MARANDA HIGH SCHOOL

Kenya Certificate Of Secondary Education

THE 2024 MOCK EXAMINATION

232 **PHYSICS** **PAPER 2**

June, 2024 **TIME: 2 Hrs**

MARKING GUIDE

232 - PHYSICS
Tuesday, 11th June, 2024
Mid-Morning
10.45am – 1.45pm

Instructions

*(a) Write your **name**, **admission number, date, stream and signature** in the spaces provided above.*
(b) All answers must be written in the spaces provided in the booklet.
(c) This paper consists of 12 printed pages with 20 questions. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing
*(d) Candidate should answer the questions in **English***

FOR EXAMINERS' USE ONLY

SECTION	QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 14	25	
B	15	13	
	16	09	
	17	10	
	18	08	
	19	09	
	20	06	
	Total	80	

SECTION A (25 MARKS)

Answer ALL the questions in this section in the spaces provided

1. Draw the electric field pattern around the charges shown in **Figure 1**. (2 marks)

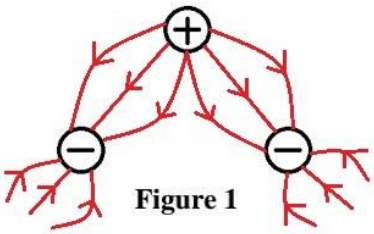


Figure 1

✓[1] pattern

✓[1] direction of field

2. The graphs in **Figure 2** represent the same wave.

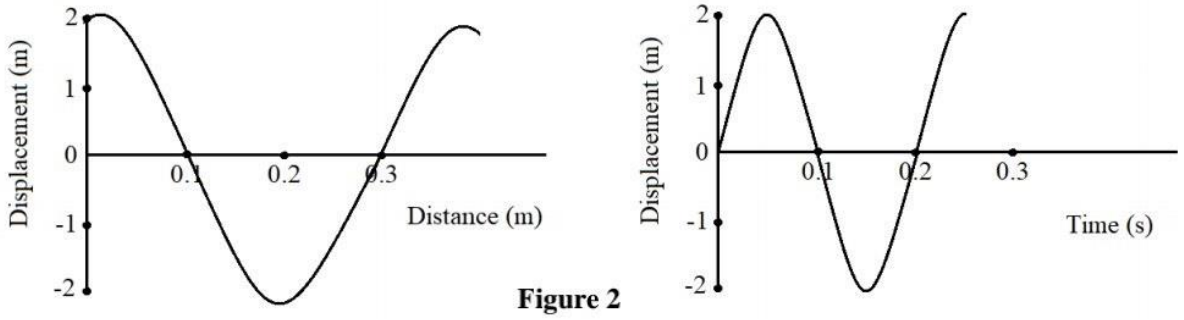


Figure 2

Determine the velocity of the wave. (3 marks)

$\lambda = 0.4m \quad T = 0.2s$

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

$= \frac{1}{0.2}$ ✓[1]

$= 5Hz$

$v = \lambda f$

$= 0.4 \times 5$ ✓[1]

$= 2m/s$ ✓[1]

3. **Figure 3** shows the image **I**, formed in a convex mirror. Complete the ray diagram to show the position of the object. (2 marks)

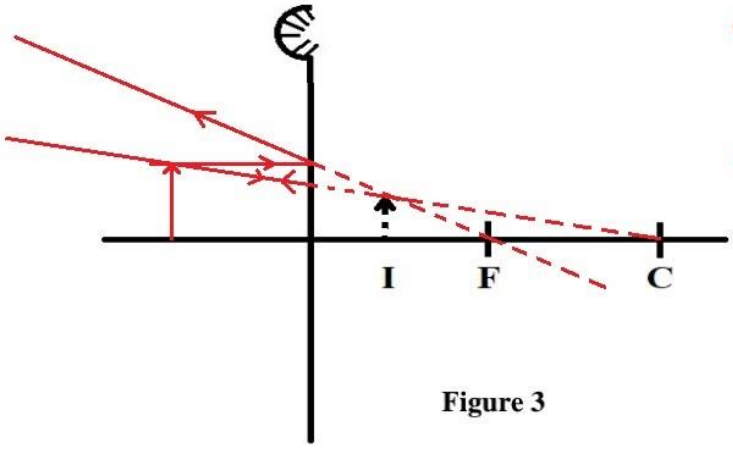


Figure 3

✓[1] 2 correct rays

✓[1] object

4. **Figure 4** shows the set-up for a simple cell.

