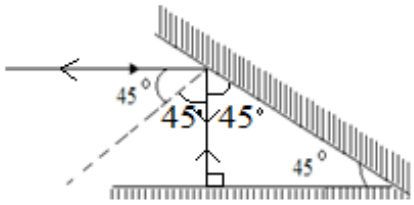
Term 2 - 2022
PHYSICS (232/2)
FORM FOUR (4)
Time: 2 Hours

Marking Scheme

SECTION A 25 MARKS

Answer all the questions in the spaces provided.

1. The figure below shows a ray of light incident on a mirror at an angle of 45°. Another mirror is placed at an angle of 45° to the first one as shown. Sketch the path of the ray until it emerges. (2 marks)



1 mark for all angles√
1 mark for all correct rays and direction√

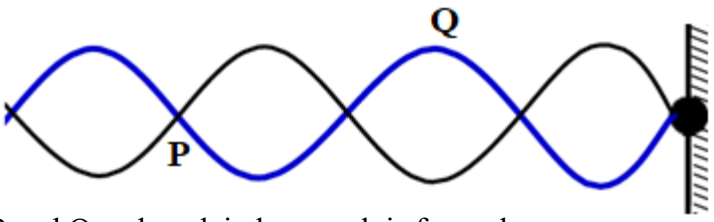
2. State any two ways of reducing the magnetic force of attraction of a magnet (2 marks)

Hitting while facing east-west direction√

Heating while facing east-west direction√

Inserting in a solenoid with a.c current facing east-west direction√

3. The figure below shows a transverse stationary wave along a string.

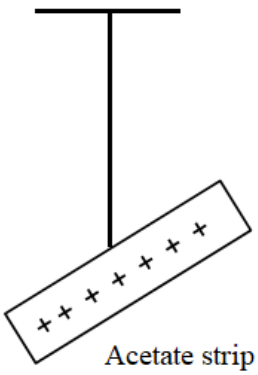


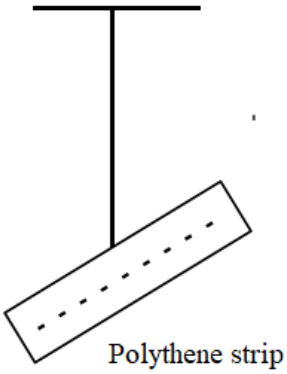
Name P and Q and explain how each is formed. (3 marks)

P – Node √ Q – Antinode√

Nodes are formed due to destructive interference while antinodes are formed due to constructive interference√

4. The diagrams below show a positively charged acetate strip and a negatively charged polythene strip freely suspended and isolated.



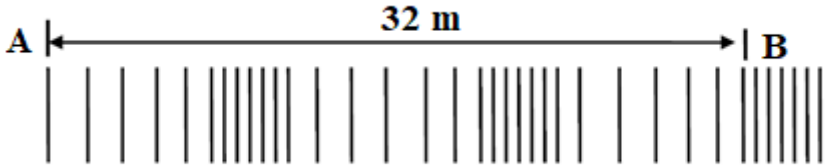


Two rods X and Y are brought up in turn to these strips. X attracts the acetate strip but repels the polythene strip. Rod Y does not repel either the acetate or the polythene. State the type of charge on each rod. (1 mark)

X Negative charges√

Y Neutral √

5. The diagram below shows waves generated from a tuning fork. If the wave takes 0.1 second to move from point A to B. determine the frequency of the wave. (4marks)



2.5 = 32

1 $= \frac{1\times32}{2.5}$

$\lambda = 12.8m$√

V$= \frac{32}{0.1} = 320\frac{m}{s}$√

f $= \frac{V}{\lambda} = 320 \times \frac{2.5}{32}$**=25Hz**√

6. Name two detectors of microwave (2 marks)

Solid state diodes,√ crystal detectors,√

7. Other than current state two other factors that affect the magnitude of force on a current carrying conductor placed in a magnetic field. (2 marks)

