Name: M/scheme Adm. No. _____ Class: _____

KASSU-JET EXAMINATIONS-2023

Kenya Certificate of Secondary Education

PHYSICS (232/2)

Paper 2

Time: 2 hours

INSTRUCTIONS TO STUDENTS

- Write your name, admission number and class in the spaces provided at the top of the page.
- Answer **ALL** the questions in section A and B in the spaces provided after each question.
- All working must be clearly shown.
- Mathematical tables and electronic calculators may be used.
- All numerical answers should be expressed in decimal notations.

Take the charge of an electron e= 1.6×10^{-19} C

For Examiner's use only

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 - 13	25	25
14	11	11
15	13	13
16	10	10
17	11	11
18	14	14
TOTAL		80

This paper consists of **15** printed pages.

SECTION A (25 MARKS)

1. A white paper is a good reflector of light but does not form an image like a mirror. Explain this observation. **(1mark)**

White paper is rough. Parallel incident rays are reflected as irregular. Mirror is smooth and incident Parallel rays are reflected regularly by mirror ✓

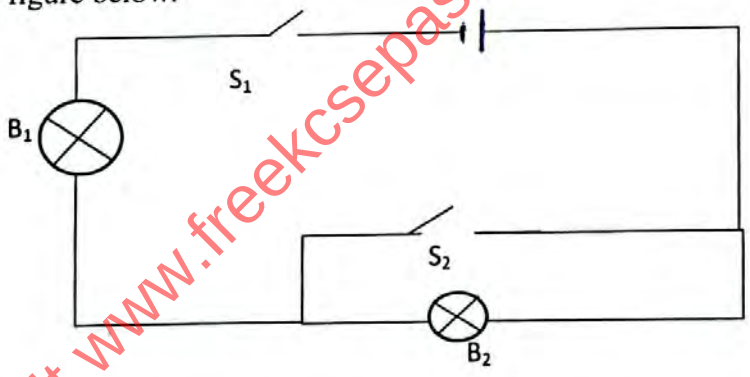
2. State and explain the observation made when an uncharged metal sphere is brought close to a negatively charged electroscope. **(2marks)**

The leaf falls/collapses/divergence decreases; ✓
Postive charge is induced on the neutral metal Sphere. This causes attraction of electrons from the metal plate and leaf to the cap hence the leaf falls; ✓

3. (a) When is a lead acid accumulator said to be fully charged? **(1mark)**

When gassing out occurs (when oxygen & hydrogen gases begin to gas out); ✓

(b) A form one student at Daima High School connected a simple electric circuit as shown in the figure below.



State and explain the observation made when switches S_1 and S_2 are both closed. **(2marks)**

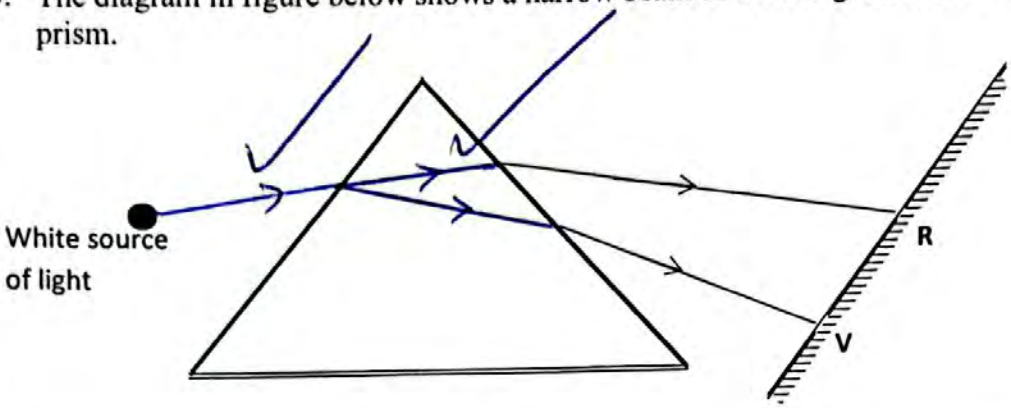
B_1 lights while B_2 does not; ✓
Current flows through B_1 since it is in a closed circuit while B_2 does not light since it is short circuited ✓

4. A magnetic material was heated and then cooled in a magnetic field. After cooling, it was found to be magnetized. Explain this using domain theory. **(2 marks)**

The dipoles vibrate due to heating; ✓
On cooling, they settle in the earth's direction of magnetic field; ✓

08

5. The diagram in figure below shows a narrow beam of white light incident on to a glass prism.



(a) Complete the diagram to show dispersion of white light. **(1 mark)**

(b) Explain the observation made on the screen. **(1 mark)**

White light has different colours of different wavelengths, hence they travel with different velocity when they enter glass. Red is refracted least since it has higher velocity than violet it's deviated most.