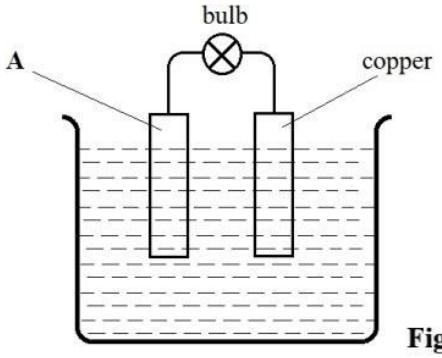


Figure 4

i) Name the **electrode A**. (1 mark)

Zinc ✓1

ii) Explain why the bulb goes off after only a short time. (1 mark)

Due to polarization ✓1 effect which causes insulation to the flow of current.

5. A 32g sample of a radio-active substance was reduced to 2g in 96 days. Determine its half-life.

(2 marks)

$32g \xrightarrow{t} 16g \xrightarrow{t} 8g \xrightarrow{t} 4g \xrightarrow{t} 2g$

let half life be t

$4t = 96$ ✓1

$t = 24$ days ✓1

OR $N = N_0\left(\frac{1}{2}\right)^{\frac{T}{t}}$ ✓1

$2 = 32\left(\frac{1}{2}\right)^{\frac{96}{t}}$

$\left(\frac{1}{2}\right)^4 = \left(\frac{1}{2}\right)^{\frac{96}{t}}$

$4 = \frac{96}{t}$ $t = 24$ days ✓1

6. A transformer in a welding machine supplies 6 volts from a 240V mains supply. If the current used in the welding is 30A. Determine the current in the mains (2 marks)

$\frac{V_s}{V_p} = \frac{I_p}{I_s}$

$\frac{6}{240} = \frac{I_p}{30}$ ✓1

$I_p = 0.75A$ ✓1

7. The figure below shows a photo-cell.

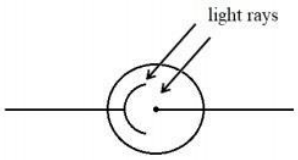


Figure 5

State the factor which determines the kinetic energy of the electrons emitted, hence show the relationship. (2 marks)

Frequency of incident light ✓1

E = hf ✓1

8. In a pin-hole camera, state the effect of making the pin-hole small but square in shape. (1 mark)

Image remains unaffected ✓1 by the change from a small circular hole to a small squared hole.

9. Suggest a reason why it is not possible to increase the strength of a magnet indefinitely. (1 mark)

At saturation point all dipoles face the same direction. ✓1

10. **Figure 6** shows a rectangular coil of a d.c. motor in a magnetic field rotating in a clockwise direction.

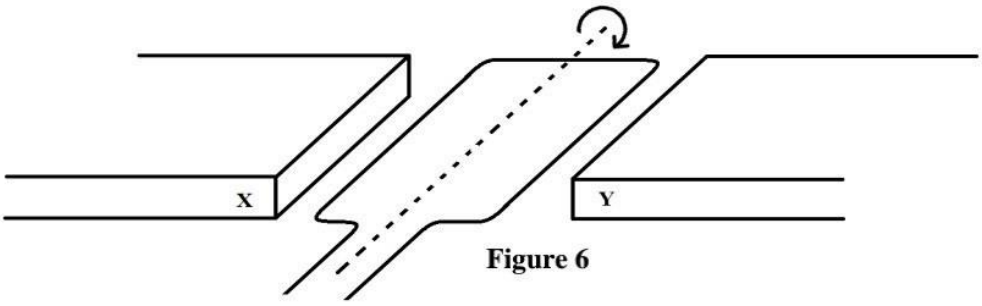


Figure 6

i) Indicate the identity of poles **X** and **Y** of the magnets. (1 mark)

X South

Y North

} ✓1 both correct (Flemming's left hand rule)

ii) Suggest **one** way of increasing the magnitude of the force in such a coil. (1 mark)

-Increasing the current -Increasing the number of turns of the coil -Increasing the strength of magnetic field [any one factor]

11. Give a reason why a fuse is always connected to the live wire in an electrical appliance. (2 marks)

Live wire carries current at full potential. ✓1 When current exceeds fuse rating, the fuse wire gets very hot and melts ✓1 hence disconnecting the circuit. This reduces risk of damage to the electrical appliance.

