NAME: Marking Scheme.....CLASS:.....ADM NO:.....

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DATE:.....

232/2
PHYSICS
PAPER 2
December 2020
TIME: 2 HOURS

KASSU JET EXAMINATION - 2020

Kenya Certificate of Secondary Education
Physics Paper 2

Instructions to candidates

- Write your name, admission number, class, signature and date in the spaces provided at the top of the page.
- This paper consists of two sections A and B.
- Answer all the questions in the two sections in the spaces provided after each question
- All working must be clearly shown.
- Electronic calculators, mathematical tables may be used.
- All numerical answers should be expressed in the decimal notations.
- This paper consists of 14 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION	QUESTION	MAX MARKS	CANDIDATE'S SCORE
A	1 – 11	25	25
B	12	10	10
	13	10	10
	14	8	8
	15	16	16
	16	11	11
TOTAL		80	80

SECTION A: (25 MARKS)

1. Explain why repulsion method is the best test for polarity of a magnet as opposed to attraction. (1 mark)

Repulsion occurs only btw like poles. Attraction occurs btw unlike poles and also btw a magnet and a magnetic material. ✓1

2. Define the following;

(i) the direction of an electric field. (1 mark)

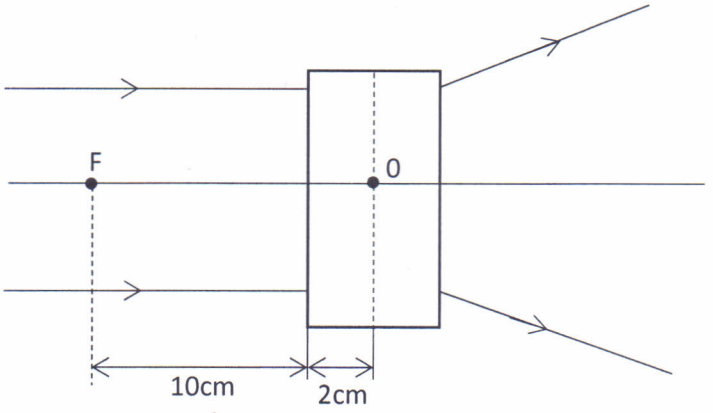
The path followed freely, by a free +ve charge. ✓1

(ii) the capacitance of a capacitor. (1 mark)

Charge stored per unit volt. ✓1

$\left(C = \frac{Q}{V}\right)$

3. The diagram below shows a set of parallel rays of light incident on a thin lens and emerging out from the lens. The lens is placed inside a blackbox with narrow opening on both sides.



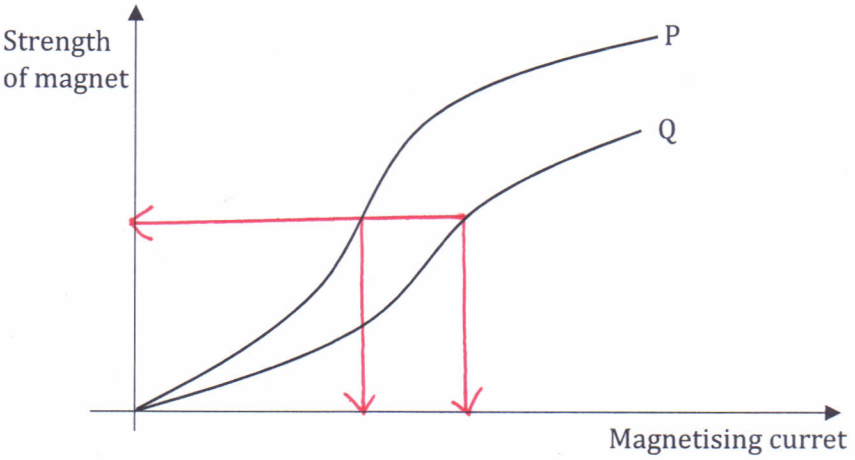
(a) State the type of the lens in the box and explain your answer. (2 marks)

Con cave lens; ✓1

- Rays parallel and close to the principal axis appear to diverge from the principal focus when refracted. ✓1

05

4. In an experiment to magnetize two substances P and Q using electric currents, two curves were obtained as shown below.