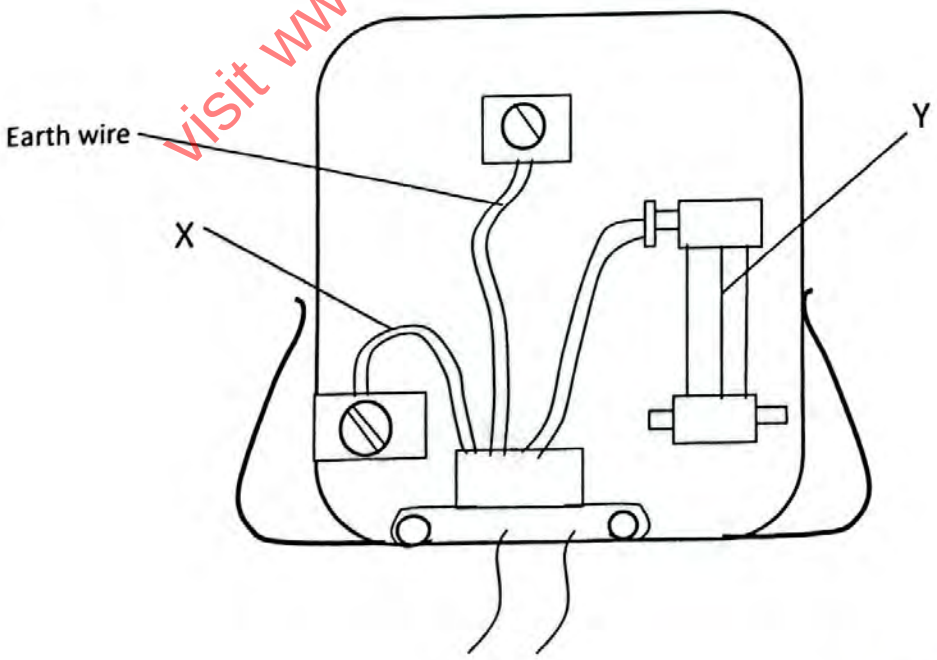
6. The potential difference across a lamp is 12V and a charge of 10C passes through it. Determine the electrical energy changed to heat and light by the lamp. **(2 marks)**

$W = QV$

$= 10C \times 12V$;

$= 120J$.

7. The figure below shows a connection to a three-pin plug.



04

(a) Identify the cable labelled **X** in the plug. **(1 mark)**

Neutral lead/cable;

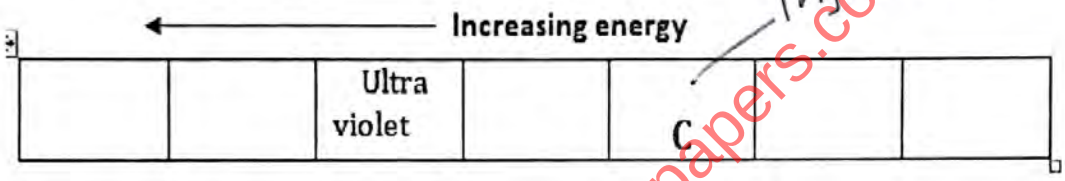
(b) State the use of the component labelled **Y** in the plug. **(1 mark)**

fuse safeguards against excess currents in a circuit;

(c) Give **one** reason why the earth pin is normally longer than the other pins. **(1 mark)**

Longer since it is the first one to enter hence opens the socket by pushing the shutter/blind for the other two pins to enter;

8. The table below shows the arrangement of electromagnetic waves in the order of increasing energy of radiation.



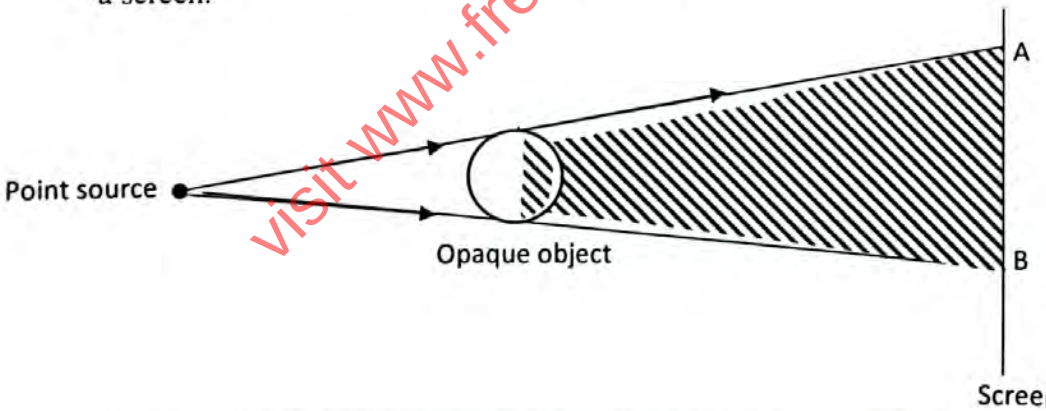
Infrared

State **one** use of the wave marked C **(1 mark)**

Infra red photography;
Drying grains
green houses;
heat seeking missiles

any one

9. The figure below shows point source of light with an opaque object placed between it and a screen.

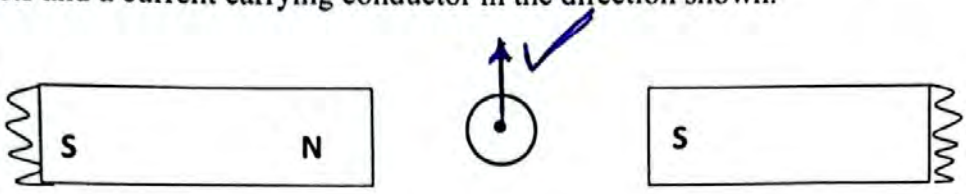


Explain the nature of the shadow formed along AB. **(2 marks)**

Completely or dark shadow (umbra); because light is completely obstructed by opaque object

06

10. The figure below shows the cross-section of a conductor held between two bar magnets and a current carrying conductor in the direction shown.