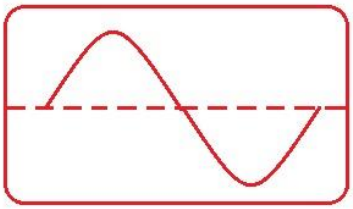
12. A time – base is adjusted so that it draws a horizontal line as shown in **Figure 7**, 50 times per second.

Figure 7

Draw a diagram of what is seen when the following are connected.

a) A battery which makes the upper y-plate positive. (1 mark)

b) An a.c. supply of 50Hz. (1 mark)



13. State **one** similarity and **one** difference between a camera and a human eye. (2 marks)

similarities

i) Both use converging lenses

ii) In both cases, the amount of light allowed in can be controlled; eye - iris, camera - diaphragm

iii) In both a real, inverted and diminished image is formed; on retina - eye, light sensitive film - camera

iv) In both cases the inner part is black to absorb rays choroid layer - eye, black paint - camera

differences

i) Focal length of eye changes while that of camera lens is constant

ii) The distance between lens and film in a lens camera can be varied zooming while it remains constant in eye

iii) A camera can only take one photo at a time when the shutter is open, while the eye forms constantly changing pictures.

14. Explain why high voltage is used for transmitting electrical power. (1 mark)

To minimise power loss ✓1 since the transmitting current will be low

($P = I^2R$)

SECTION B (55 MARKS)

Answer ALL questions in this section

15. a) State the meaning of the term photo-electric effect. (1 mark)

Production of electrons from a metal surface when the metal is illuminated by certain radiations. ✓1

b) **Figure 8** shows an arrangement used to investigate photo-electric effect.

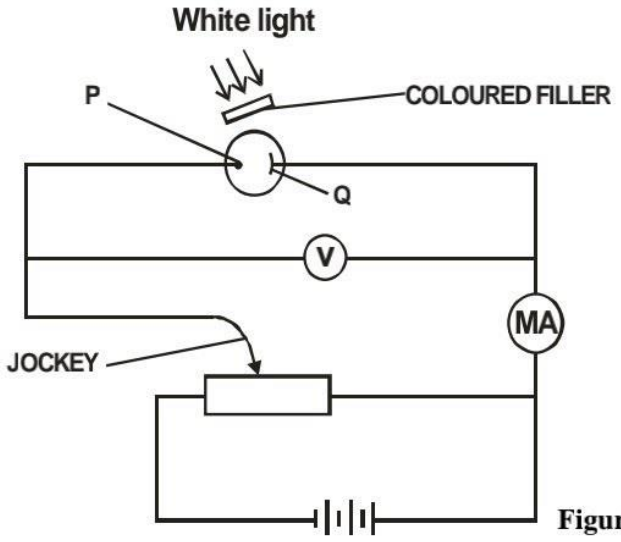


Figure 8

i) Name the parts marked **P** and **Q**. (2 marks)

P Anode ✓1

Q Cathode ✓1

ii) State **two** measurable quantities in this set up. (2 marks)

-Photocurrent ✓1

-Potential difference ✓1

iii) State how the intensity of light affects the photo-current. (1 mark)

Increase in intensity leads to increase in the number of photoelectrons hence photocurrent increases. ✓1

c) The results obtained for various monochromatic radiations of different colours are shown graphically in **Figure 9**.

