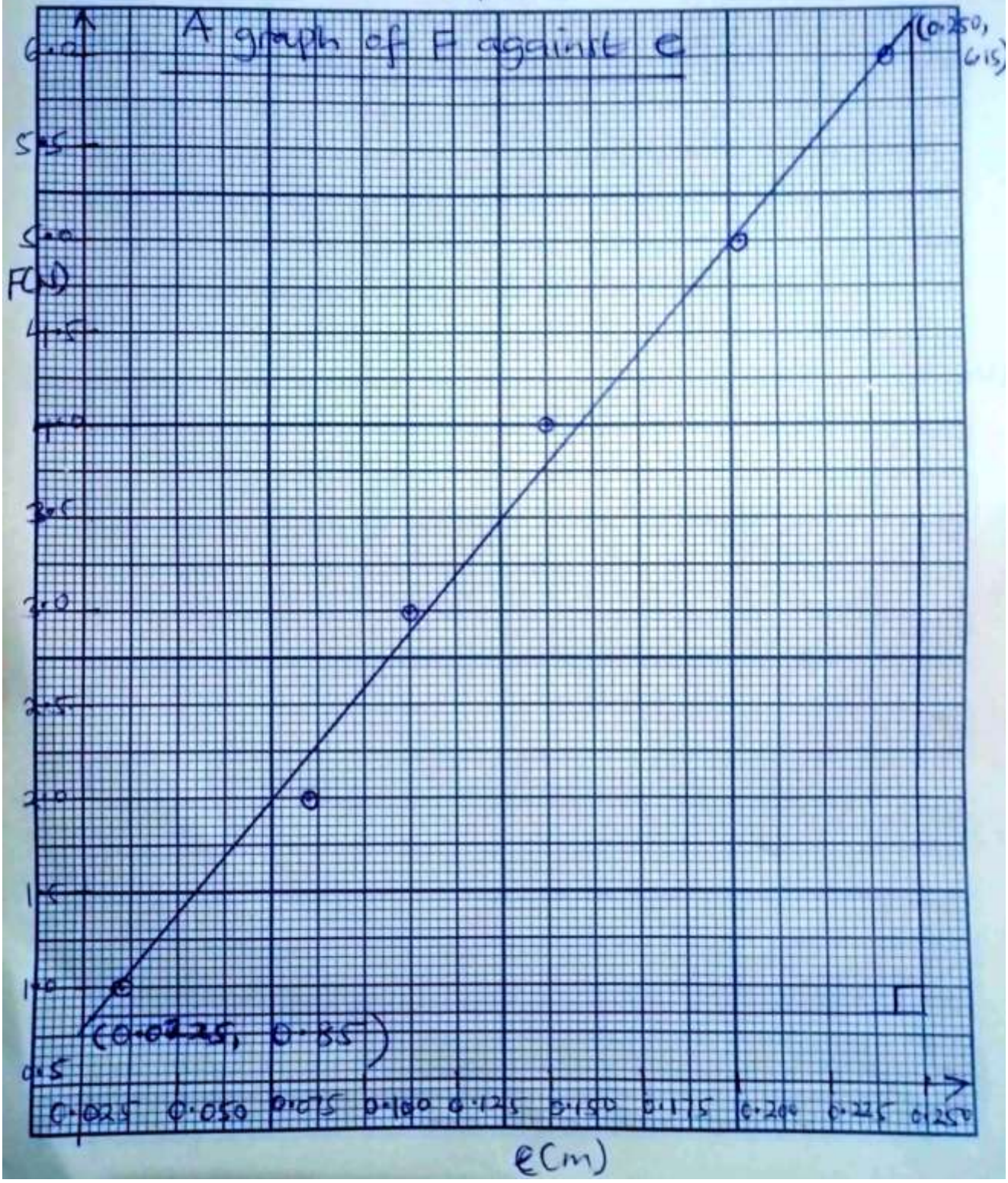
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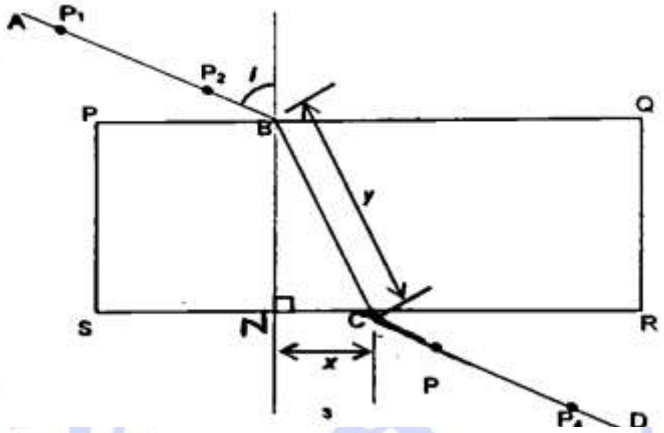
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Item three

