## SECTION A (25 MARKS)

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

1. Distinguish between real and virtual Image (1mk)

Real - Formed by intersection of real rays while virtual - formed by intersection of virtual rays.

a) A pinhole camera forms an image of size 10cm. The object is 5m tall and 20m away from the pinhole. Find the length of the pinhole camera. (2mks)

$\frac{v}{u} = \frac{hi}{ho}$

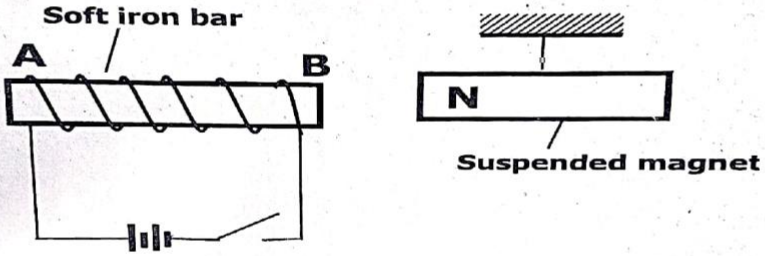
$\frac{v}{2000} = \frac{10}{500}$ ✓1

40cm ✓1

or

0.4m

2. a) The **figure 1** below shows a soft iron bar that's placed in a coil near a free suspended magnet.




State and explain the observation made when the switch is closed. (2mks)

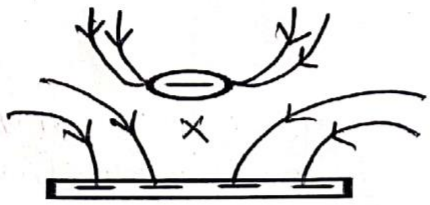
Suspended magnet is repelled / moves away from the electromagnet ✓1

Reason: Current flows forming a north pole at B ✓1

b.) Give a reason why attraction in magnetism is not regarded as a reliable method of testing for polarity. (1mk)

- Occurs either between unlike poles of a magnet or btn a magnet and a ✓1 magnetic material.

3. The **figure 2** below shows an isolated negative charge placed closer to a negatively charged plate. Draw the electric field patterns. (1mk)

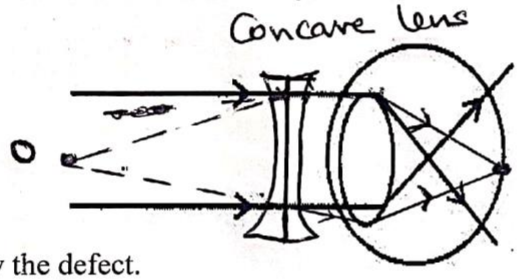



All arrows must be correct ✓

4. (a)Define the term principal focus for a diverging lens. (1mk)

Pt close to and Parallel to the Principal axis where all rays appear to diverge after refraction ✓1

(b) The **figure 3** below illustrates an eye defect;




Correct rays + Concave lens. ✓
Accept lens Symbol ✓ (1mk)

(i) Identify the defect.

Myopia / short sightedness. ✓1

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

5. (a) State the effect of pressure on the speed of sound in air. (1mk)

No Effect ✓1

(b) A boy stands 190m from a high wall and claps his hands. If he hears an echo1.3 Seconds later, calculate the speed of sound in air. (2mks)