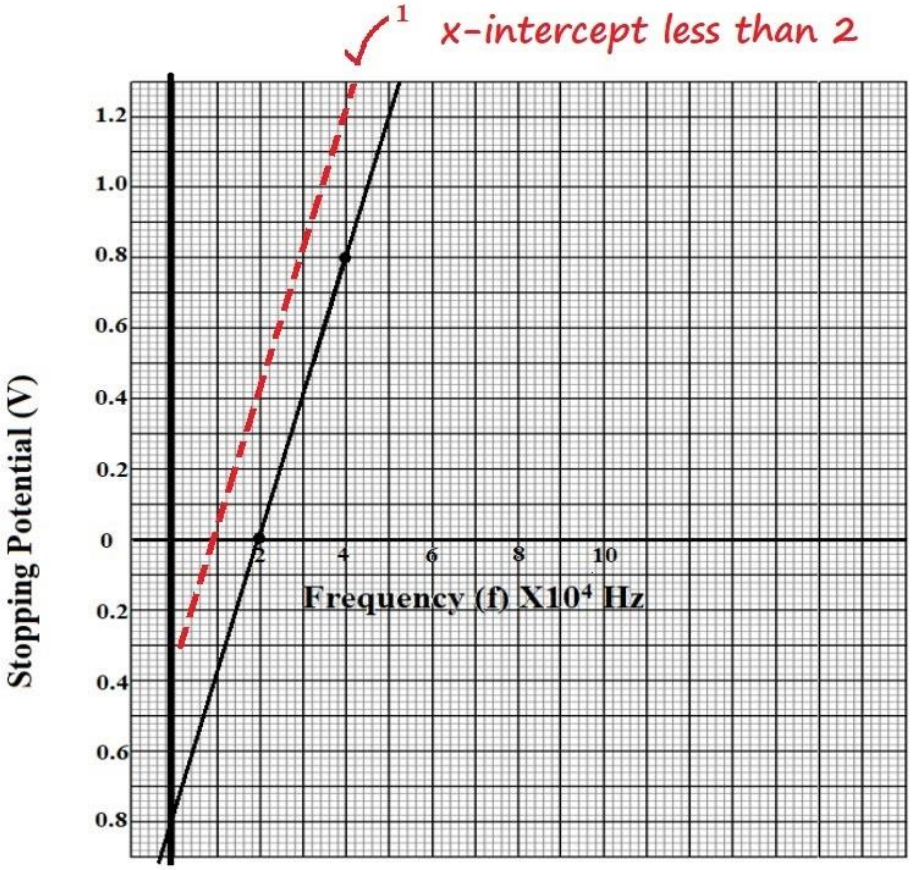


Figure 9

i) **Figure 9** indicates that there is a frequency below which no electrons are emitted. Explain this observation. (1 mark)

Energy is not enough to dislodge electrons from the metal surface since it is less than the workfunction of the metal. ✓1

ii) From the graph determine;

I) Plank's constant, **h** (Take electron charge, $e^- = 1.6 \times 10^{-19}C$) (3 marks)

gradient = $\frac{0.8 - 0}{(4-2)X10^{14}}$ ✓1

$= 0.4X10^{-14}$

but gradient = $\frac{h}{e}$

h = gradient X e

$h = 0.4X10^{-14} \times 1.6X10^{-19}$ ✓1

$= 6.4X10^{-34}JS$ ✓1

II) The work function of the metal, W_o (2 marks)

$W_o = hf_o$

$= 6.4X10^{-34} \times 2X10^{14}$ ✓1 (f_o from graph)

$= 1.28X10^{-19}J$ ✓1

III) Sketch on the same graph, the expected graph of another metal which has a lower work function than the metal used. (1 mark)

see graph

16. a) State the meaning of the term radio-active decay. (1 mark)

Disintegration of nuclei of certain atoms with release of energy. ✓1

b) State a factor that leads to radio – active decay of a nucleus. (1 mark)

-Too many neutrons

-Too few neutrons [any one factor]

c) Distinguish between nuclear fission and nuclear fusion. (2 mark)

Fission is the breaking of heavy nucleus into two or more nuclei ✓1

while fusion is the re-union of light nuclei into heavier nuclei. ✓1

d) A radio-active source, Aluminium plate and suitable detector were arranged as in **Figure 10**:

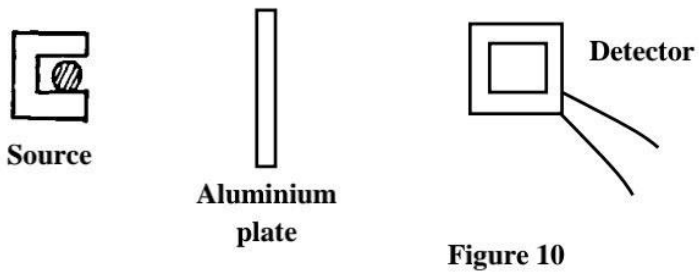


Figure 10

Before the source was introduced, the detector registered a reading of 40 counts per second. Explain this observation. (1 mark)

