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232/2
Physics Paper 2
FORM FOUR

Time:2 Hours

SULIMO MOCK EXAMINATION – 2025 KENYA CERTIFICATE OF SECONDARY EDUCATION (KCSE)

Instructions to candidates

- 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 and KNEC Mathematical tables may be used.
- All numerical answers **should be expressed** in the **decimal** notations.
- Candidates should answer the questions in **English.**

For Examiner use only

SECTION	QUESTION	MAX MARKS	CANDIDATE'S SCORE
A	1 – 13	25	
B	14	11	
	15	12	
	16	12	
	17	11	
	18	09	
TOTAL		80	

This paper consists of 16 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

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SECTION A (25 MARKS)

INSTRUCTION: Answer all the questions in this section

1. **Figure 1** below shows an object placed in front of a pinhole camera.

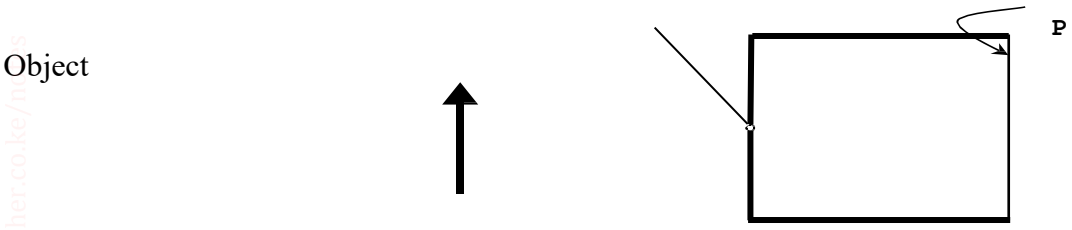

Figure 1

(a) Compare the size of the image formed to that of the object (1 mark)

- **Image is smaller/diminished**

(b) Explain what happens to the image formed when the diameter of P is doubled. (2 marks)

- **It becomes blurred. Doubling the pinhole allows more light into the camera, making the image blurred.**

2. A negatively charged rod is brought near the cap of a lightly charged electroscope. The leaf divergence first reduces but as the rod comes nearer, it diverges more.

(i) State the charge of the electroscope. (1mark)

- **Positively charged.**

(ii) Explain the behaviour of the leaf above. (1mark)

- **Negative charges are repelled to the leaf neutralizing the positive charges. As the rod comes nearer, the repulsive forces between the negative charges increase the leaf divergence.**

3. A wire made from some alloy has a resistance of 2 ohms per metre. Find the length of this wire which would be

required to make a heating coil of rating 240V, 1kW (2 marks)

$$\mathbf{R = \frac{v^2}{P} = \frac{240 \times 240}{1000}}$$

$$\mathbf{= 57.6\Omega}$$

$$\mathbf{L = \frac{57.6}{2} = 28.8m}$$

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4. **Figure 2** below shows a domestic wiring system.

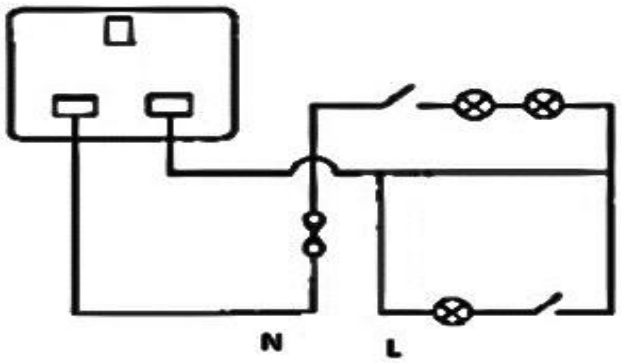

Figure 2

(i) Point out **ONE** fault in the circuit above. (1 mark)

- **Fuse connected on the neutral instead of live**
- **Lower bulb is short circuited.**
- **Bulbs are in series instead of parallel**

(ii) State one reason why the earth pin is longer than the rest in a three-pin plug that fits into the socket shown above.

(1 mark)

- **To first earth the device to protect the user from electric shock**
- **To open the shutters of live and neutral pins**

5. **Figure 3** below shows a bridge rectifier.

