NAME: ……INDEX: ……..DATE: .....

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FOCUS A365

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232/2
PHYSICS
PAPER 2
OCTOBER 2018
2 HOURS

INSTRUCTIONS TO CANDIDATES

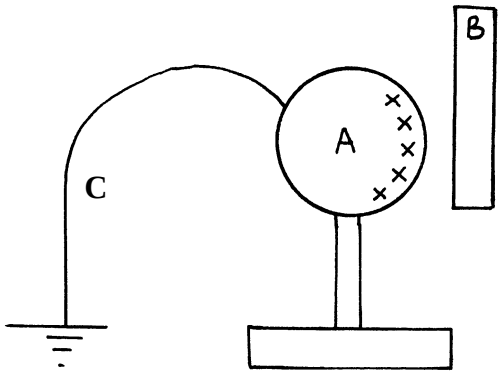
a) *Write your name and index number in the spaces provided above.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *This paper consists of two sections: A and B.*
d) *Answer all the questions in sections A and B in the spaces provided.*
e) *All working must be clearly shown in the spaces provided in this booklet.*
f) *Non programmable silent electronic calculators may be used.*
g) *This paper consists of 12 printed pages.*
h) *Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.*
i) *Candidates should answer the questions in English.*

For Examiner's Use Only

Section	Question	Maximum Score	Candidates' Score
A	Q1 – Q13	25	
B	Q14 Q15 Q16 Q17 Q18	11 12 13 9 10	
		80	

SECTION A (25 Mks) ***(Answer ALL the questions in the spaces provided)***

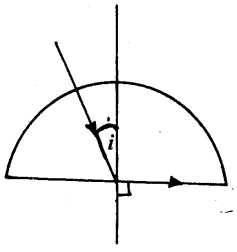
1) Figure below represents a step in charging a material A by induction.



(i) What is the charge on B? (1 mk)

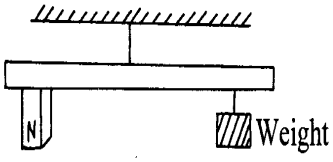
(ii) Explain what happens at C. (1 mks)

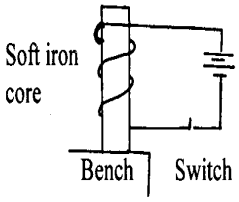
2) Figure below shows a ray of light incident on a face of semi-circular glass block.



Determine the angle of incidence *i* (refractive index of glass = 1.5) (2 mks)

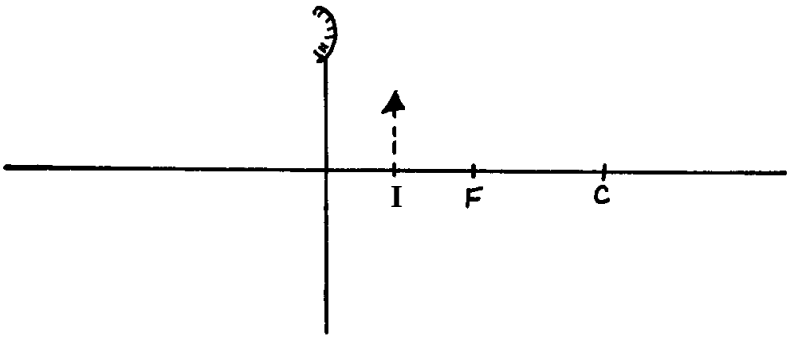
3. A metre rule is suspended by a thread such that it is in equilibrium balanced by a permanent magnet attached to the metre rule and some weight as shown in fig. bellow





If the soft iron is fixed to the bench, state and explain the effect on the metre rule when the switch is closed. (2 mks)

4. The figure below shows the image I, formed in a convex mirror. Complete the ray diagram to show the position of the object. (2 mks)



5.The graphs in the figure below represent the same wave.

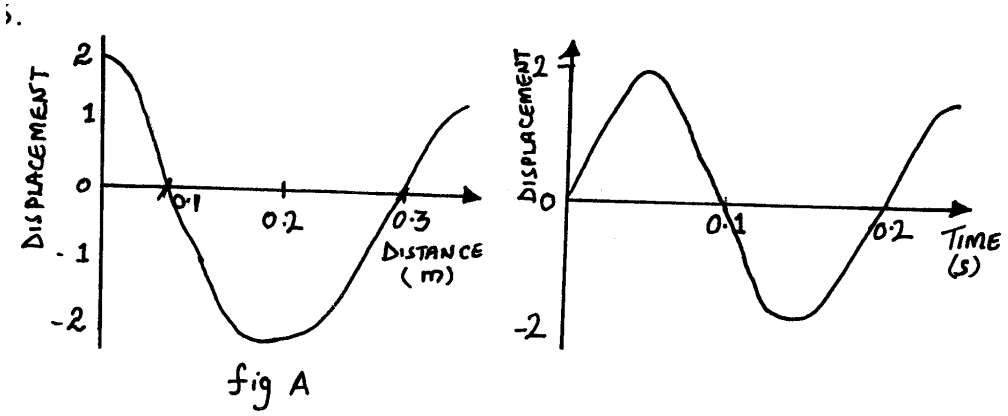
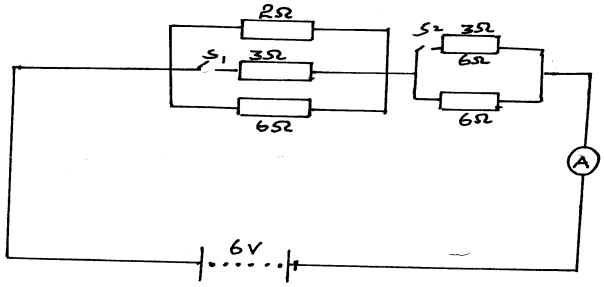


