FORM FOUR PHYSICS TOPICAL QUESTION

NAME	
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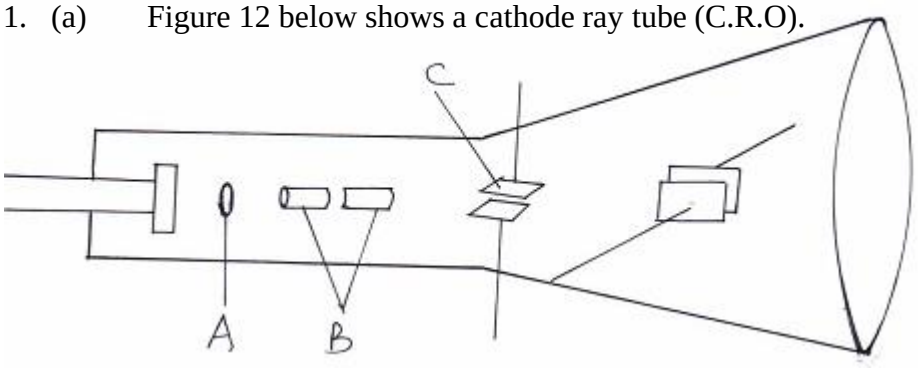
CATHODE RAYS AND CATHODE RAY TUBE QUESTIONS

1. (a) Figure 12 below shows a cathode ray tube (C.R.O).



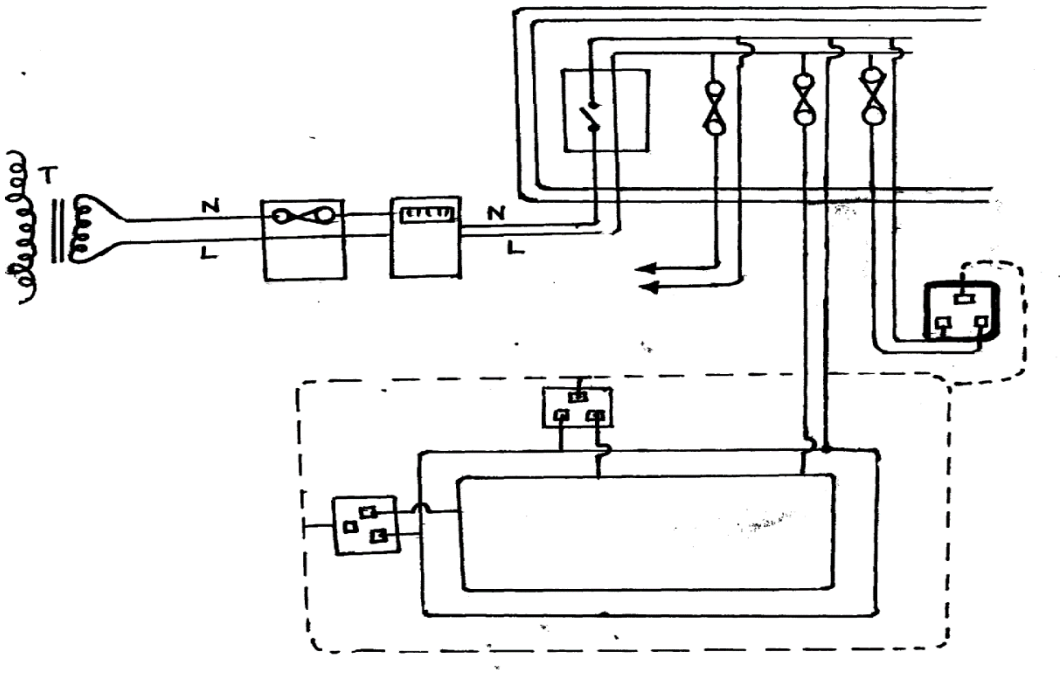
(i) Name the parts labelled **A** and **B**. (2mks)

(ii) What are the functions **A** and **C**? (2mks)

(iii) Explain how electrons are produced. (2mks)

(iv) Give a reason why the tube is evacuated. (1mk)

2. The figure 7 below represents a cathode ray oscilloscope (C.R.O)



i) Name the parts labeled A and B (2mks)

ii) What are the functions of parts labeled C and D (2mks)

iii) Explain how electrons are produced. (2mk)

iv) Give a reason why the tube is evacuated.
(1mk)

((b) i) Distinguish between cathode rays and light rays
(2mks)

(ii) State the function of A (1mk)

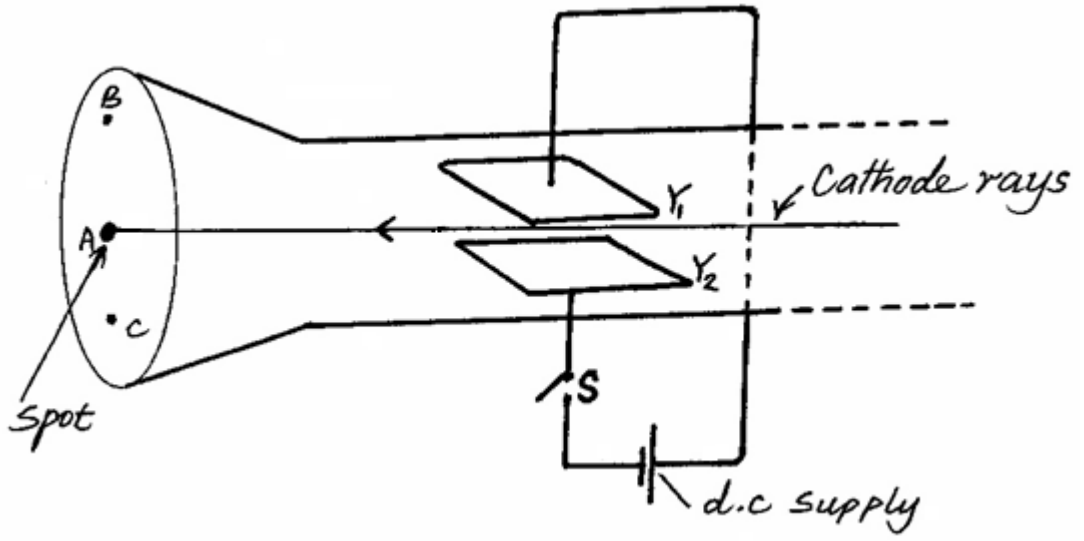
(iii) An alternating p.d is applied across the Y-plates. State what is the effect on the position of the spot on the screen? (1 mark)

(iv) A signal with a frequency of 50Hz is applied across the Y-plates. If the time base with a period of 0.04s is applied across the X-plates, sketch a graph of p.d against time showing the number of waves that can be seen on the screen of the C.R.O (2 mks)

v) The tube of the CRO is coated with graphite. State three functions of the graphite coating
(3mks)

3.

(a) The figure below shows the vertical deflection system of a Cathode Ray Oscilloscope (C.R.O).



(i) State how cathode rays are produced in Cathode Ray Oscilloscope. (1 mark)

(ii) Show on the diagram the path of the cathode rays when the switch **S** is closed. (1 mark)

(iii) State what is observed on the screen if the d.c. supply is replaced with a high frequency a.c. supply. (1 mark)

(b) An electric filament bulb is rated 24V, 0.5A.
Calculate:

(i) The power of the bulb. (2 marks)

(ii) The energy dissipated by the bulb in 80 minutes. (2 marks)

4. In a cathode ray oscilloscope the time base is set at 25ms/mm. Given that crest to crest of a signal covers a length of 6cm, determine the frequency of the signal. (3mks)

5. Figure 11 shows cathode ray oscilloscope (CRO)

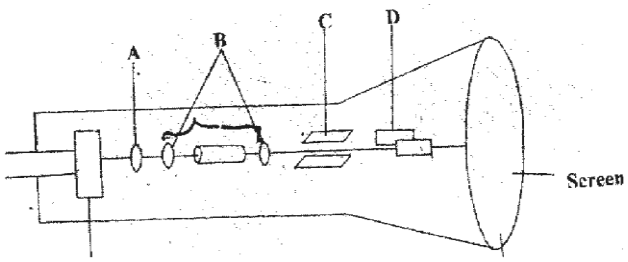


Figure 11

(a) Name parts labelled A and B (2mks)

(b) What are the functions of parts labelled C and D? (2mks)

(c) Why is the tube evaluated? (1mk)

(d) Four 40w bulbs and six 100w bulbs were switched on for 5 hours a day for domestic use in an institution. Find the monthly bill for 30 days at rate of sh 5.50 per unit with standing charge of sh 150. (3mks)

6. Figure 9 below shows a cathode ray tube in which a beam of electrons is cast on the screen

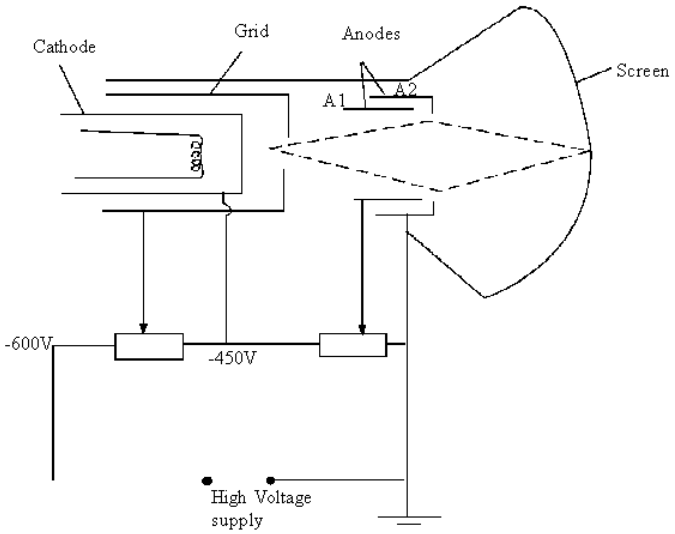


Figure 9

(a) State how the electrons are produced in the tube. (1mk)

(b) State how the electron beam is detected. (1mk)

(c) State the reason for having a variable potential difference (p.d) at the:

(i) Grid (1mk)

(ii) Anodes (1mk)

(d) Figure 10 shows the waveform of a signal applied at the Y- plates of an oscilloscope whose time-base is switched to the scale of 2 milliseconds per centimetre.

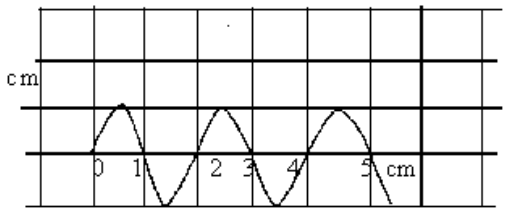


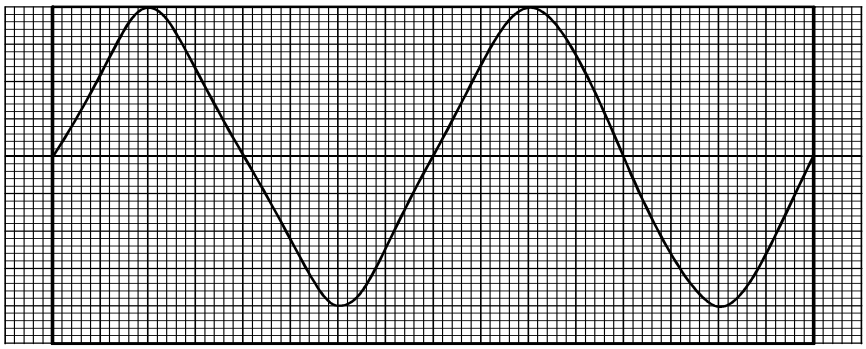
Figure 10

Determine

(i) the period of the signal (2mks)

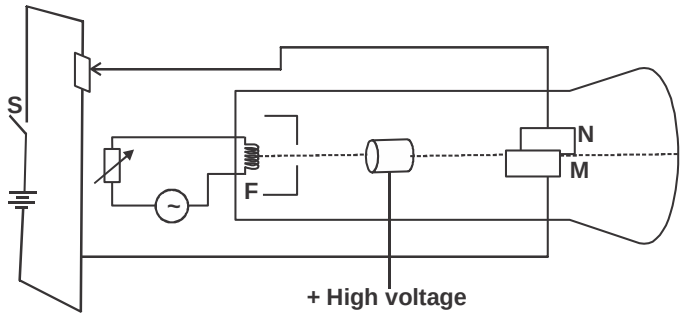
(ii) the frequency of the signal. (3mks)

7. The graph in figure shown was obtained on a cathode ray oscilloscope (CRO) screen when the output of an a.c. generator was connected to the input of the CRO. The time-base calibration of the CRO was set at 20 milliseconds per centimetre and the y-gain at 5 volts centimetre.



Determine the frequency of the voltage. (2 marks)

8. Figure 9 is a diagram of cathode ray tube. M and N are parallel vertical plates.



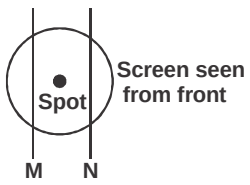


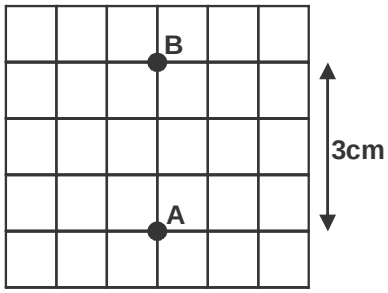
Figure 9(a) **Figure 9(b)**

a) When switch S is open, spot is seen at the centre of the screen as shown in figure 9.

i) State what happens to the spot when S is closed. (1 mark)

ii) State what would happen to the spot if the potential difference across MN is increased. (1 mark)
iii) State what would be seen on the screen if the battery is replaced with an alternating e.m.f of;
I) a low frequency of about 1HZ (1 mark)
II) a high frequency of about 50HZ. (1 mark)
b) Explain the process by which electron are produced at F. (2 marks)
c) State with a reason how the brightness of the spot can be increased. (2 marks)
d) The accelerating voltage of the tube is 1000V and the electron current in the beam is 1.5mA. Determine the energy to the screen per second. (3 marks)

9. The figure below shows the displacement of a spot on a cathode ray oscilloscope screen.



The spot appears on the CRO at position A. When DC voltage is applied to Y-plates the spot is displaced to position B. The Y-gain is set at 20V/cm.
i) State the type of voltage applied. (1 mark)
ii) Find the voltage applied. (2 marks)

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UNIFORM CIRCULAR MOTION QUESTIONS

1. (a) State two factors that reduce the stability of a vehicle while going round a banked bend. (2 marks)

(b) Three insoluble powders A, B and C of densities d_A, d_B and d_C, such that $d_A > d_B > d_C$, are mixed and put into a container. The container is then whirled in a horizontal circle as shown in figure 7.

