Name: ...Marking Scheme..... Adm No: .....

Index No: ..... Class: ..... Signature: .....

232/2

PHYSICS THEORY

JUNE 2024

TIME: 2 Hours

KASSU- JET EXAMINATION

Kenya Certificate of Secondary Education

PHYSICS PAPER 2

Instructions to candidates

- Write your name, admission no, index no and class in the spaces provided above.
- Sign in the space above.
- This paper consists of **TWO** sections; **A** and **B**.
- Answer **ALL** questions in section **A** and **B** in spaces provided.
- **All** working **must** be clearly shown in the spaces provided in this booklet.
- Non- programmable silent electronic calculators may be used.
- This paper consists of ...15... pages.
- Candidates should check the question paper to ascertain that all the pages are printe indicated and that no questions are missing.
- Candidates should answer the questions in English.

FOR EXAMINER'S USE ONLY

SECTION	QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1-13	25	
B	14	11	
	15	12	
	16	11	
	17	9	
	18	12	
TOTAL SCORE		80	

SECTION A [25 marks]

Answer **ALL** the questions in this section in the spaces provided.

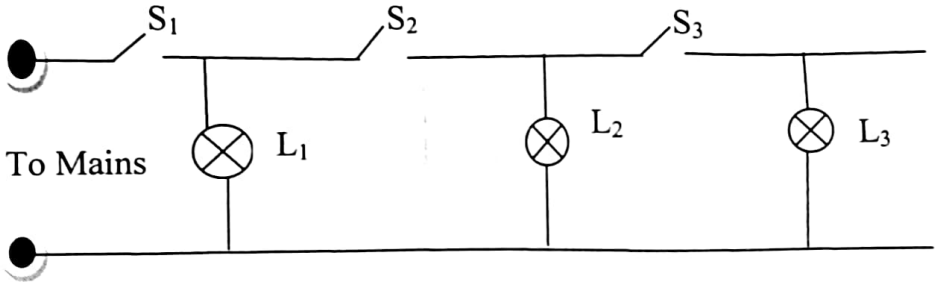
1. State how the quality of an X-ray beam can be increased. (1mk)

By increasing the accelerating Potential difference between the cathode and anode

2. State why repulsion is the sure test for polarity in magnetism. (1mk)

Attraction will occur between unlike poles of a magnet and also between a magnet and a magnetic material

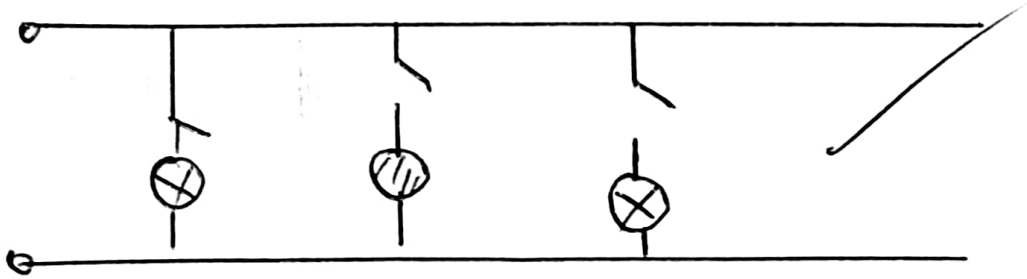
3. The figure below shows an attempt to supply each of the three lamps L_1, L_2 and L_3 with a switch.



a) Explain why this is a poor connection. (1mk)

Each bulb cannot be controlled independently.

b) Re-draw the diagram to show the correct connection in (a) above. (1mk)



4

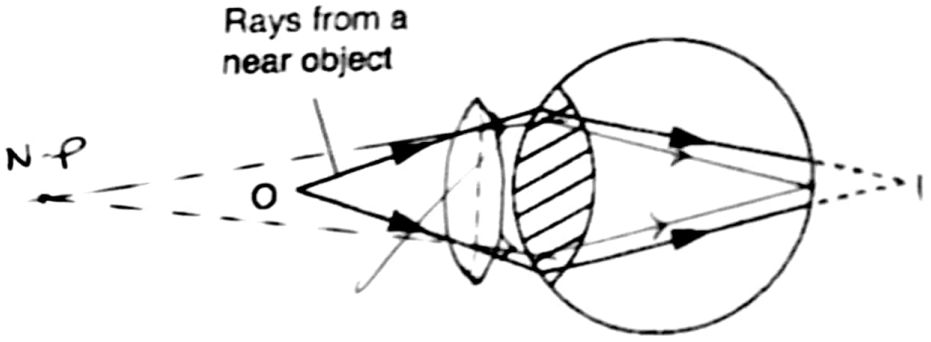
4. Pure silicon can be changed to a P-type semi-conductor by adding an impurity. Explain how this can be achieved. (2mks)

By doping silicon atom with group III element like Boron. the three electrons of silicon pair up with the impurity atom. One electron of silicon is left with no electron to pair with hence a hole is created

5. Explain how an increase in cross sectional area of a metallic conductor reduces its electrical resistance.

The number of free electrons per unit length of the thicker metallic rod is more than those in the thinner rod. (1mk)