$V = \frac{2d}{t}$

$\frac{2 \times 190}{1.3}$ ✓

292.3 m/s ✓1

6. State any two factors that determine the heating effect by an electric current. (2mks)

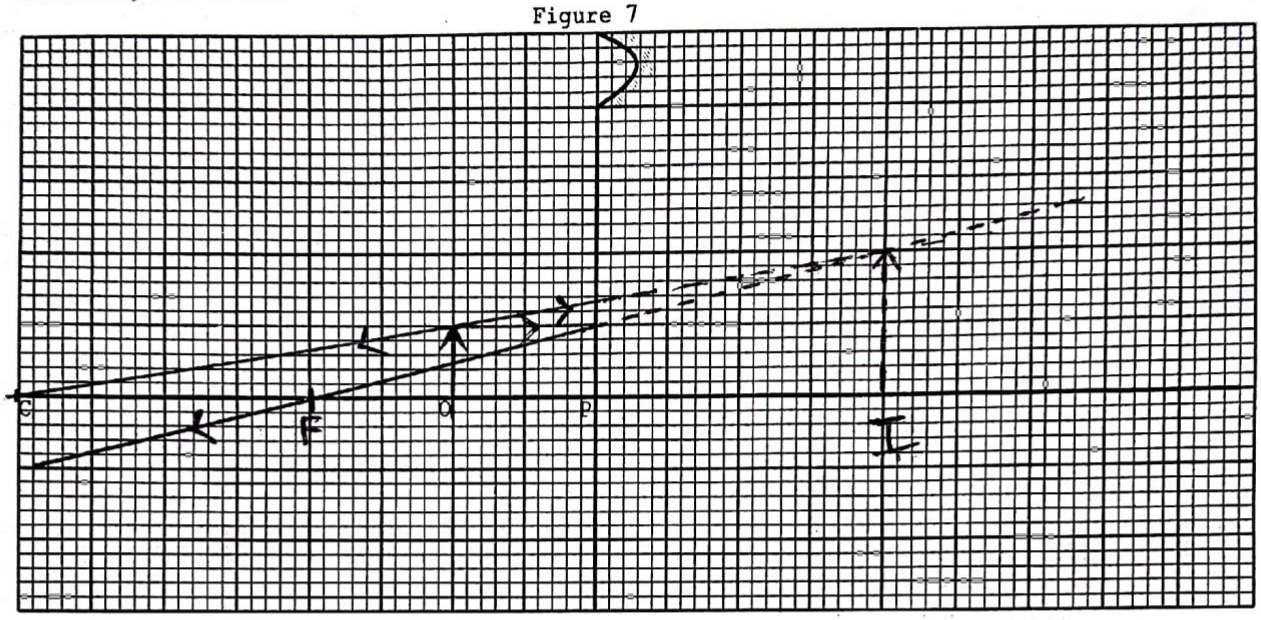
- Resistance ✓1
- Time of heating ✓1
- Current ✓1

any 2×1 ✓

~~Any~~ Any 2 correct Rays ✓2
Image Position + Nature ✓1

7. **Figure 4** below shows an object, O placed 10 cm in front of a concave mirror whose radius of curvature, C is 40 cm.

Figure 7




On the same figure, draw a ray diagram to show the position of the image formed. (3 mks)

8. **Figure 5** shows the table of electromagnetic. Spectrum in the increasing order of wavelengths.

| | | | | | | |
|---|---|---|---|---|---|---|
| **P** | **x-rays** | | **Q** | **Infra-red** | | |

Identify the radiation marked (2mks)

P. Gammar Radiation ✓1

Q. Visible light. ✓

9. State **two** reasons why the earth pin is normally longer than the other two pins in a three pin plug. (2mks)

- Openining the socket blinds. ✓1
- Conducting any leaked charges (Earthing) ✓1

10. The **figure 6** below shows a cross section of a dry cell.

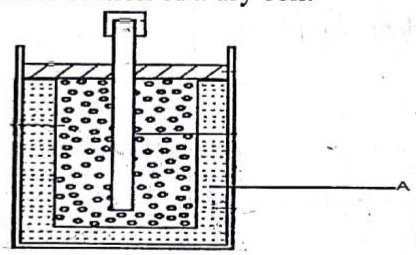



**Figure 6**

(i) Name the part labeled A (1 mark)

Ammonium chloride Paste. ✓1

(ii) State the use of manganese (iv) oxide in the cell (1 mark)

Depolarizing agent/depolarizer ✓1

OR Oxidizing hydrogen gas to water

**SECTION II (55 marks)**

11. i) In large currents, large resistors in parallel are preferred to low resistors in series. Explain (2mks)

Parallel Resistors - lower effective/total resistance than those in Series. ✓1

ii) State one condition under which ohm's law is obeyed in a metal conductor. (1mk)

✓ Temperature ✓ X-Section Area ✓ any 1x1

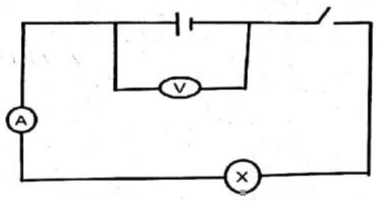
✓ Pressure ✓ - Length ✓

iii) A circuit constituting a battery, a metal wire, an ammeter and a switch connected in a series. The switch is closed and the ammeter reading noted. The metal wire is now heated. State observation on the ammeter reading and give a reason for your answer. (2mks)

Ammeter reading reduces. ✓1

Heat Resistance of a metal increases with increase in heat thus low current registered. ✓1

b.) In the **figure** 7 below, the voltmeter reads 2.4V when the switch is open. When the switch is closed, the voltmeter reads 2.1V and the ammeter reads 0.15A.