fig A

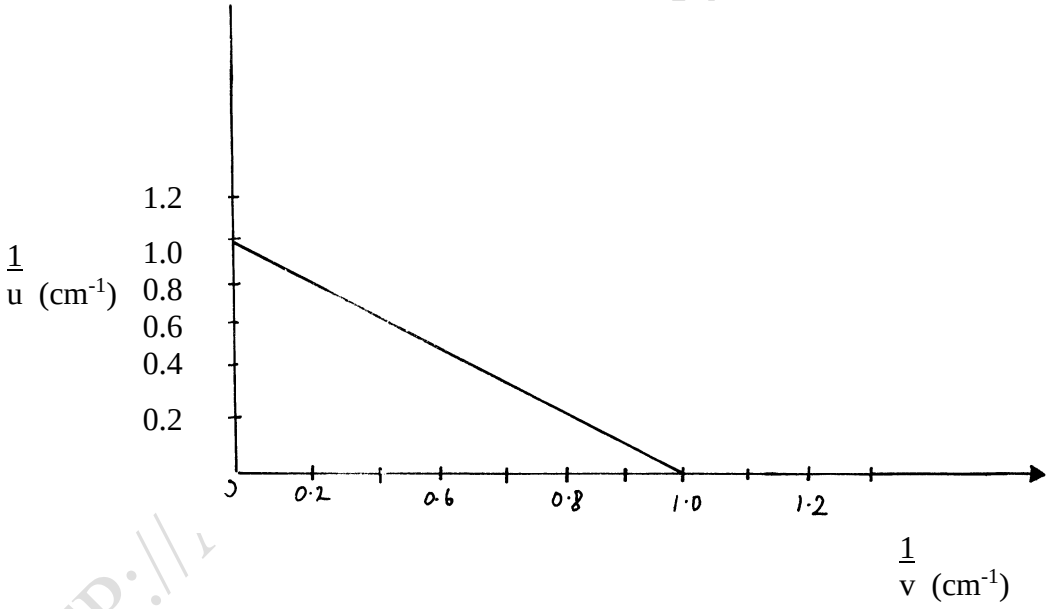
Determine the velocity of the wave. (2 mks)

6. Determine the ammeter reading when both switches are closed. (2 mks)



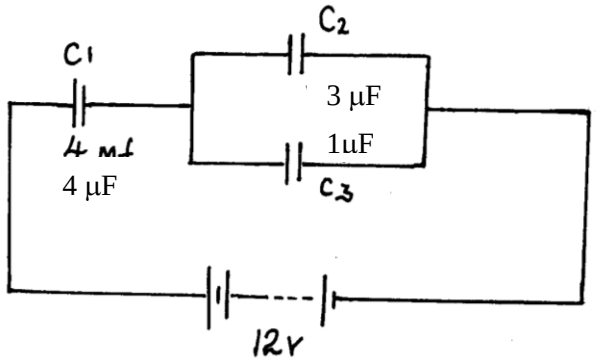
7. An immersion heater rated 1.5KW is used continuously for 30min per hour per day. Calculate the cost per week per ksh 6.70 per unit. (2 mks)

8. The figure below shows the relationship between the reciprocal of the object distance $\left(\frac{1}{u}\right)$ and the reciprocal of the image distance $(\frac{1}{v})$ for an object placed in front of a concave lens.