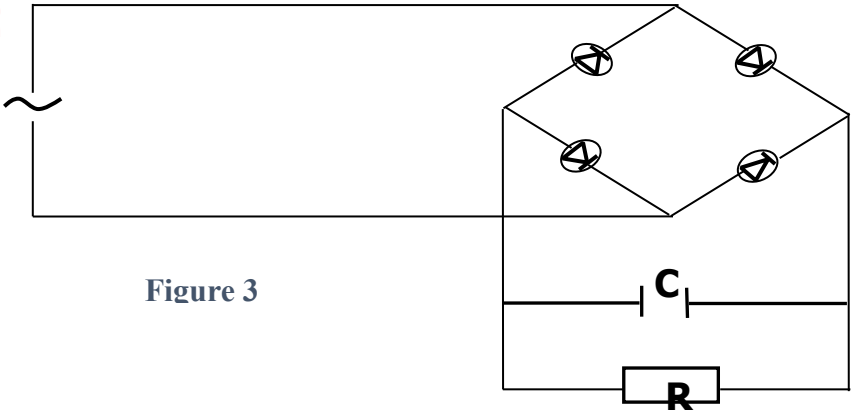

Figure 3

A capacitor has been connected across the resistor R as shown above.

(a) State the function of the capacitor in the rectifier above. (1 mark)

- **To smooth/ smoothen the output**

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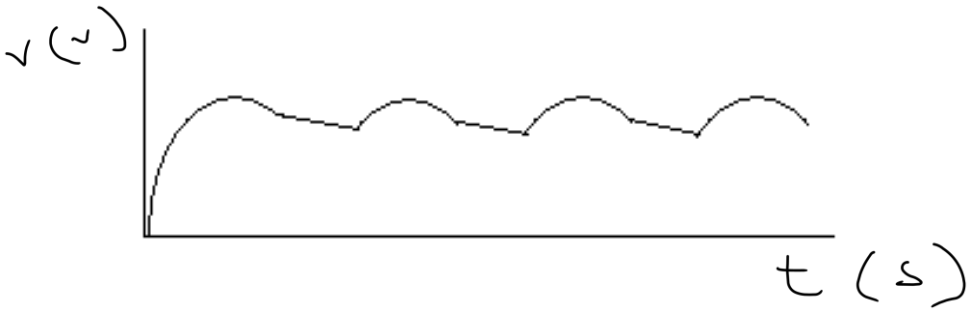
(b) Sketch on the axes provided below, the output wave profile when CRO is connected across the resistor R. (1 mark)



6. **Figure 4** below shows two pins hanging from a magnet.

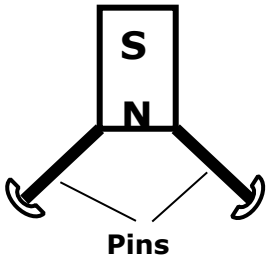


Figure 4

Explain why they do not hang vertically downwards (2 marks)

- **The pins become induced magnets with the lower ends attaining like polarities/ North poles- which repel each other.**

7. The diagram in **figure 5** below shows an object placed in front of a concave mirror. By use of correct ray diagram, locate the position of the image. (2 marks)

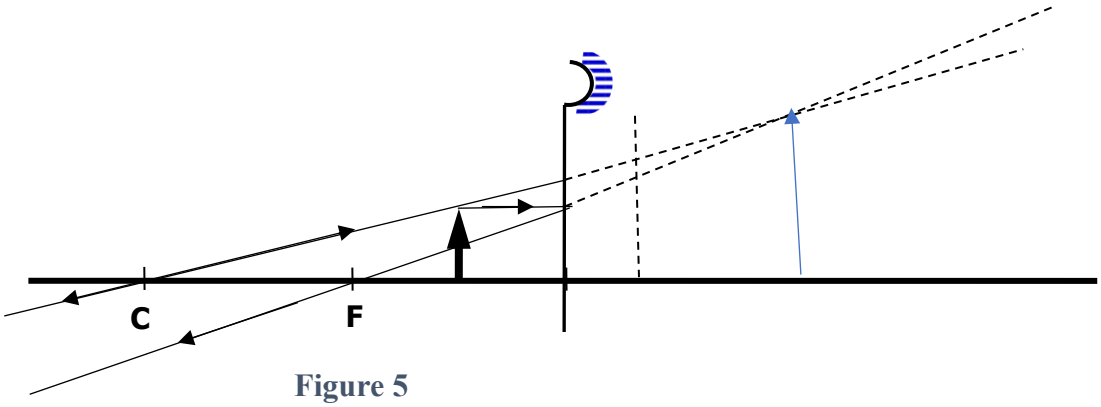


Figure 5

8. **Figure 6** below shows how the displacement varies with time for a certain wave.

