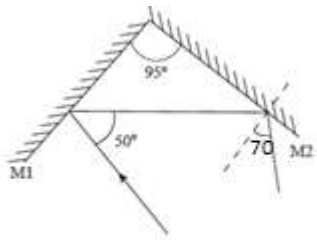
232/2 PHYSICS PAPER 2

MARKING SCHEME

FORM THREE 2024

1. The figure shows a ray incident on a plane mirror M_1 at an angle of 50°. Mirror M_1 is inclined at an angle of 95° to a second mirror M_2:

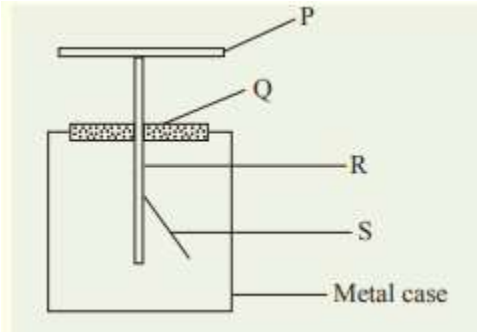
(i) Complete the diagram to show how the ray will finally be reflected from mirror M_2 (1 mk)



(ii) State the angle of reflection in M_2. (1 mark)

70^{o}

2. The following figure shows the features of a gold-leaf electroscope.



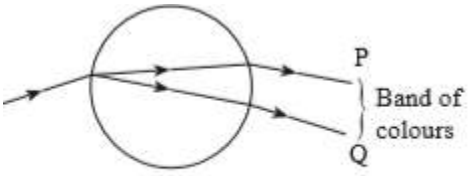
(a) (i) Name the parts P, and S. (1mks)

S – gold-leaf

(ii) Explain the purpose of the metal case. (1mk)

The metal case shields the gold leaf from external influence other than the charge brought near the metal cap.

3. The figure below shows the formation of a band of colours when white light traverses a drop of water:



(i) Explain why it is split into different colours between P and Q. (2 marks)

Dispersion occurs because different colours have different wavelength (different indices of refraction), hence they travel with different velocity in water.

(ii) What natural phenomenon is associated with the above? (1 mark)

Formation of rainbow.

4. A boy standing in front of a high wall claps his hands once and hears an echo after 0.64 seconds. If he moves 20 m farther away from the wall and claps again, he hears the echo after 0.76 seconds. Calculate the speed of sound. (3 marks)

Let the distance be d from the wall.

Speed = $2d/t = 2d / 0.64$

Final distance from the wall = d + 20

Speed = $2(d +40)/ 0.76$

Speed remains constant hence,

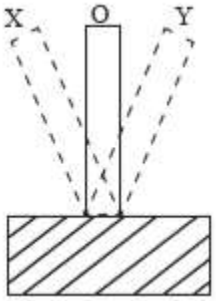
$2d/ 0.64 = 2(d +40)/ 0.76$

d = 106.67 m

Speed = $2 \times 106.67/ 0.64$

= 333 m/s

5. The diagram below shows a blade fixed on a wooden base and plucked to vibrate about the rest position.



If the movement from O to X and back to O takes 0.4 seconds, calculate the frequency of vibration of the blade. (2 marks)

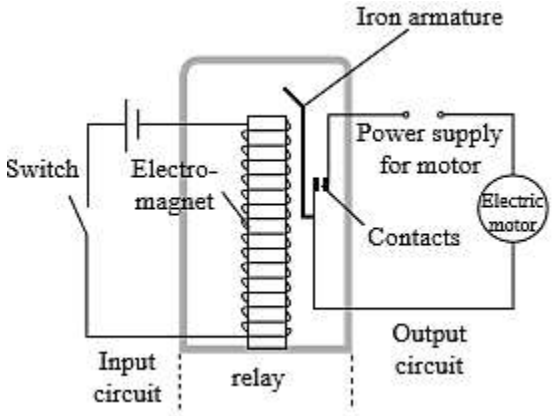
Half oscillation = 0.4 seconds

1 complete oscillation = 0.8 s

Frequency = 1/T

= 1 /0.8 = 1.25 Hz

6. The figure below shows an electromagnet relay switch.



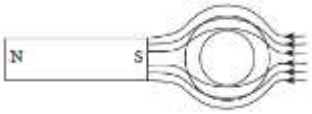
Explain its operation. (2 marks)

When the switch is on the electromagnet attracts the armature which closes the contact C thus completing the circuit for the motor.

7. The diagram below shows a soft iron ring lying next to the south-pole of a magnet.

(a) Complete the diagram to show the magnetic field patterns between the magnet and the ring.