From the graph, determine the focal length of the lens. (2mks)

9. In the circuit below C_1= 4 μF, c_2= 3μF and c_3 = 1μF . Given that V= 12V, calculate the charge stored on the 3μF capacitor C_2 (2 mks)

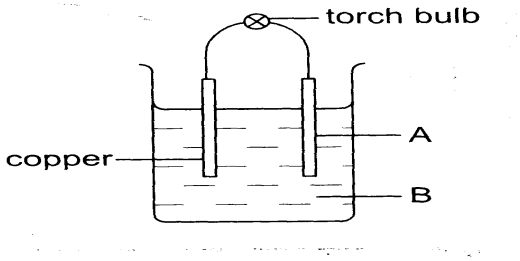


10. What is the difference between a hard and soft magnetic material in terms of the domain theory. (1mk)

11. Complete the following table: (2mks)

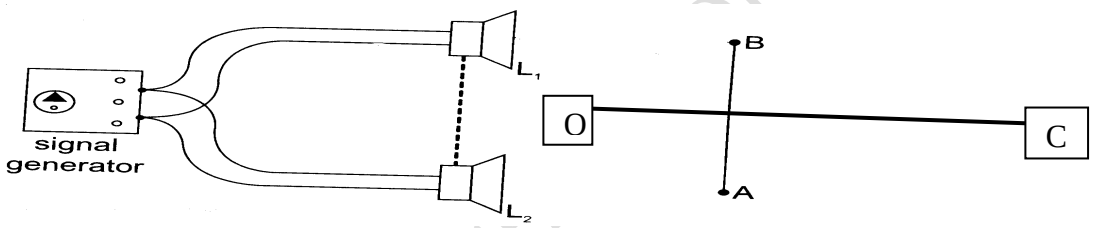
Radiation	Source	Detector	Application
X- rays	X-ray tube		
Ultra violet	The sun		

12. The figure below shows a simple cell



Identify electrode A and solution B (2marks)

13. The set up below was used by a student to investigate interference in sound waves.



If the speakers are connected to an audio generator, state what is observed when one walks along AB and OC. (2mks)

SECTION B (55 MARKS)

(Answer ALL questions in this section)

14. Figure below shows an x-ray tube

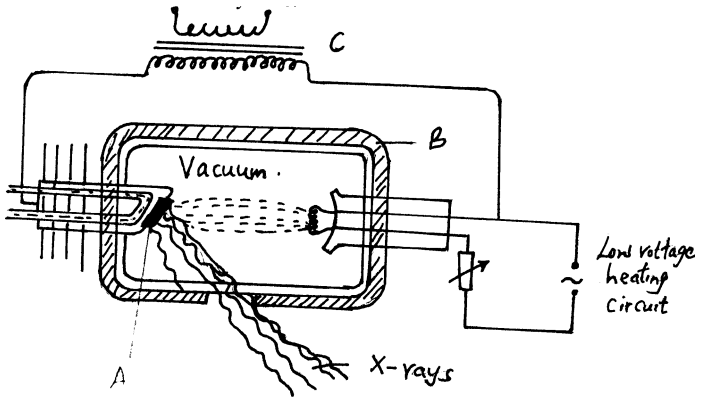


Fig. 6

a) i) Name the elements used in making the parts labeled A and B. (2 marks)

A:

B:

ii) Explain the use of the part labeled C. (2 marks)

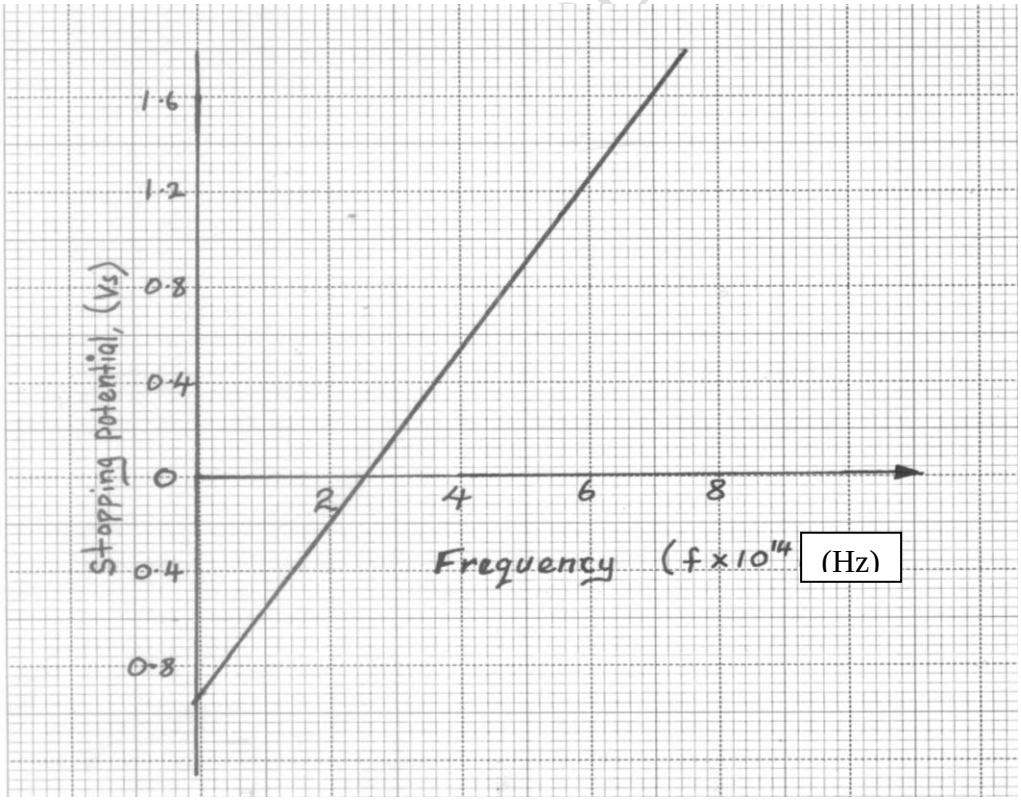
iii) Explain how the x-rays are produced. (2 marks)