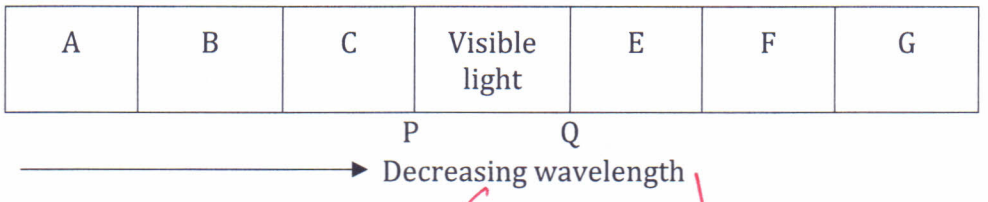
(i) Explain the difference between substances P and Q with reference to domain theory. (1 mark)

Dipoles in P align easily (easily magnetised) than those in Q.
(i.e. P is easily magnetised than Q)
To magnetise them to same strength, P requires less current than Q

(ii) State and explain which of the two substances in (i) above would be suitable for use as a core of an electromagnet. (1 mark)

P. It is easily magnetised than Q. or
It is magnetically soft. (tied)

5. The letters in the figure below represents different types of radiations in the electromagnetic spectrum.



(i) Which colours of spectrum appears at P and Q?

P - Red (1 mark)

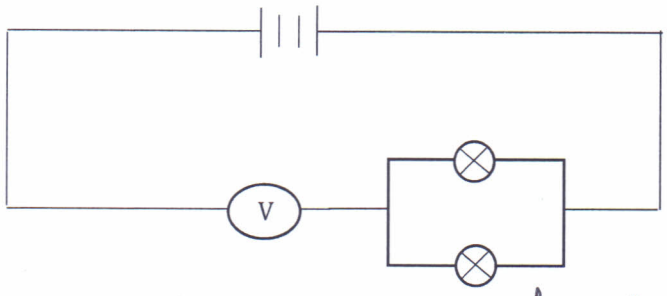
Q - Violet (1 mark)

04

(ii) How is radiation marked C detected? (1 mark)

Thermopile, bolometer, skin thermometer with blackened bulbs. (any one) ✓1

6. The diagram below shows a circuit that was connected by a form one student. Comment with a reason on the brightness of the bulbs. (2 marks)

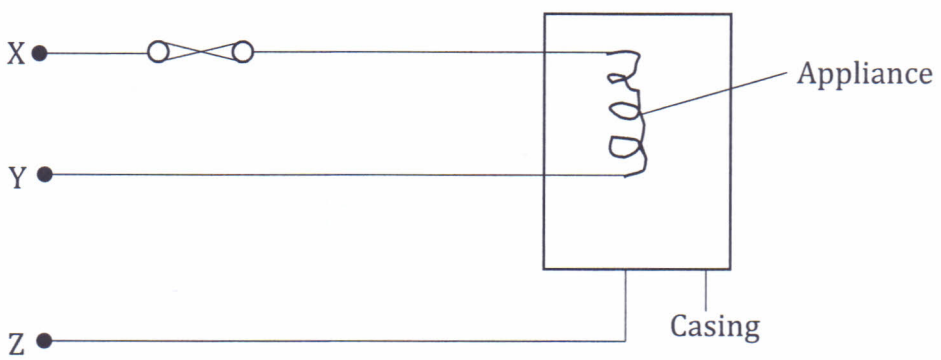


The bulbs do not light. No current flow since the ✓1 voltmeter is wrongly connected. The voltmeter should be out of the circuit not in circuit. ie. it should be connected across the device whose voltage is to be determined.

7. A car battery requires topping up with distilled water occasionally. Explain why this is necessary and why distilled water is used. (2 marks)

- Replace water lost ✓1 due to evaporation when the cell is working.
- Distilled water is used since it ✓1 doesn't have ions that can react with the ✓ acid to form insoluble compounds.