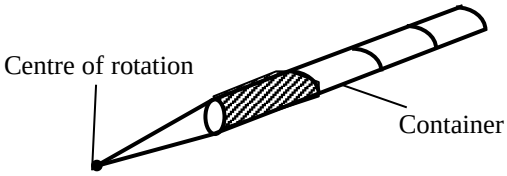


Figure 7

(i) Label on figure 7, the positions of the powders after some time. (1 mark)

(ii) Give a reason for your answer in b (i) (2 marks)

(c) Figure 8 shows two masses 0.1kg and 2kg connected by a string through a hole on a smooth horizontal surface.

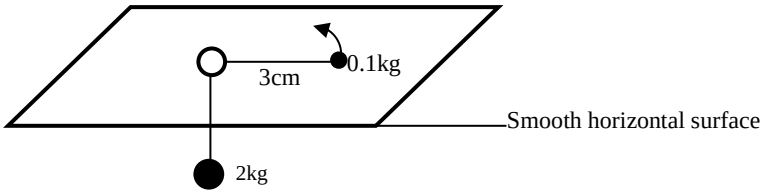


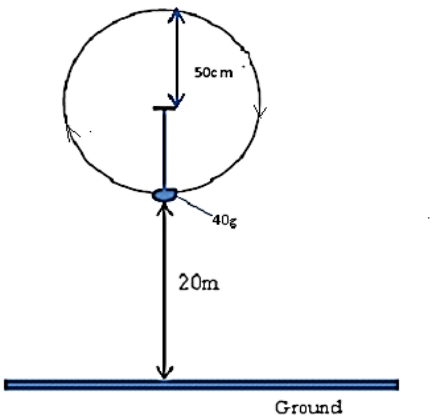
Figure 8

The 0.1kg rotates in a horizontal circle of radius 3cm. Calculate the angular velocity of the 0.1kg mass, when the system is in equilibrium. (3 marks)

(d) A bicycle wheel makes 300 revolutions per minute. Calculate the angular velocity of the wheel. (3 marks)

2. (a) Give reason why a body moving in a circular path with constant speed is said to be accelerating. (1mark)

(b) A stone of mass 40g is tied to the end of a string 50cm long such that it is 20m above the ground at its lowest level as shown in the diagram below. It is whirled in a vertical circle at 2rev/s.



(i) If the string breaks at its lowest levelas shown, what is the velocity with which it travels? (2 mark)

Calculate the maximum tension in the string. (3marks)

(ii) Calculate the maximum tension in the string. (2 marks)

(d) Determine the maximum horizontal distance it travels from the breaking point (2 marks)

3. (a) Distinguish between angular velocity and linear velocity. (1marks)

(b) A pendulum bob is whirled with uniform speed in a horizontal circle of radius 20cm.The bob describes an arc of length 5cm within 15 seconds.

Calculate

i) Angular velocity (3marks)

ii) The uniform speed of the bob along the circular path (2marks)

iii) The frequency with the bob moves along the circular path (2marks)

iv) State why the bob is accelerating yet it moves with the uniform speed along its path (1mks)

4. (a) The moon goes round the earth at constant speed. Explain why it is true to say that the moon is accelerating. (1 mark)

(b) A string of negligible mass has a bucket tied at the end. The string is 60cm long and the bucket has a mass of 45g. The bucket is swung horizontally making 6 revolutions per second. Calculate:

(i) The angular velocity. (1 mark)

(ii) The centripetal acceleration. (2 marks)

(iii) The tension on the string. (2 marks)

(iv) The linear velocity. (1 mark)

(c) Figure 6 shows of mass m = 200g attached to the centre of a rotating table with a string. The radius of the spring was varied and different values of angular velocity recorded. The mass of the body remained constant throughout the experiment.

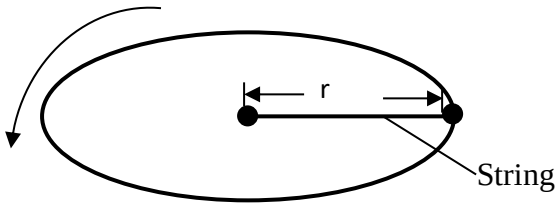
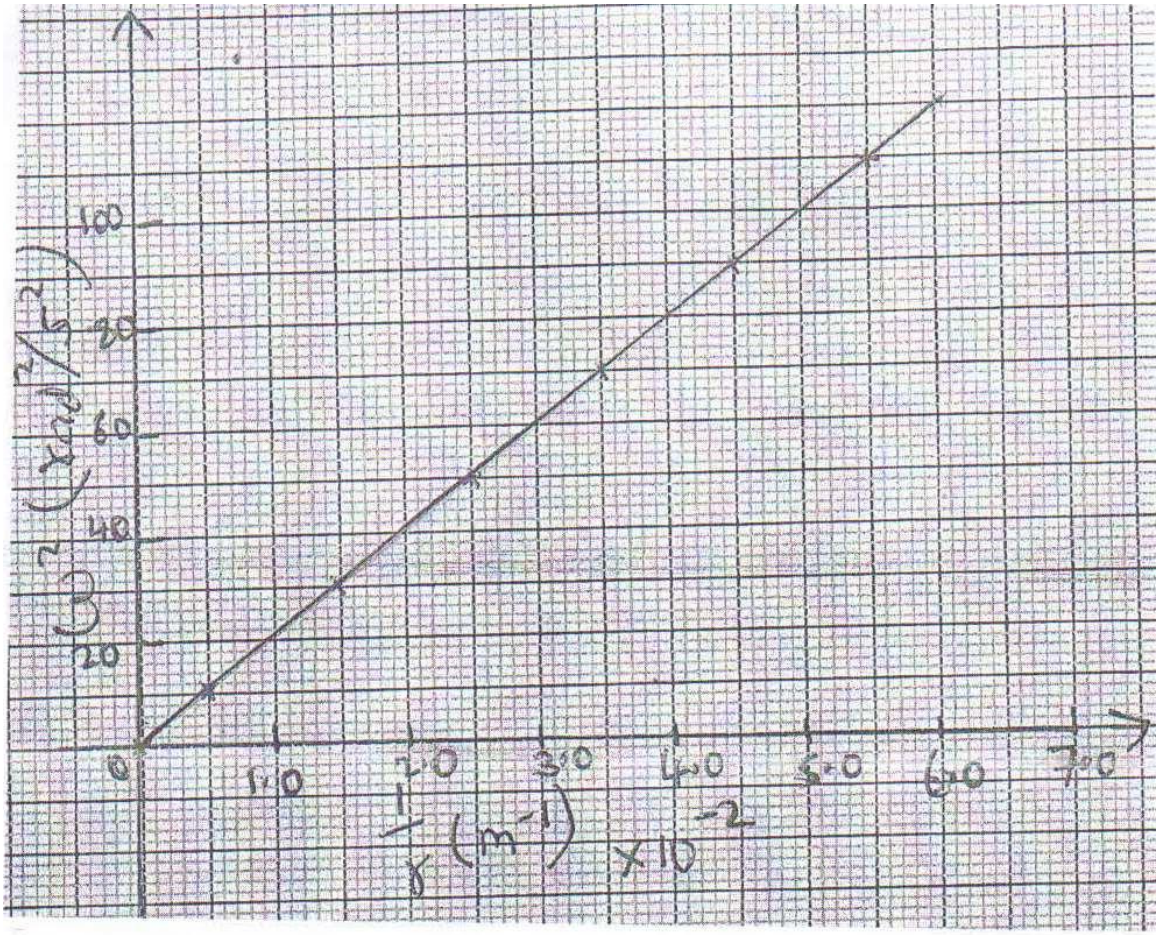


Figure 6

The results obtained for angular velocity and radius were used to plot the following graph.

From the above graph;



(i) Calculate the value of the slope. (2 marks)

(ii) If ω^2 and $\frac{1}{r}$ are related by the equation; $\omega^2 = \frac{p}{r}\ x\frac{1}{m}$, find the value of P. (2 marks)

(iii) State the significance of **P**. (1 mark)

5. (a) Define angular velocity. (1mk)

(b) A string of length 70cm is used to whirl a stone of mass 0.5kg in a circle of a vertical plane at 5 rev/s. Determine.

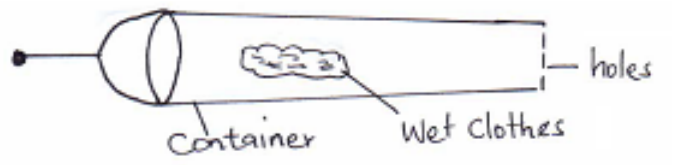
(i) The period. (2mks)

(ii) The angular velocity. (3mks)

(iii) The centripetal force. (3mks)

(c) (i) Explain why bodies in a circular motion undergo acceleration even when their speed is constant.(1mk)

(i) The figure below shows a container with small holes at the bottom in which wet clothes have been put.

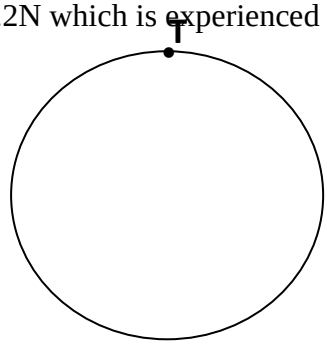


When the container is whirled in air at high speeds, it is observed that the clothes dry faster. Explain how the rotation of the container causes the clothes to dry faster.

(2mks)

6. (a) One of the factors that affect the centripetal force is the mass of the body. State **two** other factors. (2mks)

(b) A mass of 400g is rotated by a string at a constant speed V in a vertical circle of radius 100cm. The minimum tension in the string is 7.2N which is experienced at point T.



(i) Determine the velocity V of the mass at point T. (3mks)

(ii) Determine the maximum tension in the string. (2mks)

(c) The anchor of a ship is made of steel and has a weight of 3200N in air. A ship floating in water is held by the anchor submerged in water. (Density of steel is 8000kgm^{-3}).

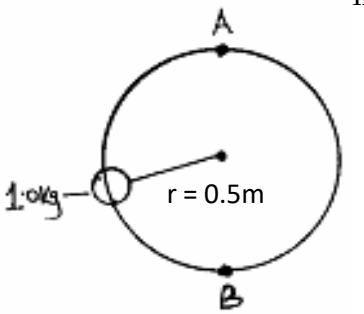
Calculate.

(i) The volume of the anchor. (2mks)

(ii) The up thrust on the anchor. (2mks)

(iii)The apparent weight of the anchor. (2mks)

7. The figure below shows an object of mass 1kg whirled in a vertical circle of radius 0.5m at a uniform speed of 5m/s.



(i) Determine:

I the centripetal force on the object. (3mks)

II the tension in the string when the object is at A. (2mks)

III the tension in the string when the object is at B. (2mks)

(ii) The speed of rotation is gradually increased until the string snaps. At what point is the string likely to snap. Explain. (2mks)

8. (a) State the factors affecting centripetal force. (3mks)

(b) A mass of 0.4 kg is rotated by a string at a constant speed V in a vertical circle of radius 1 m. The minimum tension in the string is 6N.

(i) Indicate on the diagram below the position of the object for the minimum tension, (1mk)

(ii) Write an expression for this uniform force experienced. (1mk)

(iii) Use your expression to determine the velocity V. (3mks)

(iv) Determine maximum tension on the string. (2mks)

c) Using the kinetic theory of gases explain how a rise in temperature of a gas causes arise in the volume of the gas if the pressure is kept constant. (3mks)

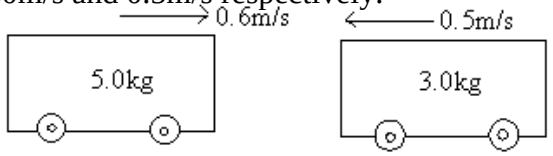
9. (a) Name two forces acting on a racing car, when racing along curved road. (2mks)

(b) A particle on a wheel moves through an angle of 60^0 in 0.2 seconds, if the radius of the wheel is 30cm determine the

(i) Angular velocity of the wheel. (2mks)

(ii) Linear speed of the particle. (2mks)

(c) The figure below shows two trolleys of mass 5.0kg and 3.0kg travelling towards each other at 0.60m/s and 0.5m/s respectively.