Length of the conductor within the magnetic field√

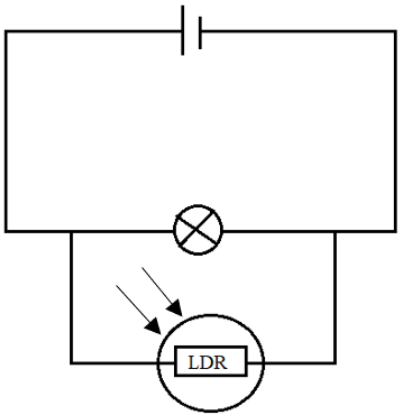
Magnetic field strength√
Angle between the conductor and magnetic field lines√

8. Give a reason why a concave mirror is not preferred as a driving mirror. (1 mark)

It mostly forms real images after reflection;driving mirrors should always give virtual images (forming behind the mirror)√

It has a narrow field of view√

9. A student connected the set up below in the laboratory. Explain the observation made on the bulb when the set-up below is taken to a dark room (2 marks)



Brightness of the bulb increases. √

The resistance of the LDR increases when the intensity of the light increases this causes more current to flow through the bulb.√

10. A person standing 110 m from the foot of a cliff claps his hands and hears a sound 0.75 seconds later. Find the speed of sound in air. (3 marks)

In 0.75 seconds, the sound has traveled 220 m√

$Speed = \frac{distance}{time}$√

$\frac{220m}{0.75s} = 293.3\frac{m}{s}$√

11. The figure below is part of electromagnetic spectrum.

A		Visible light	UV	

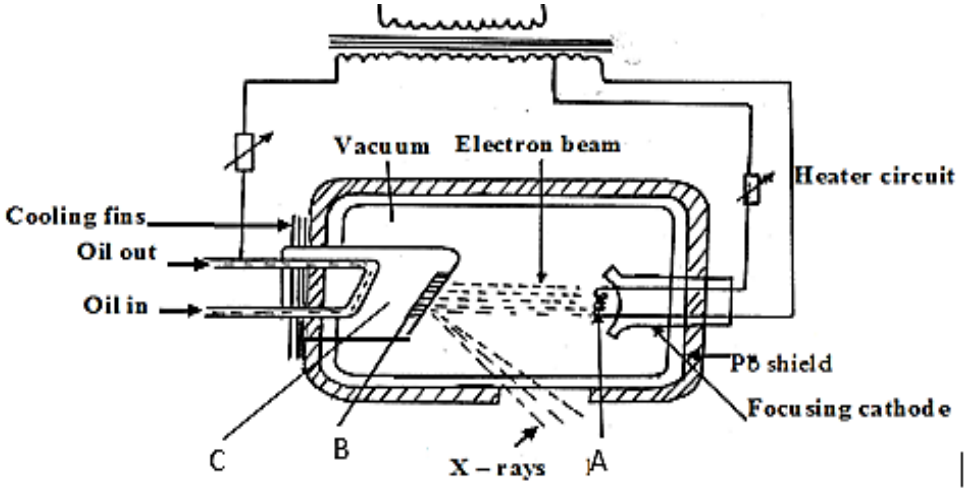
Identify radiation A and state its source. (2 marks)

Microwaves √ – Magnetrons/ Maser

SECTION B 55 MARKS

Answer all the questions in this section in the spaces provided.

12. (a) The figure below shows a X-ray tube.