8. The figure below shows the wiring in a modern mains appliance.



05

Identify the wires X, Y and Z. ~~(2 marks)~~ (3mks)

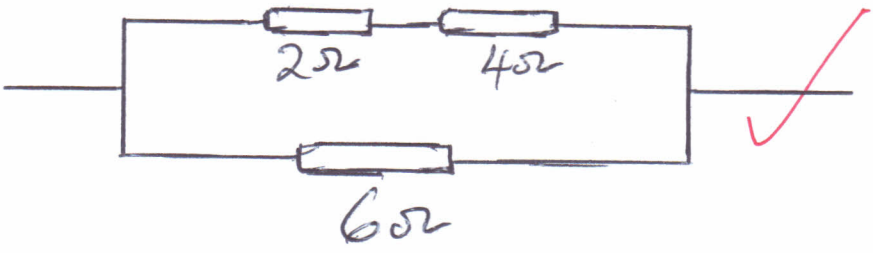
X - Live wire

Y - Neutral wire

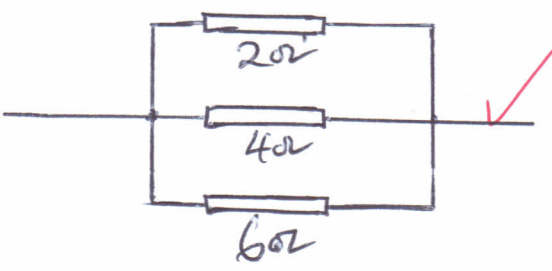
Z - Earth Wire

9. Three resistors of resistance 2.0Ω, 4.0Ω and 6.0Ω are connected together in a circuit. Draw a circuit diagram to show the arrangement to the resistors which gives;

(i) An effective resistance of 3.0Ω ~~(2 marks)~~ (1mk)



(ii) A minimum resistance. (1 mark)



10. When rod X was rubbed with material Y, it was observed that the material acquired a negative charge.

(i) State the charge on the rod X. (1 mark)

positive charge

(ii) Explain how the rod X acquired the charge. (1 mark)

During rubbing electrons were transferred from rod X to the material.

(iii) Explain briefly how you would test the nature of the charge on rod X using an electroscope. (2 marks)

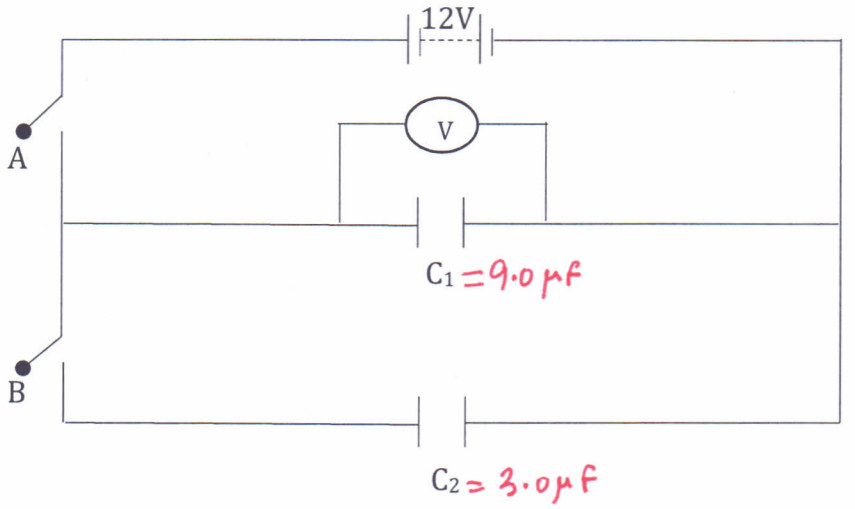
- Charge the electroscope +vely
- Bring the rod close to the cap of the electroscope.
- Look for an increase in the divergence of the leaf. This will confirm that X is +vely charged.