6. Figure show a human eye with a certain defect.



i) Name the defect. (1mk)

Long sightedness ✓

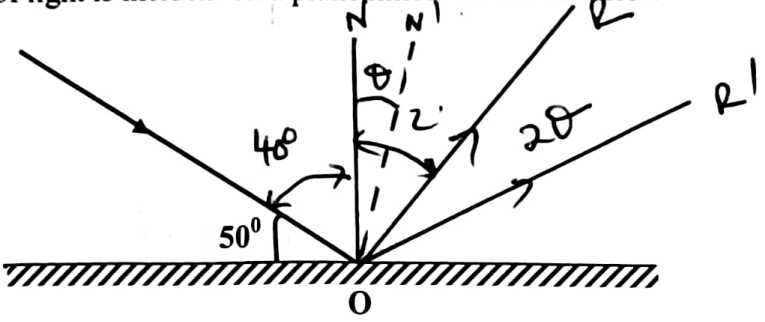
ii) State the cause of the defect named above. (1mk)

Long focal length or Short eye ball. ✓

6

iii) On the same diagram, sketch the appropriate lens to correct the defect and the rays to show the effect of the lens. (2mks)

7. A ray of light is incident on a plane mirror as shown below



When the mirror is rotated clockwise about **O**, the angle between the reflected ray and the new reflected ray is 120^0. Determine the angle of rotation of the mirror. (2mks)

$2\theta + 2\theta = 120$ ✓

$2 \times 40 + 2\theta = 120$ ✓

$2\theta = 120 - 80 = 40$

$\theta = \frac{40}{2} = 20^0$ ✓

8. Two light bulbs rated at **100W, 240V** and **150W, 240V** are connected to 240V mains in turn. Which of the two bulbs will light brightly if they are connected in series? (2mks)

$P = I^2 R$

$P \propto R$

$R_{100} = \frac{V^2}{P} = \frac{240^2}{100} = 576\Omega$ ✓

$R_{150} = \frac{240^2}{150} = 384\Omega$

100W bulb will be bright ✓

$R_{100} > R_{150}$

9. A car battery is rated 60Ah and supplies a constant current for 1,200 minutes. Calculate the amount of current that can be circulated. (2mks)