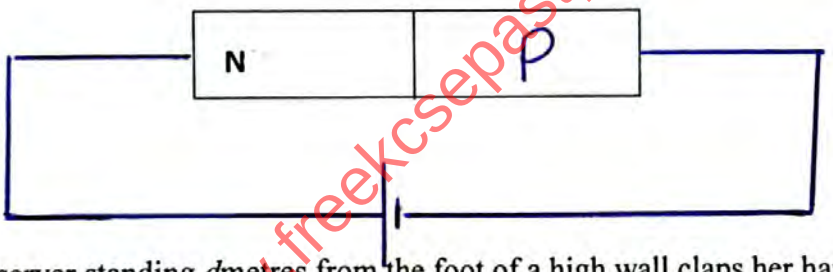


(a) Indicate with an arrow on the diagram the direction in which the conductor will move when it is released. **(1 mark)**

(b) State **one** adjustment that can be made on the diagram to increase the magnitude of the force on the conductor carrying current. **(1 mark)**

✓ any one - Increase size of current in the conductor;
- Use stronger magnets;
- Increase length of conductor in magnetic field;

11. The figure below shows a block diagram of a P–N junction diode. On the same diagram, show how a cell may be connected so that it is reverse biased. **(1 mark)**



✓ CAO

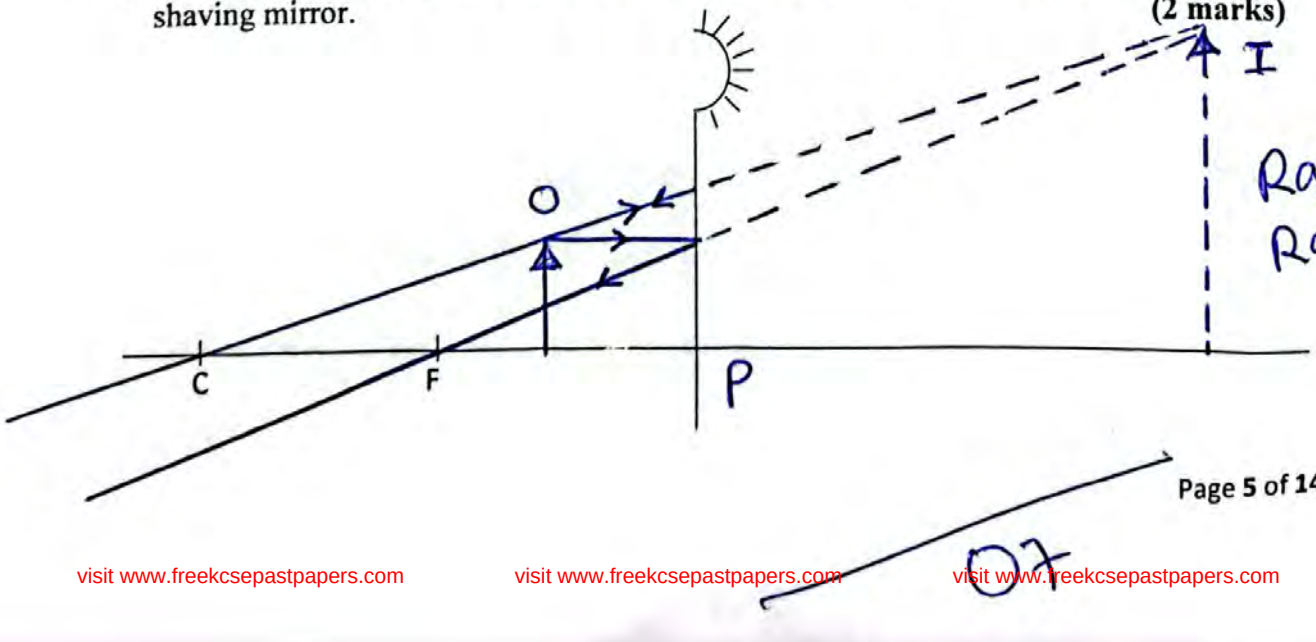
12. An observer standing *d* metres from the foot of a high wall claps her hands once and an echo reaches her after 0.5 seconds. If the velocity of sound in air is 330m/s, determine the value of *d*. **(2 marks)**

$V = \frac{2d}{t}$

$330 = \frac{2(d)}{0.5}$;✓

$d = \frac{330 \times 0.5}{2} = 82.5m$ ✓;

13. Complete the ray diagram below to illustrate how a concave mirror can be used as a shaving mirror. **(2 marks)**

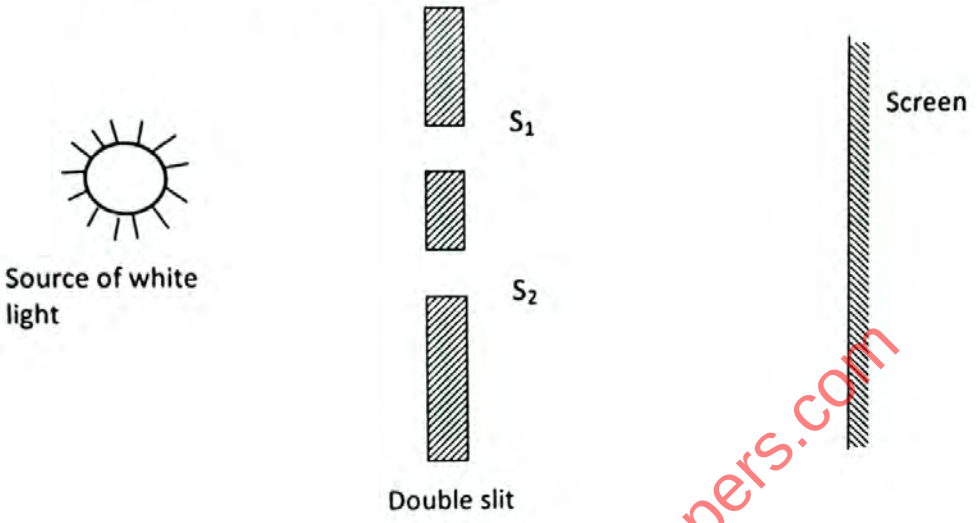


Ray 1 ✓
Ray 2 ✓

07

SECTION B (55 MARKS)

14. (a) In an experiment to observe interference of light waves, a double slit is placed close to the source.