11. Distinguish between intrinsic semi-conductor and extrinsic semiconductor. (2 marks)

Intrinsic semi-conductor is a pure semi-conductor, while extrinsic semi-conductor is an intrinsic semi-conductor that has been doped i.e impurity has been added to improve conductivity.

SECTION B: (55 MARKS)

12. The following figure shows a circuit where a battery of an e.m.f. 12v, switches A and B, two capacitors C_1 = 9.0μF and C_2 = 3.0μF and a voltmeter connected as shown below.



(i) Determine the charge on C_1 when the switch A is closed and B open. (2 marks)

$Q_1 = C_1 V = 9 \times 10^{-6} \times 12 = 1.08 \times 10^{-4}$ C

or

108 μC

06

(ii) What is the voltmeter reading when switch A is closed and switch B open? (Assume capacitor C_1 is fully charged). (1 mark)

$V = 12V$ when fully charged.

Switch A is now opened and switch B closed. Determine:

(iii) The effective capacitance of C_1 and C_2. (2 marks)

$C_E = 9 + 3 = 12\,\mu F$

(iv) The voltmeter reacing V. (3 marks)

$$V = \frac{Q}{C} = \frac{1.08 \times 10^{-4}}{12 \times 10^{-6}} = 9V$$

OR

$$V = \frac{Q}{C} = \frac{108\,\mu C}{12\,\mu F} = 9V$$

(v) The energy stored by C_1 (2 marks)

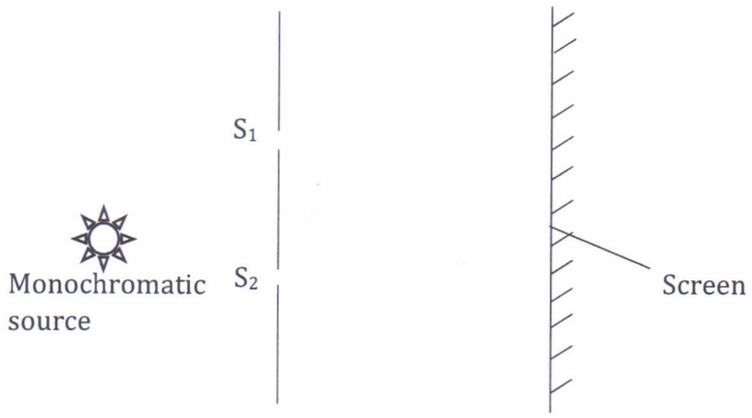
$$E_1 = \frac{1}{2} C_1 V^2 = \frac{1}{2} \times 9 \times 10^{-6} \times 9^2 =$$

- Sub
- Ans

$$3.645 \times 10^{-4}\ J$$

08

13. (a) In an experiment to study one of the properties of waves, a double slit was placed close to the source of monochromatic light as shown below.



(i) What property of waves is being investigated? (1 mark)

Interference of light. ✓

(ii) State the function of the double slit. (1 mark)

Acts as a coherent source of light. ✓

(iii) State and explain the observation made on the screen. (2 marks)

- Alternate bright and dark fringes are seen on the screen. ✓
- Bright fringes are points where constructive interference occurs, ie. crest from one source meets a crest from the other source, and where a crest from one meets a trough from the other destructive interference occurs, representing dark fringes ✓

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

(I) the slit separation S_1 S_2 is decreased. (1 mark)