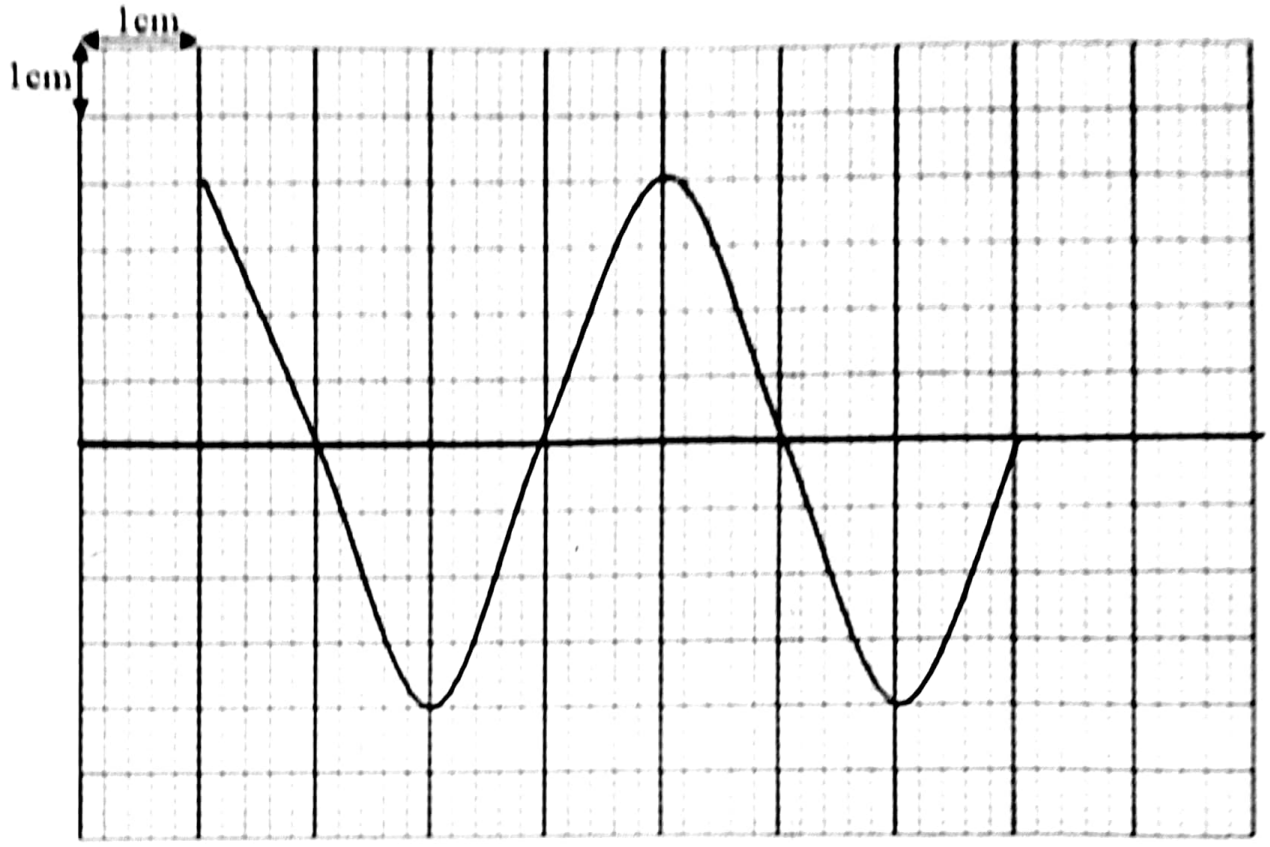
$Q = It$

$60 = I \times \frac{1200}{60} = 20I$ ✓

$I = \frac{60}{20} = 3A$ ✓

6

10. An a.c voltage display on a C.R.O whose vertical sensitivity was set at **20V / cm** appeared as shown below.



(a) Determine the peak value of the voltage. (1mk)

$V_0 = 4 \times 20$

$= 80\,V$ ✓

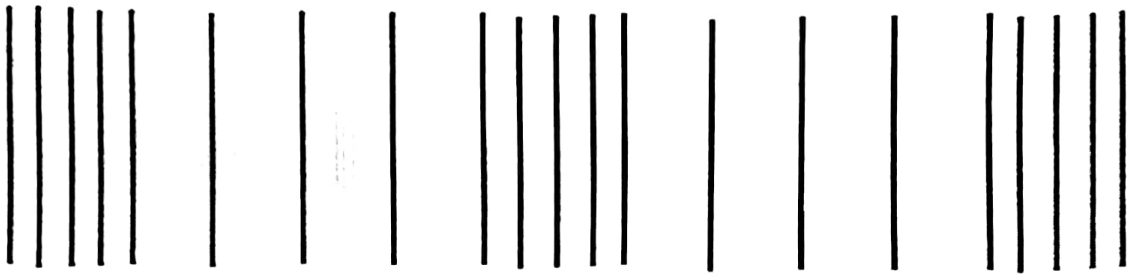
(b) If the time base was set at **25 ms/cm**, determine the frequency of the electrical wave. (2mks)

$T = 25 \times 4 = 100\,mS = 0.1\,S$ ✓

$f = \frac{1}{0.1} = 10\,Hz$ ✓

3

11. The diagram drawn to scale shows longitudinal waves from a slinky spring produced at a frequency of 3Hz. Calculate the speed of the waves. (2mks)

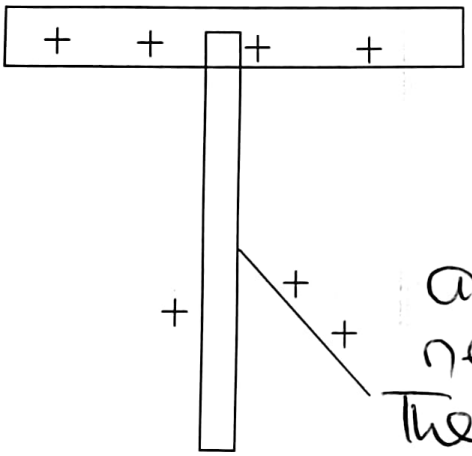


$\lambda = 6.2\,cm \quad f = 3Hz$

$V = f\lambda = 3 \times 6.3$ ✓

$= 18.6\,cm/s$ ✓

12 .The diagram shows a positively charged electroscope. A neutral rod is brought near the cap of the electroscope. State and explain the observation made. (2mks)