(i) Name the part labelled C (1 mark)

Anode / copper anode√

(ii) State the property of the material labelled B on the diagram which makes it suitable for use in the X-ray tube. (1 marks)

High melting point√

(iii) Why is C inclined at an angle of 45°? (1 mark)

To direct x rays out of the tube through the window√

(iv) State the adjustment that can be made to vary

I. The quality of X-rays (1 mark)

Varying the accelerating voltage (increasing / decreasing the accelerating voltage√

II. The quantity of the X-rays. (1 mark)

Increasing or decreasing (varying) the heating current at the cathode √

(v) An x-ray tube has an accelerating potential of 100KV. Determine the maximum frequency of the x-rays produced.
(Plank's constant = 6.63 × 10 $^{-34}$ Js, e = 1.6 × 10^{-19}C) (3 marks)

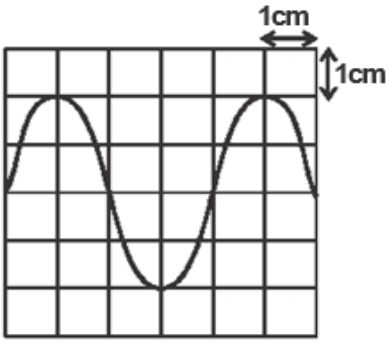
k.e = eV =hf√

= 100000 × 1.6 × 10^{-19}√

= 1.6 × 10^{-14} J

f =2.413 ×10^{19}Hz√

(b) In a CRO, waveform given below was displayed on the screen when the sensitivity at the Y plate was10V/cm and time base set at 20 milliseconds/cm.



Determine:

(i) peak voltage (2 marks)

$y - gain \times no.of\ divisions$√

$10\frac{V}{cm} \times 2cm = 20V$√

(ii) frequency of the signal (2 marks)

T. base $= 4 \times 20$

$= 80ms$

$= 0.08$√

f= $\frac{1}{0.08}$

=12.5 Hz√

13. a) $88226\ Ra$ decays into $86222\ Rn$ by emission of an alpha particle. Write a nuclear equation for the decay (1 marks)

$88238Ra \qquad 86222Rn + 24He$√

b) i)What do you understand by the term half-life of a radioactive substance? (1 mark)

Time taken by radioactive substance to decay to/by half of its original mass.√

ii)A G.M tube registers 20 counts. When a radioactive source is brought close to it, it registers 3220 counts and 120 counts 30 hours later. What is the half-life of this substance? (3 marks)

$Initial = 3220 - 20$

$$Final = 120 - 20\surd$$

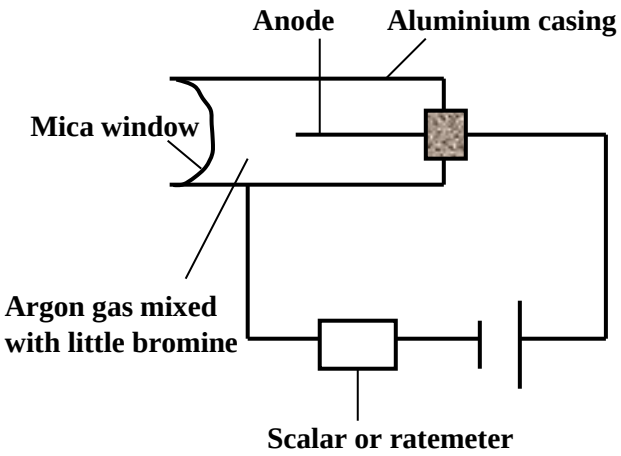
$$100 = 3200\left(\frac{1}{2}\right)^{\frac{30}{t}}\surd$$

$$\left(\frac{1}{2}\right)^{5} = \left(\frac{1}{2}\right)^{\frac{30}{t}}$$

$$5 = \frac{30}{t}$$

$$t = 6\ Hours\ \surd$$

c) The figure below shows a G.M tube.



i) What is the purpose of the mica window? (1 mark)

To allow all radiations to penetrate√

ii) Explain the purpose of the bromine (2 mark)

To absorb k.e of the ions hence preventing secondary ionization / Quenching agent

iii) Why should argon gas be kept at low pressure (1 mark)

For easier ionization / for faster ionization√

iv) What is meant by the term "*dead time*" as used in GM tube (1 mark)