Separation of fringes increase. ✓

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

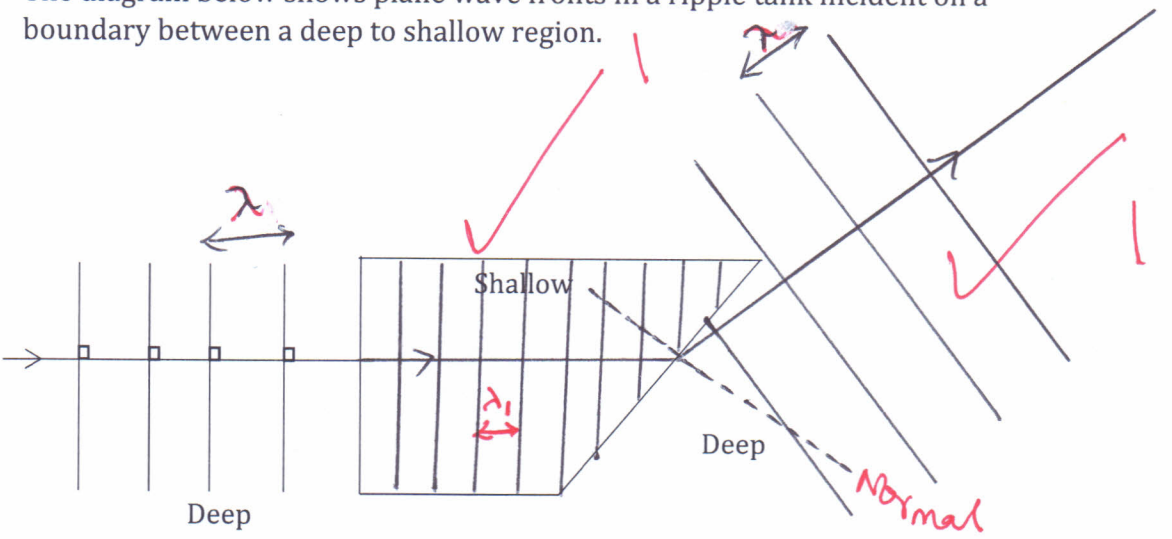
Central fringe is white; fringes on either side are coloured. ✓

(III) S_1 and S_2 are made larger. (1 mark)

No fringe and ∴ no interference. ✓

07

(b) The diagram below shows plane wave fronts in a ripple tank incident on a boundary between a deep to shallow region.



Key: $\lambda > \lambda_1$

On the same diagram, sketch the wave pattern in and beyond the shallow region. (2 marks)

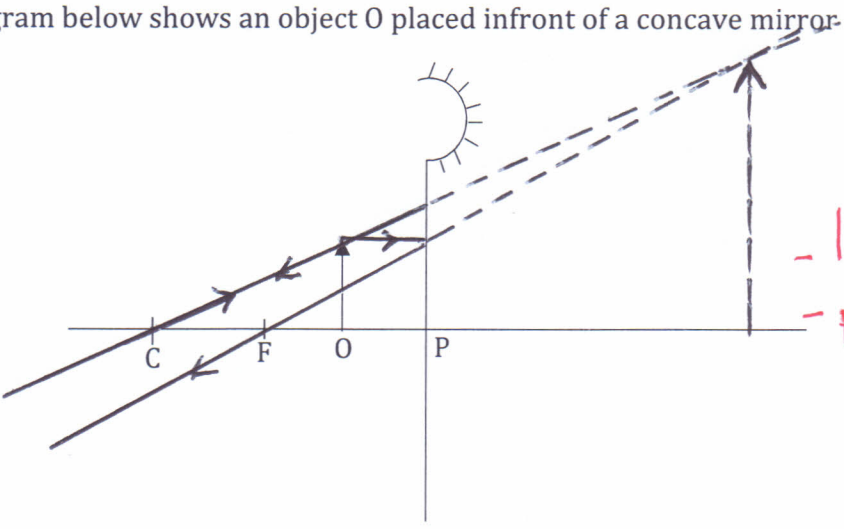
(c) The equation below represents a nuclear decay. (1 mark)

$$^{232}_{90}W \xrightarrow{A} {}^{228}_{88}X$$

Identify the radiation A.

A - ..... α particle .....

14. (a) The diagram below shows an object O placed infront of a concave mirror as shown.



- Image
- Parallel rays

5

(i) Complete the diagram to show the image formed. (2 marks)

(Refer to diagram)

(ii) State two characteristics of the image formed. (1 mark) (any two)

Virtual; upright, magnified, behind the mirror.