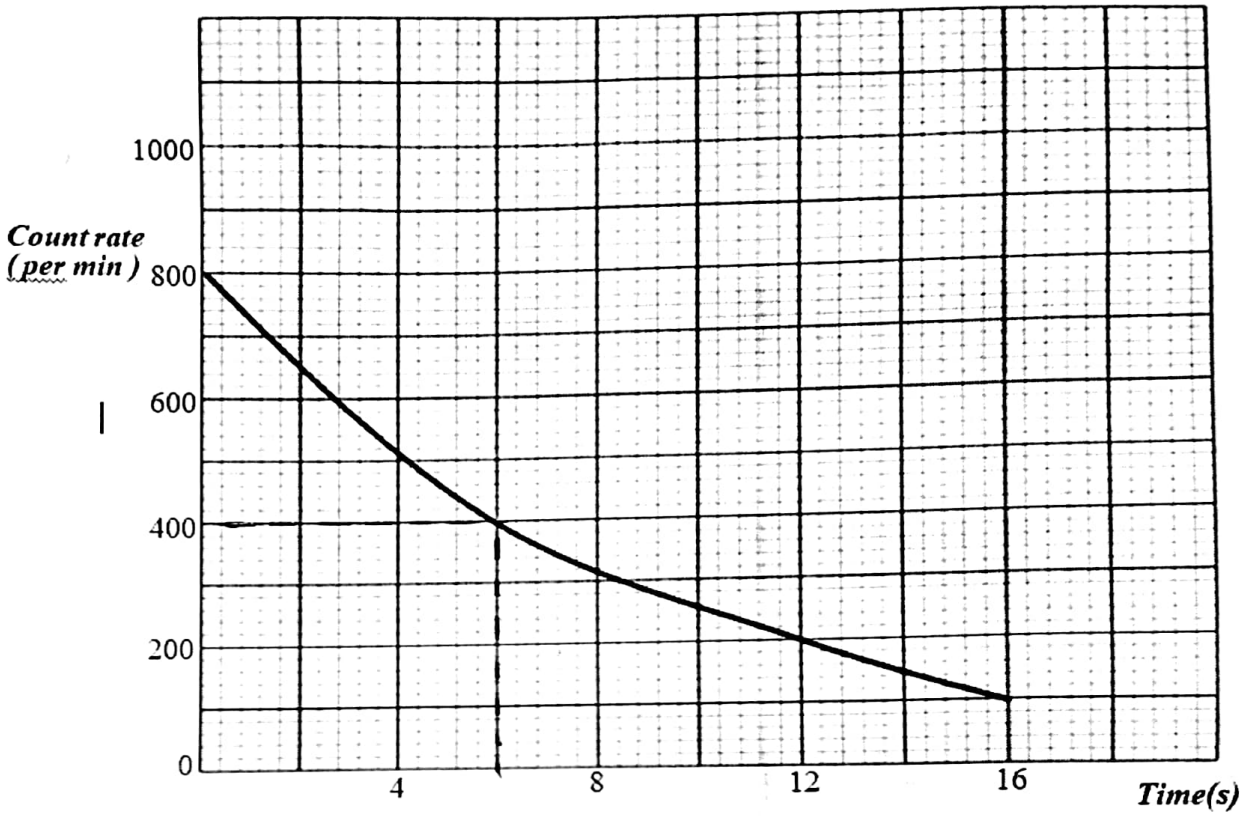
The leaf divergence decreases. ✓

The electroscope induces an opposite charge on the neutral rod.

The induced negative charges repels negative charges on the metal cap to the leaf and plate.

Some of the positive charges are neutralized causing the decrease in the leaf divergence

13.The figure below a decay curve for a certain element. The diagram is drawn to scale.



From the graph determine the half-life of the element . (1mk)

$t_{1/2} = 6\ s$

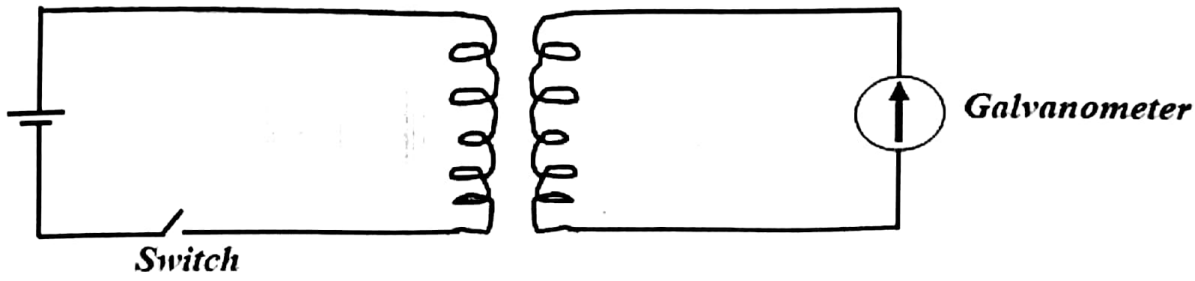
SECTION B [55 marks]

Answer **ALL** the questions in this section in the spaces provided below

14. (a) State the Lenz's law of electromagnetic induction. (1mk)

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

(b) The figure below shows circuit that can be used to demonstrate mutual induction.



(i) State what is observed when the switch is closed. (1mk)

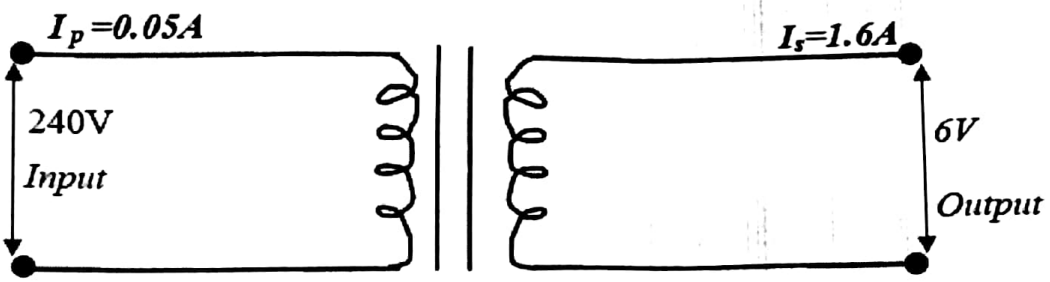
The pointer of the galvanometer is deflected to one side and then back to zero.