iv) Why is the x-ray tube evacuated? (1 mark)

b) The penetrating power of x-rays is normally varied depending on the intended use. Explain briefly how this is done. (2 marks)

c). An x-ray tube is operating with an anode potential of 20KV and a current of 40mA.
Determine the number of electrons hitting the target per second. (2mks)
(The charge of an electron is 1.6×10^{-19}C)

15.1n 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. (1 mark)

ii) Find the plank's constant h. (2 marks)

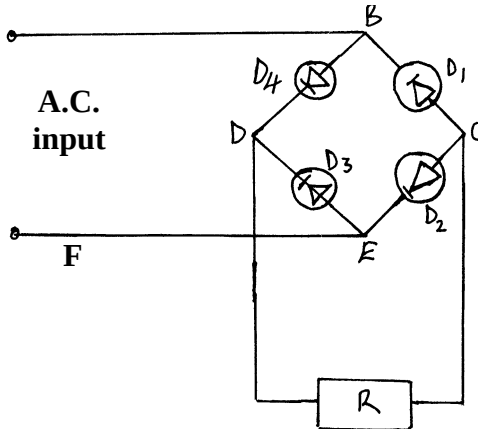
.(Take the charge of an electron to be 1.6×10^{-19} C)

iii) Calculate the work function of the metal in joules. (2 marks)

b) The threshold frequency of sodium is 4.8×10^{14} Hz. Calculate the work function of sodium.

(Take the plank's constant to be 6.6×10^{-34} Js) (2mks)

c) The figure below shows a bridge rectifier.

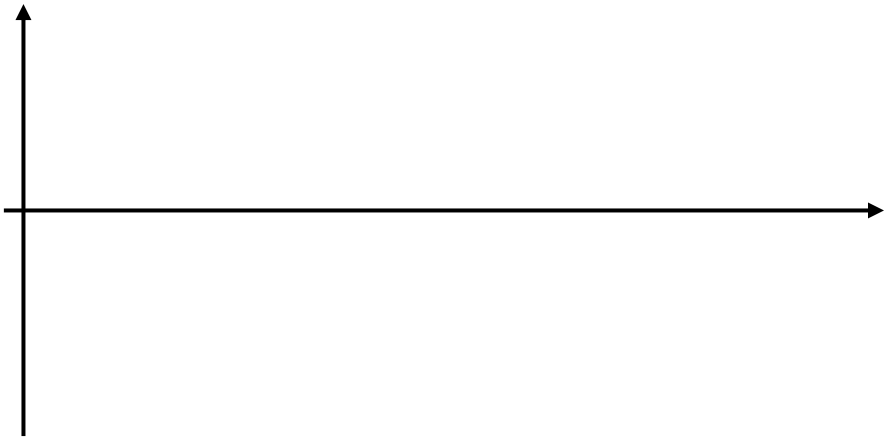


i) Define the term rectification. (1 mark)

ii) Describe how the illustrated rectifier works. (2 marks)

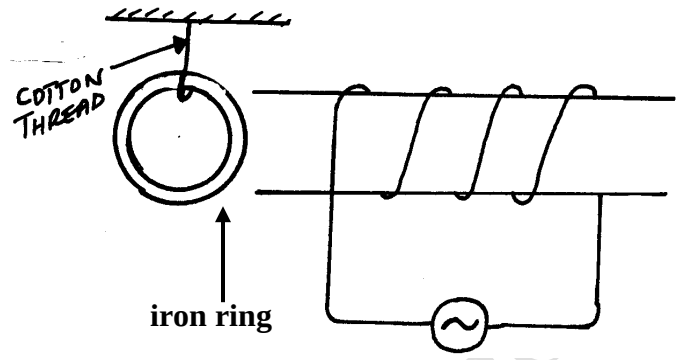
iii) State the modification that can be made on the arrangement to improve the quality of the output. (1 mark)

iv) Sketch on the areas below how the improved output is displayed on a C.R.O screen.
(1 mark)



16. a) State the Faraday's Law of Electromagnetic Induction. (1 mk)