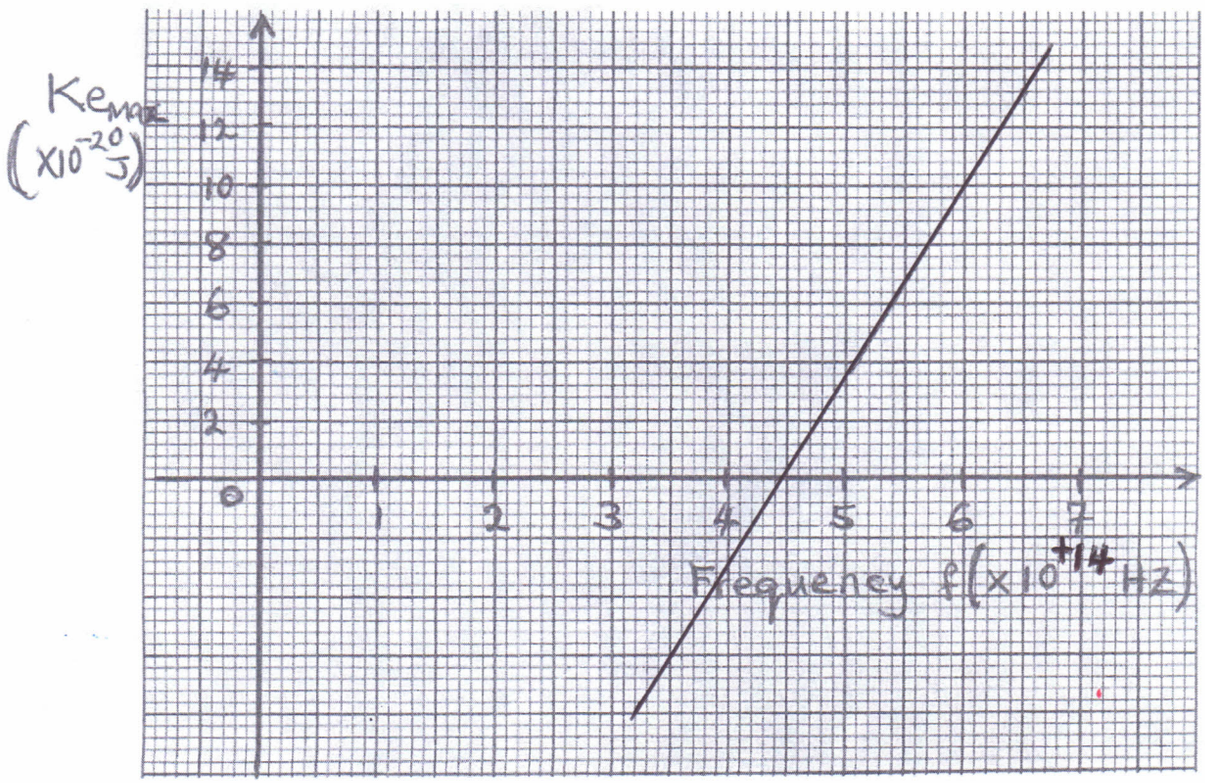
(b) (i) State two factors that determine the speed by which electrons are emitted from metal surface by light falling on it. (2 marks)

$hf = hf_o + Ke$

$\therefore K.e = hf - hf_o$

- Frequency of incident radiation / wavelength.
- Work function of the metal surface / type of metal

(ii) In an experiment using a photocell, light of varying frequency but constant intensity was shone onto the surface of a metal. The maximum kinetic energy, $(Ke)_{max}$ emitted for each frequency, was determined. The graph below shows how Ke_{max} varies with frequency f.



03

From Einstein's equation, $hf = \Theta + Ke_{max}$, where Θ is the work function. Determine.