Determine the

a) E.m.f of the cell (1mk)

2.4V ✓1

b) Internal resistance of the cell (3mks)

Lost voltage = 2.4 − 2.1

= 0.3V ✓1

Ir = 0.3 ✓1

0.15r = 0.3

r = 2.0Ω ✓1

c) Resistance of the bulb (2mks)

V = IR

2.4 = 0.15R ✓1

R = 14Ω ✓1

OR

E = I(R + r)

2.4 = 0.15(R + 2) ✓1

R = 14Ω ✓1

d.) Explain why a voltmeter of high resistance is more accurate in measuring potential difference that one of low resistance (1mk)

Allows negligble/no current to flow thus not interfering the current in the circuit ✓1

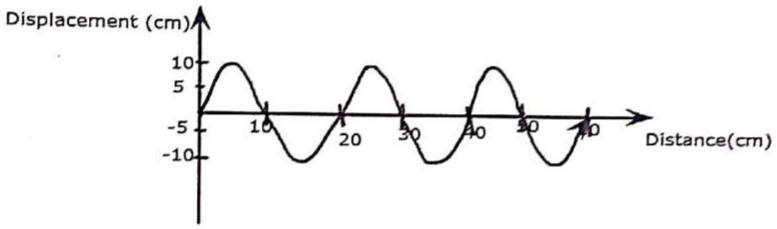
d.) Distinguish between electrical resistance and a resistor (1mk)

Resistance – opposition offered by a conductor to the flow of current; Resistor – a device that designed to oppose current flow.

12. a) I. Define the term wavelength of a longitudinal wave (1mk)

Distance btn any two successive Compressions or rarefactions. ✓1

II. The **figure 8** below shows a displacement distance for a certain wave motion.




Determine

i) The amplitude of the wave (1mk)

10cm ✓1

ii) The wavelength of the wave (1mk)

20cm. ✓1

iii) Given that the frequency of the wave is 40Hz, determine the:

I. Periodic time (T) (1mk)

$T = 1/f = 1/40 = 0.025$ ✓1

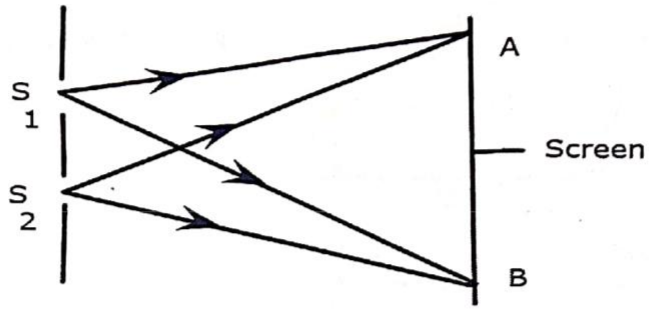
II. Speed of the wave (3mks)

$V = \lambda f$ ✓1

$0.2 \times 40$ ✓1

8m/s ✓1

b.) **Figure 9** below shows light rays from two coherent sources $S_1$ and $S_2$ falling on screen. Dark and bright fringes are observed between A and B




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

- Produce Coherent waves that cause interference ✓1

ii) State how

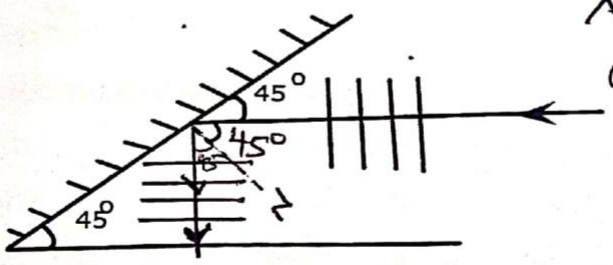
I. Bright fringes are formed (1mk)

- Due to Constructive ✓ interference / OR when two crests or troughs Meet ✓1

II. Dark fringes are formed (1mk)

Due to destructive ✓ interference / OR when a crest and trough of the two waves meet ✓1

c). **Figure10** below shows plane water waves incident on a plane reflector placed at an angle to the path of the waves.