If the trolleys fuse on collision. Calculate the velocity of the combined trolleys. (2mks)

(ii) A goalkeeper catches a ball of mass 450g moving with a velocity of 20m/s. Determine

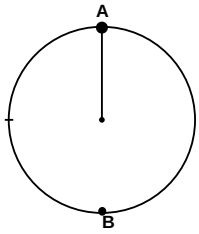
(I) momentum of the ball. (2mks)

(II) the average force applied by the goalkeeper hands to stop the ball in 0.4 seconds. (2mks)

10 (a) A stone of mass 450g is rotated in a vertical circle at 3 revolutions per second. If the string has a length of 1.5m, determine:

(i) the linear velocity. (3 marks)

(ii) the tension of the string at positions A and B. (4 marks)



(b) State two factors affecting centripetal force. (2 marks)

c) (i)When a planet, orbits the sun, it experiences a centripetal force. State what provides the centripetal force. (1 mark)

(ii) State the purpose of banking roads at bends. (1 mark)

(iii)A student whirls a stone of mass 0.2kg tied to a string of length 0.4m in a vertical plane at a constant speed of 2 revolutions per second. (Take acceleration due to gravity g as $10ms^{-2}$)

I. State two forces acting on the stone when it is at the highest point. (2 marks)

II. Determine the angular velocity of the stone. (2 marks)

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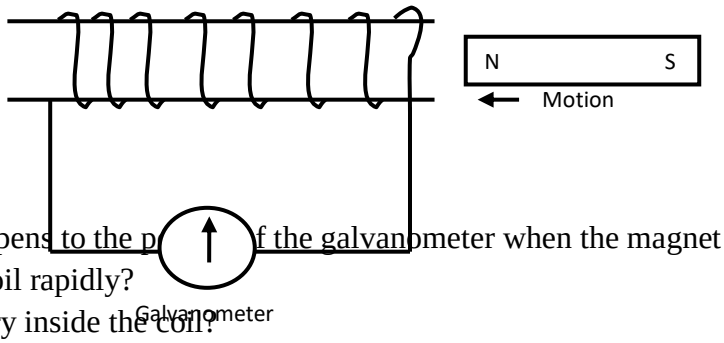
ELECTROMAGNETIC INDUCTION QUESTIONS

1. One of the factors that affect efficiency of a transformer is hysteresis losses. What is hyteresis losses

2. (a) A bar magnet is pushed into a coil as shown in **Figure 5** below.

Figure 5



Explain what happens to the p[illegible]f the galvanometer when the magnet is:

(i) Moved into the coil rapidly? (1mark)

(ii) Remains stationary inside the coil? (1mark)

(b) State **two** ways of increasing the magnitude of induced current in a generator. (2marks)

(c) A transformer has 200 turns in the primary coil and 1000 turns in the secondary coil. The primary coil is connected to an a.c source producing 100 V and rated 500 W. The current delivered by the secondary circuit was found to be 0.95 A.

(i) Determine the efficiency of this transformer. (3marks)

(ii) Explain why the efficiency is less than 100%. (2marks)

3. (a) The two free ends of a coil are connected to a center – zero galvanometer. When the north pole of magnet is moved towards the coil, the pointer deflects in the direction shown in figure 2.

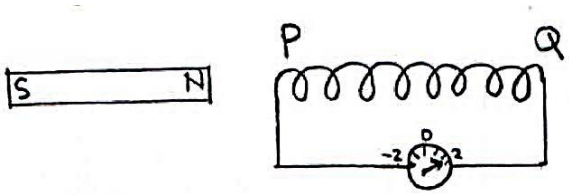


Figure 2

State with a reason the behaviour of the pointer inn the following cases:

(i) The north pole of the magnet is held stationary near P. (2 marks)

(ii) The north pole of the magnet is made to approach the coil from end Q (2 marks)

(b) State Faraday's law of electromagnetic induction. (1 mark)

(c) A transformer supplies 12V when it is connected to 240V supply of electricity. The output of the transformer is connected to 12V 36W bulb. The current drawn from the supply by the transformer is 0.5A. Calculate:

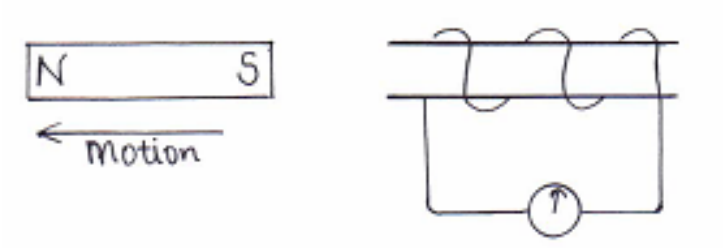
(i) the input power of the transformer. (3 marks)

(ii) the current drawn from the transformer. (3 marks)

(iii) The output power of the transformer. (1 mark)

(iv) the efficiency of the transformer (3 marks)

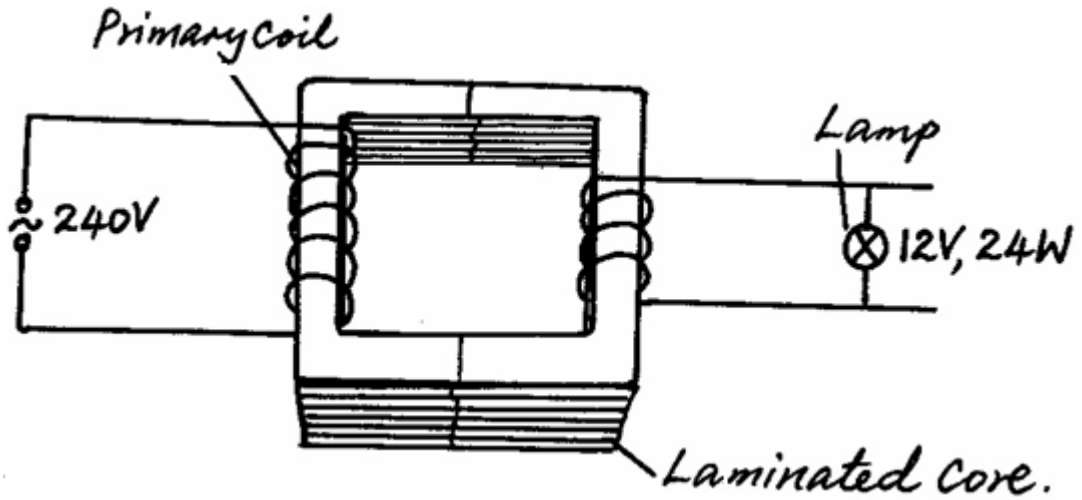
4. (a) State lenzes law of electromagnetic induction. (1mk)
(b) Figure 11 below show a magnet being pulled from a coil connected to a centre zero galvanometer.



(i)\State the observation made. (1mk)
(ii) Explain what would happen if the magnet was moved out faster.
(1mk)
(iii)\Explain the observation in b(i) above. (2mks)
(c) (i) The turns ratio of primary to secondary coils in a 100% efficient transformer is 3: 1. Calculate the current through the primary coil if the current in the secondary coil is 5A.
(3mks)
(ii) State how the energy losses are minimized in a transformer.
I Eddy current. (1mk)
II Flux linkage. (1mk)

5. Differentiate between Faradays law of electromagnetic induction and Lenz law.
(2mks)

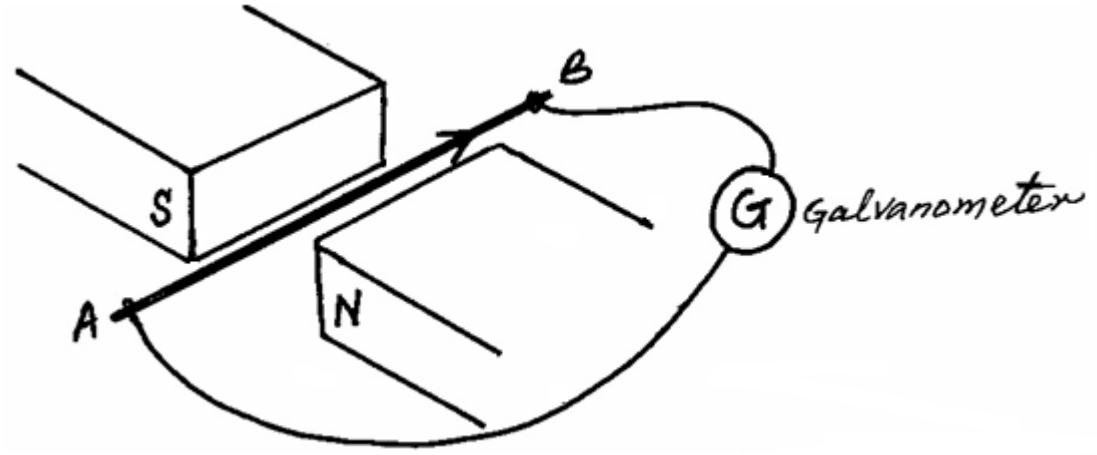
6. (a) State Faraday's law of electromagnetic induction. (1 mark)
(b) The figure below shows a 12V, 24W lamp operated by a step-down transformer that is connected to a 240V mains supply.



(i) Explain what is meant by the term '**laminated core**' and state its significance in a transformer.(2 marks)

(ii) Calculate the efficiency of the transformer if the current through the primary coil is 0.12A. (3 marks)

(c) The figure below shows a conductor AB placed in a magnetic field.



State the direction in which the wire must be moved for the induced current to flow in the direction shown. (1 mark)

(d) Explain the meaning of the term **'Hysteresis loss'** as applied in transformers and state how it can be reduced.(2 marks)

7. (a) State **one** difference between a transformer and an induction coil. (1mk)

(b) State **two** energy losses in a transformer. (2mks)

(b) A transformer has 1000 turns in its secondary coil and 10 turns on its primary coil. An alternating current of 2.5A flows in the primary circuit when it is connected to a 12V a.c. supply.

(i) State the type of transformer. (1mk)

(ii) Calculate the power input to the transformer. (3mks)

(iii)Calculate the e.m.f. across the secondary coil. (3mks)

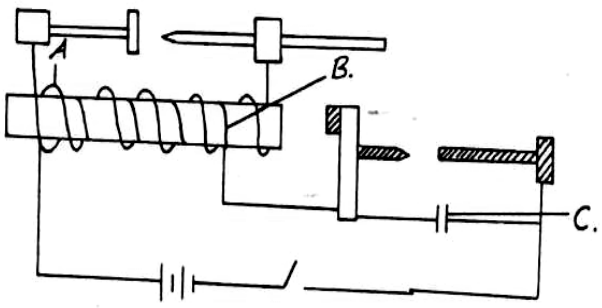
(iv)Determine the maximum current that could flow in a circuit connected to the secondary coil if the transformer is 80% efficient. (Use the e.m.f in secondary as calculated in (iii) above). (3mks)

(v) In transmitting power why is it necessary to step up before transmission. Explain. (2mks)

8. (a) What do you understand by the term mutual induction? (1mk)

(b) State **<u>two</u>** factors that determine the magnitude of e.m.f. induced in a coil. (2mks)

(c) The diagram below shows an induction coil used to produce sparks.



1.Name the parts labeled A, B and C. (3mks)

2.Explain the purpose of device C. (1mk)

(d) A transformer is used on a 240V A.C. supply to deliver 12A at 120A to a hating coil. If 20% of energy taken from the
supply is dissipated in the transformer.
(i) What is the current in the primary coil? (3mks)
(ii) Give **two** causes of 20% energy dissipation in the transformation above.
(2mks)

9. a) The figure 6 shows two coils A and B placed close to each other. A is connected to a steady D.C supply and a switch B is connected to a sensitive galvanometer.

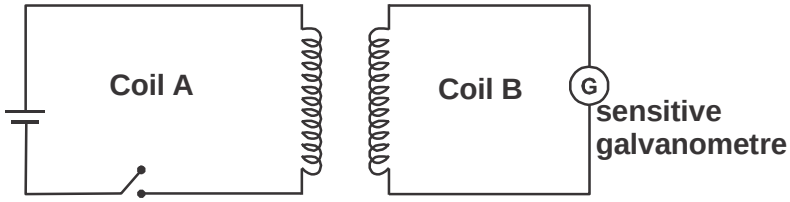
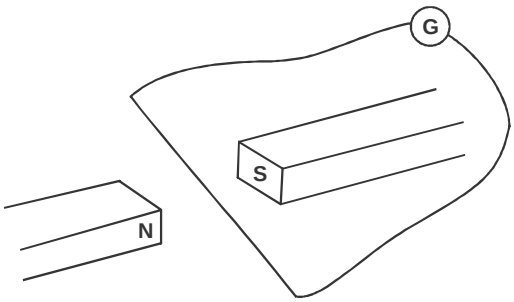


Figure 6
i) The switch is now closed. State the observation made on the galvanometer. (2 marks)
ii) Explain what would be observed if the switch is then opened. (2 marks)
b) The primary coil of a transformer has 1000 turns and the secondary coil has 200 turns. The primary coil is connected to a 240V ac mains supply.
i) Explain how e.m.f is induced in the secondary coil. (2 marks)
ii) Determine the secondary voltage. (3 marks)
iii) Determine the efficiency at the transformer gives that the current in the primary coil is 2.0A and in secondary coil is 0.80A. (2 marks)

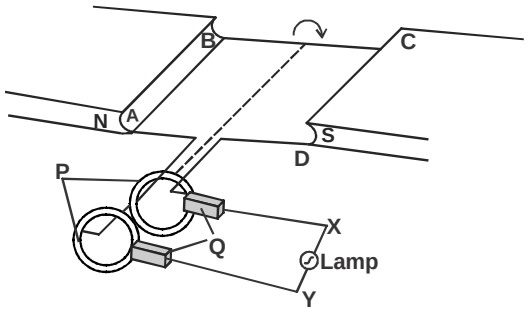
10. a) State Lenz's law of electromagnetic induction. (1 mark)
b)



A wire placed between the poles of two permanent magnets is connected as shown in figure 10.
i) State and explain what is observed when the wire is moved up and down. (2 marks)
ii) Suggest two ways of altering the magnitude of the effect you have stated in (i) above. (2 marks)
c) Explain why the core of a transformer is :
i)\laminated (1 mark)
ii) made of soft iron (1 mark)
d) A heater rated 3KW is used for 30 minutes everyday for 30 days. Calculate the cost of the electricity consumed in the 30 days given that its charged at Ksh.7.00 per unit. (3 marks)

11. State two conditions necessary for electromagnetic induction to occur. (2 marks)

12. The figure below shows a simple form of an a.c generator.



a) Name the parts P and Q (2 marks)
b) State the functions of P and Q (1 mark)
c) State two ways of increasing the e.m.f produced by this apparatus. (2 marks)
d) Which terminals X and Y is positive if the coil is rotating in the direction shown ? (1 mark)
e) State one use of electricity where it is essential to use a direct current. How will you modify the above apparatus to obtain a d.c output? (2 marks)
f) Differentiate between a generator and a motor. (2 marks)

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ELECTROMAGNETIC SPECTRUM QUESTIONS

7. Below is part of a circuit that was setup by form four students of Okok Seconday School during a physics practical lesson to demonstrate full wave rectification using two diodes. Complete the circuit by correctly placing the load R and two diodes.