(ii) Explain why when the switch is closed then opened the deflection of the pointer is greater than during closing. (2mks)

Higher rate of change of magnetic flux during opening as the current drops instantly to zero lower rate of change during closing as current rises from zero to maximum after sometime.

4

(c) The figure below shows a demonstration transformer used to step down **240V** mains supply to **6V a.c** for use in a power pack supply.



(i) If the number of turns in primary coil is **240**. Determine the number of turns in the secondary. (2mks)

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} \Rightarrow N_s = \frac{6V \times 240}{240}$$

$= 6$ turns.

(ii) Determine the efficiency of the transformer. (3mks)

$P_s = I_s V_s = 1.6 \times 6 = 9.6W$

$P_p = I_p V_p = 0.05 \times 240 = 12W$

$\eta = \frac{P_s}{P_p} \times 100\% = \frac{9.6}{12} \times 100\% = 80\%$

(iii) Power losses in the transformer be by copper losses and hysteresis loss among other causes. State one other cause of power losses. (1mk)

Flux Leakage - any one
Eddy Current

(iv). Explain how the power losses stated in (iii) above is minimized. (1mk)

- Winding both primary and secondary coil on a common core inform of loop
- Laminating the core

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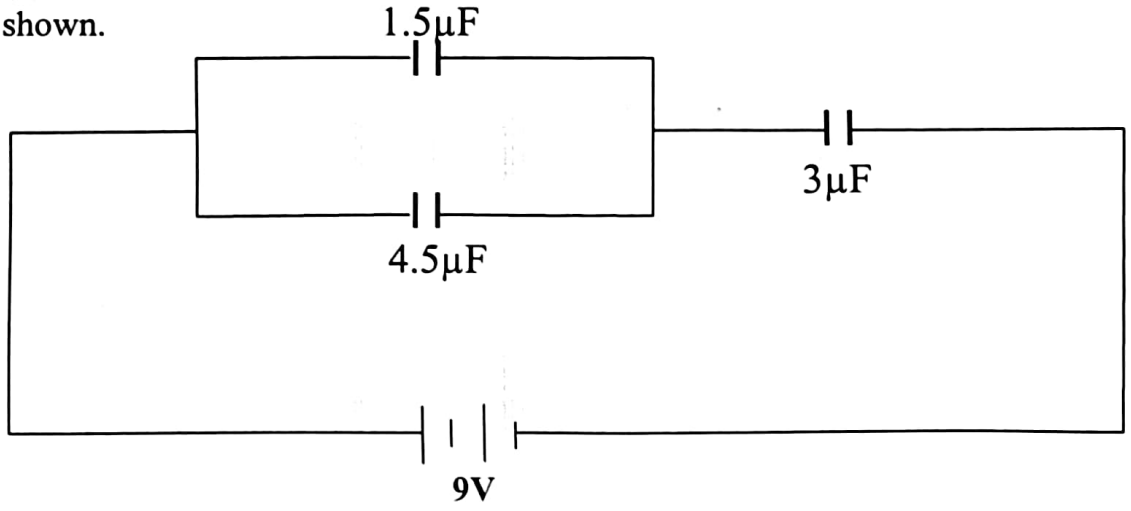
15. (a) State **TWO** factors that affect the capacitance of a parallel plate capacitor. (2mks)

- Area of overlap of the plates
- Distance of separation of the plates
- Dielectric material between the plates

(b) The figure below shows three capacitors **1.5μF**, **4.5μF** and **3μF** connected to **9V** supply as shown.



Determine;

(i) The total capacitance of the circuit. (3mks)

$C_p = 1.5 + 4.5 = 6\mu F$

$C_T = \left(\frac{6 \times 3}{6+3}\right) = 2\mu F$

(ii) The total charge stored in the capacitors. (2mks)

$Q_T = C_T V$

$= 2\mu F \times 9$

$= 18\mu C \quad = 1.8 \times 10^{-5} C$

(iii) The charge stored in **3μF** capacitor. (2mks)

$Q_3 = Q_T = 1.8 \times 10^{-5} C$

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c) The voltage across 4.5μ capacitor. (2mks)