(i) the threshold frequency, f_0 from the graph (1 mark)

4.45×10^{14} Hz

(ii) the planks constant, h (2 marks)

$h = \frac{(13.2-0)\times 10^{-20}}{(6.5-4.45)\times 10^{14}} = (6.439 \times 10^{-34}$ Js)

15. (a) An electric cooker has an oven rated 3KW, a grill rated 2KW and two rings each rated at 500W. The cooker operates from 240V mains. What is the cost of operating all the parts for 30 minutes if electricity cost Ksh.6.50 per unit? (3 marks)

Total Power $= 3\text{KW} + 2\text{KW} \times \left(\frac{2\times 500}{1000}\right) = 6$ KW

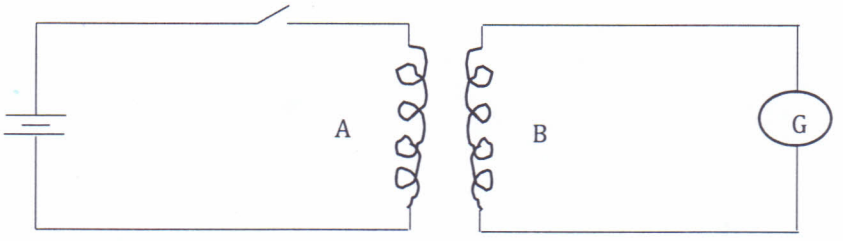
Total Units (Kwh) $= 6\text{ KW} \times \frac{30}{60}\text{ hr} = 2$ Kwh

If 1 unit = sh. 6.50

∴ 2 Units = ?

$= 2 \times 6.50 =$ Ksh. 13.00

(b) Fig. below shows identical copper coils A and B placed close to each other. Coil A is connected to a d.c. power supply while coil B is connected to a galvanometer.



(i) State and explain what is observed on the galvanometer when the switch is closed. (2 marks)

- The galvanometer shows a deflection in one direction and then returns to zero mark.

Closing switch causes a change in the magnetic flux in the primary coil which links with secondary coil, inducing an e.m.f and current in secondary coil. Both emf and current lasts for only a short time because as long as the switch is closed, the magnetic flux in primary coil remains constant.

08

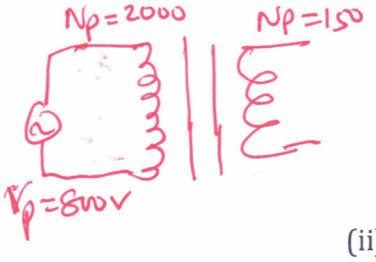
(ii) State what is observed on the galvanometer when the switch is opened. (1 mark)

The pointer will deflect in the opposite direction and then returns to zero mark. ✓

(iii) State what would be observed if the number of turns of coil B is doubled. (1 mark)

The pointer will deflect more. ✓

(c) A transformer with 2000 turns in the primary circuit and 150 turns in the secondary circuit has a primary circuit connected to a 800V ac source. It is found that when a heater is connected to the secondary circuit, it produces heat at the rate of 1000w. Assuming 90% efficiency, determine the;



(i) Voltage in the secondary circuit. (2 marks)

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} \Rightarrow V_s = \frac{150 \times 800}{2000} = 60V$$ ✓ ✓

(ii) the current in the primary circuit. (2 marks)

$$P_p = \frac{P_s}{0.9} = \frac{1000}{0.9} = 1111.1\ W$$ ✓

$$I_p = \frac{1111.1}{800} = 1.389\ A.$$ ✓

Alt. method

$$n = \frac{P_o}{PI}$$

$$\frac{90}{100} = \frac{I_s V_s}{I_p V_p}$$

$$0.9 = \frac{1000}{I_p \times 800}$$ ✓

$$I_p = \frac{1000}{0.9 \times 800}$$ ✓

$$= 1.389\ A$$ ✓

(iii) Current in the secondary circuit (1 mark)

$$P_o = I_s V_s$$

$$1000 = I_s \times 60$$ ✓

$$I_s = 1000/60 = 16.67\ A$$

07

(d) A cell drives a current of 5A through a 1.6Ω resistor. When connected to a 2.8Ω resistor, the current that flows is 3.2A. Determine the e.m.f. (E) and internal resistance (r) of the cell. (4 marks)

$E = I(R+r)$

$E = 5(1.6+r)$ —(i)

$E = 3.2(2.8+r)$ —(ii)

$5(1.6+r) = 3.2(2.8+r)$

$8 + 5r = 8.96 + 3.2r$

$1.8r = 0.96$

$r = 0.96/1.8 = 0.5333\ \Omega$

$E = 5(1.6+0.5333)$

$= 5(2.133)$

$= 10.67\ V$

16. (a) State how each of the following can be increased in an x-ray tube.