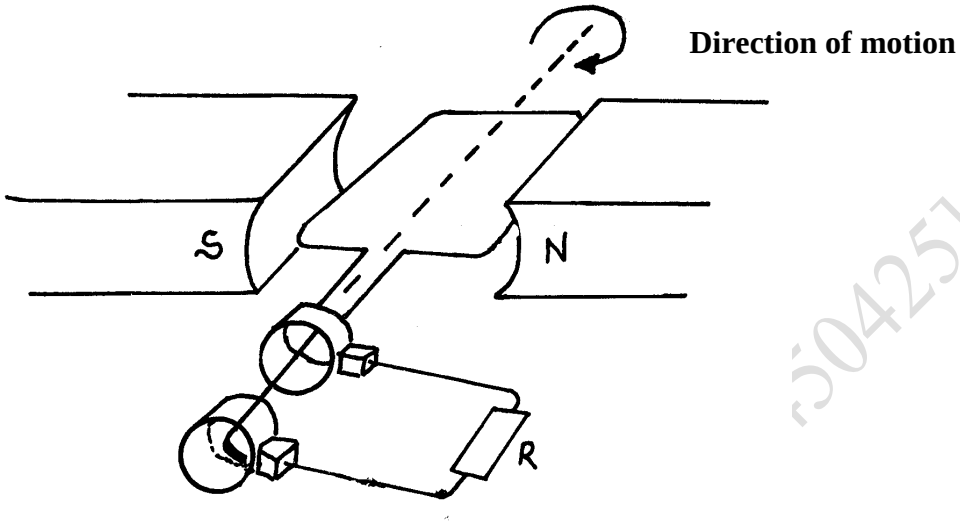
b) Coil carrying a large alternating current is placed close to a iron ring suspended freely on a silk thread as shown in the diagram below.



(i) Explain why the ring is repelled continuously. (2 mks)

(ii) State and explain what would be observed when a direct current is used instead of an alternating current. (2 mks)

c) The diagram below is a simplified illustration of an E.M.F. generator.



(i) Show the direction of induced current through R when the coil is in the position shown in the diagram. (1 mk)

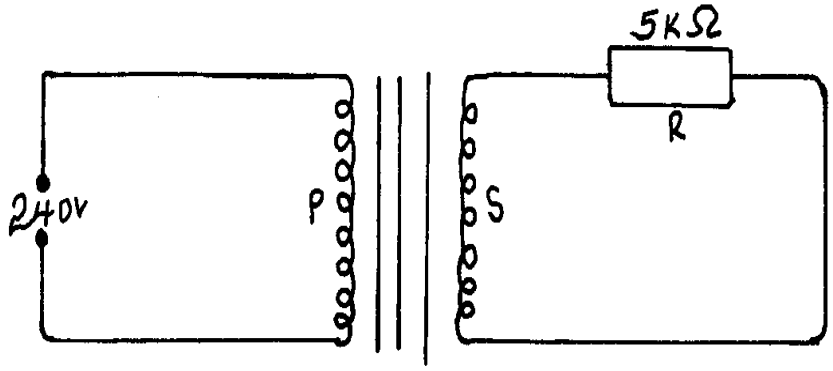
(ii) State and explain three ways of increasing the amount of induced current in this set up.
(2 mks)

(iii) On the axes below, sketch a graph to show how potential difference across R varies with time. The coil is initially horizontal.
(1 mk)

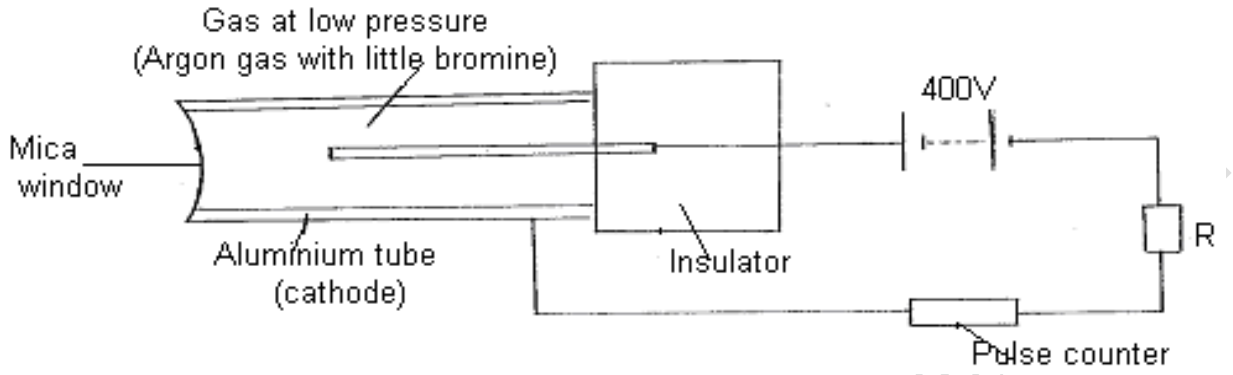
d) State and explain any two ways by which energy losses are reduced in transformation. (2 mks)

e) The figure below shows a step – down transformer connected to a 240V mains socket. The primary coil P has 4000 turns while the secondary coil has 200 turns. The efficiency of the transformer is 60% and a current of 50A flows through P. Calculate the current through S.