$\lambda_i = \lambda_r$ ✓1

angles ✓1

Complete the diagram to show the reflected waves (2mks)

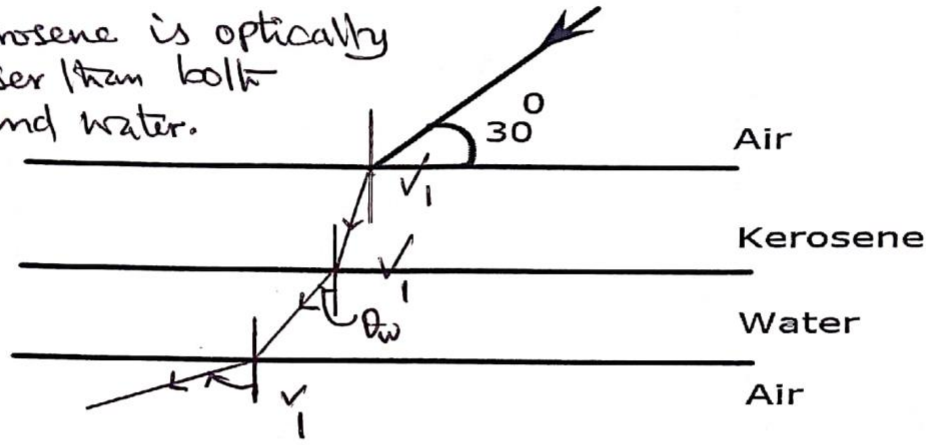
Note its Sine Not Sin

13. State Snell's law (1mk)

Ratio of the Sine of angle of incidence to the Sine of angle of refraction is constant for a given pair of parallel media.

a.) The **Figure 11** below shows a ray of light travelling incident on air-kerosene interface.

Note Kerosene is optically denser than both air and water.




On the same diagram sketch the path of light as it traverses through the media showing the angle of refraction in air (3mks)

(i) If the speed of light in kerosene is $2.08 \times 10^8$ m/s, find the refractive of kerosene. (**speed of light in air=$3.0 \times 10^8$**) (2mks)

$$n = \frac{c}{v}$$

$$\frac{3.0 \times 10^8}{2.08 \times 10^8} \checkmark_1$$

$$1.442 \checkmark_1$$

iii.) Determine the angle of refraction in water ($_an_w = 4/3$) (4mks)

$$_an_k = \frac{\sin 60}{\sin r}$$

$$1.442 = \frac{0.8660}{\sin r}$$

$$r = \sin^{-1}\left(\frac{0.8660}{1.442}\right)$$

$$= 36.91^\circ \checkmark_1$$

$$_kn_w = \frac{\sin 36.91}{\sin \theta_w} \checkmark_1$$

But $_kn_w = {}_kn_a \cdot {}_an_w$

$$= \frac{1}{1.442} \times \frac{4}{3} \checkmark_1$$

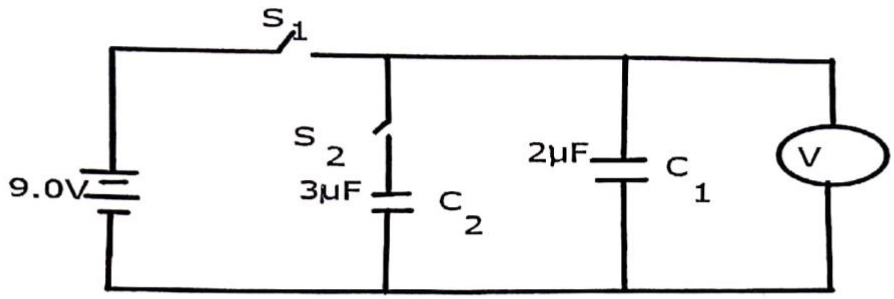
$$(0.9246)$$

Accept any alternative work but correct.

$$\therefore \theta_w = \sin^{-1}\left(\frac{\sin 36.91}{0.9246}\right)$$

$$= 40.50^\circ \checkmark_1$$

14. The **Figure 12** below shows a circuit with a battery, two switches, two capacitors and a volt meter




Determine

(i) The charge on $C_1$ when switch $S_1$ is closed and $S_2$ open. (2mks)

$Q = C_1V$ ✓

$2 \times 9$ ✓1

$1.8 \times 10^{-5}C$ ✓2 OR $18\mu C$ ✓1

ii.) The effective capacitance; $C_T$ when both switches $S_1$ and $S_2$ are closed. (3mks)

$C_T = C_1 + C_2$ ✓

$3 + 2$ ✓1

$5\mu F$ or $5.0 \times 10^{-6}F$ ✓1

(b)State and explain the expected final reading on the voltmeter when switch $S_1$ is closed while $S_2$ is open. (2mks)

9.0V ✓1

The p.d across a fully charged Capacitor $C_1$ is equal to the voltage of the source ✓1