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Determine the frequency of the wave. (2 marks)

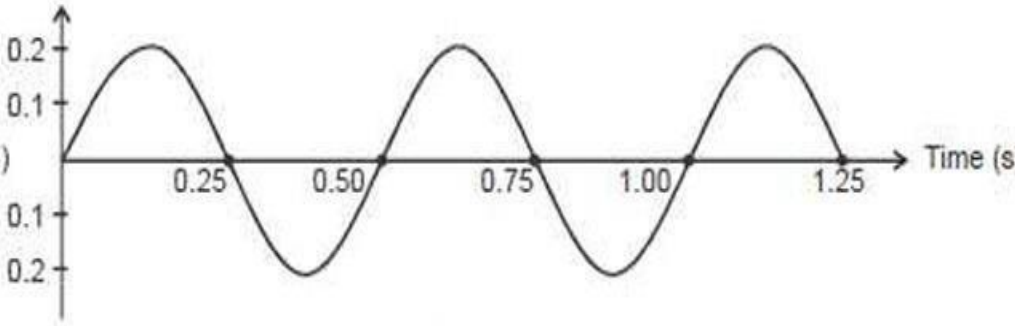


Figure 6

$$f = \frac{1}{T} = \frac{1}{0.50} = 2Hz$$

9. Explain why sound energy travels faster in a metal block than in water. (1mark)

- **Particles in the metal block are closely packed hence energy transfer through vibrations is faster than in water in which particles are far apart.**

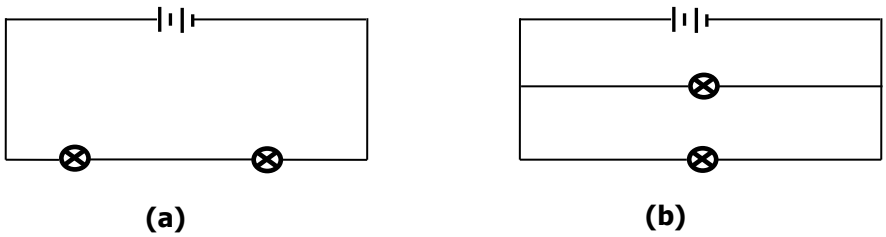
10. Define the term absolute refractive index of a medium. (1 mark)

- **Is the ratio of the speed of light in vacuum to the speed of light in a medium.**

11. A form 4 student at MEC was investigating the brightness of bulbs which she setup in the electric circuits below.

She used identical bulbs and cells. The circuits shown in **figure 7** (a) and (b) below were what she setup.

Figure 7



Identify with a reason, the setup in which the bulbs were brightest. (2 marks)

- **Set up (b): each of the bulbs are connected across the battery of 3.0v, while in (a), the energy from the battery is shared by the bulbs.**

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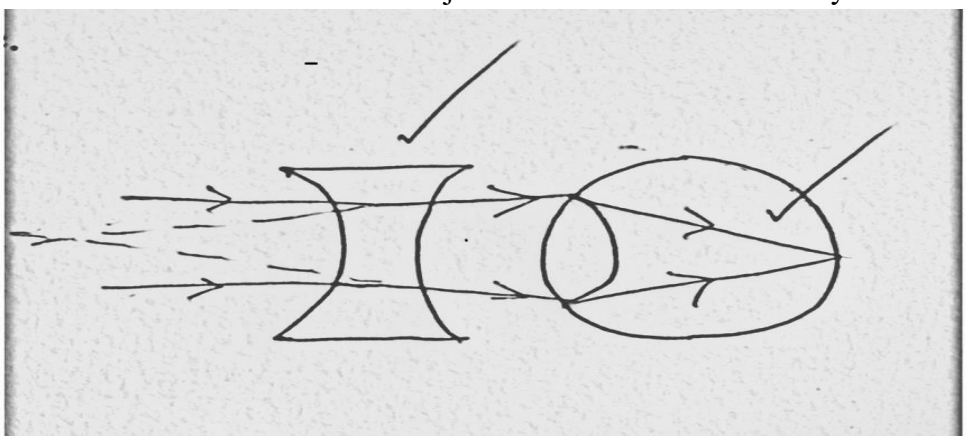
12. **Figure 8** below shows how a distant object is focused in a defective eye.



(i) Explain the above defect. (1mark)

- **This is shortsightedness in which the eye can only focus near objects into the retina.**
- **It is a defect caused by a long eyeball and a short focal length of the eye lens.**

(ii) On the same diagram, sketch the appropriate lens to correct the defect and sketch rays to show the effect of

the lens. (2 marks)

13. **Figure 9** below shows some region of part of the electromagnetic spectrum.