(i) Intensity of x-rays. (1 mark)

Increasing the heating current.

(ii) penetrating power of x-rays. (1 mark)

Increasing the Anode voltage/ increasing speed of the electrons.

(b) An x-ray tube has an electron beam current of 10mA and is accelerated through a p.d of 60KV. The efficiency is 0.5%. Calculate;

(i) the input power (2 marks)

$P = Ir = 10 \times 10^{-3} \times 60 \times 10^{3} = 600W$

(ii) the quantity of heat produced per second. (1 mark)

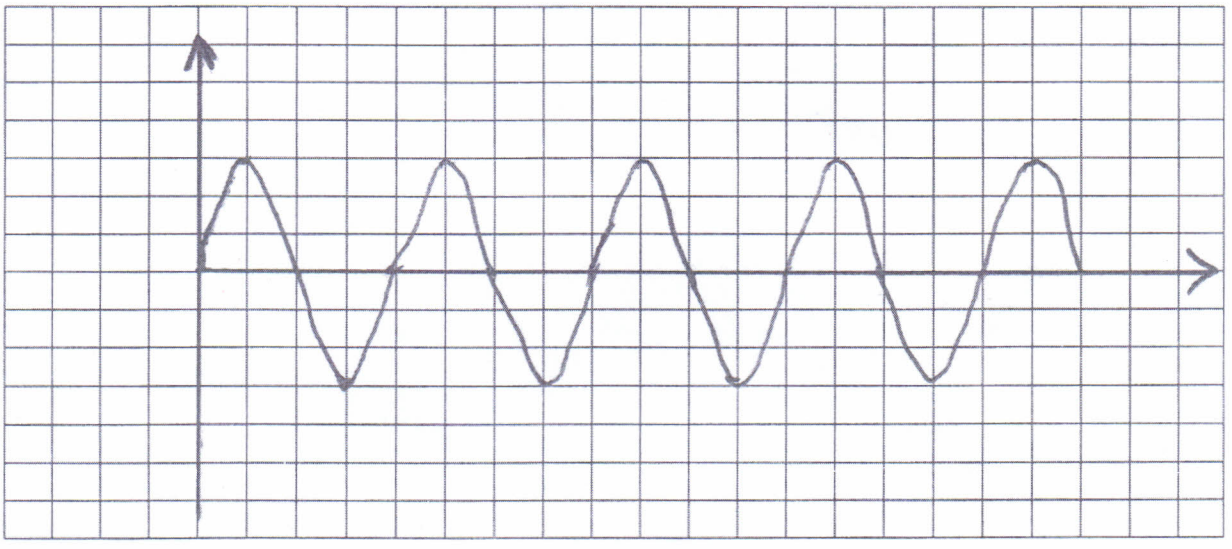
$H = \frac{99.5}{100} \times 600 = 597W$

09

(iii) the number of electrons hitting the target per second. (2 marks)

$$n = \frac{Q}{e} = \frac{It}{e} = \frac{10 \times 10^{-3} \times 1}{1.6 \times 10^{-19}} = 6.25 \times 10^{16} \text{ electrons.}$$

(c) The fig. below shows an a.c. signal on the C.R.O screen.



Determine:

(i) The frequency of the signal given that the time base is set at 10ms/div. (2 marks)

$$f = \frac{1}{T} = \frac{1}{4 \times 10 \times 10^{-3}} = \frac{100}{4} = 25 \text{ Hz.}$$

(ii) The peak voltage of the signal given that the y-gain is set at 50v/div (2 marks)

V_o $3 \times 50 = 150 \text{ V}$

06