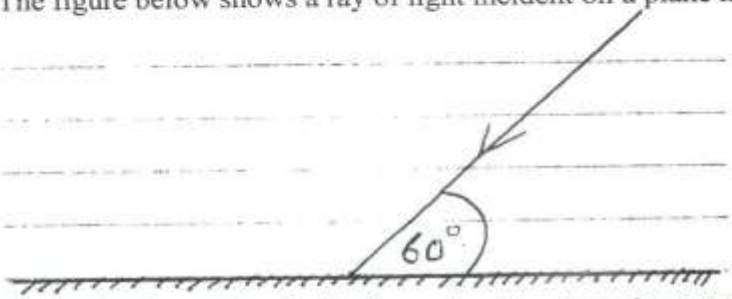
FORM THREE PHYSICS PAPER 2
MARKING SCHEME

SECTION A: (25 MARKS)

1. Under which condition is the potential difference across the terminal of a cell equal to its e.m.f? (1mk)

When the cell is on open circuit.

2. The figure below shows a ray of light incident on a plane mirror



Determine the angle of reflection when the mirror is rotated 10° anticlockwise (2mks)

$r = 30 + (2 \times 10)$
$= 50°$

3. A soldier standing some distance from a wall blows a whistle and hears its echo 1.8 seconds later. How far is the wall from the soldier? (Speed of sound in air = $330ms^{-1}$) (3mks)

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

$d = \frac{Vt}{2} = \frac{330 \times 1.8}{2}$

$= 297M.$

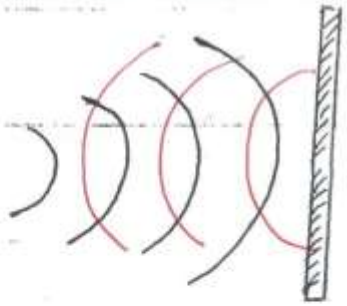
4. Other than temperature, state any other factor that affects the resistance of an ohmic conductor (1mk)

- temperature
- length of conductor
- cross-sectional area of conductor.

5. Using the domain theory, differentiate between magnetic and non-magnetic materials (1mk)

In magnetic materials, the magnetic domains are aligned.
In non-magnetic materials the magnetic domains face in all directions.

6. The figure below shows circular waves approaching a plane barrier.



On the same diagram, sketch the reflected rays (1mk)

7. State one application of the following: (2mks)

a) Convex mirrors

As a driving mirror or in supermarts.

b) Parabolic mirrors

— reflectors
— solar concentrators.

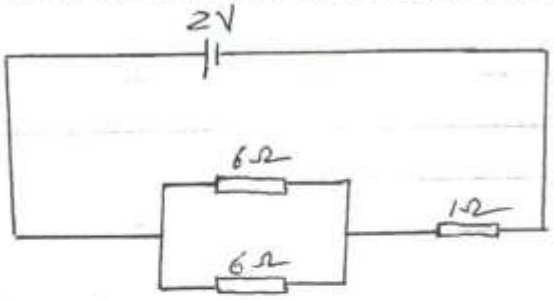
8. A pin is placed below the surface of transparent water of depth 10cm and refractive index 1.33. Calculate the vertical displacement of the pin (3mks)

$n = \frac{\text{real depth}}{\text{apparent depth}}$

$\text{apparent depth} = \frac{10}{1.33} = 7.52\text{cm}.$

$\text{displacement} = 10 - 7.52 = 2.48\text{cm}.$

9. The figure below shows an arrangement of resistors in a circuit.



Determine:

a) The effective resistance (2mks)