Due to background radiation from other radioactive sources in the surrounding. ✓1

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

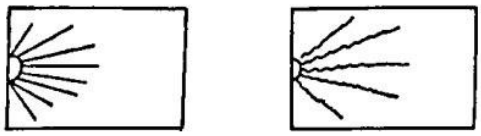
$$^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{90}_{38}Rn + {}^{a}_{b}X + 10\,{}^{1}_{0}n$$

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

a = 236 - 91 ✓1 = 145

b = 92 - 38 ✓1 = 54

ii) The following are tracks formed by radio-active radiation.



X Y

Figure 11

Identify the type of radioactive particle that forms each set of tracks. (2 marks)

X Alpha ✓1

Y Gamma ✓1

17. a) State **two** factors that determine capacitance of a parallel plate capacitor. (2 marks)

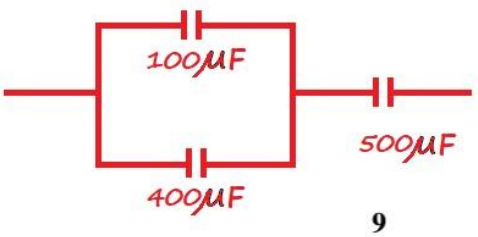
-Distance of separation of plates ✓1

-Dielectric constant ✓1

-Cross sectional area of plates [any two factors]

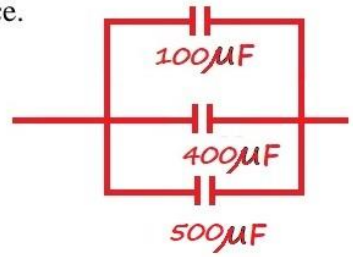
b) Three capacitors of capacitance 100μF, 500μF and 400 μF are connected together in a circuit. Draw a circuit diagram to show the arrangement of the capacitors which gives;

i) The effective capacitance of 250μF. (1 mark)



✓1

ii) Maximum capacitance. (1 mark)



✓1

c) **Figure 12** shows a circuit where a battery of e.m.f. 6V, a voltmeter, switches **x** and **y**, and two capacitors of capacitance 2μF and 4μF are connected.

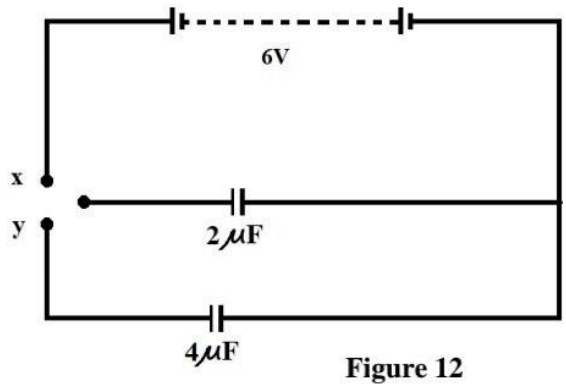


Figure 12

i) Determine the charge stored in the 2μF capacitor when switch **x** is closed and switch **y** is open. (2 marks)

$Q = CV$

$= 2X10^{-6} \times 6$ ✓1

$= 1.2X10^{-5}C$ ✓1

ii) When the switch **y** is finally closed and switch **x** is open, determine the potential difference across each capacitor. (4 marks)

Effective capacitance $C_T = 2\mu F + 4\mu F = 6\mu F$ ✓1

$V = \frac{Q}{C}$ ✓1

$= \frac{1.2X10^{-5}}{6 X10^{-6}}$ ✓1

$= 2V$ ✓1

18. **Figure 13** shows part of an X-ray tube. The anode is made up of a thick copper metal with embedded tungsten.