(i) State the function of the double slit. **(1 mark)**

Act as coherent sources of light ;

(ii) State and explain what is observed on the screen. **(2 marks)**

Alternate bright and dark fringes are seen on the screen ;
Bright fringes formed due to constructive interference
Dark fringe are formed due to destructive interference

(iii) State what is observed on the screen when;

I. the slit separation S_1S_2 is reduced. **(1 mark)**

Fringe separation becomes widely spaced

$y \uparrow = \frac{\lambda D}{a \downarrow}$

II. white light source is used in place of monochromatic source. **(1 mark)**

Central bright fringe is white, all other bright fringes are coloured (spectrum)

III. State and explain the difference in the patterns observed on the screen other than the difference in colour when the source of red light is replaced by a source of violet light. **(2 marks)**

$y = \frac{\lambda D}{a}$; $\lambda_R > \lambda_V$

$y_R > y_V$

Fringe separation of red light is wider than the fringe separation of violet light ;
Red light has a greater wavelength than violet ;

07

IV. In a Young's slit experiment using sodium light, seven fringe spaces were found to occupy 2.8mm when viewed through a microscope eye piece. Calculate the fringe separation.

(1 mark)

$7y = 2.8\,mm$ ✓

$y = 0.4mm$;

(b) A real image, half the size of the object is formed by a lens. If the distance between the object and the image is 45cm, determine the focal length of the lens.

(3 marks)

$m = \frac{1}{2} = \frac{V}{u}$

$u = 2V$

$u + V = 45$,

$2V + V = 45$ ✓

$u = 15cm, V = 30cm$;

$f = \frac{uV}{u+v} = \frac{15 \times 30}{15+30} = \frac{450}{45}$ ✓

$= 10\,cm$;

15. (a) (i) State Lenz's law.

(1 mark)

The direction of induced e.m.f is such that the induced current it causes to flow produces a magnetic effect that opposes the change producing it.

(ii) A power station generators 10kV at current of 5A. The voltage is stepped up to 200kV before being transmitted through cables. Assuming the transformer is 80% efficient. Determine the output power in the secondary coil.

(2 marks)

Power input $= I_p V_p = 5 \times 10,000$

$= 50,000W$ ✓

Power output $= \frac{80}{100} \times 50,000 = 40,000W$ ✓

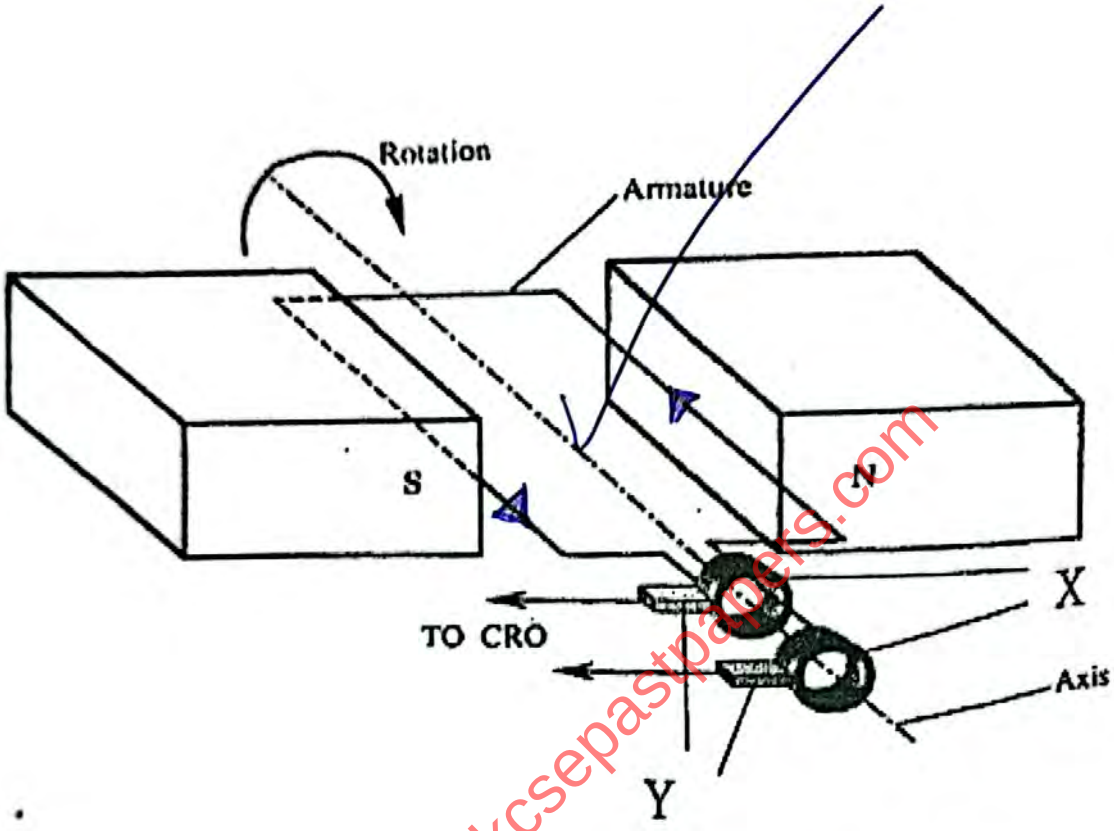
(iii) State with reason which coils are thicker in the step up transformer

(2 marks)

Primary coil; to minimise heat loss due to high current in the primary coil

09

(b) The diagram below shows a simple alternating generator (a.c)rotating in clockwise direction just passing horizontal position.