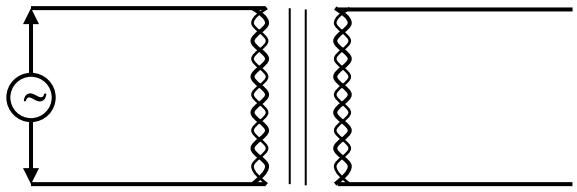

Fig. 5

8. The chart below shows part of the electromagnetic spectrum.

A	**B**	Visible light	UV light	**C**

(a) Identify the radiation marked A and C. (1mark)

(b) Give **one** application of the radiation marked **B**. (1mark)

9. (i) Arrange the following waves in order of decreasing wavelength.
Infrared, X-rays, microwaves, yellow light, radio waves, red light. (1 mark)

(ii) State one application of infrared wave. (1 mark)

10. Complete the following table
(2 marks)

Radiation	Source	Detector	Application
Radio			Communication
	Hot body		Drying clothes

11. State **one** use of microwaves. (1mk)

12. State:

(a) **Two** applications of microwaves. (2 marks)

(b) **one** detector of infrared radiation. (1 mark)

13. The chart below shows an arrangement of different parts of the electromagnetic spectrum.

Radio wave	Infrared rays	B	Ultra-violet	χ-Rays	Gamma-Rays

Name the radiation represented by **B**. (1mk)

14. Arrange the following in order of increasing wavelength: Visible light, X-Ray, Ultra Violet Radiation and Radio Waves. (1mk)

15. Figure 3 shows an electromagnetic spectrum.

A	B	C	Visible light	D	E	F

Figure 3

Given that F has the shortest wavelength;

a) Identify radiation B (1 mark)

b) State one application of E. (1 mark)

16. State one use of ultra violet waves. (1 mark)

17. i) Arrange the following waves in order of increasing frequencies. (1 mark)
Gramma rays, radio waves, infrared, UV and X-rays

ii) Name the electromagnetic radiation used in heating. (1 mark)

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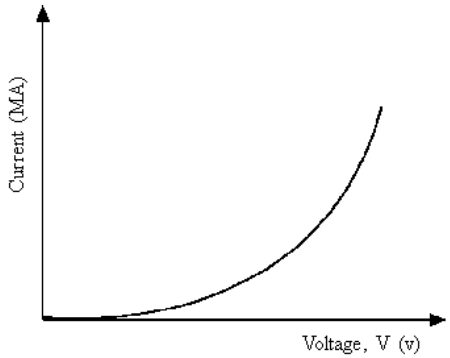
ELECTRONICS QUESTIONS

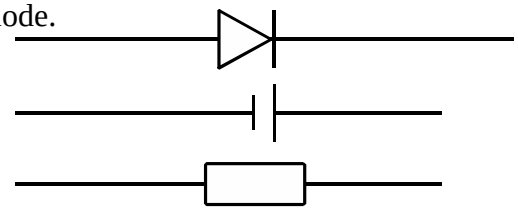
1. Explain briefly how a p-type semiconductor is made. (1 mark)
2. Explain how doping a pure semi-conductor produces on n-type semi-conductor. (3 marks)
3. Explain how a P-type semiconductor is made from a pure semiconductor. (2mks)
4. Sketch diode circuit in reverse biased mode. (1mk)
5. (a) When a germanium crystal is doped with arsenic, it becomes an N-type semiconductor. Explain how the change occurs. (Number of electrons in the outmost shell for germanium 4, Arsenic = 5)(2mks)

   (b) The graph shows current against voltage for a semiconductor diode.



In the space provided, draw a circuit diagram that may be used to obtain values needed to draw the above graph. (2mks)

6. Explain why a p-n junction diode will conduct when connected in forward bias. (1 mark)
7. Using the components symbols shown in the figure 1, sketch a series circuit diagram for a forward biased diode.



NAME	
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MAINS ELECTRICITY QUESTIONS

1. An electric kettle is rated at 1.8 kW, 240 V. Explain the choice of the safest fuse for the kettle. (the available fuses are 5 A, 10 A, and 20 A) (3marks)

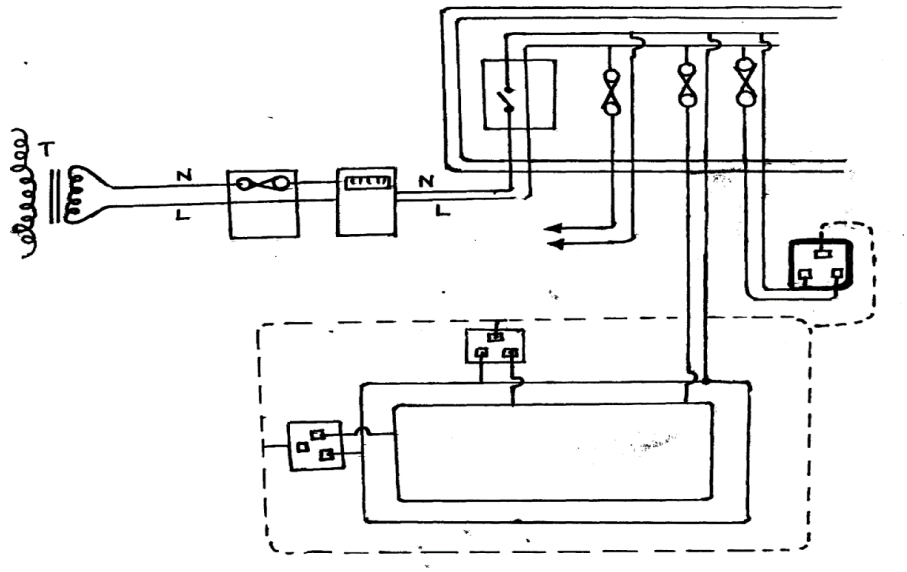
2. An electric immersion heater rated 240V, 3kW is to be connected to a 240V mains supply, using a 10A fuse. Showing your working, state whether the fuse is suitable or not for circuit. (3 marks)

3. A heater of resistance R_1 is rated P watts, V volts while another of resistance R_2 is rated 2P watts, $^{V}/_{2}$ volts. Determine the ratio R_1 to R_2. (3mks)

4. (a) What is the purpose of a fuse? (1 mark)

(b) The diagram in figure 9 below shows a ring – main circuit used by an electrician in a certain house.
(i) Identify two faults in the installation. (2 marks)

Fig 9

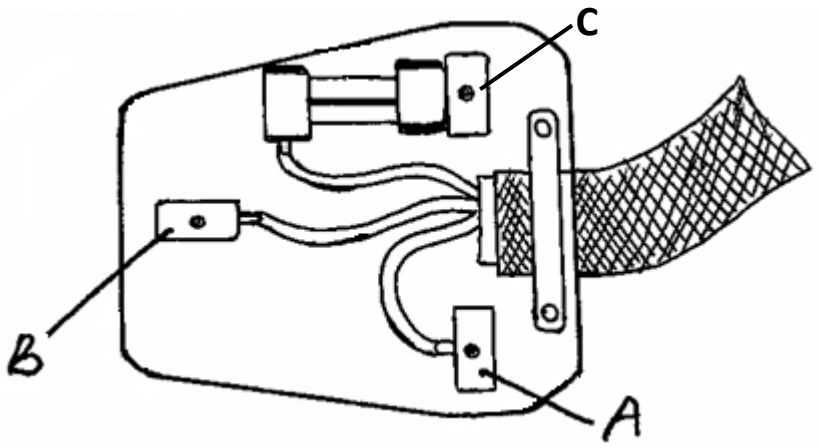


ii) Explain why the 3 – pin plug fuse has a longer earth pin than the live and neutral pins. (2 marks)

iii) Identify the type of transformer T used in the diagram in Fig. 9 (1 mark)

(c) A cooker rated 2.0kW was operated for 40minutes each for 30days. If the cost of each kilo – watt – hour unit is Shs. 15.50, Calculate the cost of electricity used. (4 marks)

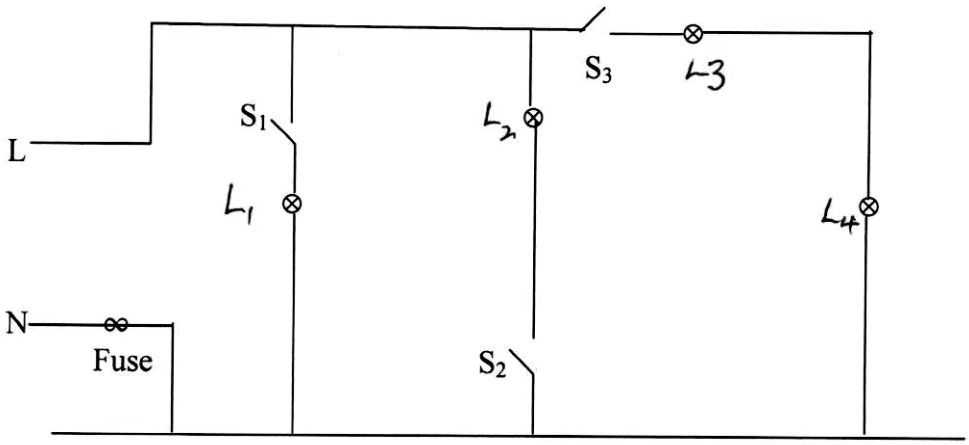
5. (a) The figure below shows the inner parts of a three-pin plug.



(i) Identify the pins **A** and **B**. (2 marks)

(ii) State the reason why the pin **B** is normally longer than the other two pins **A** and **C**. (1 mark)

6.



Identify and explain **two** faults in the light circuit shown in the figure above. (2mks)

7. (a) State two factors that determine the magnitude of an induced emf in a conductor. (2mks)

(b) A power station has input of 50kw at p.d. of 10 Kv. A transformer with secondary coils of 1000 turns is used to step down the voltage to 1000v for transmission along grid. Assuming there is no power loss, calculate:

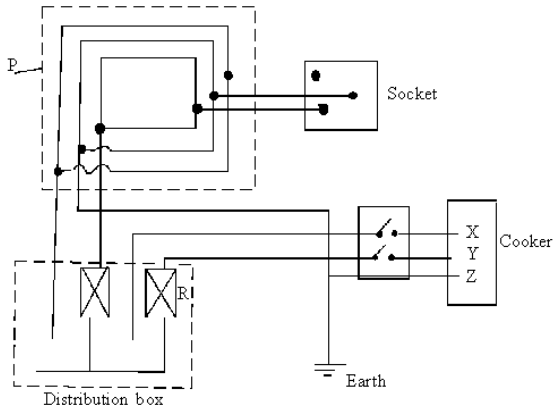
(i) Current in primary coil. (2mks)

(ii) Number of turns in primary coil. (2mks)

(iii) Current in secondary coil. (2mks)

(c) State which of coils in thicker and why. (2mks)

8. Figure 8 shows a section of a house wiring system.



a) Name the

(i) circuit labelled

(1mk)

(ii) terminals labelled X and Y (2mks)

(b) i) State the purpose of R in the circuit. (1mk)

(ii) Give a reason why R is connected to Y but not to X. (1mk)

(c) Determine the cost of using the electric iron rated 150W for a total of 30 hours given that the cost of electricity per KWh is Ksh 8. (1mk)

9. The diagram below shows an electrical appliance connected to the mains.

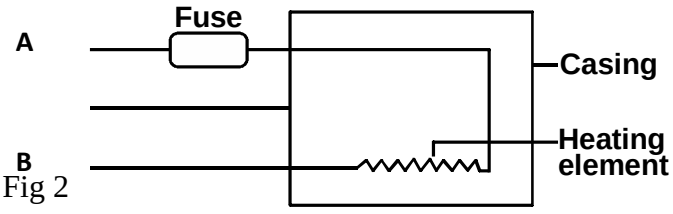
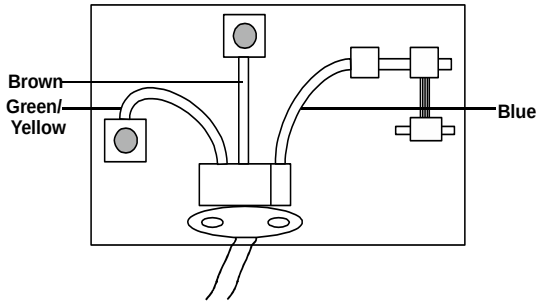


Fig 2

I. Name the colour codes for leads A and B (2 marks)

II. What is the purpose of the fuse. (1 mark)

10. (a) Figure 7 shows a connection of the three pin plug.