(2 mks)



17.a) (a) **Figure** below shows the 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)

b) Uranium – 235 was bombarded with a neutron and fission took place in the following manner:-

$$^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{90}_{38}Rn + ^{a}_{b}X + 10\,^{1}_{0}n$$

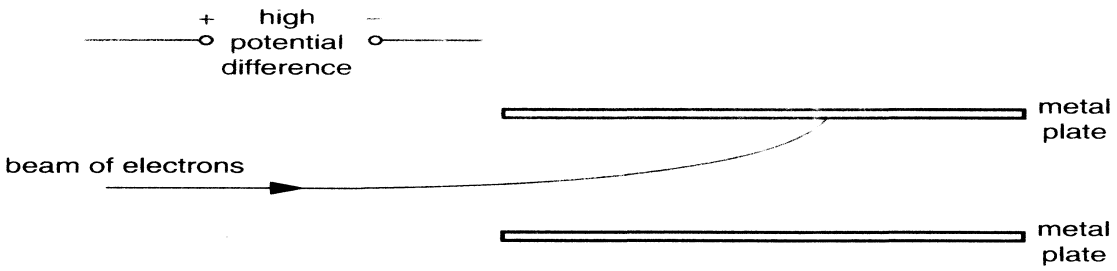
Determine the values of a and b. (1 mks)

a.....

b……

c) A radioactive element A of half life 31 days decays to element B. A sample of A of mass 32g is kept in a container. Assuming B is stable; calculate the mass of B that will be in the container after 124 days. (2 mks)

d) The figure below shows how a beam of electrons would be deflected by an electric field produced between two metal plates.



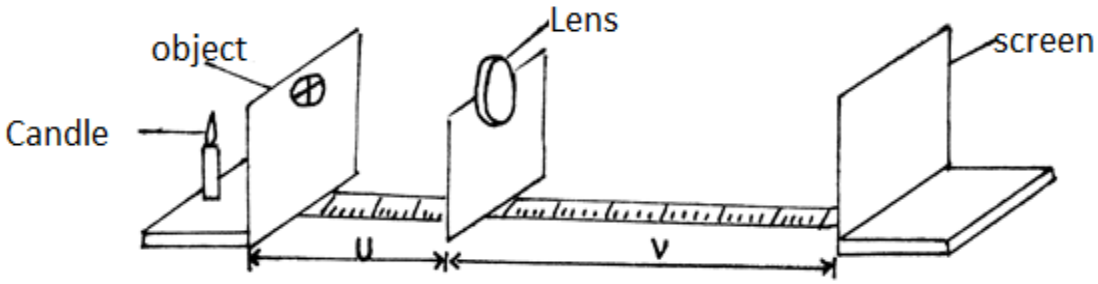
(i)Draw the missing connections. (1mk)

(ii)Explain why the beam of electrons is deflected in the direction shown. (1mk)

(iii) State how the deflection system of a television system differs from that of a CRO. (1mk)

(iv) Give the reason why it is possible to have a wider screen in the television set than on the CRO. (1mk)

18a) The figure below shows an object placed in front of a thin lens. The focal length of the lens is 10cm.The screen is adjusted until an image which is magnified 5 times is obtained.



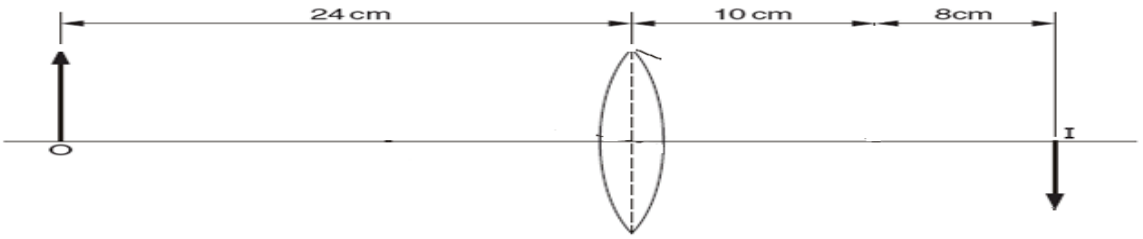
From the information

(i)Which type of lens was in the experiment. (1mk)

(ii)State any other characteric of the image formed. (1mk)

(iii)Find the value of u (2mks)

b) The figure below shows an object and an image formed by a certain lens.