(i) Name the parts labelled X and Y (2 marks)

X Slip ring; ✓

Y Carbon brush; ✓

(ii) State the functionof feature labelled Y. (1 mark)

Conducts current and act ✓ as lubricant since it is slippery;

C4

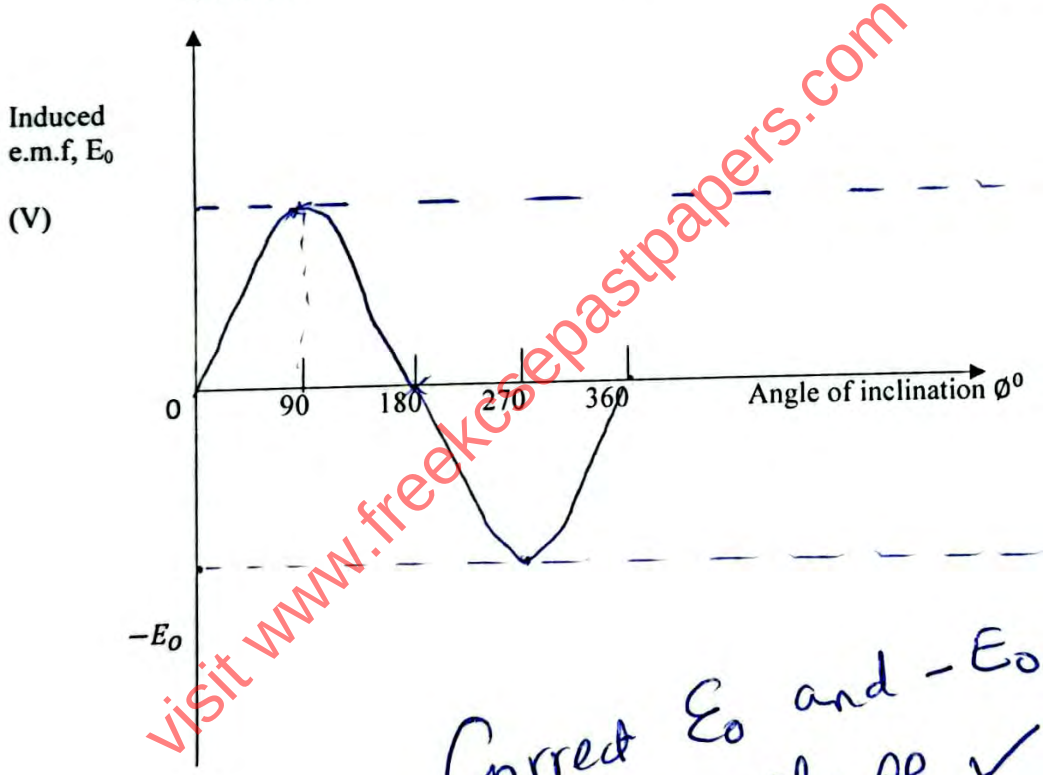
(iii) On the same diagram show the direction of the induced current in the rectangular coil. **(1 mark)**

(marked Pg 8)

(iv) State **two** ways in which the induced e.m.f. in the coil be increased. **(2 marks)**

- Increase speed of rotation
- Increase the strength of magnetic field
- Winding coils on laminated soft core.

(v) On the axes below sketch the variation of induced e.m.f, E_0, against angle of inclination Ø of the coil for one revolution starting from vertical position. **(2 marks)**