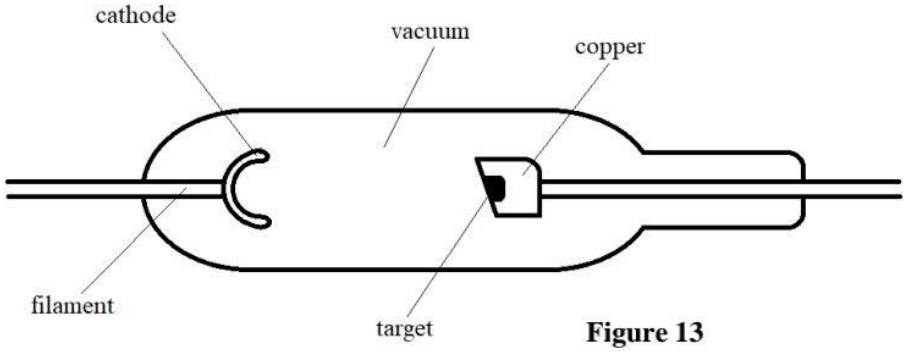


Figure 13

a) Explain why the tube is evacuated. (2 marks)

To avoid collision of cathode rays (electrons) ✓1 with air atoms which reduce the kinetic energy of X-rays. ✓1

b) Explain how the intensity of X-rays can be controlled. (2 marks)

High filament current ✓1 increases the number of cathode rays hence more X-rays are produced and vice versa. ✓1

c) State **one** property of the material used as a target. (1 mark)

Has a high melting point ✓1

d) An X-ray tube operates at 100kV between the cathode and the anode. Calculate the **maximum energy** of X-ray protons produced. (Take electronic charge = 1.6×10^{-19}C) (3 marks)

K.E. = eV ✓1

$= 1.6X10^{-19} \times 1,000,000$ ✓1

$= 1.6X10^{-13}$J ✓1

19. a) **Figure 14(a)** shows plane wave fronts produced in a ripple tank.

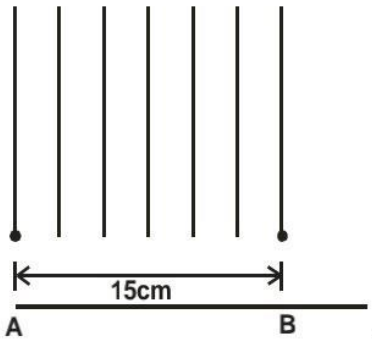


Figure 14(a)

Given that the distance between **A** and **B** is 15cm, determine the wavelength of the wave. (2 marks)

$\lambda = \frac{15}{6}$ ✓1

$= 2.5cm$ ✓1

b) **Figure 14(b)** shows the wave starting from two coherent sources S_1 and S_2.

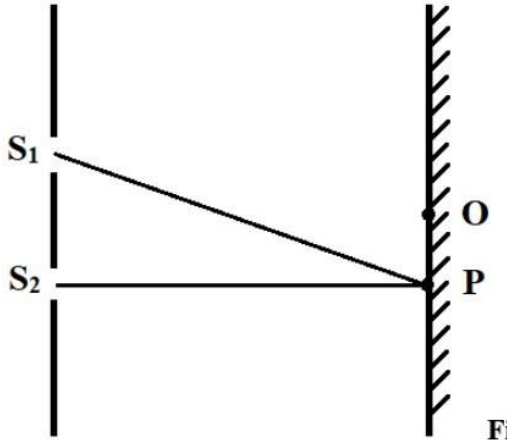


Figure 14(b)

What would be observed at **P** if the waves are:

i) Light waves. (1 mark)

Bright fringe ✓1

ii) Sound waves. (1 mark)

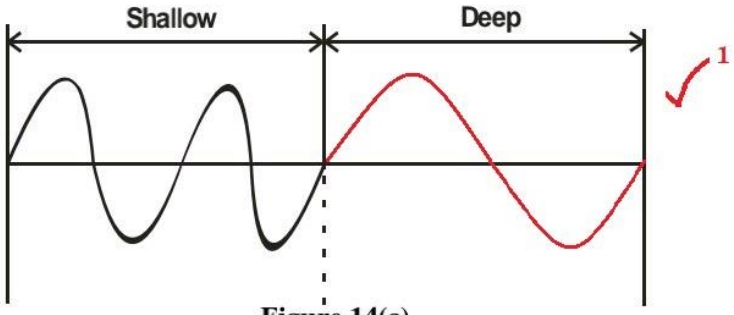
Big crest ✓1

c) Give **one** example of a transverse wave and **one** example of a longitudinal wave. (2 marks)

Transverse – water waves ✓1

Longitudinal – sound waves ✓1

d) **Figure 14(c)** shows a displacement of a particle in a progressive wave incident on a boundary between shallow and deep regions.