- **Aim:** An experiment *to determine the refractive index of the glass block* provided so *as to determine if it can be used for fitting in the window.*
- **Hypothesis**: The *refractive index* of the glass block provided ranges from 1.4 to 1.7
- **Variables**:
  Independent Variables - Angle of incidence, *i*
  Dependent Variable - Angle of refraction, *r,* distances *x* and *y*.
  Controlled Variables - Light intensity, thickness of the glass block, Position of the tracing of the glass block.
- **Procedures**

a) The apparatuses were arranged as shown below:



b) A white plain sheet of paper was fixed on a soft board using drawing pins.
c) A glass block was placed in the middle of the sheet of paper and its outline PQRS was traced.
d) The glass block was removed and a normal line BN was drawn such that PB = 2cm.
e) The angle of incidence, i = 10^0 was measured using a protractor and line AB was drawn.
f) Two optical pins P_1 and P_2 were fixed on line AB.
g) The glass block was placed back to its tracing and after looking through the glass block from side E, two optical pins P_3 and P_4 were fixed so that they appeared to be in a straight line with the images of P_1 and P_2 through the glass.
h) The glass block and the optical pins were removed from the sheet of paper, and the positions of P_3 and P_4 were joined to meet SR at C. C was joined to B.
i) The distances x and y were measured and recorded.
j) Procedures (e) to (i) were repeated for more values of angle i = 20 ^{o}, 30 ^{o}, 40 ^{o}, 50 ^{o} and 60 ^{o}.
k) The results were tabulated in a suitable table including values of Sin$i$ and $\frac{x}{y}$.
l) A graph of Sin$i$ against $\frac{x}{y}$ and its slope, n was determined.
m) The slope of the graph was the refractive index of the glass block used.

- **Possible sources of errors**
  -Parallax error in reading distances from a metre rule
  -Scratched or cloudy glass block
  -Poor alignment of pins for example placing the pins too close to each other
- **Precautions to the above sources of errors**
  -The eyes should be placed perpendicular to the scale of the metre rule being read**.**
  -Cleaning the glass block by removing dust and ensuring it is in a proper condition before use.

-Aligning the pins correctly by ensuring they are not very close to each other and they are fixed vertical.

- **Table of results.**

$i(^{\circ})$	x (cm)	y(cm)	Sin$i$	$\frac{x}{y}$
10	1.0	7.1	0.174	0.14
20	1.6	7.2	0.342	0.22
30	2.5	7.5	0.500	0.33
40	3.3	7.8	0.643	0.42
50	4.2	8.2	0.766	0.51
60	4.6	8.6	0.866	0.53