(i) Identify two mistakes in this wiring. (2 marks)
(ii) What would happen if this plug was connected to the mains of the socket? (1 mark)
(iii) State two reasons why the earth pin is normally longer than the other two pins. (2 marks)

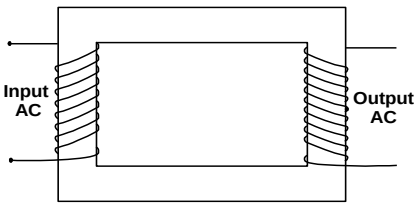
(b) A house has five rooms with 240V, 60W bulbs. If the bulbs are switched on from 7.00pm to 10.30pm
(i) Calculate the power consumed per day in kilowatt-hours. (3 marks)
(ii) Find the cost per week for lighting these rooms at Kshs 670 per unit. (2 marks)

11. An electric heater is found to have a resistance of 950W when operating normally on a 240V mains. Determine the power rating of the heater. (2 marks)

12. (a) The figure below shows part of the lighting circuit of a house.

i) Explain why a fuse is included in the circuit. (1 mark)
ii) Explain why the fuse is placed in the live wire rather than in the neutral wire. (1 mark)
iii) Each lamp has a power of 60W. Calculate the current through one lamp when it is switched on. (2 marks)
iv)The fuse has a rating of 4A. Calculate the maximum number of lamps that can be connected and switched on without the
fuse blowing. Each bulb is parallel with the power supply. (2 marks)

b) i) The figure below shows a step-up transformer commonly used at a power station.



What is meant by a step-up transformer
ii) Why does a transformer work with AC only? (1 mark)
iv) State two ways in which power is lost in a transformer. (2 marks)
v) Explain why the emf produced at a power station is stepped up. (2 marks)

13. A device is marked 1000W 240V. What fuse rating would be suitable for the device.(3 marks)

14. A heater rated 3KW is used for 30 minutes everyday for 30 days. Calculate the cost of the electricity consumed in the 30 days given that its charged at Ksh.7.00 per unit. (3 marks)

15. An electric iron box has a resistance of 60□. For how long should it be switched on in order to dissipate 288,000 joules of energy if it operates at 240V. (3 marks)

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PHOTOELECTRIC EFFECT QUESTIONS

18. Figure 10 shows photocell used in a set-up for a burglar alarm.

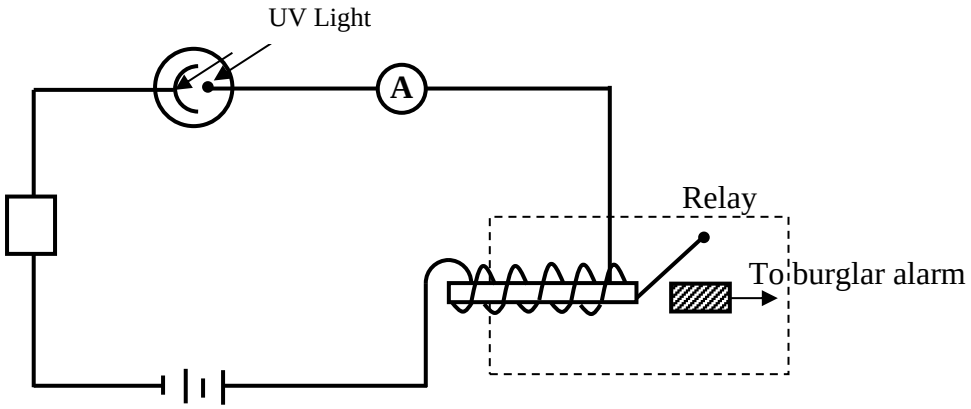


Fig. 10

(i) Give a reason why the photocell is usually evacuated. (1 mark)

(ii) State the function of the resistor R in this circuit (1 mark)

(iii) Explain why a particular radiation such as ultra-violet light is used to strike a given cathode surface. (2 marks)

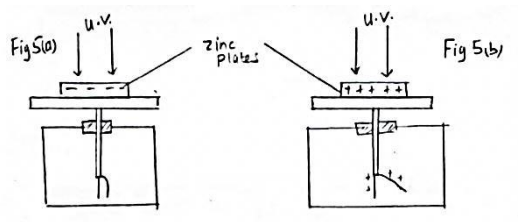
(iv) Explain how the set-up in the figure can be used as a burglar alarm. (3 marks)

(b) Light of frequency 5.50 x 10^{14} Hz is incident on a surface whose work function is 2.5ev.

(i) Determine the energy of photons of light in eV. (Take h = 6.63 x 10^{-34} Js) and 1eV (3 marks)

(ii) Will photoelectric emission occur? Explain (2 marks)

19. (a) Figures 5(a) and 5(b) shows ultra violet radiation striking polished zinc plates placed on negatively and positively charged gold leaf electroscopes respectively.



Explain why the leaf collapses in fig (a) but does not collapse in fig (b) (4 marks)

(b) (i) State two factors which determine the speed of photoelectrons emitted from a metal surface. (2 marks)

(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 (K. E. $_{max}$) of photoelectrons for each frequency, f, was measured. The graph in figure 6 shows K.E.$_{max}$ varies with f.

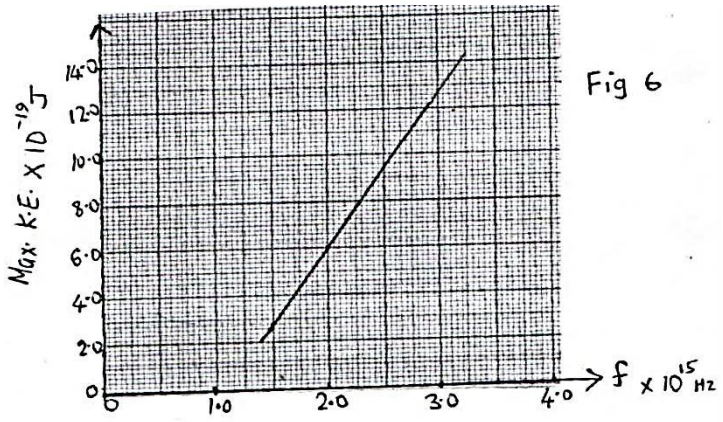


Fig 6

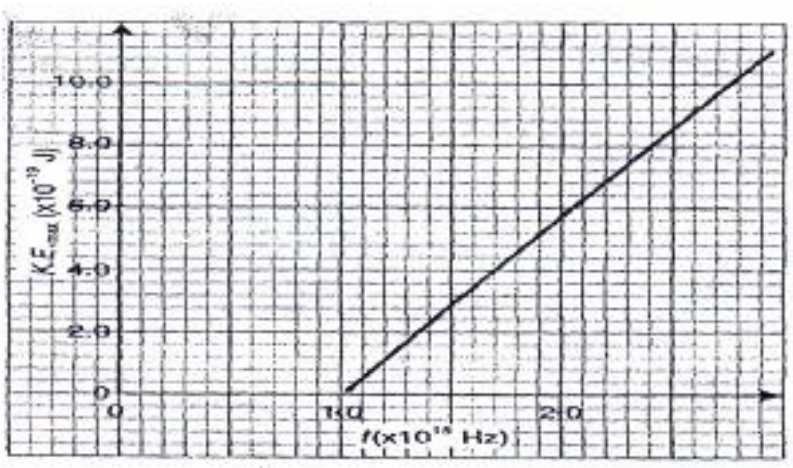
Given $K.E_{max} = hf - \emptyset$, from the graph, determine the values of:

(a) The h (planks constant) (3 marks)

(b) The ∅ from the graph. (3 marks)

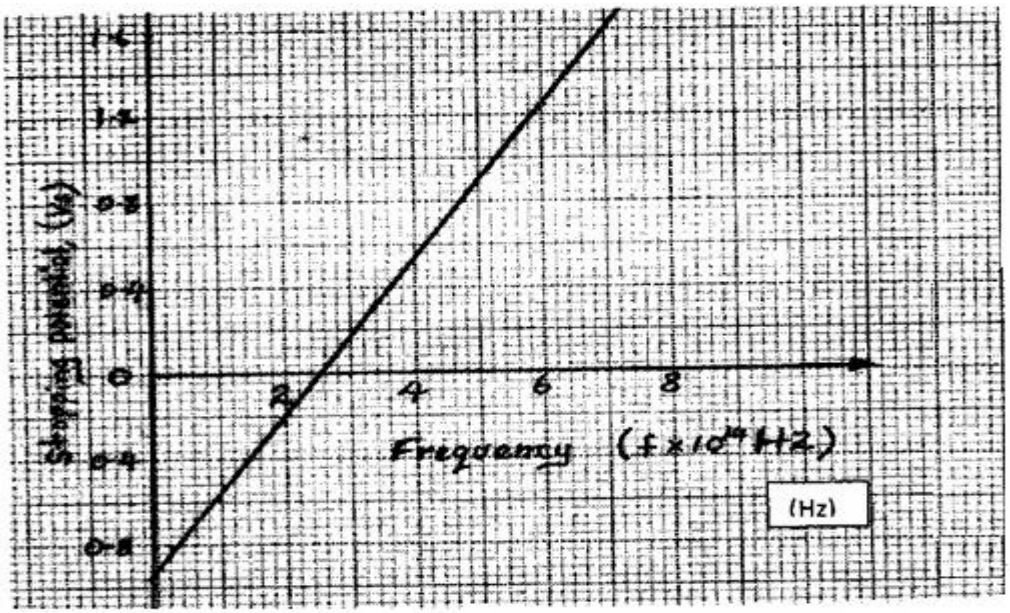
(c) Light of frequency 5.5 x 10^{14} Hz is made to strike a surface whose work function is 2.5Ev. Show that photoelectric effect will not take place. (Use the values of h from (b) above.
(Take e = 1.6 x 10^{-19}C) (3 marks)

20. In an experiment using a photocell, ultraviolet light of varying frequency strikes a metal surface. The maximum kinetic
energy (K.E max) of photoelectrons for each frequency, f, is measured. The graph below shows how the maximum kinetic energy varies with the frequency, f.



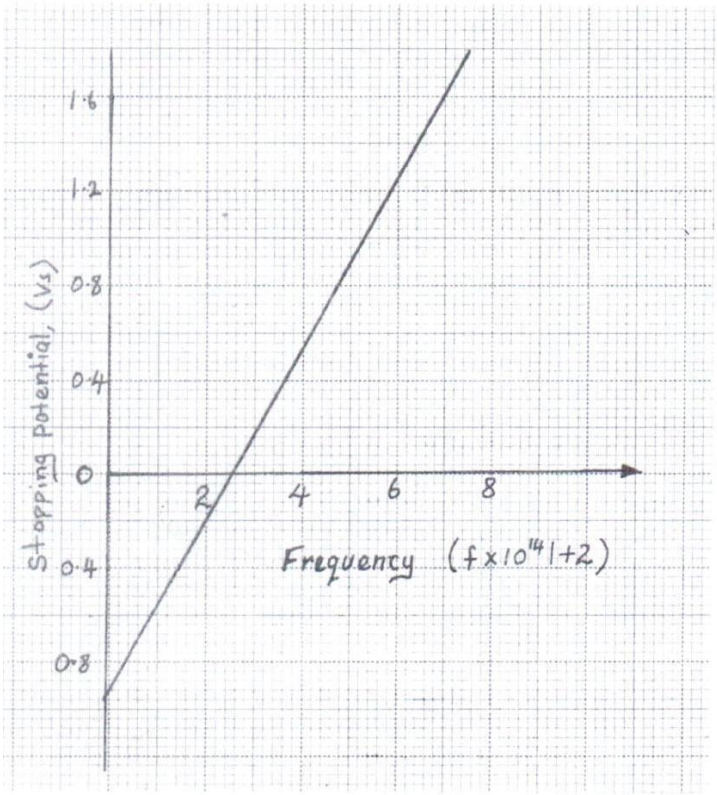
(a) Use the graph to determine:-
(i) Planck's constant, h. (3mks)
(ii) Work function of the metal. (3mks)

21. In an experiment to find the relationship between frequency of radiation and kinetic energy of photoelectrons in a photoelectric device, the following graph was obtained.



Use the graph to answer the following questions.
(i) Determine the threshold frequency. (1 mark)
(ii) Find the plank's constant h. (Take the charge of an electron to be 1.6×10^{-19}C). (3 marks)
(iii)Calculate the work function of the metal in joules. (2 marks)

22. In an experiment to find the relationship between frequency of radiation and kinetic energy of photoelectrons in a photoelectric device, the following graph was obtained.



Use the graph to answer the following questions.

(a) (i) Determine the threshold frequency. (1mk)

(ii) Find the plank's constant h. (3mks)

(Take the charge of an electron to be .6 x 10^{-19}C)

(iii) Determine the work function of the metal in joules. (2mks)

(b) Determine the threshold wavelength of a metal whose work function is 2.4 x 10^{-18}J. (3mks)

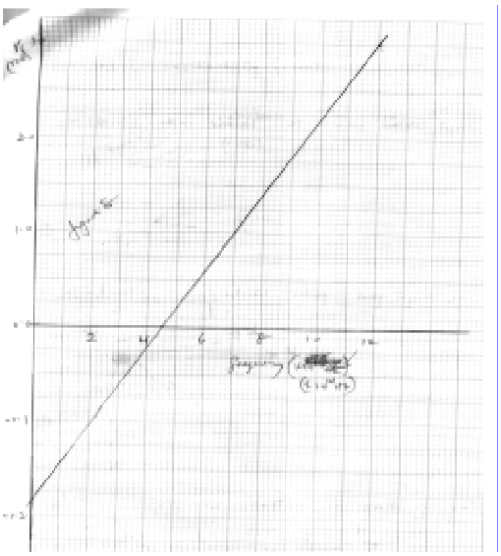
(Take the plank's constant to be 6.63 x 10^{-34}Js)

23. Define the term threshold wavelength as used in photoelectric emission. (1mk)

7. (a) Define photoelectron. (1mk)

(b) State two factors affecting photoelectric effect. (2mks)

(c) Figure 8 on graph paper shows graph of stopping potential against frequency (graph paper)



(i) Define stopping potential. (1mk)

(ii) Given that stopping potential (Vs) is related to frequency by equation.

$$Vs = \frac{hf}{e} - \frac{Wo}{e}$$ where $e = 1.6 \times 10^{-19}$ C

Determine from graph

i) Planck's constant (h) (4mks)

(ii) Work function (wo) in (ev) (3mks)

8. (a) State two factors that determine the speed of photoelectrons emitted by a metal surface. (2mks)

(b) In an experiment using a photocell, a u.v. light of varying frequency but constant intensity was made to strike a metal surface. The maximum kinetic energy (k.e. max) of photoelectrons for each frequency, f, was measured. The graph shows how KE max varies with f.