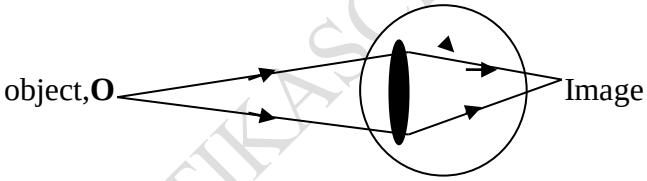


By drawing suitable rays

(i) Locate the position of the focal point F of the lens. (1mks)

(ii)Find the value of focal length f. (1mk)

c) The figure below shows a defective eye



(i) state the cause of the defect. (1mk)

(ii)What type of lens is used to correct the defect? (1mk)

d)State any two similarities between an eye and a camera. (2mks)

MARKING SCHEME

SECTION A(25 mks)

1) (i) Negative charge;
(ii) Earthing ; electrons from A are grounded

2) $1.5 = \frac{\sin 90}{\sin i}$

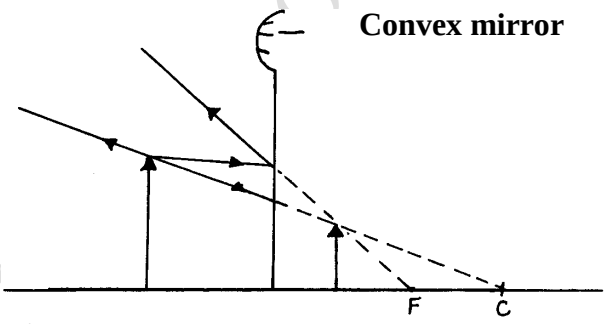
$\sin i. = {}^{1}/_{1.5}$

$i = \sin^{-1}({}^{1}/_{1.5})$

$i = 41.8^{o}$

3) The rule moves anticlockwise, the soft iron core gets magnetized with the upper end having a south pole and hence attracts the north pole of the magnet.

4.



2 correct rays **2 mks**

5.

$\lambda = 0.4m$

$T = 0.2s$

$\therefore f = \frac{1}{T} = \frac{1}{0.2} = 55^{-1}$

$\therefore v = f\lambda$

$= 0.4x5$

$= 2m/s$

6. Parallel resistors

$1/R = ½ + {}^{1}/_{3} + {}^{1}/_{6}$ R1 = 1

$1/R2 = {}^{1}/_{3} + {}^{1}/_{6} = 2$

Series resistor $R_1+R_2 = 3$

Current $= {}^{V}/_{R} = {}^{6V}/_{3} = 2A$;

7.Cost = kwhx6.70;

$=1.5 \times {}^{30}/_{60} \times 24 \times 7$;

= 1.5x12x7
= sh.126

8. 1/f=y-intercept
= 1.0
f=1.0cm

9. $\frac{1}{C_T} = \frac{1}{4} + \frac{1}{4}$

$C_T = \frac{4 \times 4}{8} = 2\ \mu F$;

$Q_T = CV = 2 \times 10^{-6} \times 12$
$= 2.4 \times 10^{-5}$ C; ✓

Charge stored in C_2 of 3 µF
$= \frac{3}{4} \times 2.4 \times 10^{-5}$; ✓
$= 1.8 \times 10^{-5}$ C; ✓ -3

10. The dipoles of a soft magnetic material are easily aligned and disaligned.

The dipoles of a hard magnetic material are difficult to align and disaligned

11

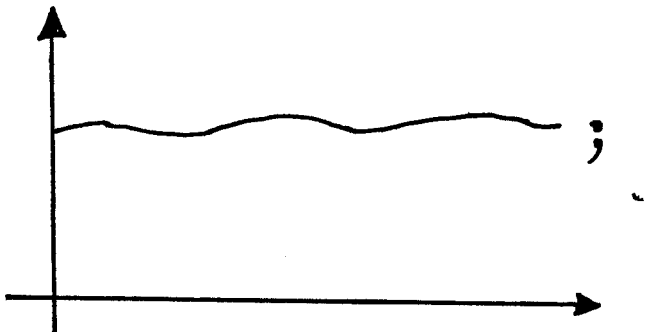
Radiation	Source	Detector	Application
X- rays	X-ray tube	Photographic paper	To inspect broken bones or fractures, detecting of flaws
Ultra violet	The sun	Paper lightly smeared with vaseline	To detect forgeries

12. A- zinc B- Dilute sulphuric acid

13.AB- alternate loud and soft sound.
OC-loud sound all through.

SECTION B (55MARKS)

14(a) (i) A: tungsten or molybdenum target ;	1 mark
B: lead shielding;	1 mark
(ii) x – rays tube requires very high accelerating voltage ;	1mrk
The C steps up voltage to the required potential;	1mark.
(iii) – Current is allowed to flow through the filament in the cathode heating it	1 mark
and boiling off electrons (through thermionic emission);	1 mark
The high potential difference between the cathode and the target (anode) ;	1 mark
accelerates the electrons to hit the target;	1mark
The X – rays are produced when the electrons hit the target;	1 mark
(iv) The tube is evacuated so that electrons do not lose some of their energy through collision with air molecules on their way to the target;	1 mark
(b)The penetrating power of x – rays is varied by varying the accelerating potential (between the anode and the cathode)	
The electrons are caused to move faster hitting the target with greater impact causing radiation of higher energy content;	
(c)	
$\frac{Q}{t} = I \text{ or } I = \frac{ne}{t}$	1 mark
$= n \times \frac{1.6 \times 10^{-19}}{t}$	
$= \frac{40}{1000} = n \times 1.6 \times 10^{-19}$	1mark
$\Rightarrow n = \frac{40}{100} \times \frac{1}{1.6 \times 10^{-19}}$	1mark
= 2.5 x 10^{17} electron per second	