- **Data analysis using graph**

From the graph,

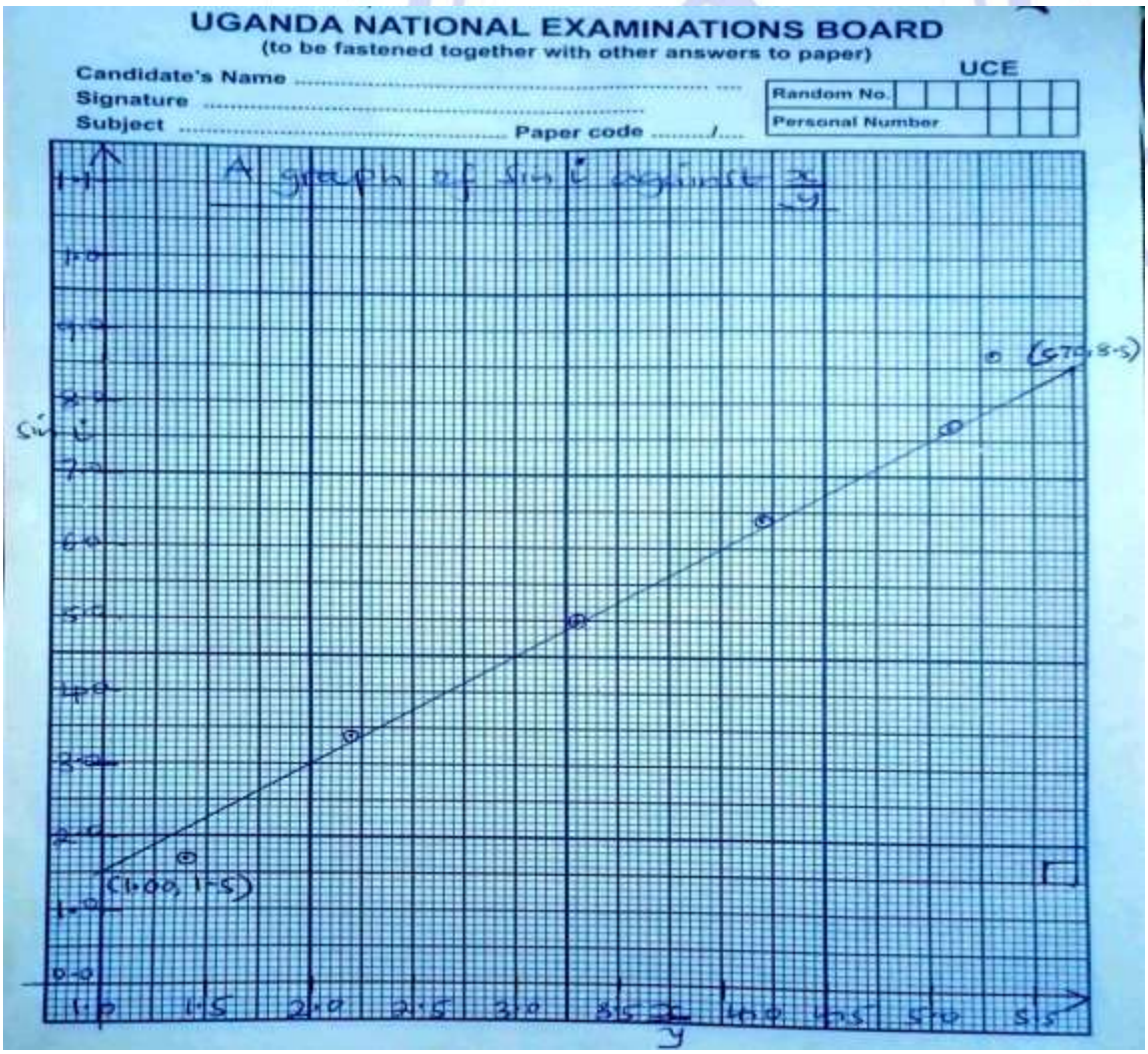
Slope, $n = \frac{(8.5-1.5)}{(5.70-1.00)}$

$n = \frac{7.0}{4.70}$

n = 1.5

- **Conclusion and advise**

Since the refractive index of the glass block is 1.5, which is between 1.4 to 1.7, therefore its suitable for fitting in the windows and therefore the parent is advised to use the glass material.