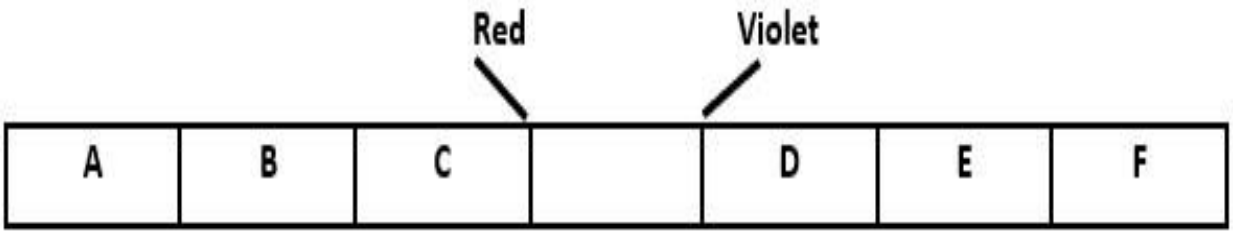


Figure 9

State one use of the wave in the region labelled B. (1 mark)

- **Heating**
- **Cooking**
- **Any other for microwaves**

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SECTION B (55 MARKS)

INSTRUCTION: Answer all the questions in this section

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

- **The direction of induced emf is such that the induced current it causes to flow produces a magnetic field which opposes the change producing it.**

(b) The diagram in **figure 10** below shows a magnet and a coil of wire which is connected to a galvanometer.

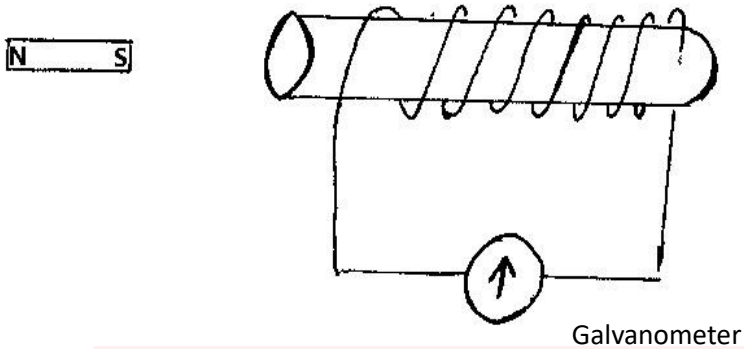

Figure 10 er

The magnet is moved slowly into the coil.

i. State the observation made. (1 mark)

- **Galvanometer deflects to the right. Or deflects in a clockwise direction.**

ii. Explain the observation above. (2 marks)

- **Moving the magnet towards the coil causes a change in the magnetic flux linkage inducing an emf in the coil. The end near the approaching magnet attains a south pole to oppose the approaching pole. The induced current flows through the wire such that the galvanometer deflects to the right.**

iii. State two ways in which the magnitude of the induced emf in the coil can be increased. (2 marks)

- **Increase the number of turns of the coil.**
- **Increase the speed of moving the magnet**
- **Use a strong magnet**

(c) A transformer has 400 turns in the primary coil while the secondary coil has 200 turns. The transformer is connected to 240V a.c mains. If a current of 2.5A flows in primary coil and
4.8A flows in secondary coil,

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i. Calculate the voltage across the secondary coil if the efficiency of the transformer is 95%. (2 marks)

$$\textbf{efficiency} = \frac{\textbf{power output}}{\textbf{power input}}$$

$$95\% = \frac{v \times 4.8}{240 \times 2.5} \times 100\%$$

$$v = \frac{95\% \times 240 \times 2.5}{4.8 \times 100\%}$$

$$= 118.75v$$

ii. State how energy loss in the transformer due to hysteresis is minimized (1 mark)

- **Use of a soft magnetic material**

(d) An insulated copper wire was wound on an iron nail to form a weak electromagnet. State ***two*** changes that could be made to increase the strength of the electromagnet. (2 marks)

- **Increase the number of turns of the copper wire**
- **Increase the size of current**

15. **a) Figure 11** below shows a set up used to observe interference of light waves.

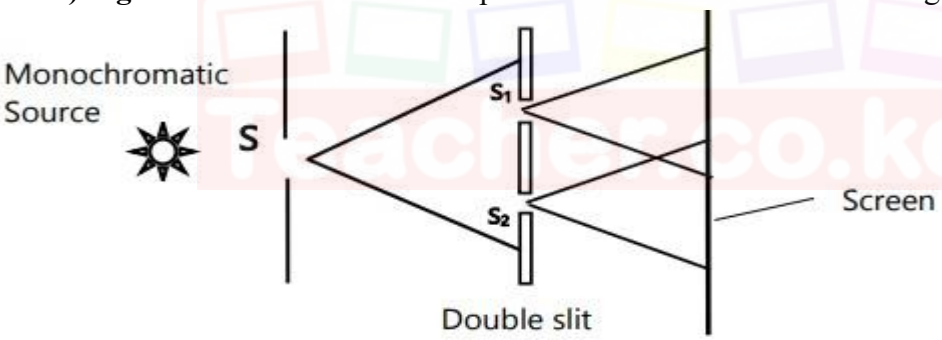

Figure 11

i. Define the term interference as used in waves (1 mark)