15(a) (i) 2.5×10^{14} Hz $gradient = \frac{1.8 - 0.2}{(7.5 - 3.0) \times 10^{14}}$;	1 mark
(ii) $\frac{h}{e} = \frac{1.8 - 0.2}{(7.5 - 3.0)10^{14}}$;	1 mark
$\frac{1.8 - 0.2 \times 1.6 \times 10^{19}}{(7.5 - 3.0) \times 10^{14}}$ $= 4.267 \times 10^{-34} Js$	1mark
(iii) Work function = hf_o $= 2.5 \times 10^{14} \times 4.267 \times 10^{-34}$; $= 1.0668 \times 10^{-19}$	1mark
(b) $W_0 = hf_0$ $= 6.6 \times 10^{-34} \times 4.8 \times 10^{14}$; $= 3.168 \times 10^{-19}$ j ;	1 mark 1 mark
(c) (i) rectification is a process of converting alternating current to direct current ; (ii) during one half cycle, A is at higher potential relative to F; Diodes D_4 and D_2 are forward biased. Current flows from A- B –D_4 –R_2- D_2 to F; During the next half cycle, F is at a higher potential relative to A; Diodes D_3 and D_1 are forward biased. Current flows from F- E- D_3 –R – D_1 – B –A ;	1 mark 1 mark 1 mark 1 mark
(iii)a capacitor can be connected across the output resistor R; 	1 mark 1mark 1 mark 1 mark 1 mark

16. a) Induced e. m. f. is directly proportion to the rate of change of flux linkage or rate of flux cutting. ✓

b) (i)There is a continuous change in magnetic flux in the coil and in the ring as well.

The ring induces an e. m. f. and current which according to Lenz's law, opposes The change causing it ✓2

(ii) The ring would be repelled as the switch is closed and attracted as the switches opens

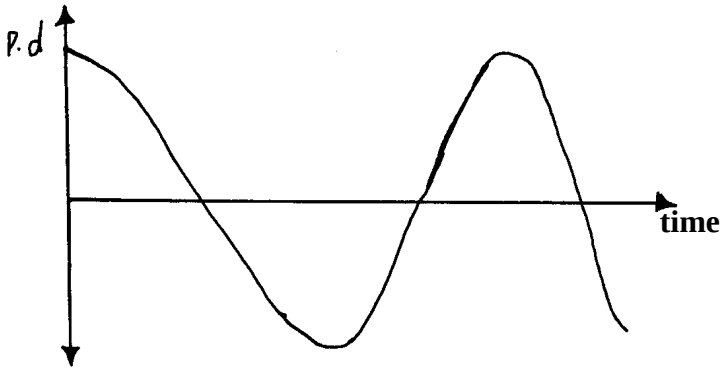
It is unaffected when the switch remain closed✓2

c) (i) To the left/clockwise✓

(ii) By the increasing the speed of the coil so that magnetic flux changes faster✓

- using more turns of the coil to increase the magnetic flux linkage ✓
- applying stronger magnetic field to increase flux density ✓

(iii)



d) - By laminating the core to reduce eddy currents ✓

- Using thick copper wire coils to reduce heating effect ✓

e)

$$I_S V_S = \frac{60}{100} I_P V_P$$

$$IV_S = \frac{200}{4000} X\, 240$$

$$I_S = \frac{60}{100} X \frac{50X\,240}{200X\,240} X\, 4000$$

$$= 600A$$

17a) i) To be easily ionized by the radiations. (1mk)

(ii) Quenching agent /absorbing kinetic energy of the positive ions ; (1mk)

b) a=236 – 91 = 145 (1mk)

b=92 – 38 = 54

c) Amount of A – remaining $= \left(\frac{1}{2}\right)^4 \times 32$

$= 2$ g;

Amount of β (mass of y) = 32- 2 ; (2mks)

= 30 g ;

d(i)

(ii) It is negatively charged.
(iii) Television uses magnetic coil to deflect the electron beam while CRO uses an electric field.
(iv) Magnetic field produces a greater deflection than an electric field.

18a) (i) convex lens

(ii) inverted

(iii) 5=v/u
V=5u
1/10=1/5u+1/u
U=12cm

b(i)

(ii) f=10cm

C (i) eye ball too long or focal length of the eye lens too short
(ii) concave lens/diverging lens

d) both use a convex lens, both form real inverted images.