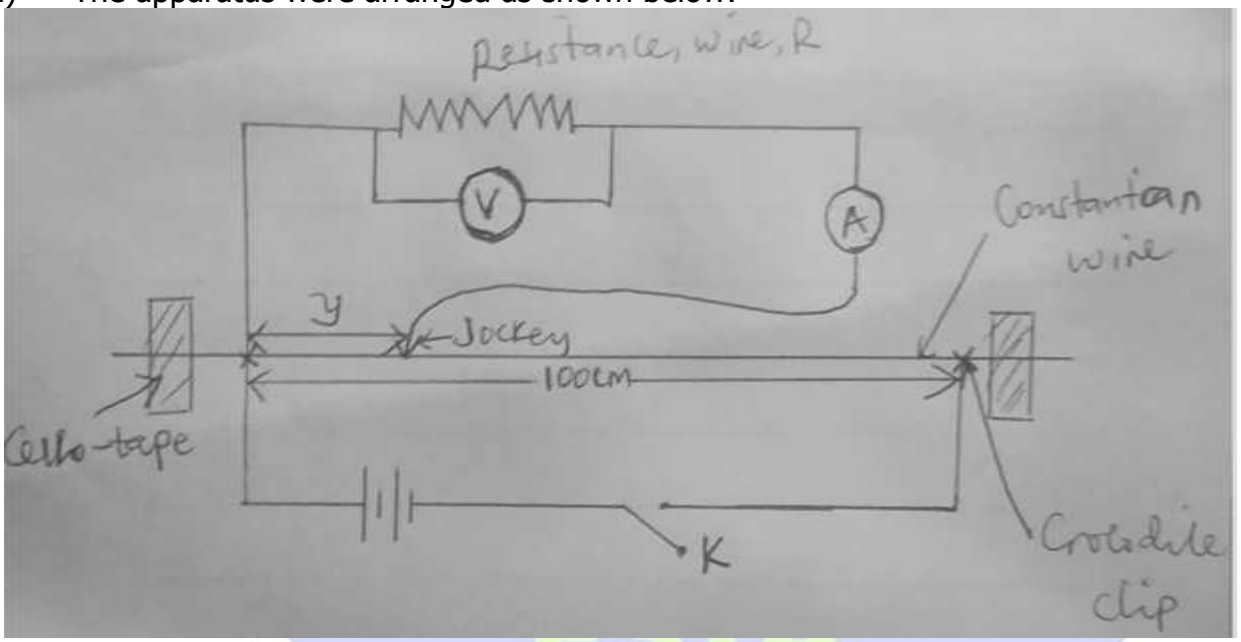
Item five.

- **Aim:** An experiment *to determine the resistance of the piece of wire* provided so as *to determine if its fit for use in the damaged flat iron*.
- **Hypothesis**: The *resistance of the wire* ranges from $10\Omega to 65\Omega$.
- **Variables**:

  Independent variable:- Length of the Constantine wire
  Dependent variables: - Voltmeter reading, V.
  - Ammeter reading, A.
  Controlled/fixed/constant variables: - Thickness of the wire,
  -Temperature of the wire

- **Procedures**

a) The apparatus were arranged as shown below:



b) The circuit was connected as shown above
c) The length, y was adjusted to 0.100m and switch K was closed.
d) The voltmeter reading, V and Ammeter reading, I were taken and recorded.
e) The switch was opened.
f) Procedures (c) to (e) were repeated for values of y = 0.200m, 0.300m, 0.400m, 0.500m and 0.600m.
g) The results were recorded in a suitable table including values of $\frac{1}{V}$ and $\frac{1}{I}$
h) A graph of $\frac{1}{I}$ against $\frac{1}{V}$ was plotted and its slope, R was determined.
i) The slope of the graph equals to the resistance of the piece of wire.

- **Possible sources of errors**

  -Parallax error in taking ammeter and voltmeter readings
  -over used or drained cells
  -loose connections cause fluctuating readings.

- **Precautions to the above errors**

  -The eyes should be at right angles to the scale of the instrument being read
  -Use new dry cells
  -Ensure that the connections are tight.