- **A phenomenon that occurs when two or more waves overlap/ merge resulting in a new wave formation or no wave at all.**

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

- **Acts as a coherent source/ to diffract light and make it interfere with itself**

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

- **A series of alternate bright and dark fringes. Bright fringes are due to constructive interference while dark fringes are due to destructive interference.**

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b) State what will be observed on the screen when

I. white light is used instead of monochromatic source. (1 mark)

- **central fringe remains white while subsequent fringes are coloured according to ROYGBIV**

II. The slit separation distance is increased. (1 mark)

- **Distance between the fringes decreases**

c) Name **ONE** factor that determines the velocity of photoelectrons produced on a zinc metal surface when light is shone on it. (1 mark)

- **Work function of the metal**
- **Intensity of the light**
- **Energy of the radiation**

d) The graph in **figure 12** shows the variation of stopping potential, *Vs* with incident radiation's frequency, *f* for a certain metal producing photoelectrons.

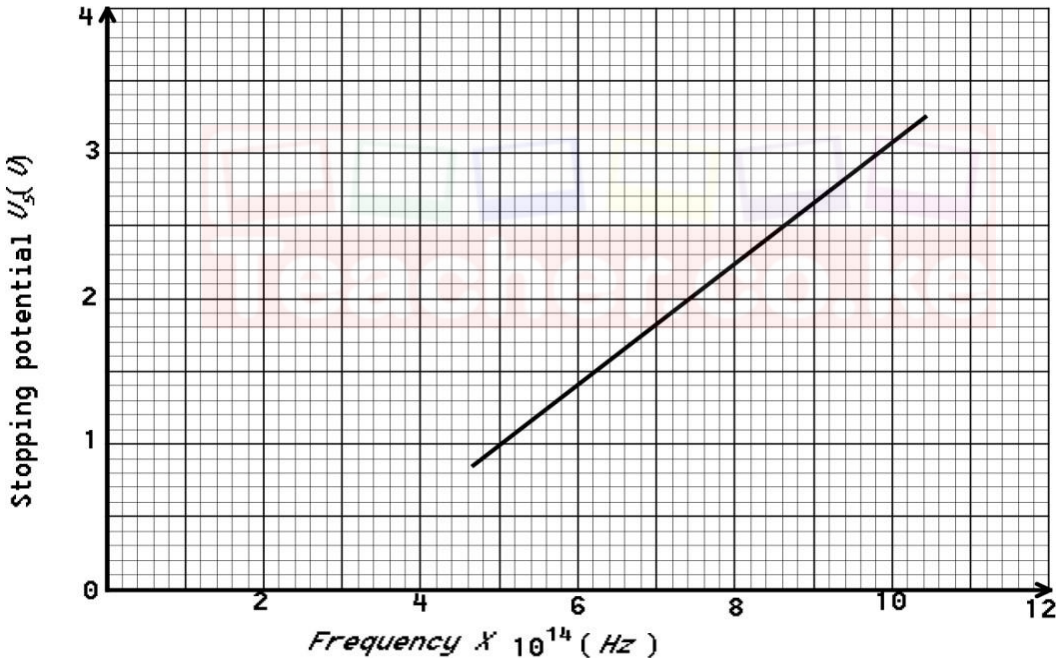

Figure 12

i. Determine threshold frequency. (1 mark)

- $f_o = 2.6 \times 10^{14} \text{Hz}$

ii. Use the graph to determine the maximum wavelength of the radiation that would dislodge electrons from the zinc surface. ($c = 3.0 \times 10^8\ ms^{-1}$) (2 marks)

- $\lambda_o = \frac{c}{f_o}$
- $\frac{3.0 \times 10^8}{2.6 \times 10^{14}}$
- $\lambda_o = 1.153 \times 10^{-6} \text{m}$

