SECTION A (25 MARKS)

Answer ALL the questions in this section in the spaces provided

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

Real Images are images that can be focused on a Screen While virtual images cannot.

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)

$h_i' = 10cm$
$h_o = 500cm$
$v =$
$u = 2000cm$

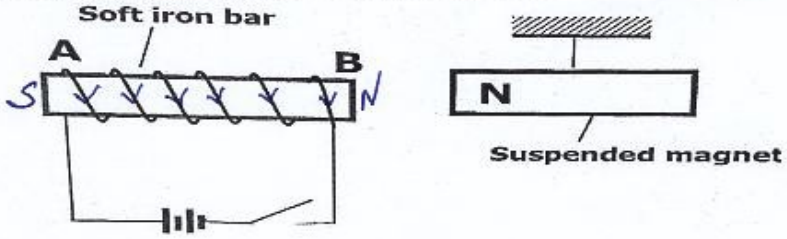
$\frac{h_i'}{h_o} = \frac{v}{u}$

$\frac{10}{500} = \frac{v}{2000}$

$\frac{40}{200}d = \frac{500}{500}v$

$v = 40\,cm$

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



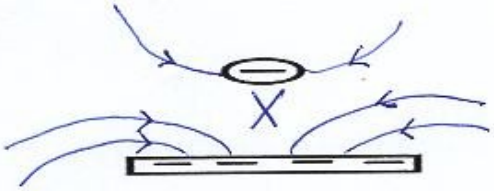
State and explain the observation made when the switch is closed. (2mks)

The Suspended Magnet is repelled and pushed away. when the circuit is closed, current flow and a North pole at end B is created which repels with the North pole of the Suspended Magnet.

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

Attraction in Magnetism can occur between a Magnet and a Magnetic Material and also between Unlike poles of two Magnets.

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



4. Two pins are hanging from a magnet as shown in the diagram below **(figure 3)**

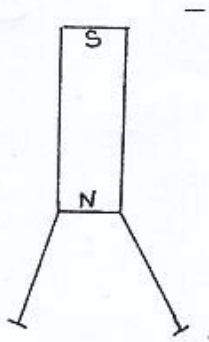


fig 3

Explain why they do not hang vertically downwards. (2mks)

The pins ends gains similar polarity (by induction) i.e Both hanging ends becomes North poles hence they repels each other.

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

Pressure has no effect on the speed of air provided the temperature is kept constant.

(b) A boy stands 190m from a high wall and claps his hands. If he hears an echo 1.3 Seconds later, calculate the speed of sound in air. (2mks)

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

$= \frac{2 \times 190}{1.3}$

$= \frac{380}{1.3}$

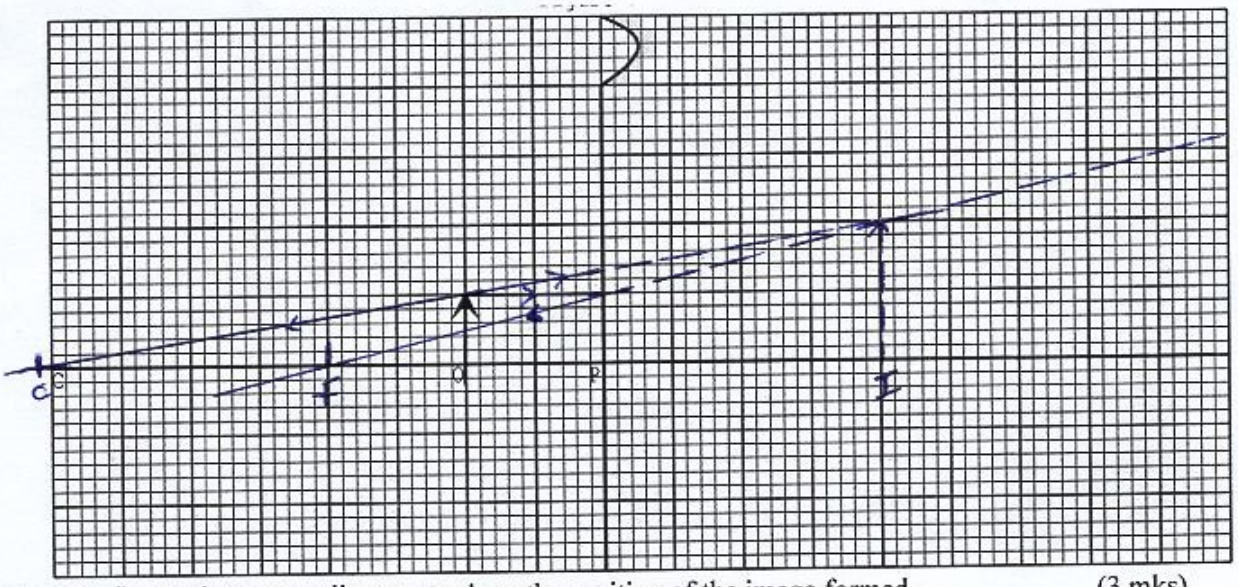
$= 292.31 \text{ m/s}$

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

i) Resistance of the conductor.
ii) Time taken to heat.
iii) Current supplied (amount)

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.