- **Table of results.**

y(m)	V(V)	I(A)	$\frac{1}{I}(A^{-1})$	$\frac{1}{V}(V^{-1})$
0.100	1.00	0.04	25	1.00
0.200	1.20	0.06	17	0.83
0.300	1.40	0.08	13	0.71
0.400	1.60	0.10	10	0.63
0.500	1.80	0.12	8	0.56
0.600	2.00	0.14	7	0.50

From the graph,

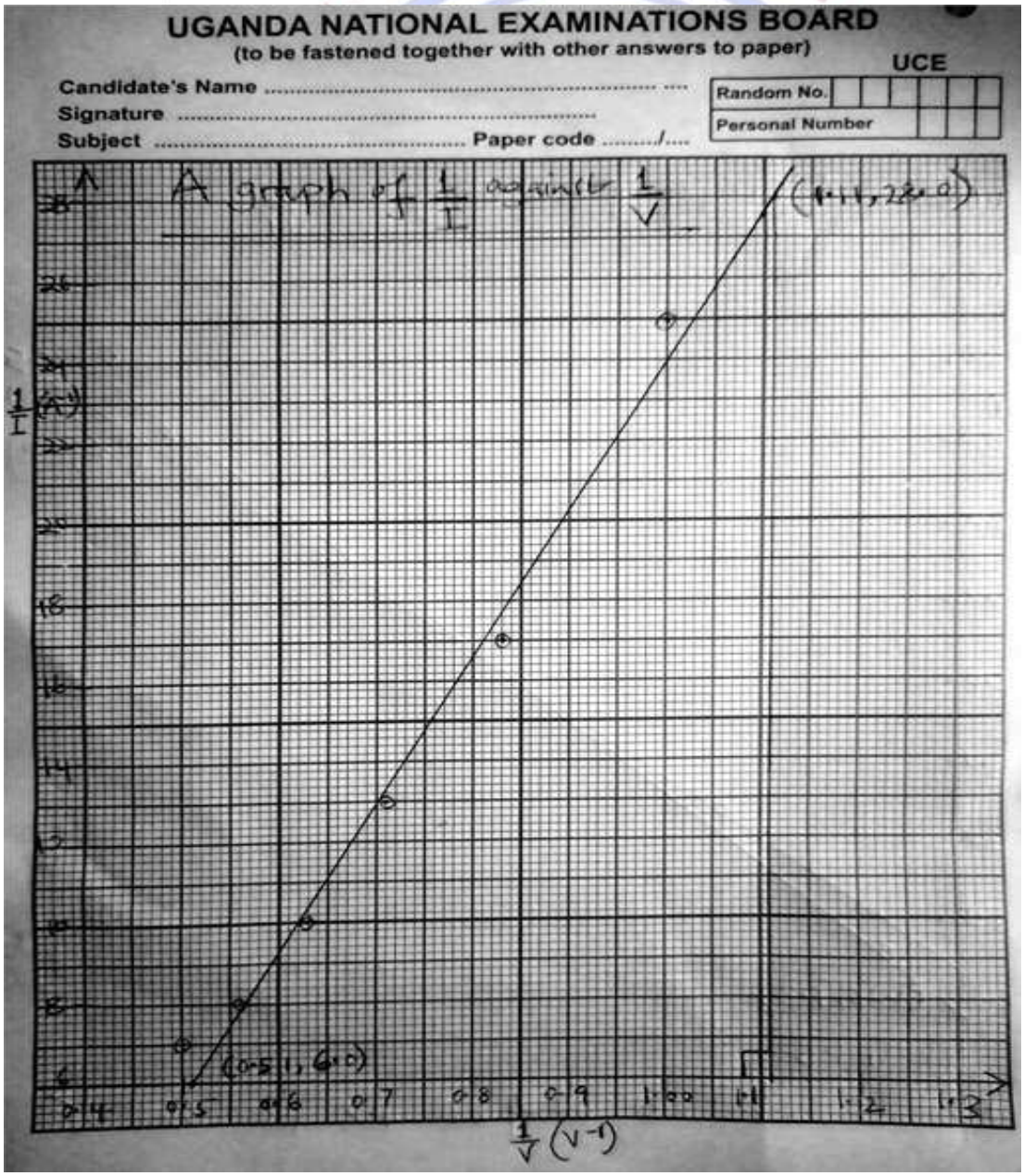
Slope, R = $\frac{(28.0-6.0)(V^{-1})}{(1.11-0.51)(A^{-1})}$