$V = \frac{Q}{C} = \frac{1.8 \times 10^{-5}}{6 \times 10^{-6}}$

$= 3$

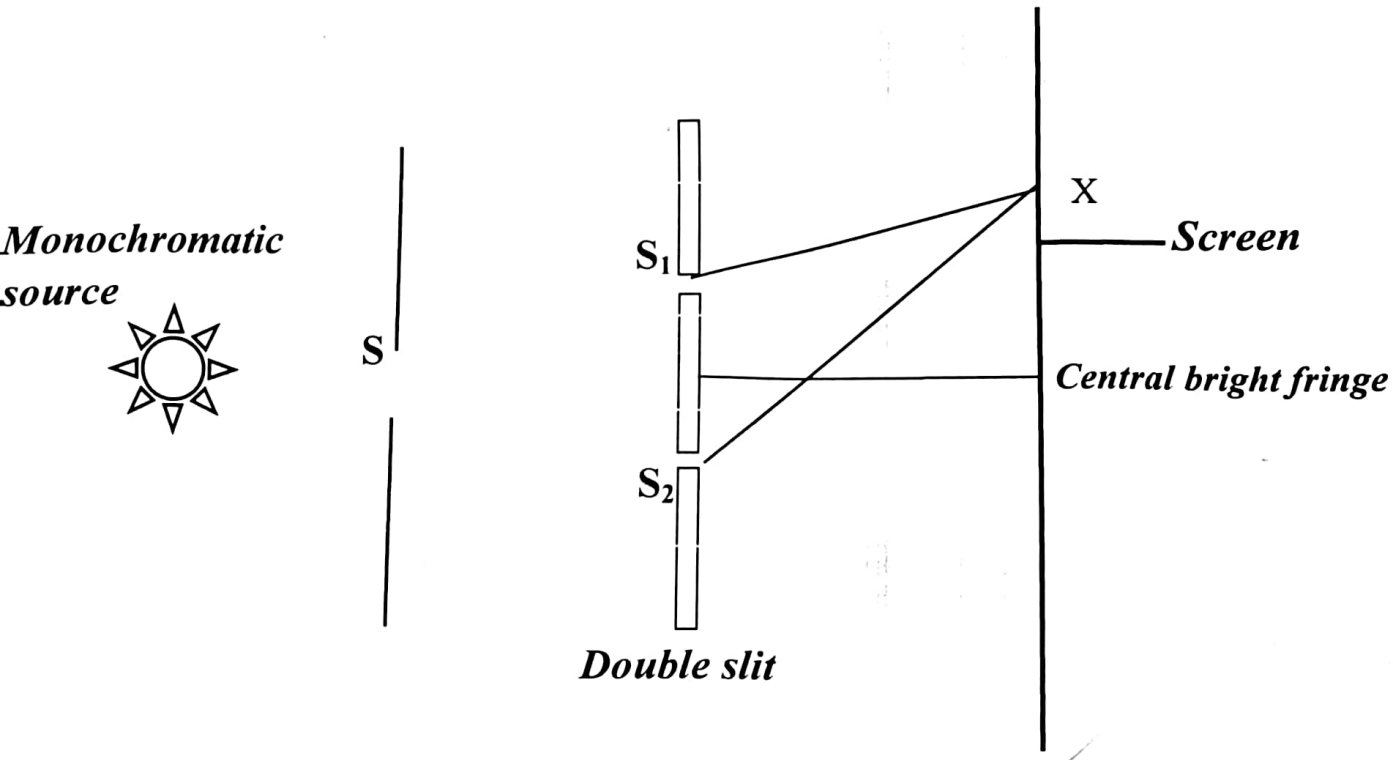
(d) State **ONE** application of capacitors. (1mk)

- Tuning circuits in radios
- Reduction of sparking at contacts

16. (a) Distinguish between stationary waves and progressive waves. (1mk)

The waveforms do not move through the medium while progressive wave, the waveforms move throug the medium away from it source

(b) In an experiment to observe interference of light a double slit is placed close to the monochromatic source of light as shown in the figure below



(i) State the function of the double slit S_1 and S_2 (1mk)

Source of coherent waves

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

Alternating bright and dark fringes
For bright fringes constructive interference while dark fringes destructive interference

(iii) State what is observed on the screen if white light is used in place of monochromatic light. (2mks)

Central bright fringe while all other bright fringes are colours of the rainbow.

(iv) Given that **X** is the first dark fringe above the central bright fringe and **S_1X=40.00mm** and **S_2X=40.0009mm.** Determine the wave length of light used. (2mks)

Path diff $= \frac{n}{2}\lambda$ $n = 1, 3, 5$

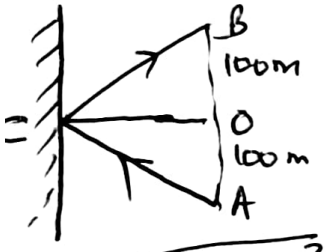
$S_2X - S_1X = \frac{\lambda}{2}$

$\frac{\lambda}{2} = 40.0009 - 40$ mm

$\lambda = 2 \times 0.0009$

$= 1.8 \times 10^{-3}$ mm

(c) Two men **A** and **B** were standing **200m** apart and **324m** each from a vertical cliff. Man **A** shots a gun and **B** heard the second gunshot being an echo from the cliff after **2 seconds**. Use the information to determine the velocity of sound in air. (3mks)



$AC = \sqrt{100^2 + 324^2}$

$= \sqrt{114976} = 339.08$m

Velocity $= \frac{339.08 \times 2}{2}$

$= 339.08$ m/s.

17. a) State Snell's law. (1mk)

For a pair of media the ratio of the sine of angle of incidence to the sine of angle of refraction is a constant.