Horizontal Scale : 1cm rep 5 cm



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

8 State two advantages of an alkaline battery over lead acid battery. (2mks)

i) Requires Less Maintenance.
ii) Large current can be drawn from them for a longer time.
iii) Highly portable.

9. An electric bulb with filament of resistance 480Ω is connected to 120 V mains supply. Determine the energy dissipated in 7 min (3 mks)

$E = \frac{V^2 t}{R}$ | $= \frac{120^2 \times 7 \times 60}{480}$ | $= \frac{6048\,000}{480}$ | $= 12600$ Joules.

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

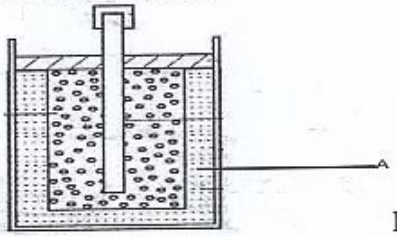


Figure 6

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

Ammonium Chloride Jelly/paste.

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

It acts as the depolariser.

SECTION II (33 marks)

11. a) i) In large currents, large resistors in parallel are preferred to low resistors in series.
Explain Parallel resistors allow diversion of current hence they do not overheat. (1mk)

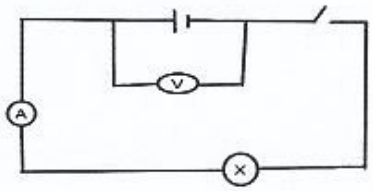
ii) State one condition under which ohm's law is obeyed in a metal conductor. (1mk)

- If the temperature is kept constant.
- Physical conditions are constant.

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)

- The reading reduces.
- Resistance of conductors increases with increase in temperature hence current flowing reduces.

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

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

2.4V (when circuit is open)

ii) Internal resistance of the cell (3mks)

$E = V + Ir$

$2.4 = 2.1 + (0.15 \times r)$

$2.4 = 2.1 + 0.15r$

$2.4 - 2.1 = 0.15r$

$\frac{0.3}{0.15} = \frac{0.15r}{0.15}$

$r = 2\Omega$

iii) Resistance of the bulb (2mks)

$V = IR$

$2.1 = 0.15 \times R$

$R = \frac{2.1}{0.15} = 14\Omega$

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

High resistance voltmeters takes less current hence can even be used when current is low.

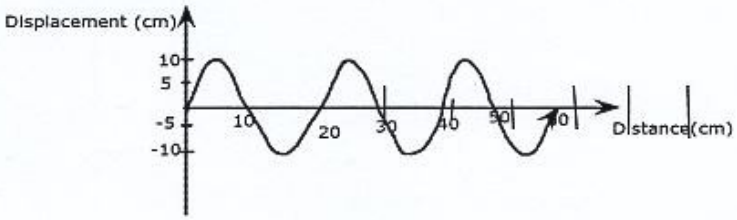
d.) Distinguish between electrical resistance and a resistor (1mk)

Electrical resistance is the opposition offered by a conductor to the flow of current while resistor are conductors specially designed to offer a particular resistance to the flow of electric current.

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

This is the distance between two successive compressions or rarefactions.

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



b) Determine

i) The amplitude of the wave (1mk)

10 cm

ii) The wavelength of the wave (1mk)

20cm.

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

I. Periodic time (T) (1mk)

$T = \frac{1}{F} = \frac{1}{40} = 0.025$ Sec.