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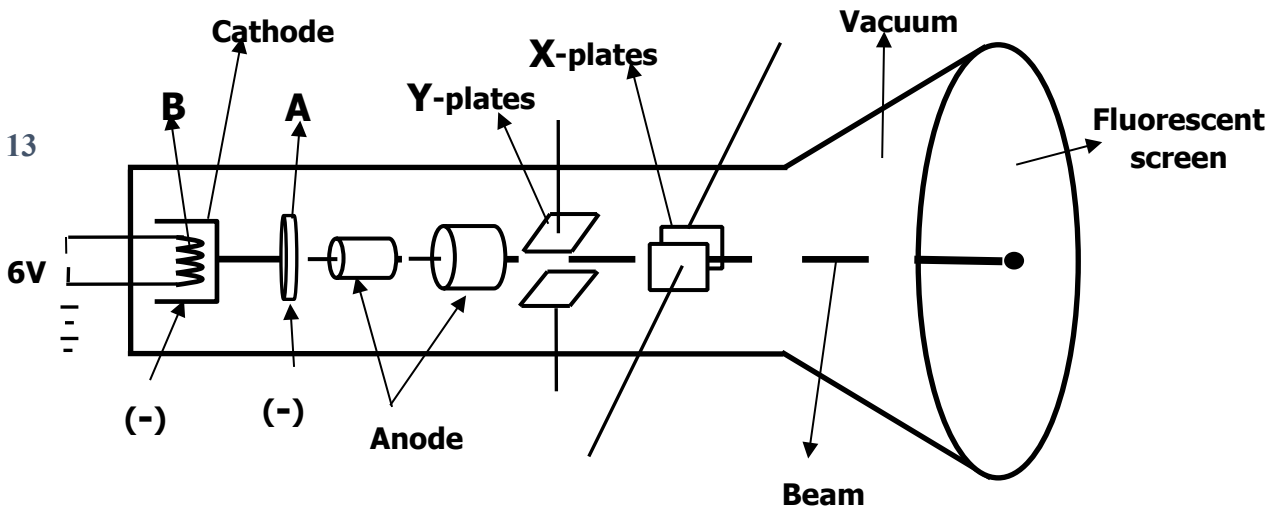
iii. Determine work function given planks constant as 6.63 x 10^{-34}Js (2 marks)

- $\mathbf{w_o = hf_o}$
- $\mathbf{6.63 \times 10^{-34} \times 2.6 \times 10^{14}}$
- $\mathbf{w_o = 1.7238 \times 10^{-19} J}$

16.a) **Figure 13** below shows the features of a cathode ray tube.

Figure 13



(i) Name the parts labeled:

A- Grid/ cylindrical grid (1mark)
B- Heater element (1mark)

(ii) Explain how the cathode rays are produced (2 marks)

- **The heater element heats up the cathode which emits electrons by thermionic emission. The electrons are attracted to the anodes which accelerate them to emerge as cathode rays.**

(iii) Explain why the Cathode Ray oscilloscope must be evacuated. (1mark)

- **To reduce collision between cathode rays and air molecules which would reduce their kinetic energy or ionize them.**

b) The **figure 14** below shows a cathode ray beam entering a magnetic field, perpendicular to the plane of the paper. Complete the diagram to show the path of the beam in the field. (1mark)

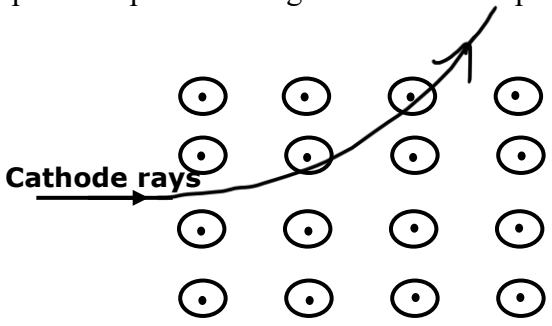


Figure 14

c) An X-ray tube is operating with an anode potential of 20kV and a current of 10 mA.

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I. Explain how the Intensity of X-rays from such a tube may be increased. (1 mark)

- **Increasing the cathode current increases the number of emitted electrons thus more x-rays.**

II. Calculate the number of electrons hitting the anode per second. (2 marks)

- $\mathbf{Q = It}$
- $\mathbf{10 \times 10^{-3} = 10 \times 10^{-3} coulombs}$
- $\mathbf{n = \frac{Q}{e}}$
- $\mathbf{\frac{10 \times 10^{-3}}{1.6 \times 10^{-19}} = 6.25 \times 10^{16} electrrons}$

III. Determine the velocity with which the electrons strike the target.

$(charge\ of\ an\ electron = 1.6x10^{-19}c\ , mass\ of\ electron = 9.11x10^{-31}kg)$

(3 marks)

- $\mathbf{ev = \frac{1}{2}mv^2}$

$$\mathbf{1.6 \times 10^{-19} \times 20000 = \frac{1}{2} \times 9.11 \times 10^{-31} v^2}$$

$$\mathbf{v^2 = 7.025 \times 10^{15}}$$

$$\mathbf{v = 8.382 \times 10^{7} m/s}$$

17.a) The diagram in **figure 15** below shows a Geiger Müller (G.M.) tube.