Time taken by positive ions to move from anode to cathode√

v) Briefly explain how the GM tube works. (2 marks)

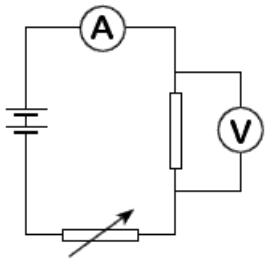
When the radiations enters through the mica window, argon gas is ionized and the positive ions move to the walls (cathode) as negative ions move to the anode.√ As the ions accelerate, they cause further ionization (secondary ionization) leading to avalanche of electrons which enables pulse current to flow and pulse voltage is registered across resistor R√

14. (a) State the Ohms Law (1 mark)

Current flowing through a conductor is directly proportional to the p.d across its end and provided that temperature and other physical conditions are kept constant.√

(b) You are provided a rheostat, 2 cells, a voltmeter, an ammeter, a switch and a fixed resistor.

i) Draw a circuit diagram that can be used to verify Ohm's law. (2 marks)



ii) Describe how the above set up can be used to determine Ohms law. (4 marks)

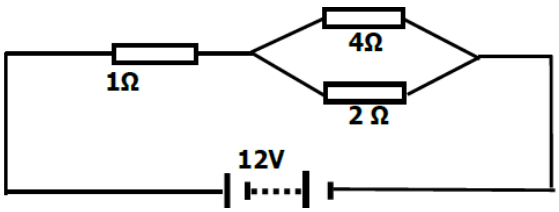
(i) Vary the voltage using the variable resistor and record the corresponding values of voltage and current√

(ii) Repeat for several values of current and voltage and tabulate√

(iii) Plot a graph of P.d against current.√

(iv) The graph is a straight line with positive gradient. Showing that current through a conductor is directly proportional to the P.d across it.√

(b)**Study** the circuit diagram below and answer the questions that follow.



Calculate

(i) Determine the total resistance in the circuit. (2 marks)

$$R_T = R_1 + \frac{R_2 R_1}{R_2 + R_1}\surd$$

$= 1 + \frac{8}{6}$

$= 2.333\ \Omega$√

(ii) The current through the 4Ω resistor (3 marks)

$I_T = \frac{12}{2.333} = 5.150$A√

P.D = IR=6.849V√

$I_{4\Omega} = \frac{V}{R}\frac{6.849}{4} = 1.712$A√

15. a) State Snell's law (1 mark)

The ratio of sine of angle of incidence to that of sine of angle of refraction is constant for a given pair of medium

b) A ray of light travelling from water to glass makes an angle of incident of 30^0. Find the angle of refraction in the glass. Refractive index of water $= \frac{4}{3}$. Refractive index of glass $= \frac{3}{2}$ (3 marks)

$\frac{\sin i}{\sin r} = {}_w n_g$

$\frac{\sin 30}{\sin r} = \frac{3}{2} \times \frac{3}{4}$√

$\frac{0.5}{\sin r} = \frac{9}{8}$

$Sin\ r = 0.5 \times \frac{8}{9}$√

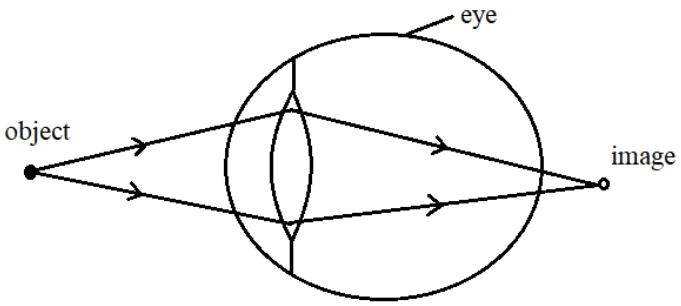
$r = 26.39^0$√

c) State the necessary and sufficient conditions for total internal reflection to occur. (2 marks)