II. Speed of the wave (3mks)

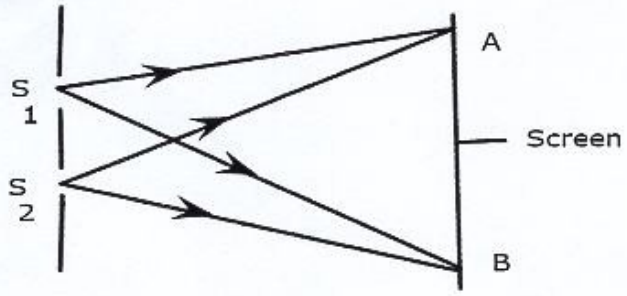
$V = f\lambda$

$\lambda = \frac{20}{100} = 0.2m.$

$V = 40 \times 0.2$

$V = 8$ m/s

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)

They are for defraction of source light so as to produce two 'equal' waves.

ii) State how

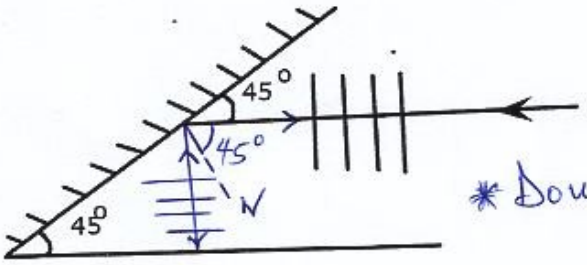
I. Bright fringes are formed (1mk)

Through constructive interference between the two waves

II. Dark fringes are formed (1mk)

Through destructive interference.

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



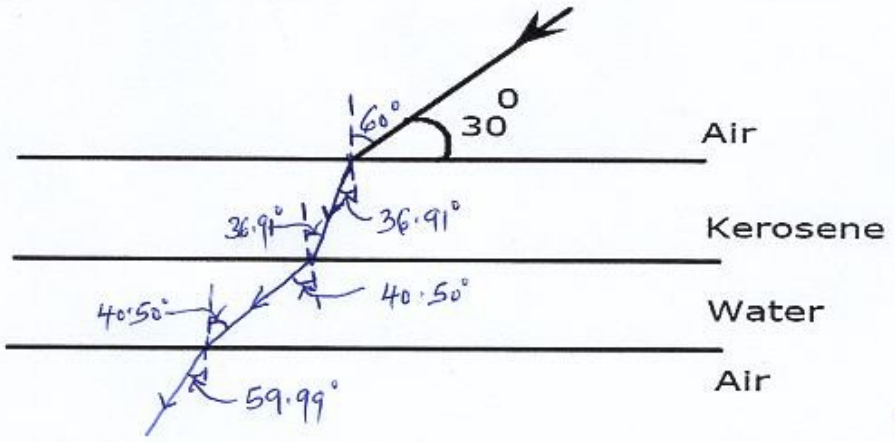
* Double reflection.

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

13. a.) State Snell's law (1mk)

The law states that for a given pair of medium, the ratio of the sine of angle of incidence to the sine of angle of refraction is a constant.

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



$_a\eta_k$

(i) If the speed of light in kerosene is 2.08 x10^8 m/s, find the refractive of kerosene. **(speed of light in air=3.0 x10^8)** (2mks)

$\eta = \frac{\text{Velocity in Air}}{\text{Velocity of Light Kerosene}}$

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

$= 1.442$

$_a\eta_k = 1.442$

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

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

$\frac{\sin 60}{\sin x} = 1.442$

$\frac{\sin 60}{1.442} = \sin x$

$\sin x = 0.6640$

$x = 36.91°$

$_k\eta_a\,_a\eta_w =$

$\frac{500}{721} \times \frac{4}{3} = \frac{2000}{2163}$

$_k\eta_w = 0.9246$

$\frac{\sin i}{\sin r} = 0.9246$

$\frac{\sin 36.91}{\sin r} = 0.9246$

$\frac{\sin 36.91}{0.9246} = \sin r$

$\sin r = 0.6495$

$r = 40.50°$

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

$\frac{\sin i}{\sin r} = \frac{3}{4}$

$\frac{\sin 40.50}{\sin r} = 0.75$

$\frac{\sin 40.50}{0.75} = \sin r$

$\sin r = 0.8659$

$r = 60°$

14. (a) State Ohm's law. (1 mark)

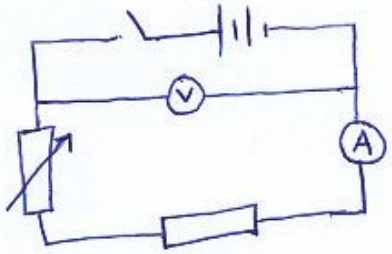
The Law states that the current flowing through a conductor is directly proportional to the potential difference across the conductor provided the temperature is kept constant.