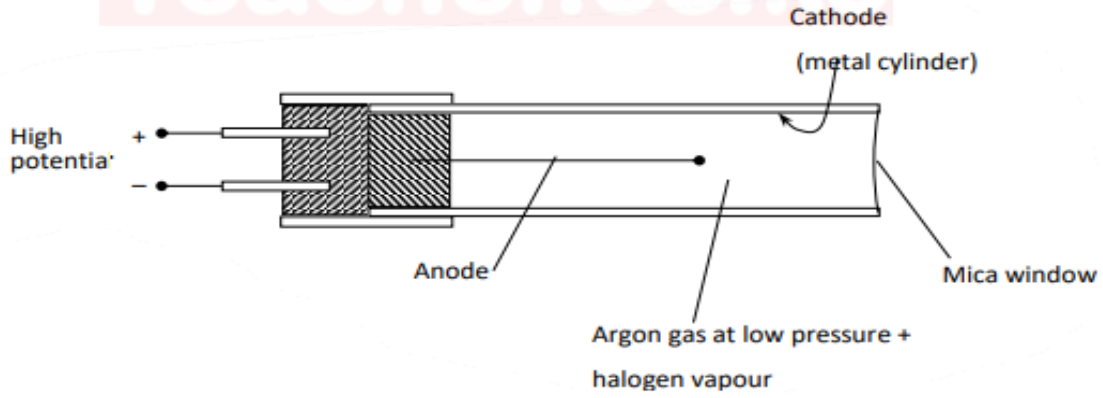

Figure 15

i. Give the reason why mica window is made thin. (1 mark)

- **To increase the sensitivity of the GM tube.**

ii. Explain how the radiation entering the tube through the window is detected by the tube. (3 marks)

- **The radiation passes through the mica window, ionizes the argon gas. Positive ions are attracted to the cathode while the negative ions attracted to the anode. A current is the registered on the pulse-counter/scaler.**

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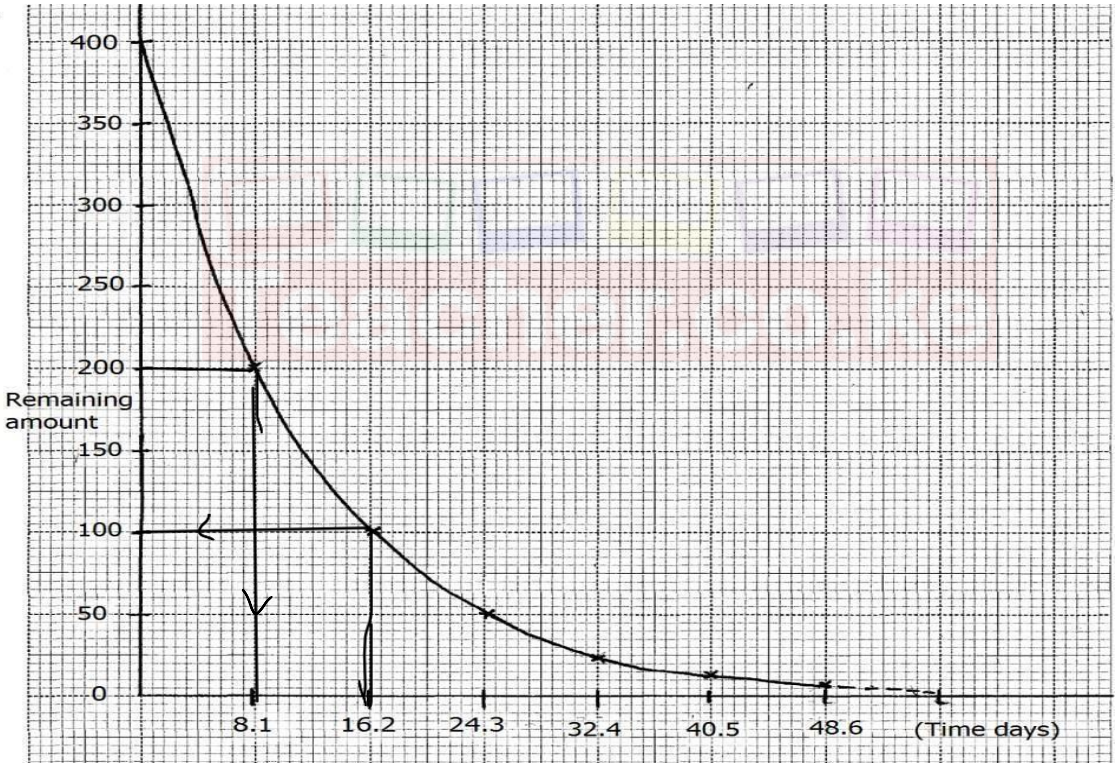
iii. State the purpose of the halogen vapor (1 mark)

- **Absorbs the kinetic energy of the positive ions, hence quenching the tube.**

b) The half – life of cobalt – 60 is 5years. Determine the time it will take for a sample of cobalt- 60 to take for the activity to decrease to $\frac{1}{6}$ of its original value. (2 marks)

- $\mathbf{N = N_0\left(\frac{1}{2}\right)^{\frac{T}{t}}}$
- $\mathbf{\frac{1}{6} = \left(\frac{1}{2}\right)^{\frac{T}{5}}}$
- $\mathbf{\frac{T}{5} = \frac{LOG\frac{1}{6}}{LOG\frac{1}{2}}}$
- $\mathbf{T = 12.92 \cong 13\ years.}$

c) The graph below shows radioactive decay of iodine.