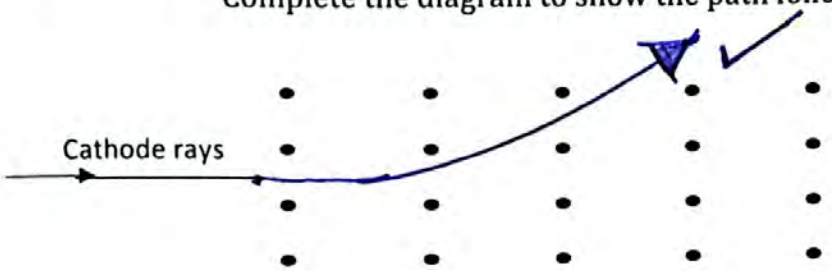


Correct E_0 and $-E_0$ ✓

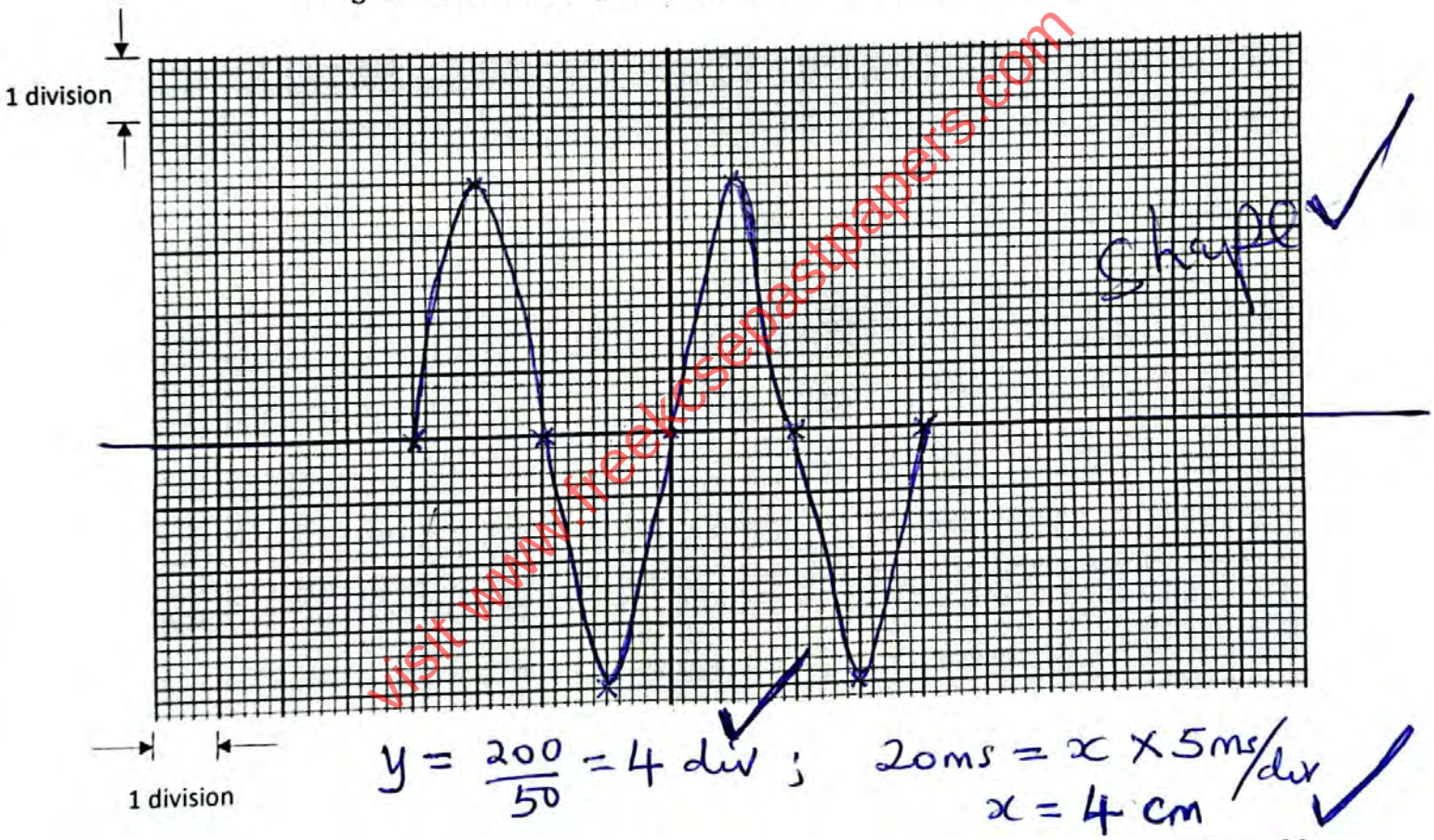
Correct shape ✓

04

16. (a) The diagram below shows cathode rays going through a magnetic field. Complete the diagram to show the path followed by the cathode rays. **(1 mark)**



(b) The time base setting of a CRO is set at 5 ms/division while the y-gain is at 50 V/division. In the grid provided, sketch the graph of an a.c signal with a peak voltage of 200V and frequency 50Hz. (Show at least one cycle).**(3 marks)**



$y = \frac{200}{50} = 4$ div ; $20ms = x \times 5ms/div$

$x = 4$ cm

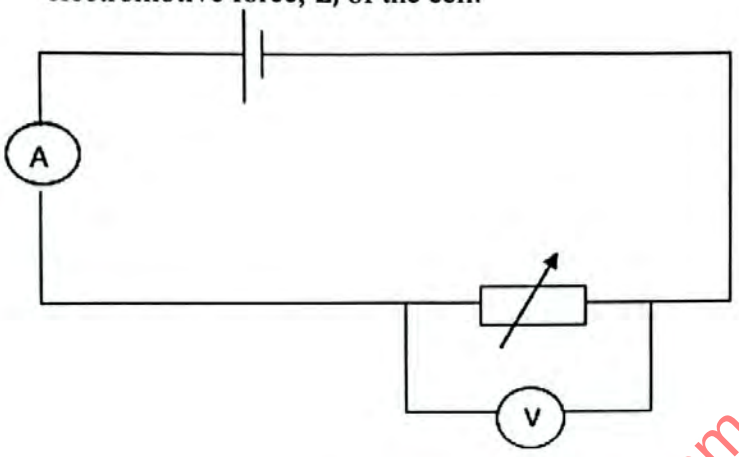
(1mark)

(c) (i) State Ohms law.

The amount of current flowing through a Conductor is directly proportional to the P.d across its end provided temperature and other physical conditions are kept Constant; ✓

5

(ii) Figure below shows a simple electric circuit used to investigate the relationship between the internal resistance r of a cell and the electromotive force, **E**, of the cell.



I. Show that the terminal voltage of the cell is given by;

(2 marks)

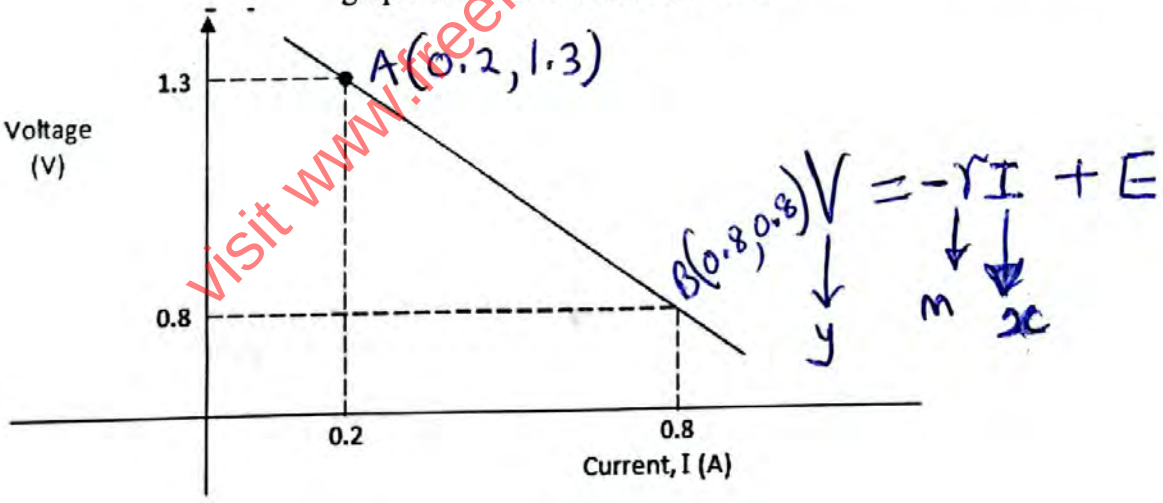
$V = E - Ir$

$E = I(R + r)$;