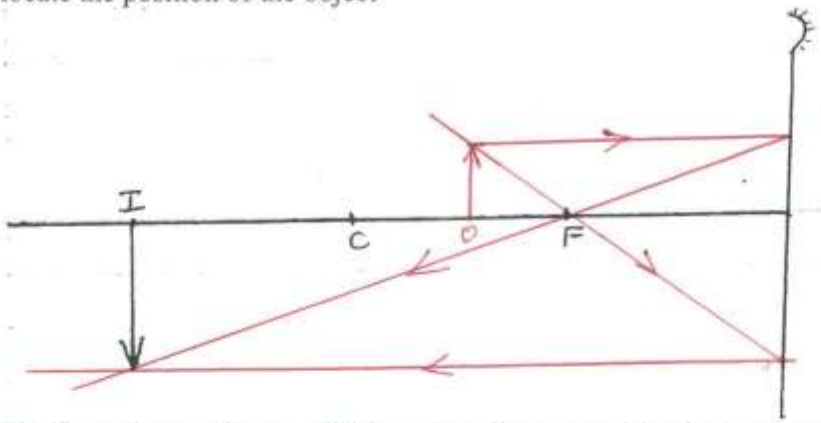
$R = \left(\frac{6 \times 6}{6+6}\right) + 1 = 3 + 1 = 4\Omega.$

b) The voltage drop across the 1Ω resistor (3mks)

$I = \frac{V}{R} = \frac{2}{4} = 0.5A$

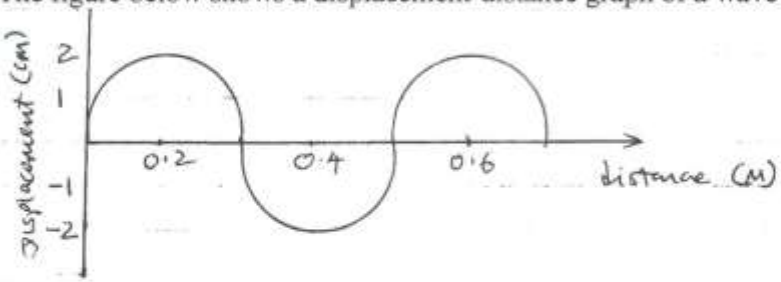
$V = IR = 0.5 \times 1 = 0.5V$

10. The figure below shows the image I formed by a concave mirror. Using ray diagrams, locate the position of the object (3mks)



correct object position – 1MK
correct rays – 2MKs

11. The figure below shows a displacement-distance graph of a wave travelling at $2ms^{-1}$



Determine:

a) The amplitude (1mk)

2CM

b) The wavelength (1mk)

$0.5 - 0 = 0.5\,M$

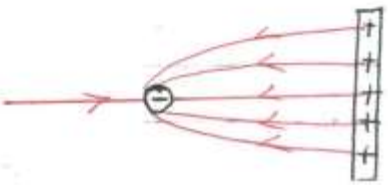
c) The frequency of the waves (2mks)

$c = f\lambda$

$f = \frac{c}{\lambda} = \frac{2}{0.5} = 4\,Hz$

SECTION B (55MARKS)

12. a) Draw the electric field pattern between the charges shown below (2mks)



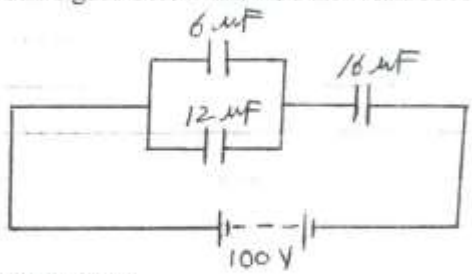
Correct pattern – 1MK
correct direction – 1MK.

b) State two factors that affect the capacitance of a parallel plate capacitor (2mks)

(a) area of plates
(b) distance apart of the plates
(c) dielectric between the plates

Any two correct - 2mk

c) The figure below shows a network of resistor connected to a 100V power source.