Given that KE max = h f – Ø, determine the values of h and Ø from the graph.

h = (3mks)

Ø= (3mks)

(c) Light of frequency 5.5×10^{14}Hz is made to strike a surface whose work function is 2.5 eV. Show that photoelectric effect will not take place. (3mks)

9. (a) (i) Distinguish between threshold frequency and threshold wavelength. (1 mark)

(ii)The maximum wavelength required to cause photoelectric emission on a metal surface is 8.0×10^{-7}m. The metal surface is irradiated with light of frequency 8.5×10^{14}HZ. (Take $h = 6.62 \times 10^{-34}$Js, $C=3.0 \times 10^{8}$ms^{-1})

Determine

I. The threshold frequency. (2 marks)

II. Maximum kinetic energy of the electrons. (3 marks)

b) The graph below in figure 7 shows the variation of stopping potential Vs, against reciprocal of the wavelength, $^1/_\lambda$ for a certain metal. If the work function of the metal was 2.08×10^{-19} and velocity of electromagnetic wave is 3.0×10^8 ms^{-1}

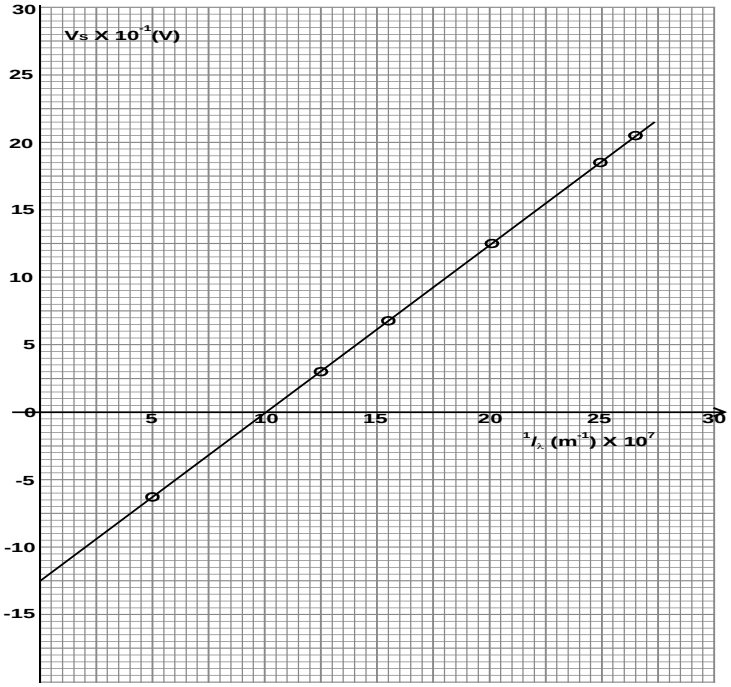


Fig. 7

The equation of the graph is given by $V_{(S)} = \frac{hc}{e\lambda} - \frac{W_O}{e}$ use the graph to determine

(i) the slope of the graph. (3 marks)

(ii) the value of the electronic charge. (4 marks)

10. In an experiment involving photo electric emission from a metal surface the following readings were obtained.

Stopping voltage Vs / v	0.2	0.6	1.0	1.8	2.2
Frequency f/10^{14}Hz	8.0	9.0	10.0	12.0	13.0

(a)Explain how you would change the frequency of the incident radiation, without changing the source of radiation. (1 mark)

(b) Plot a graph of slopping voltages, V_S, (y-axis) against frequency, f, (5 marks)

c) Use Einstein's equation of photoelectric effect, namely hf = hfo + ev$_S$ and your graph in part (b) to determine a value for

(i) Planck's constant. (3 marks)

(ii) Work function of the metal. (2 marks)

RADIOACTIVITY QUESTIONS

24. Figure 12 shows a diffusion cloud chamber for detecting radioactivity.

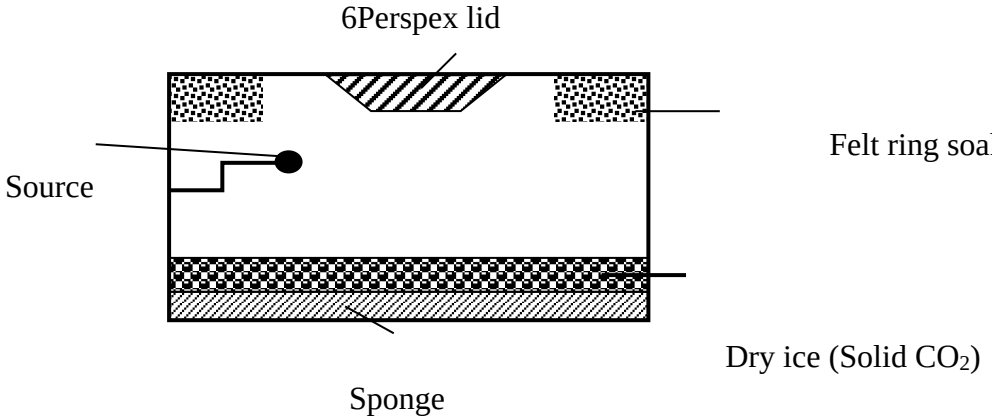


Fig. 12

(a) State the function of the following.

(I) Alcohol (1 mark)

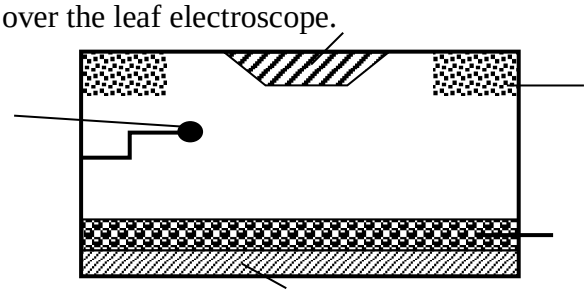
(II) Solid CO_2 (1 mark)

(b) When radiation from the source enters the chamber, some white traces are observed.

(I) Explain how the traces are formed. (1 mark)

(II) State how the radiation is identified (1 mark)

(c) A leaf electroscope can be used as a detector of radiation. State two advantages of the diffusion cloud chamber over the leaf electroscope.



25. Below is radioactive decay.

$$^{232}_{90}A \xrightarrow{K} {}^{228}_{88}B \xrightarrow{\gamma\ gamma} {}^{y}_{x}C$$

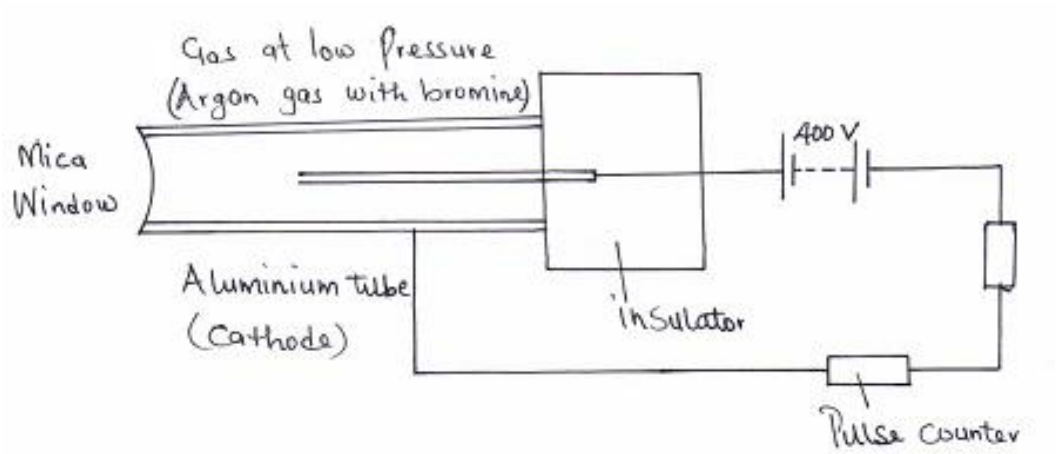
(i) Identify radiation K (1 mark)

(ii) Determine the values of x and y

(2marks)

26. A radioactive sample of half life 130 days initially has 1.0 x 10^{20} radioactive atoms. Determine the number of radioactive atoms that would have decayed after 390 days. (3 marks)

27. (a) Figure 13 below shows a diagram of a Geiger Muller tube connected to a power supply and a pulse counter.



(i) Why should the argon gas be at low pressure? (1mk)

(ii) State the purpose of the bromine gas in the tube. (1mk)

(iii) Suggest **one** way of increasing the sensitivity of the tube.

(1mk)

(iv) Find the value of a and b in the following equation. (2mks)

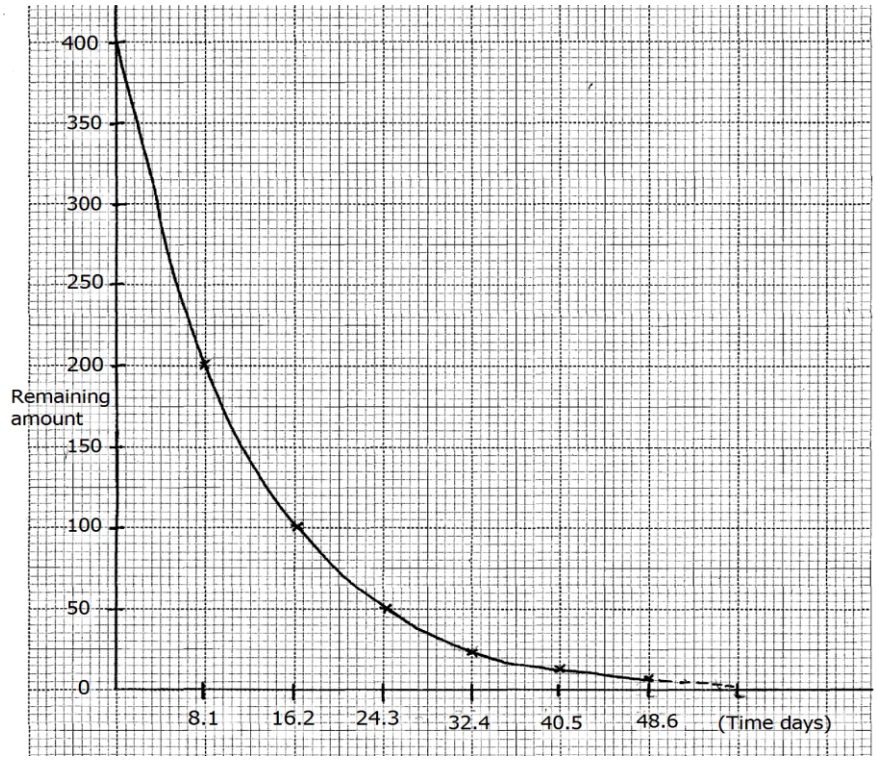
$$^{234}_{92}U \rightarrow {}^{a}_{b}X + 2\alpha$$

5. a) Name any two types of radiations given out in a radioactive process. (2mks)

b) The half – life of cobalt – 60 is 5years.

How long will a sample take for the activity to decrease to $^1/_{16}$ of its original value.
(3mks)

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. (2mks)

(ii) Determine the half – life of iodine. (2mks)

(iii)Mass remaining after 17 days.
(1mk)

6. The following reaction is part of a radioactive series.

$$^{210}_{83}A \xrightarrow{z} {}^{210}_{84}B \xrightarrow{\gamma\ (Gamma)} {}^{x}_{y}C$$

(a) Identify the radiation **z**. (1 mark)

(b) Determine the values of χ and **y**. (2 marks)

7. A radioactive sample of half-life 260 days initially has 2.0×10^{20} radioactive atoms. Calculate the number of atoms that would decay after 780 days.
(3mks)

8. Radium $^{226}_{88}Ra$ disintegrates into a new stable element lead $^{206}_{82}Pb$. How many Alpha and Beta particles are emitted? (2mks)

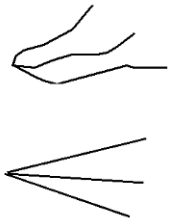
9. Define half life as used in radioactivity. (1mk)

10. (a) Define radioactivity. (1mk)

b) Identify the radiations of tracks in figure 9 below.