(b) You are provided with the following apparatus:

- Connecting wires ✓
- An ammeter ✓
- Fixed resistor ✓
- A voltmeter ✓
- A variable resistor ✓
- Switch ✓
- 2 dry cells in a cell holder ✓

(i) In the spaces below, draw the circuit that can be used using the apparatus above to verify Ohm's Law.

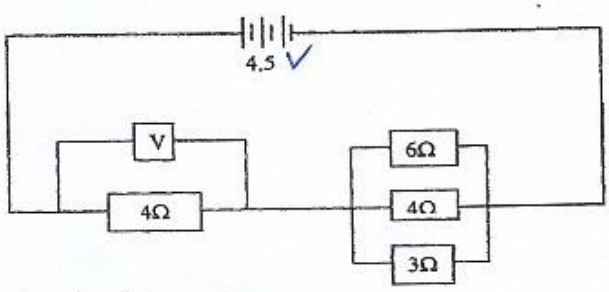
(3 marks)



(ii) Briefly explain how you can obtain the results to verify Ohm's law. (4mrk)

- Close the switch and record the reading on the voltmeter and that of Ammeter on a table.
- Adjust the variable resistor to have a new reading of the current in Ammeter and p.d at the voltmeter.
- Repeat the procedure and tabulate the data on a table.
- Plot a graph of p.d (V) against current (A). The graph is a straight line through the origin (proving the direct proportion)
- The gradient of the graph ($\frac{\Delta V}{\Delta A}$) gives the resistance of fixed resistor ~~[illegible]~~.

(c) Study the circuit diagram below and answer the questions that follow.



(i) Calculate the effective resistance of the circuit. (3mrks)

Parallel Arrangement:

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_2}$

$= \frac{1}{6} + \frac{1}{4} + \frac{1}{3}$

$= 0.1667 + 0.25 + 0.3333$

$\frac{1}{R_T} = 0.75$

$R_T = 1.333$

Series

$R_T = R_1 + R_2$

$= 1.333 + 4$

Effective Resistance $= 5.333\ \Omega$

(ii) Find the voltmeter reading. (2mrks)

$V = IR$

$4.5 = I \times 5.333$

$I = \frac{4.5}{5.333}$

$I = 0.8438A$

Current through 4Ω is also $0.8438A$

$V = IR$

$V_{4\Omega} = 0.8438 \times 4$

$= 3.3752\ V$

15. a) Describe two factors that affects the strength of an electromagnet (2 mks)

i) Amount of current → The high the amount of current, the stronger.

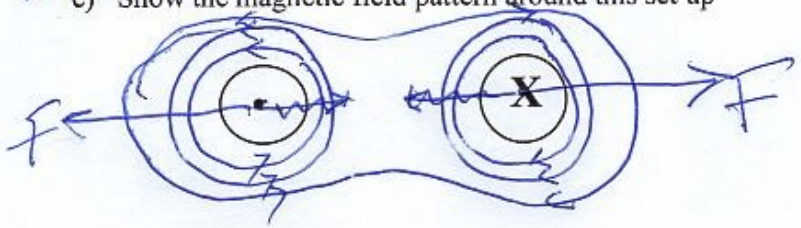
ii) Shape of core → U-shaped are stronger.

iii) Number of turn → The more the stronger.

b) State Fleming's left hand rule (1 mks)

If the left hand is held with the thumb, the first finger and the second fingers mutualy at right angles so that the first finger points in the direction of the magnetic field and the second finger in the direction of the current then the thumb points in the direction of motion of the force.

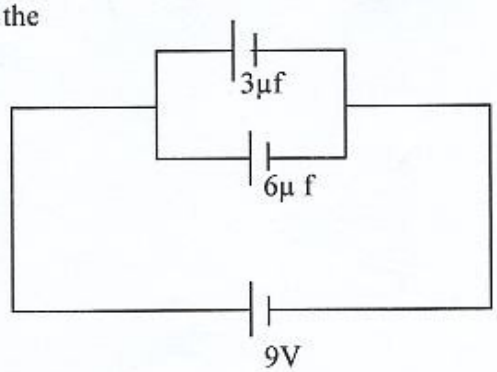
c) Show the magnetic field pattern around this set up (2 mks)



16. a) Define the term capacitance (1 mks)

① This is a measure of the amount of charge a capacitor can store; ② charge stored per unit voltage.

b) Determine the



i) Charge in 3μF (2 mks)

$Q = CV$ ✓

$= 3 \times 10^{-6} \times 9$ $\Big| = 2.7 \times 10^{-5} C$

ii) P.d across 6μF (2 mks)

9V