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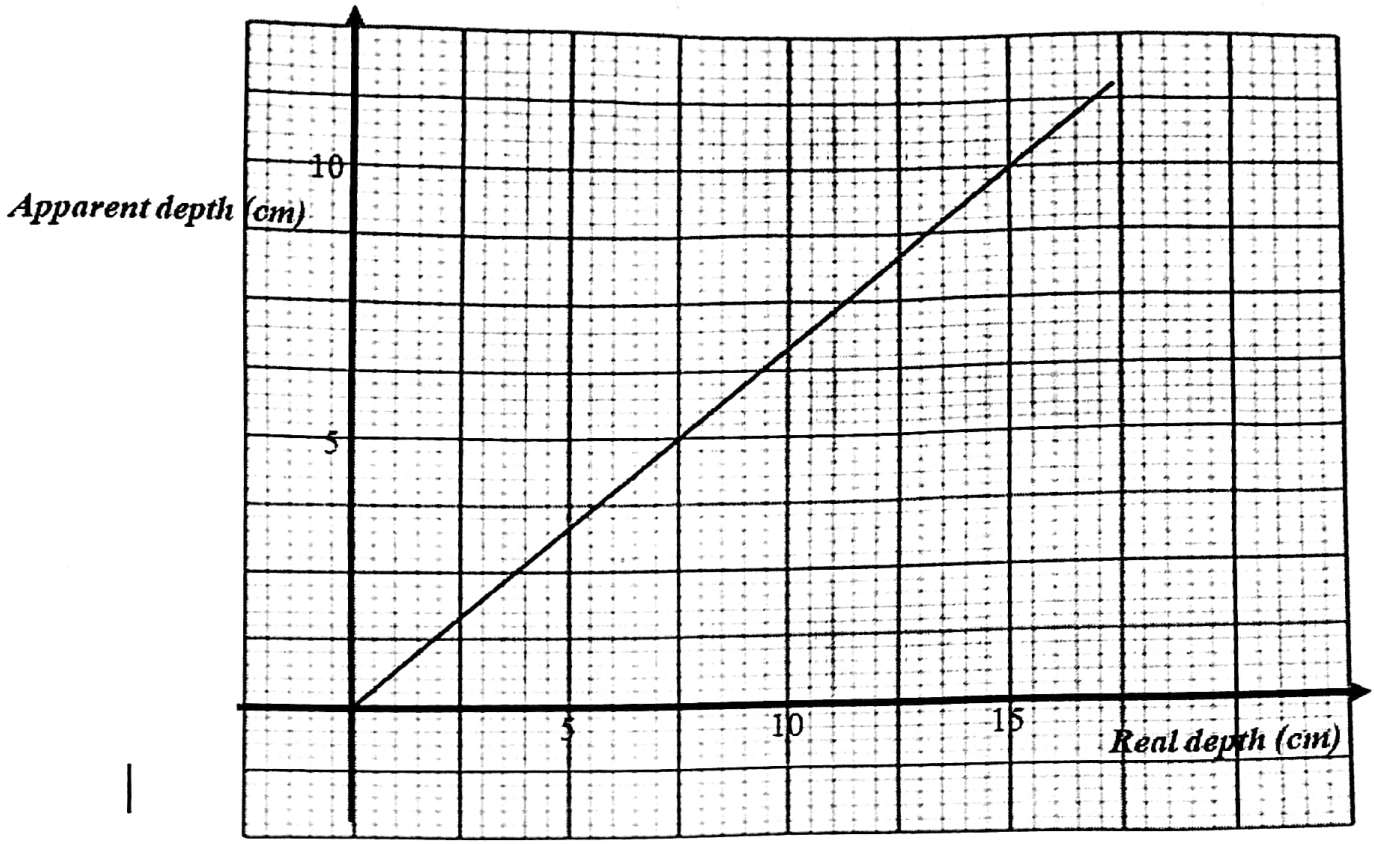
(b)The figure shows a graph of apparent depth against real depth for a given liquid.



From the graph determine the:

i) The refractive index of the liquid . (3mks)

$a = \frac{1}{\eta} \cdot t$ ✓

$\frac{1}{\eta}$ = gradient ✓

$\frac{1}{\eta} = \frac{10-0}{150-0} = \frac{10}{15}$ ✓

$\eta = \frac{1}{\text{gradient}}$

$= \frac{15}{10}$

$= 1.5$ ✓

ii) The velocity of light in the liquid if the speed of light in air is 3×10^8 m/s. (2mks)

$\eta = \frac{V_a}{V_L} \Rightarrow V_L = \frac{3\times10^8}{1.5}$ ✓

$= 2\times10^8$ m/s ✓

(c)One of the conditions for total internal refraction to occur is that angle of incidence must be greater than the critical angle of the medium, state the other condition. (1mk)

the ray of light must be travelling from an optically denser medium to an optically less dense medium. ✓

6

(d)State any **TWO** applications of prisms. (2mks)

. Rectification (smoothing circuits)
. In tuning circuits
. In delay circuits, In flash cameras