Figure 9 (1mk)

(i)



(ii) (1mk)

(c) Identify radiations using figure 10 below. (3mks)

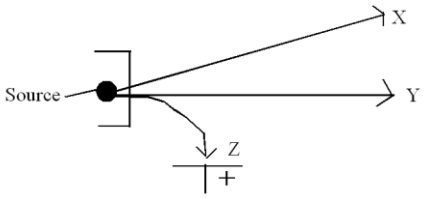


Figure 10

X Y and Z

(d) The following reaction is part of radioactive series

$$^{210}_{83}X \xrightarrow{h} {}^{210}_{84}Y \xrightarrow{\alpha} {}^{c}_{b}Z$$

Identify radiation h and values of b and c (3mks)

11. (a) The initial mass of a radioactive substance is 20g. The substance has a half-life of 5 years. Determine the mass remaining after 20 years. (2mks)

(b) When a radiation was released into a diffusion cloud chamber, short thick track were observed. State with a reason, the type of radiation that was detected. (2mks)

(c) Radium undergoes radioactive decay by emitting an alpha particle to form a daughter nuclide Q as in the reaction.

$$^{226}_{88}Ra \longrightarrow \text{Alpha particles} + {}^{x}_{y}Q$$

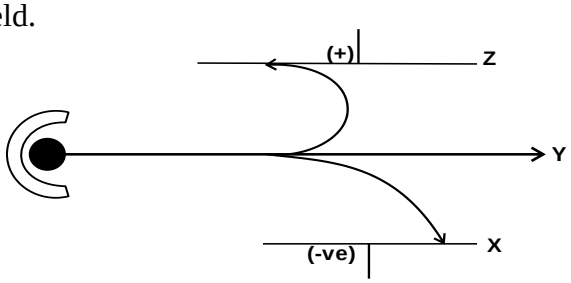
Determine the values of

(i) x (1mk)

(ii) y

(1mk)

12. a) The diagram below shows the path taken by three radiations X, Y and Z from a radioactive source, through an electric field.



(i) Identify X, Y and Z. (3 marks)

(ii) Give a reason for the differences in deviation shown by X and Z. (1 mark)

b)A radioactive source infront of a Geiger-muller tube shows a high count rate. The count rates are then taken from the source after placing a thin paper, then a thin aluminium foil and finally a thick lead slab, one at a time between the source and the G - M tube. It was observed that the paper had no effect on the count rate, aluminium had a small effect while the count rate was reduced greatly with lead.

(i) Give reasons for the three observations. (2 marks)

(ii) Deduce the possible radiations from the source. (2 marks)

(iii) State any two applications for the radiations entitled. (2 marks)

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THIN LENSES QUESTIONS

28. Some students wish to determine the focal length of a convex lens of thickness 0.6cm using an optical pin and a plane mirror. Figure 6 shows the experimental set up when there is no parallax between the pin and the image.

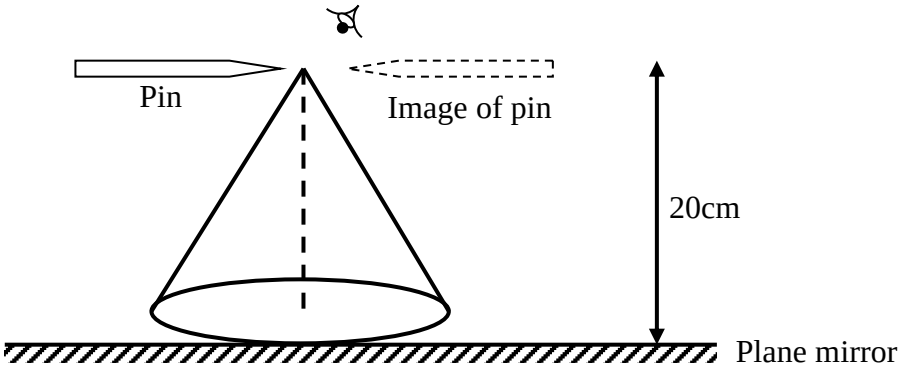


Fig. 6

Determine the focal length of the lens (2 marks)

(b) An optician in Eldoret Hospital examined an eye of a patient and made the following observations:
Eye too short and the focal length of the eye lens short

(i) State the eye defect the patient could be having. (1 mark)

(ii) Use a diagram to describe how the defect could be corrected. (2 marks)

(c) The graph below shows the variation of 1/v and 1/u in an experiment to determine the focal length of a lens.

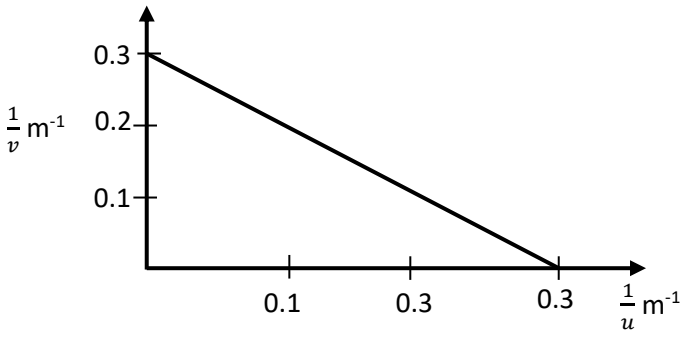


Fig. 7

(i) Use the graph to determine the focal length (3 marks)

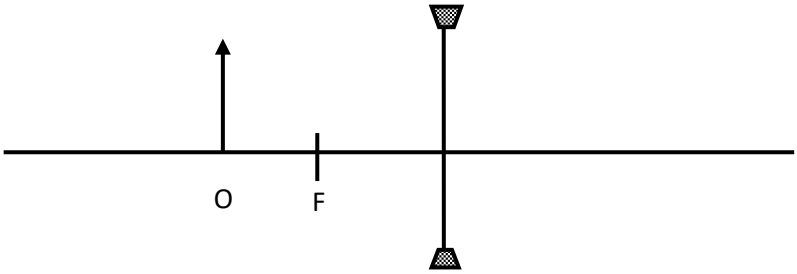
(ii) What is the power of the lens used? (2 marks)

(d) A converging lens forms an image which is three times the object. Determine the focal length of the lens if the distance between the object and the screen is 80cm. (3 marks)

29.

(a) Figure 12 shows an object O placed in front of a diverging lens whose principal focus is F.

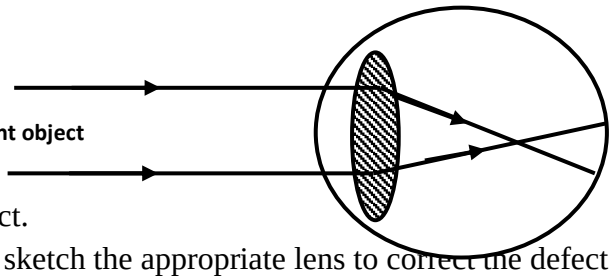
Figure 12



On the diagram, draw rays diagram to locate the image formed. (3marks)

(b) **Figure 13** shows a defective eye focusing a distant object.

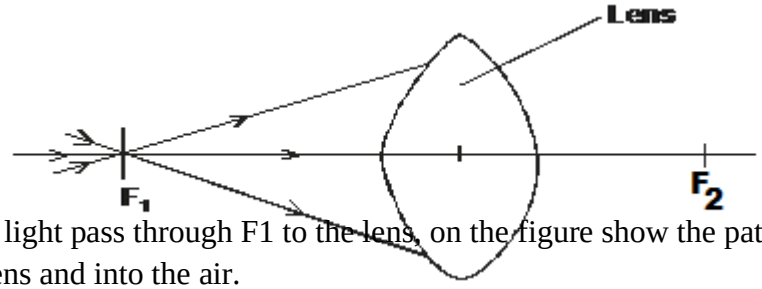
Figure 13



(i) Name the defect. (1mark)

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

30. (a)**Figure 10** shows a glass lens in air and its two focal points F1 and F2.



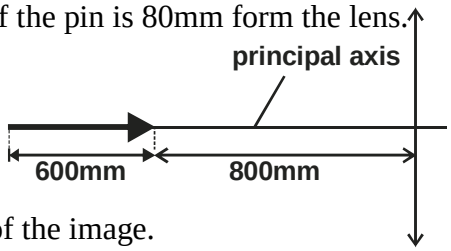
Three rays of light pass through F1 to the lens, on the figure show the path followed by the three rays through the lens and into the air. (3 marks)

(b) I State one possible cause of myopia. (1 mark)

II. State the type of lens that is used to correct myopia. (1 mark)

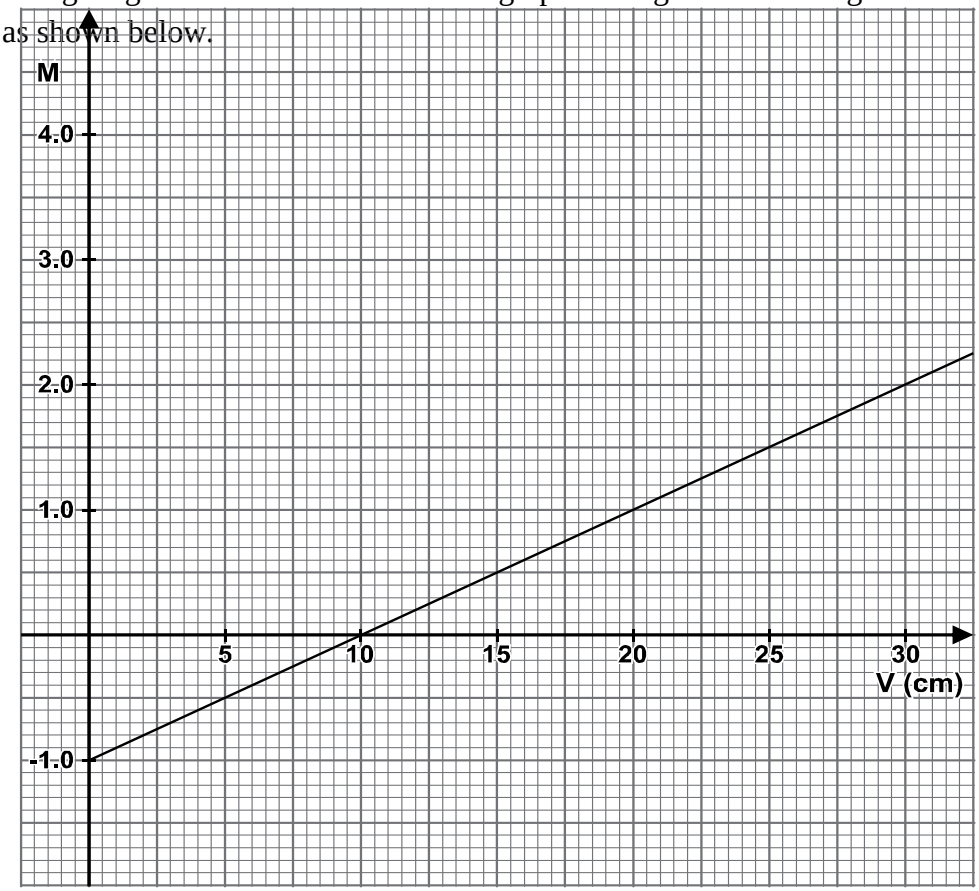
(c) The **figure 11** below shows a pin 60mm long placed along the principal axis of a lens of focal length 50mm. The near end of the pin is 80mm form the lens.

Fig 11



Determine the length of the image. (4 marks

(d) In an experiment to determine the focal length of a converging lens several values of image distance and the corresponding magnification were obtained. A graph of magnification m against image distance (V) was plotted as shown below.



From the graph determine the focal length of the converging lens. (4 marks)

31. State the name of the eye defect corrected by convex lens. (1mk)

32. (a) State <u>one</u> similarity and one difference between a concave lens and a convex mirror (2mks)

(b) A lens forms a focused image on a screen when the distance between the object and the lens is 100cm. the size of the image is twice that of the object.

(i) What kind of lens was used? Give a reason (2mks)

(ii) Determine the distance of the image from the lens (2mks)

(iii) Determine the power of the lens (3mks)

(c) The figure shown in figure 9 shown below is a human eye with a certain defect

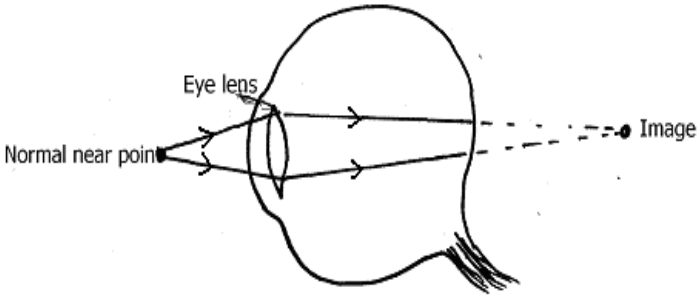
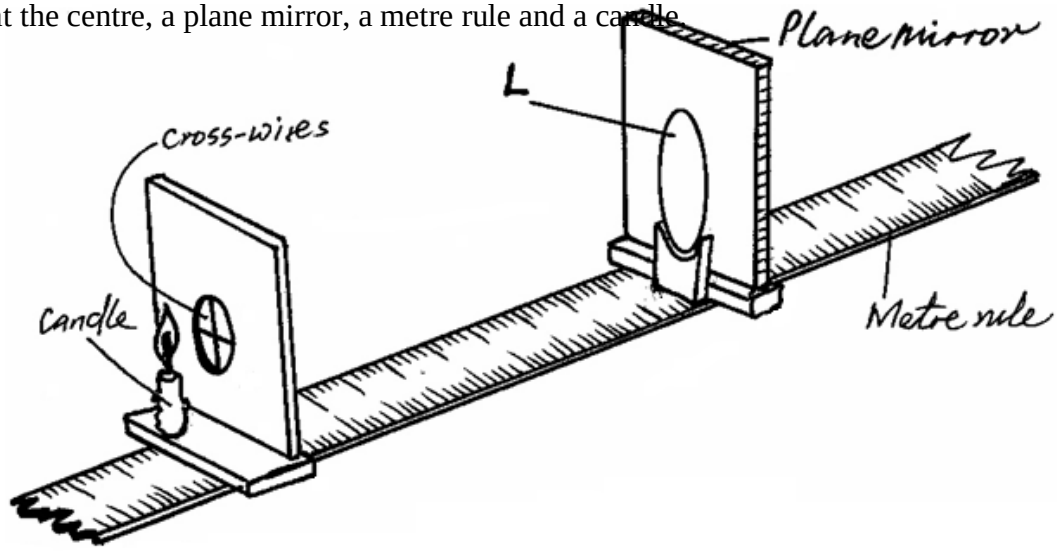


FIG 9

(i) Name the defect (1mk)

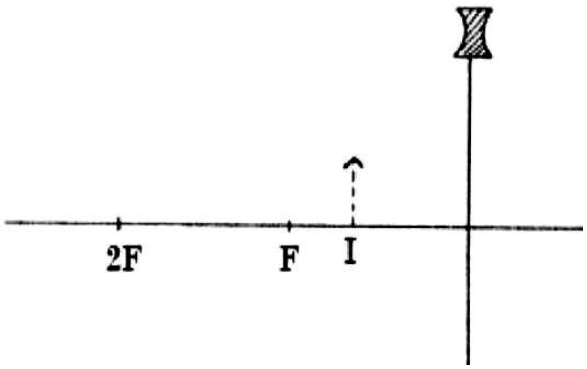
(ii) On the same diagram, sketch the appropriate lens to correct the defect and sketch rays to show the effect of the lens. (2mks)

33. The figure shows an experimental set up consisting of a mounted convex lens **L**, cardboard screen with cross-wires at the centre, a plane mirror, a metre rule and a candle.