$E = IR + Ir$

$E = V + Ir$; $V = E - Ir$

II. Several values of current and voltage were collected and the graph was drawn as shown below.



Use the graph to calculate the internal resistance of the cell. **(3 marks)**

$-r$ = Slope

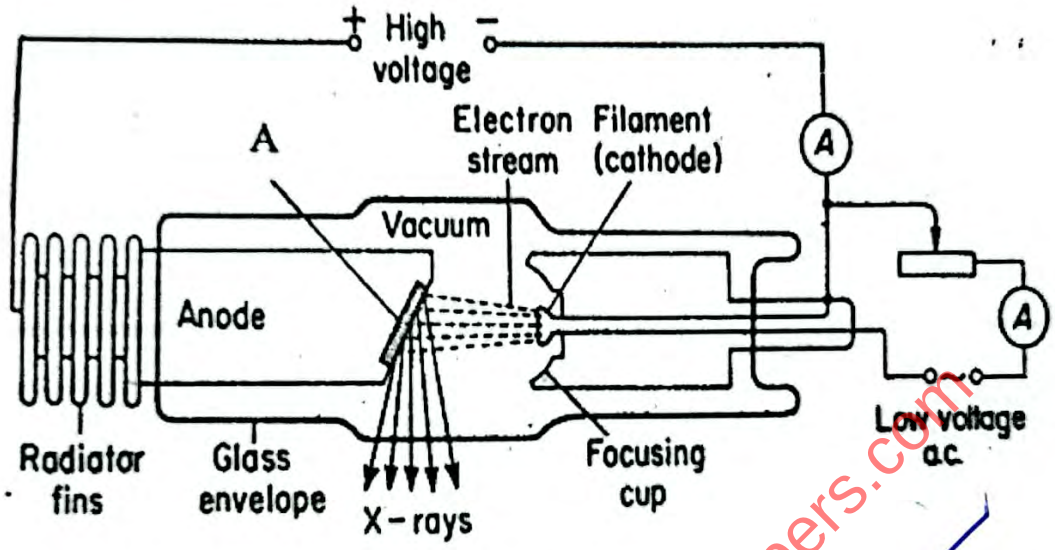
$r = -\left(\frac{0.8 - 1.3}{0.8 - 0.2}\right)\frac{V}{A}$

$r = -(-0.8333)$

$r = 0.8333\ \Omega$

05

17. The diagram shows a picture of a machine that produces X-rays. Use it to answer the questions that follow



(a) Explain how the X-rays are produced **(2marks)**

The hot filament heats up the cathode to high temperatures and produces electrons by thermionic emission. The e⁻ are accelerated at high potential to the anode and hit it. The K.e of the e⁻ is converted to x-rays & heat;

(b) (i) The machine is almost entirely surrounded by a metal shield. Name this metal and explain why this metal must surround it. **(2marks)**

Lead; to absorb X-rays produced at unsuitable angles;

(ii) State the reason why the cathode is concave shaped **(1mark)**

To focus the electrons onto the target;

(iii) Explain the function of the radiator fins in facilitating the cooling of the anode target **(1 mark)**

- Increase the effective area for conduction of heat from the target;

(c) (i) State the adjustment that should be made in order to produce X-rays of higher strength. **(1mark)**

Increase the acceleration P.d between anode and cathode that will increase the speed of electrons.

(ii) The tube operates at 50KV and the tube current is 20mA. Calculate the number of electrons hitting the target per second **(2marks)**

$Q = It = ne$

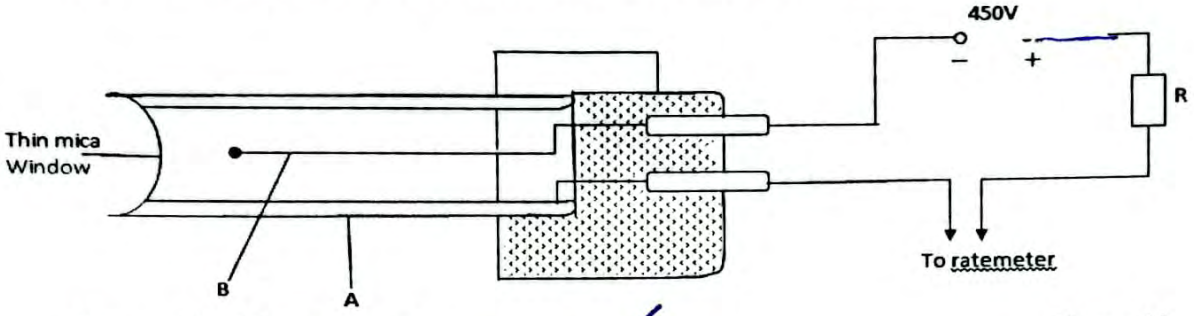
$n = \frac{It}{e}$

$n = \frac{20\times10^{-3}\times1}{1.6\times10^{-19}}$

$n = 1.25\times10^{17}\ e$

09

18. (a) The diagram below shows one of the detectors of radiation.