Determine:

i) The effective capacitance of the circuit (3mks)

Parallel, $C = 16 + 12 = 18\ \mu F$

$$C_T = \frac{18 \times 16}{18 + 16} = \frac{288}{34} = 8.47\ \mu F$$

ii) The charge on the 16uF capacitor (3mks)

~~$Q = CV$~~
~~$= 8.47\ \mu F$~~

$Q = CV$
$= 8.47 \times 10^{-6} \times 100$
$= 8.47 \times 10^{-4} C$

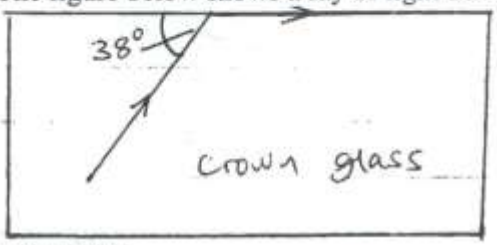
iii) The p.d. across the 12uF capacitor (3mks)

$Q = CV$
$V = \frac{Q}{C} = \frac{8.47 \times 10^{-4}}{18 \times 10^{-6}} = 47.1V$

13. a) State the Snell's law of refraction of light (1mk)

The ratio of sine of the angle of incidence to the sine of the angle of refraction is a constant for a given pair of media.

b) The figure below shows a ray of light travelling from crown glass to air.



Determine:

i) The refractive index of crown glass (3mks)

$c = 90 - 38 = 52^\circ$

$n = \frac{1}{\sin c}$

$= \frac{1}{\sin 52^\circ}$

$= 1.27$

ii) The speed of light in crown glass. (3mks)
(Speed of light in air = $3.0 \times 10^8 ms^{-1}$)

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

$c' = \frac{3.0 \times 10^8}{1.27}$

$= 2.36 \times 10^8 m s^{-1}$.

c) i) What would be the effect on the image of increasing the length of a pinhole camera? (1mk)

It would be enlarged, but less bright.

iii) A girl stands 5m in front of a pinhole camera of length 50cm. If the girl is 1.2m tall, determine the size of her image as formed by the pinhole camera (3mks)

$\frac{H_I}{H_0} = \frac{V}{u}$ $\frac{H_I}{120} = \frac{50}{500}$

$H_I = \frac{50 \times 120}{500}$ or

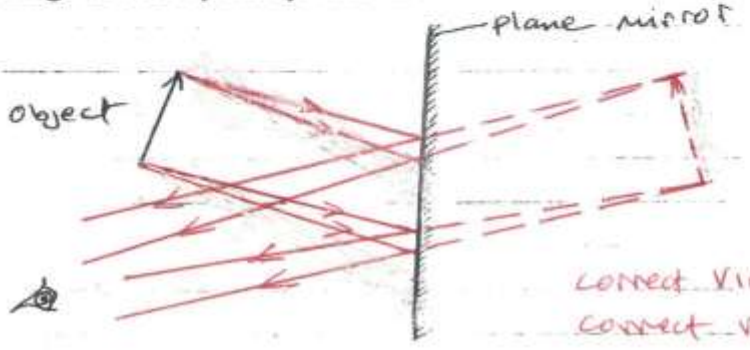
$= 12cm$

$H_I = \frac{V H_0}{u}$

$= \frac{0.5 \times 1.2}{5}$

$= 0.12 M$.

d) The figure below shows an object in front of a plane mirror. Using rays, locate the image as seen by the eye shown (3mks)



correct virtue image — 1mk
correct rays — 2mks.

14. a) Define the Ohms law (1mk)

The current flowing through a metallic conductor is directly proportional to the p.d. across its ends provided the temperature and other physical conditions remain constant.

b) State the effect on the resistance of a conductor when the conductor is heated (1mk)

It increases.

c) Three identical dry cells each of e.m.f 1.6V are connected in series to a resistor of resistance 11.4Ω. If a current of 0.32A is flowing through the circuit, determine:

i) the total e.m.f of the cells (1mk)

$1.6 \times 3 = 4.8\ V$

ii) the internal resistance of each cell (3mks)