✓1

Figure 14(c)

i) Assuming there was no loss of energy, complete the diagram to show what is observed after the boundary (1 mark)

.

ii) Explain the observation in **(i)** above. (2 marks)

The speed increases ✓1 leading to increase in wavelength ✓1 of the wave.

20. **Figure 15** shows a rectifier circuit for an alternating current input using four diodes

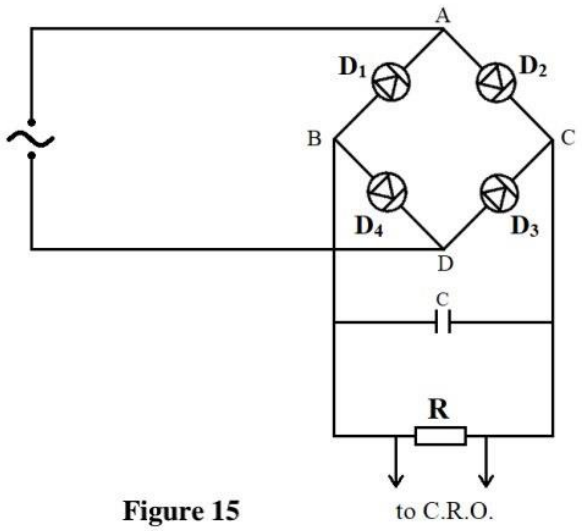


Figure 15

(i) Explain how rectification is done (3 marks)

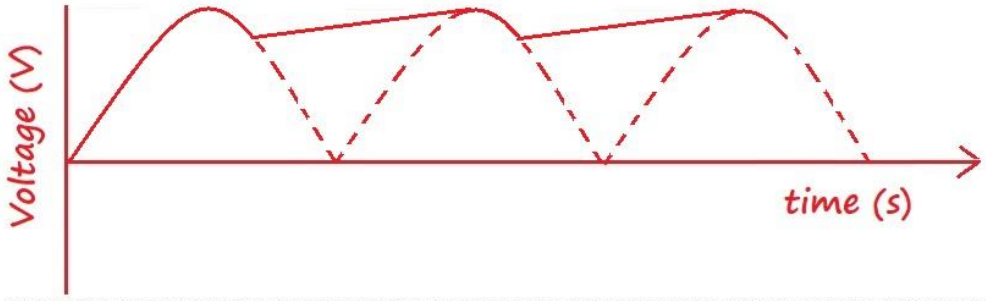
During the first half cycle, D_2 and D_4 are forward biased. ✓1 Current flows from A, D_2, C, B, D_4, D via the load. ✓1

During the second half cycle, diodes D_3 and D_1 are forward biased. ✓1 Current flows from D, D_3, C, B, D_1, A via the load R.

(ii) State the function of the capacitor (1 mark)

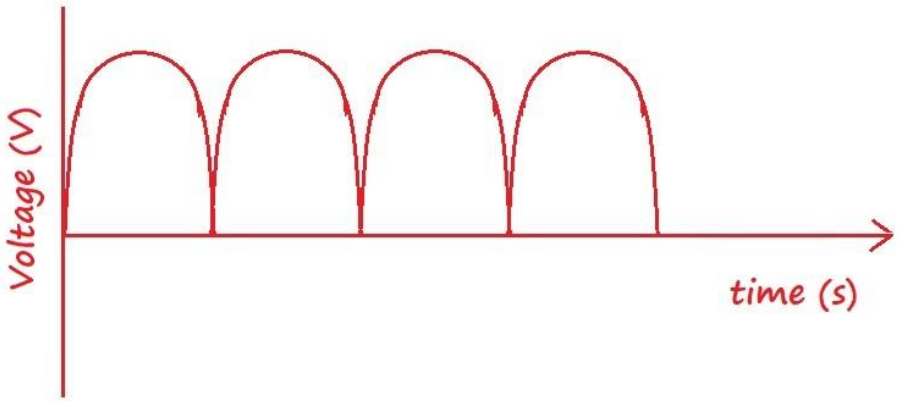
To smoothen the output ✓1

(iii) Sketch a graph to show how the p.d. across the **resistor R** varies with time. (1 mark)



✓1

(iv) On the space provided, sketch a wave form when a C.R.O. is connected across **R** when the capacitor has been removed. (1 mark)



✓1