1. Light must move from an optically denser to optically less dense medium.√

2. The incidence angle in an optically denser medium must be greater than the critical angle√

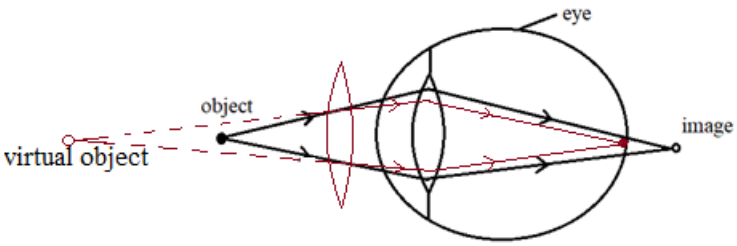
d) The figure below shows a human eye defect.



(i) State one possible cause of this defect. (1 mark)

Longer focal length√ Shorter eyeball√

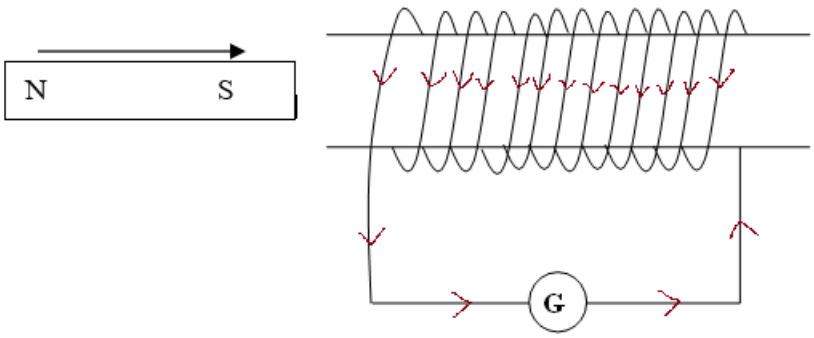
(ii) On the diagram, show how the defect is corrected. (2 mark)



16. (a) State the Lenz's law of electromagnetic induction. (1 mark)

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

(b) A bar magnet is moved into a coil of an insulated copper wire connected to a zero centre galvanometer as shown below



(i) Show on the figure above the direction of the induced current in the coil (1 mark)

(ii) State and explain what is observed on the galvanometer when the south pole of the magnet is moved into and then withdrawn from the coil. (2 marks)

The pointer deflects in one direction and comes back to zero. √When magnetic fields cut through the conductor, emf is induced which makes the current to flow and the pointer deflect but comes back to zero when there is no relative motion between the coil and the magnet√

(c) A transformer has 800 turns in the primary and 40 turns in the secondary winding. The alternating voltage connected to the primary is 240V and current of 0.5.A. If 10% of the power is dissipated as heat within the transformer, determine the current in the secondary coil.

(3 marks)

$$\frac{N_G}{N_P} = \frac{V_S}{V_P}$$

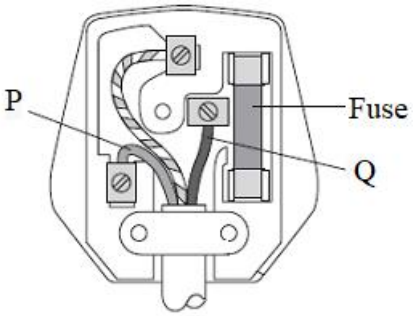
$\frac{40}{800} = \frac{V_S}{240}$√

$V_S = \frac{40+240}{800} = 12V$

$\frac{V_S I_S}{V_P I_P} \times 100 = 90$√

$I_S = \frac{0.9 \times 240 \times 0.5}{12} = 9\ A$√

(d) The diagram below shows a three-pin plug.



(i) Name the colour of conductors P and Q (2 marks)

P - Blue / Black√

Q – Red / Brown√

(ii) Why is the earth pin longer than the rest in the three-pin plug shown above? (1 mark)

To open the blinds√

To earth the appliance before current start flowing√