Describe how the set-up may be used to determine the focal length, f, of the lens. (4 marks)

34. The figure below shows the image formed when an object is placed in front of a concave lens.



Using suitable rays, locate the position of the object. (3mks)

35. (a) An object is placed 30cm in front of a thin converging lens of focal length 20cm. The set up is represented in the figure.lens

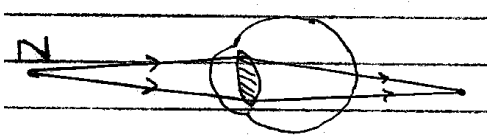
(i) On the same figure construct a ray diagram to locate the position of the image. (3 Mks)

(ii) Determine the magnification produced. (2 Mks)

(b) An object 6cm tall is placed 40cm from a convex lens of focal length 50cm.
Find the position of the image. (2Mks)

(c) State two differences between the human eye and the camera. (2 Mks)

(d) The figure below shows an eye defect.



(i) Identify the defect. (1 Mk)

(ii) State the cause of the defect. (1 Mk)

9. (a) Define refractive index. (1mk)

(b) The critical angle of a material is 43.2^0. Determine the refractive index of that material. (2mks)

(c) Define the term accommodation as used in lenses. (1mk)

(d) Figure 7 shows eye deflect

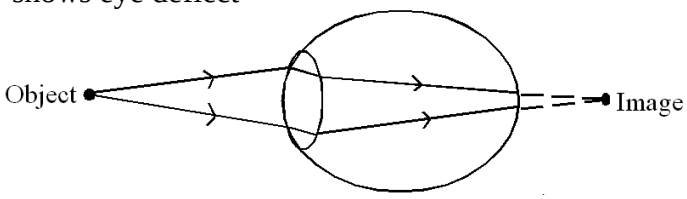


Figure 7

(i) Identify the defect. (1mk)

(ii) Show how the defect can be corrected on same diagram. (2mks)

(e) An object is placed 40cm in front of concave lense of focal length 20cm. Determine the position of the image. (3mks)

10. You are provided with the following apparatus to determine the focal length of a lens.

- ✓ A biconvex lens and lens holder
- ✓ A lit candle
- ✓ A white screen
- ✓ A metre rule

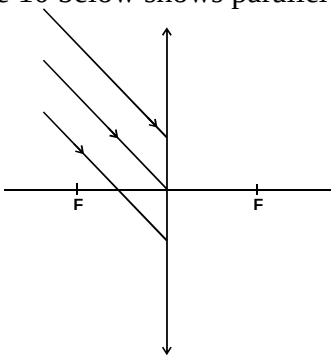
(a) State two measurements that you would take. (2mks)

(b) Explain how the measurements in (a) above would be used to determine the focal length of the lens. (2mks)

(c) Describe the procedure you would follow in determining the focal length of the above lens. (2mks)

(d) Draw a diagram to show how you would arrange the above apparatus to determine the focal length of the lens. (1mk)

11. Figure 10 below shows parallel rays of light incident on a convex lens.



Complete the ray diagrams to show the emergent beam in each case. (2 marks)

(b)Table 2 below shows values of object distance U and corresponding value of image distance V for a convex lens.

Object distance U (cm)	10	15	20	25	30	35
Image distance V (cm)	24.6	17.1	13.3	11.8	10.9	10.4

Table 2

(i)Plot a graph of (U + V) against UV. (5 marks)

(ii) Determine the focal length of the lens. (3 marks)

(c) Give one difference between the eye and the camera. (1 mark)

12. a)An object O placed in front of a converging lens L_O forms an image I on the other side of the lens. Another converting lens

L_e is placed such that the two lenses form a compound microscope.

(i) Draw a reason of the set up and sketch the rays to show how the final image is formed. (5 marks)

(ii) What is meant by virtual image? (1 mark)

(iii) A lens forms a clear image on a screen when the distance between the screen and the object is 80cm. If the image is 3 times the height of the object, determine. The distance of the image from the lens. (2 marks)

13. a) Distinguish between seal image and a virtual image. (1 mark)

b)The distance between an upright image and the object produced by a thin lens is 40cm. The image is 3 times as tall as the object.

i) State the type of lens used. (1 mark)

ii) Determine the object distance. (2 marks)

iii) Determine the radius of curvature. (3 marks)

iv) State one application of the lens as used in question (b) above. (1 mark)

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X-RAYS QUESTIONS

1. (a) State what determines the quality of X-rays in an X-rays tube. (1mk)

(b) State **one** use of X-rays in industry. (1mk)

(c) An X-ray tube operates with a p.d. of 200kv. Only 0.5% of the kinetic energy of the electrons is converted into X-rays.

Calculate the frequency of the X-rays produced, take planks constant = 6.63×10^{-34}Js. (3mks)

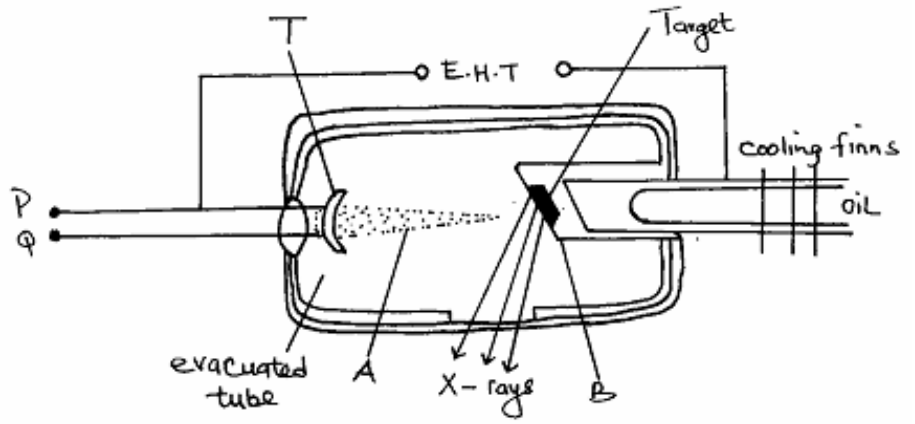
2. (a) State the property of lead that makes it a suitable material for shielding an x-ray tube. (1 mark)

(c) State how an increase in temperature of the filament in an x-ray tube affects the nature of x-rays produced. (1 mark)

(a) State **two** properties of χ-rays. (2mks)

(b) Figure 6 below shows an χ-ray tube. Use it to answer questions that follow.

Figure 6



(i) Name parts labelled **A** and **B**. (2mks)

(ii) Explain how a change in the potential across P changes the intensity of the χ-rays produced in the tube. (2mks)

(iii) During the operation of the tube, the target becomes very hot. Explain how this heat is caused. (2mks)

(iv) Name a suitable material for the target. (1mk)

(v) Name the part labelled **T**. (1mk)

(vi) Why is the tube evacuated? (1mk)

(c) In a certain χ-ray tube, the electrons are accelerated by a p.d. of 24000V. Assuming all the energy goes to produce χ-rays, determine the frequency of the χ-rays produced. (Plank's constant h = 6.62×10^{-34}Js and charge on an electron, e = 1.6×10^{-19}C). (3mks)

3. State **one** property of high quality X-rays. (1mk)

4. State the energy transformations when fast moving electrons are suddenly stopped by metal target. (1mk)

5. (e) Figure 12 shows X-ray tube

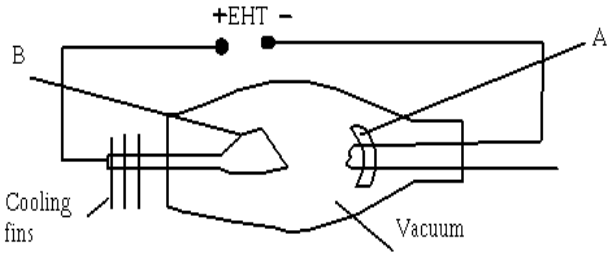


Figure 12

(i) Identify parts A and B. (2mks)

(ii) Calculate the number of electrons hitting the anode per second. (2mks)

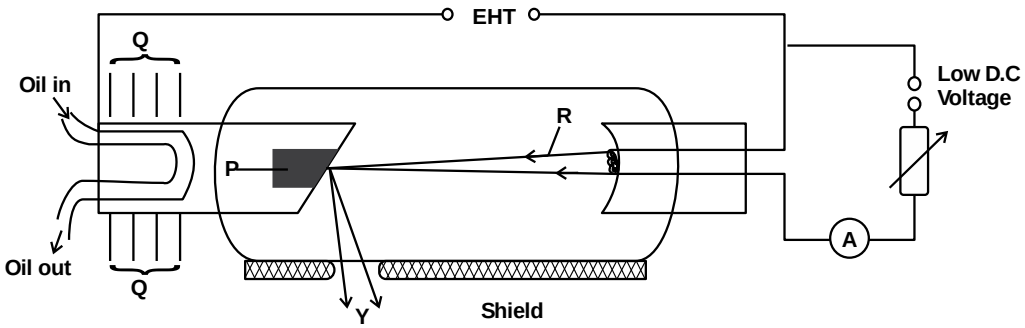
(iii) X-ray tube is operating at 15kV and current of 15mA. Determine the velocity of electrons as they strike the target. ($e = 1.6 \times 10^{-19}$, $Me = 9.1 \times 10^{-13}$ kg) (3mks)

6. In an X-rays tube it is observed that the intensity of X-rays increases when the potential difference across the filament is increased. Explain this observation. (2 marks)

7. Explain how the intensity of X-rays in an X-ray tube can be controlled. (1 mark)

8. Distinguish between x - rays and g - rays based on production. (1 mark)

9. Figure 11 shows the main parts of an X-ray tube.



a) Name the parts labelled Q and R. (2 marks)

b) Explain the effects on the X-rays produced when :

i) The ammeter reading is raised. (2 marks)

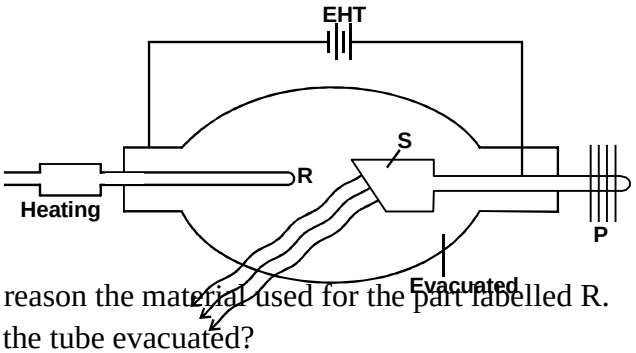
ii) The extra high tension voltage (EHT) is increased. (2 marks)

c) State with reason the material used to make the part labelled P. (3 marks)

d) The Y-gain of a C.R.O is connected at 50V/cm. An alternating voltage source connected to the input terminal produces a sine wave curve with an amplitude of 3.5cm. Determine the highest voltage produced by the source. (3 marks)

10. Distinguish between soft and hard x-rays in terms of their production. (1 mark)

11. a) The diagram below shows an X-ray tube drawn by a student. Use it to answer the questions which follow.



State with reason the material used for the part labelled R. (2 marks)

ii) Why is the tube evacuated? (1 mark)

iii) How can the wavelength of the X-rays emitted from this tube be reduced. (1 mark)

b) X-rays are emitted when a tube operates at 3×10^2 V and a current of 0.01 A is passing through it (take e = 1.6×10^{-19}C, Me = 9×10^{-31}). Calculate;

i) the velocity of the electron on hitting the target (3 marks)

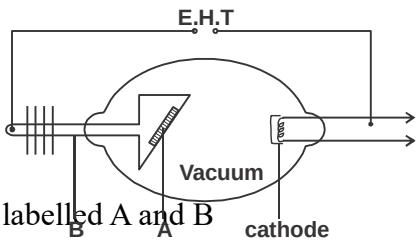
ii) the minimum wavelength of the x-rays emitted. (3 marks)

c) i) State **two** properties of x-rays. (2 marks)

ii) State **two** uses of X-rays. (2 marks)

12. State the energy transformation when fast moving electrons are suddenly stopped by a target in an X-ray tube. (1 mark)

13. **a)** The figure below shows an X-ray tube.



i) Name the parts labelled A and B (2 marks)

ii) Suggest with a reason the material used for A (1 mark)

iii) State the reason why the X-ray tube is evacuated. (1 mark)

iv) For the X-ray tube, how would the following be controlled

a) The intensity (1 mark)

b) Quality of X-ray (1 mark)

b) A potential difference of 50KV is applied across CRO tube. Given that the charge of an electrons e = 1.6 x 10^{-19}C and the mass of the electron Me = 9.1 x 10^{-31}kg. Calculate the kinetic energy of the electrons (3 marks)