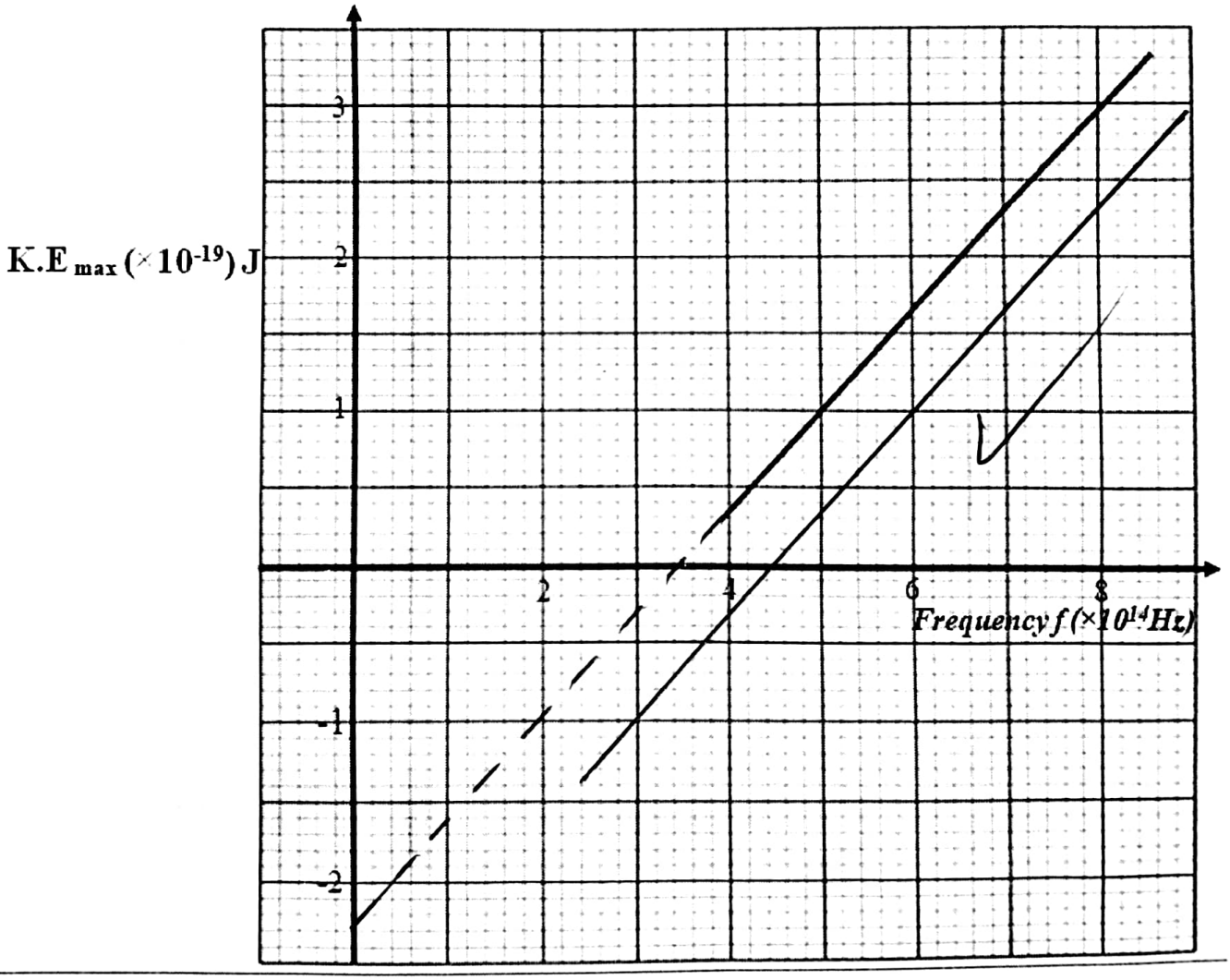
18. a) State **TWO** factors that determine the speed of photo electrons emitted from a metal surface. (2mks)

. energy of incident radiation or frequency
. work function

b) Define work function (1mk)

the minimum amount of energy needed to dislodge an electron from a metal surface

c) Figure shows a graph of maximum kinetic energy ($\mathbf{K.E_{max}}$) of photo electrons against the freqency of the incident radiation of caesium metal



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d) Given that $hf = Q + K.E_{max}$ where **h** and **Q** are constant, use the graph to determine:

i) The threshold wave length. ($c = 3 \times 10^8$ m/s) (2mks)

$f_0 = 3.5 \times 10^{14}$ Hz

$\lambda_0 = \frac{3 \times 10^8}{3.5 \times 10^{14}} = 8.571 \times 10^{-7}$ m.

ii) The value of **h** (3mks)

h = gradient

$= \frac{(2.3 - 1) \times 10^{-19}}{(7 - 5) \times 10^{14}} = \frac{1.3}{2} \times 10^{-33}$

$= 0.65 \times 10^{-33}$ Js

$= 6.5 \times 10^{-34}$ Js

iii) The value of **Q** (3mks)

$Q = hf_0$

$= 6.5 \times 10^{-34} \times 3.5 \times 10^{14}$

$= 2.275 \times 10^{-19}$ J

$-W_0 = -C$

$-W_0 = -2.25 \times 10^{-19}$

$W_0 = 2.25 \times 10^{-19}$ J.

iv) Lithium metal has a higher work function than caesium . On the same axes, sketch the graph for lithium. (1mk)

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