(i) Identify the device. **(1 mark)**

G.M tube;

(ii) Name the parts labelled **A** and **B**. **(2 marks)**

A - Cathode/metal cylinder/Aluminium casing;

B - Anode;

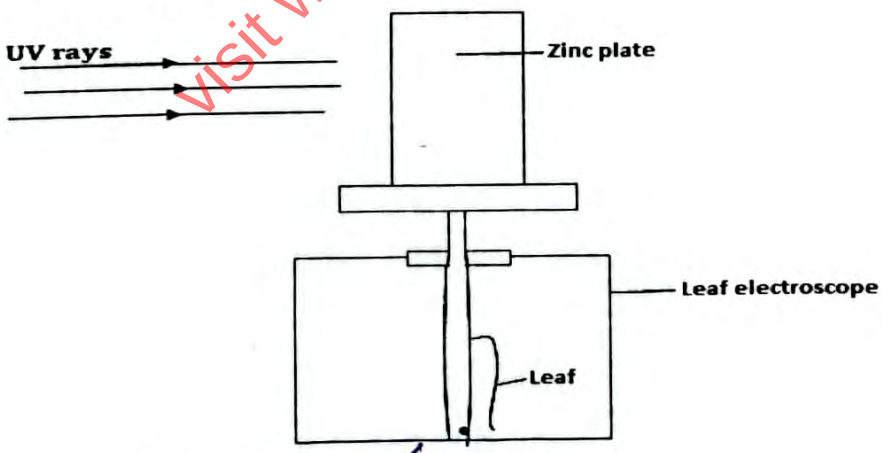
(iii) Explain how radiation entering the mica window is detected. **(2 marks)**

Radiation enters mica window and ionises argon gas. The negative ions drift to the anode while positive ions move to cathode resulting in pulse currents across R. Pulse current are amplified and fed into loudspeaker.

(iv) A small amount of halogen vapour is usually present in the tube. What is its purpose **(1 mark)**

As a quenching agent / It absorbs the K.E of the positive ions before they hit the cathode

(b) The set up below shows UV light striking a zinc plate placed on uncharged electroscope.

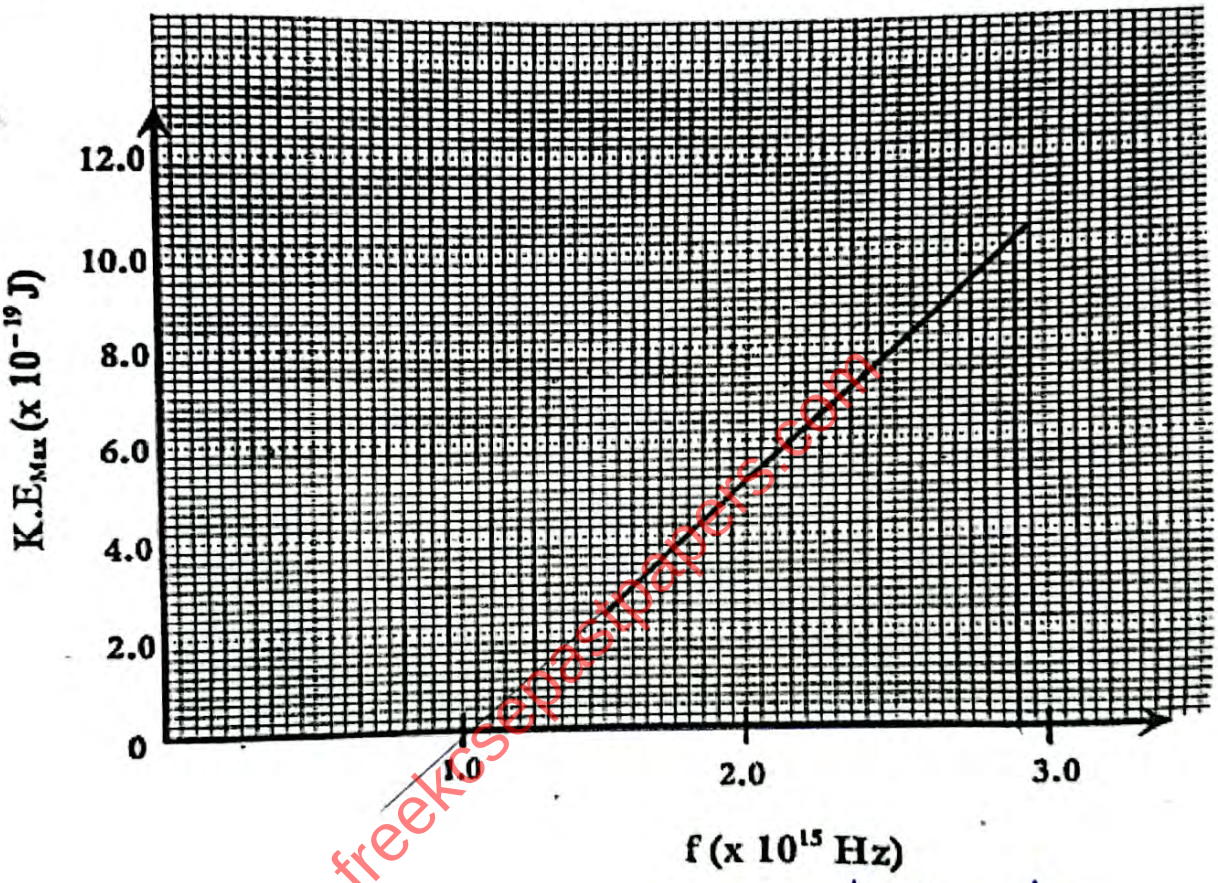


(i) State and explain the observations made. **(2 mark)**

Leaf rises; UV liberates electrons and as they escape, a net positive charge is left on the leaf and the plate causing leaf to rise;

08

ii) In an experiment using a photocell, U.V light of varying frequency but constant intensity was made to strike a metal surface. The maximum kinetic energy (KE_{Max}) of photoelectrons for each frequency, f, was measured. The graph shows how KE_{Max} varies with f.



Given that $K.E_{Max} = h f - Ø$, determine the values:

$Ke = hf - \phi$
$y \quad m \; x \quad c$

(I) Constant, h (2 marks)

h = slope ✓

$= \frac{(10.2-0)\times 10^{-19}}{(2.9-1.05)\times 10^{15}}$

$h = 5.514\times 10^{-34}$ Js ✓

II) Constant, Ø (2 marks)

$\phi = W_o = hf_o$

$= 5.514\times 10^{-34} \times 1.05\times 10^{15}$ ✓

$= 5.7897\times 10^{-19}$ J ✓

04