R = $\frac{22\ V^{-1}}{0.60\ A^{-1}}$

R = 37**Ω.**

- **Conclusion and advise**

The resistance of the piece of wire is 37 Ω which is between 10Ω to 65Ω, therefore, its fit for use in the damaged flat iron and I advise the Uncle to use it.



Requirements for item one.

a) A retortstand with two clamps
b) 100 g mass hunger
c) 100 g masses (5)
d) A pointer
e) A metre rule
f) A spring

Requirements for item three

a) A glass block
b) A soft board
c) 2 drawing/thumb pins
d) 4 optical pins
e) A geometry set with instruments
f) A white plain sheet of paper

Requirements for item five

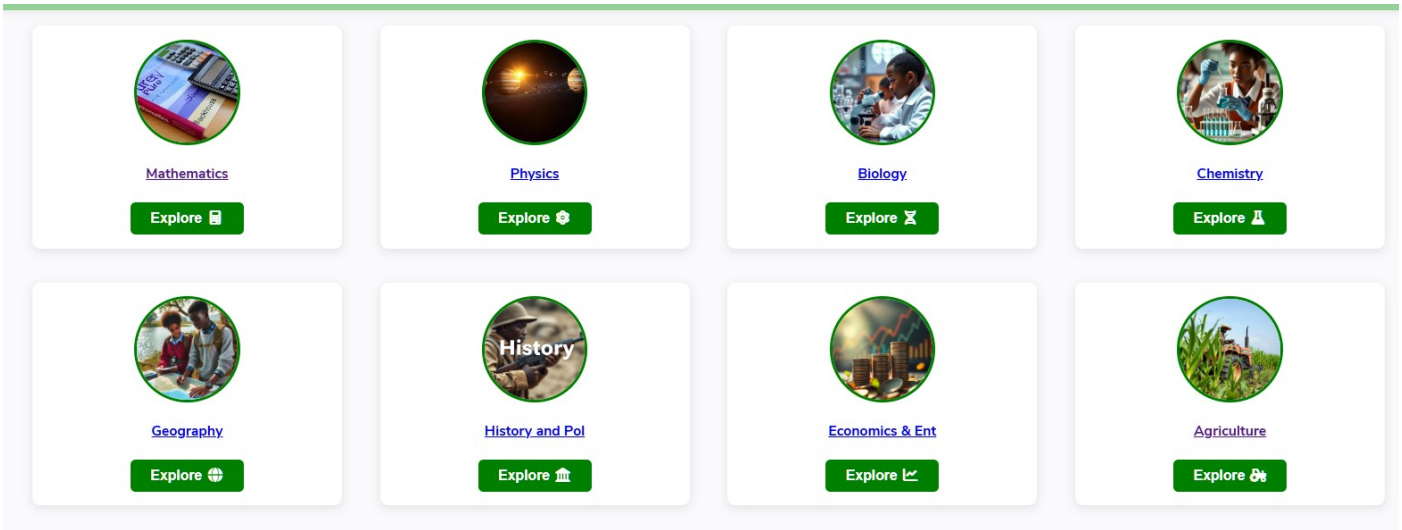
a) Nichrome wire of thickness 0.15mm and width 4mm
b) A Constantine wire of s.w,g 28, about 110 cm long
c) An ammeter with a scale in the range (0 – 1) A
d) A voltmeter with a scale ranging from (0 – 3) V
e) A jockey
f) Two crocodile clips
g) A metre rule
h) A switch
i) A double cell holder
j) Two fresh dry cells

General requirements.

a) A 30 cm ruler
b) A scientific calculator
c) A pencil for drawings
d) A rubber
e) A blue or black ball point pen

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