$\epsilon = I(r + R)$

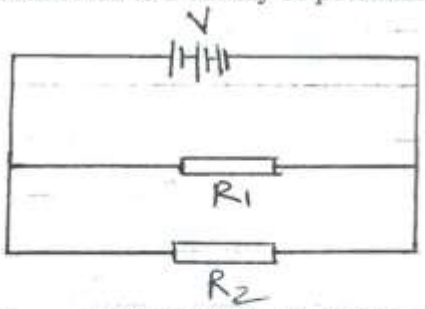
$4.8 = 0.32(r + 11.4)$

$4.8 = 0.32r + 3.648$

$r = \frac{4.8 - 3.648}{0.32} = 3.6\ \Omega$

For each cell, $r = \frac{3.6}{3} = 1.2\ \Omega$

d) The figure below shows resistors R_1 and R_2 connected in parallel. Their ends are connected to a battery of potential difference V volts.



i) In terms of V_1, R_1 and R_2, write an expression for:

I) Current I_1 through R_1 (1mk)

$I_1 = \frac{V}{R_1}$

II) Current I_2 through R_2 (1mk)

$I_2 = \frac{V}{R_2}$

III) Total current in the circuit (1mk)

$I_T = I_1 + I_2$

ii) Show that the total resistance R_T is given by (3mks)

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

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

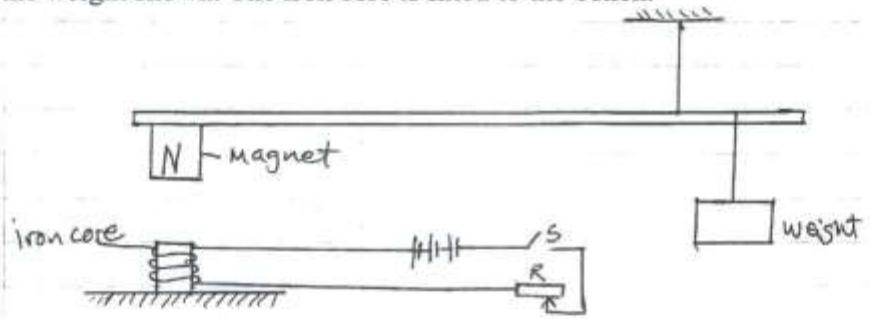
$R_T = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{R_1 R_2}{R_1 + R_2}$

15. a) State two factors that affect the strength of an electromagnet (2mks)

1. amount of current
2. Number of turns of the coil
3. soft ferromagnetic core

Any two correct – 2mks

c) In the set up shown below, the suspended metre rule is balanced by the magnet and the weight shown. The iron core is fixed to the bench.



i) State and explain the effect on the metre rule when the switch is closed (3mks)

When the switch is closed the iron core become Magnetised. The upper part of the iron core attains a south pole and attracts the metre rule which turns anticlockwise.

ii) What is the effect of reversing the battery terminals? (1mk)

The polarity of the iron core is reversed and hence metre rule is repelled turning clockwise.

d) State one defect of a simple cell and how it is corrected (2mks)

Local action – coat zinc with mercury

or

Polarisation – add potassium dichromate solution.

16. a) Differentiate between transverse and longitudinal waves (2mks)

In transverse waves, the vibrations are perpendicular to the direction of travel of the wave whereas in a Longitudinal wave, the direction of vibration of the wave is ~~of~~ the same as direction of travel of the wave.

b) State two conditions necessary for two progressive waves travelling in the opposite direction to form stationary waves (2mks)

1. Same speed
2. Same frequency
3. Same or nearly equal amplitude.

Any two correct - 2MK

c) A wave has a periodic time of 0.2 seconds and a distance of 30cm between successive troughs. Determine the speed of the wave (3mks)

$V = f\lambda$

$= 5 \times 0.3$

$= 1.5\ ms^{-1}$.

$f = \frac{1}{T} = \frac{1}{0.2}$

$= 5Hz$

$\lambda = 30cm = 0.3m$