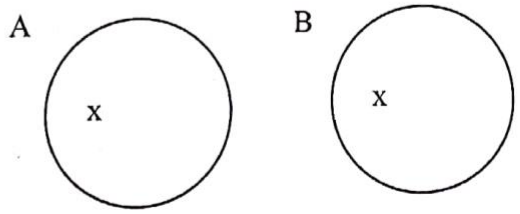
(c)Determine the expected reading on the voltmeter when switch $S_1$ is closed for a while and opened and switch $S_2$ is then closed. (2mks)

Charge on $C_1 = 1.8 \times 10^{-5}C$

$S_2$ - closed, $1.8 \times 10^{-5}C$ will be shared to charge $C_2$

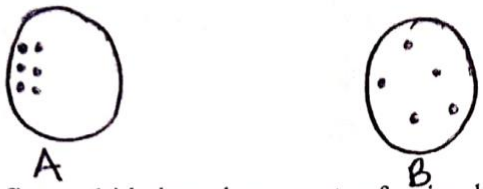
$\therefore V = Q/C = \frac{1.8 \times 10^{-5}}{5 \times 10^{-6}}$ ✓1 $= 3.6V$ ✓1

(d)The **Figure 13** below shows a polythene ball A and an aluminum coated polystyrene ball B.



Negative charges were introduced in each of the balls at the point marked x.

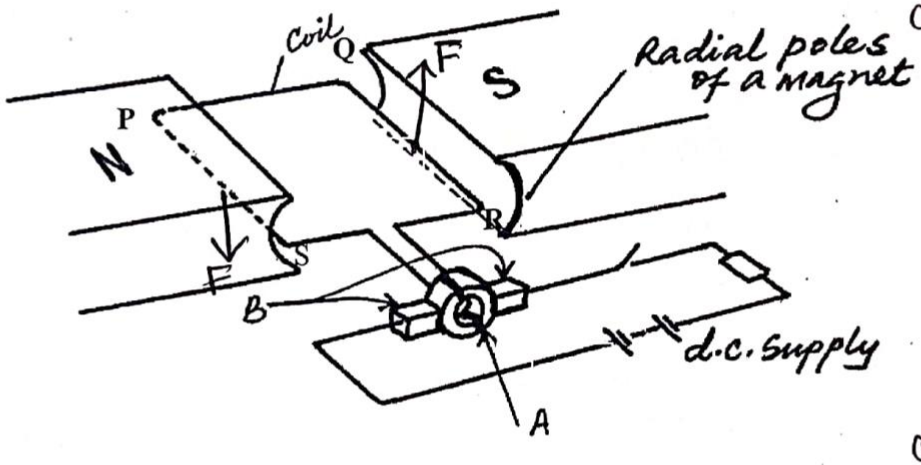
Draw similar balls and for each, indicate the final distribution of the charges .
(Use 6 dots to represent the charges in each case.) (2mks)




Uniform distribution.

15.(a) The **figure 14** below shows parts of a simple electric motor.

F-Must be shown on the coil.




(a)Show the direction of the forces F acting on sides **QR** and **PS** of the coil. (1mk) On the diagram.

(b)State the function of the devices; (2mks)

(i) A Reverse direction of current every half cycle ✓1
rotation of the coil. ✓1

(ii) B Conduct current / Lubricant ✓1

(c) State two ways of increasing the rotation of the coil. (2mks)

- Use a stronger Magnet ✓
- Increase the no. of turns of wire ✓
- Increase current ✓
- Winding the wire on a soft iron core ✓ 1

(d) (i) State one source of energy loss in a transformer (1mk)

- Eddy currents ✓ Copper Losses ✓ any 1x1.
- Hysterisis Loss ✓

(ii) How can the above energy loss be minimized. (1mk)

Follow Student's work above ✓

Marks in (ii) is tied to d(i)

ii) A transformer is used on the 240V A.C supply to deliver 9.0A at 80V to a heating coil. If 10% of the energy taken from the supply is dissipated in the transformer itself, what is the current in the primary winding? (3mks)

Power output $= V_s I_s$.

$80 \times 9$

$= 720W$ ✓1

$80 \rightarrow 720$

$100 \rightarrow ?$

Power Input $= \frac{100 \times 720}{80} = 800W$ ✓1

Power Input $= V_p I_p$.

$800 = 240 \times I_p$.

$I_p = \frac{800}{240}$

$= 3.333A$ ✓1

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