Use the graph to determine the:-

i. Fraction of the amount remaining after 16.2 days**.** (1mark)

100

ii. Determine the half – life of iodine**.** (1mark)

- **8.1 days**

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d) The following is a decay series of Uranium 238.

$$^{238}_{x}U \xrightarrow{\alpha - Particle} Th \xrightarrow{\beta - Particle} {}^{y}_{91}Pa$$

Determine the values of x and y. (2 marks)

X= 92

Y= 234

18.**(a) Figure 16** represents two parallel plates of a capacitor separated by a distance, *d.*

Each plate has an area of A square units.

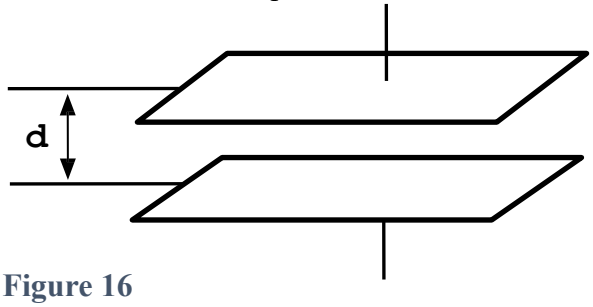

Figure 16

Suggest **ONE** adjustment that can be made on the capacitor so as to reduce the effective charge stored per unit voltage (1 mark)

- **Increase the distance d**
- **Reduce the area of overlap of the plates.**

(b) Figure 17 below shows a capacitor **C** being charged.

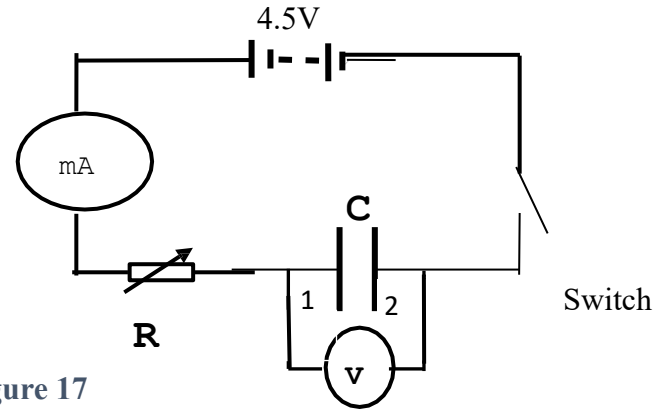

Figure 17

(i) State what will be observed on the following when the switch is closed.

I. The voltmeter. (1mark)

- **Reading increases**

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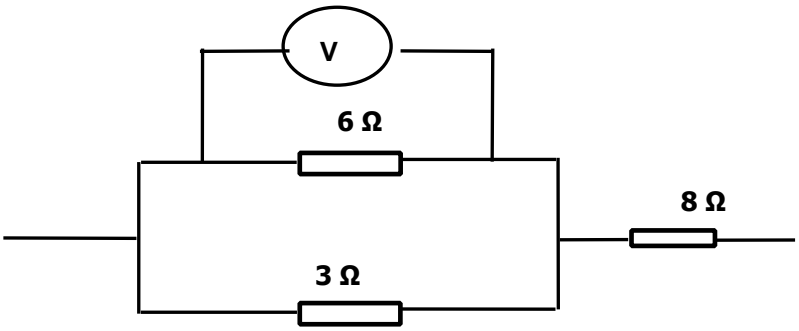
II. The Milliammeter. (1mark)

- **Reading decreases.**

III. Explain how the capacitor is charged (2marks)

- **Electrons flow from the negative of the battery to plate 2, at the same rate, electrons flow from plate 1 to the positive terminal of the battery. Equal negative charges and positive charges accumulate on plate 2 and plate 1 respectively. A potential is then developed between the palates.**

(c) **Figure 18** below shows three resistors connected as shown.



If the voltmeter reads **4V**, find the:

(i) Effective resistance. (2marks)

- $\frac{6\times3}{6+3} = 2\Omega + 8\Omega = 10\Omega$

(ii) Current through the 3Ω resistor. (2 marks)

- $\mathbf{I} = \frac{\mathbf{V}}{\mathbf{R}} = \frac{4}{3} = 1,333\mathbf{A}$

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