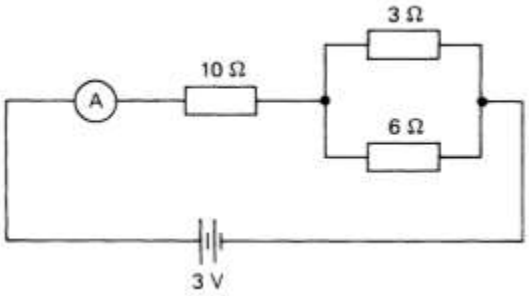
(1 mark)



(b) State a practical application of the above effect. (1 mark)

Magnetic shielding.

8. The diagram shows an electrical circuit containing a battery of e.m.f. 3 V, an ammeter of negligible internal resistance and three resistors with resistances shown.



What is the reading on the ammeter? (3mks)

$$\frac{1}{R_e} = \frac{1}{3} + \frac{1}{6} = \frac{3}{6} R_e = \frac{6}{3} = 2\Omega$$

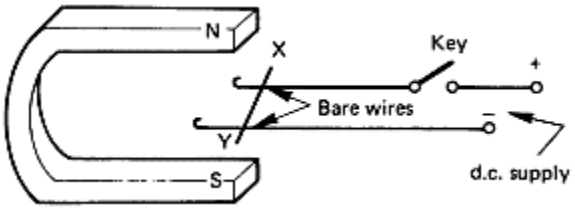
$$R_T = (10 + 2) = 12\Omega$$

$$I = \frac{v}{R} = \frac{1}{4} = 0.25A$$

9. State one characteristic of image formed by a pinhole camera which is similar to lens camera (1mk)

-The image is real / diminished

10. The diagram shows a U-shaped magnet and an electrical circuit made of a conductor xy.



(i) Explain why the bare wire moves when the key is closed (1mk)

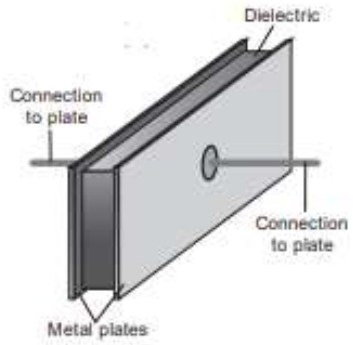
It experiences some force due to interaction between magnetic field and current

ii) In which direction will the wire xy move (1mk) The wire will move to the right.

11.The image (I) for the convex mirror is always located between F and the pole, it is also diminished. State two more characteristics of the image(I). (2mks)

-It is virtual
-It is erect

12. The following diagram shows a capacitor.

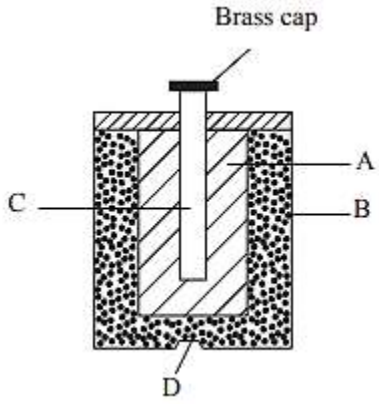


Explain what is a capacitor (1mk)

A capacitor is a device that stores charges.

SECTION B (55 marks)

13. (a) The figure below shows a dry cell.



(i)Name the parts labelled A, B and C. (3 marks)

A – Manganese (IV) Oxide.
B – Ammonium chloride.
C – Carbon rod.

(ii) Explain the purpose of parts A, C and D in the cell. (3 marks)

A – Depolarizer.
C – Positive terminal.

D – Acts as a container/ negative terminal.

(iii)State the polarity of end marked D. (1 mark)

Negative terminal.

(iv) Explain why the terminal voltage of the cell is likely to be less than its EMF when in use. (1 mark)

Because of internal resistance. of the cell.

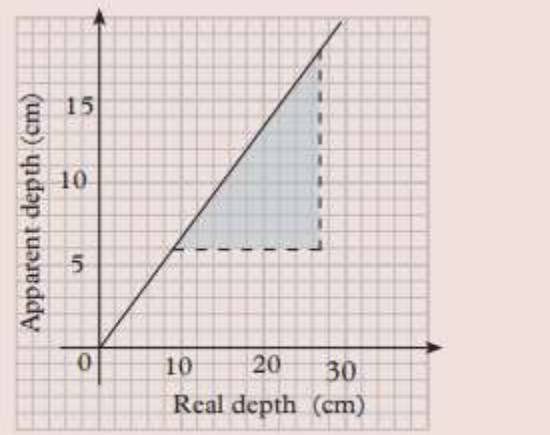
(b) (i) A lead-acid cell is rated 50 Ah and supplies a steady current of 2 A. What does the term '50 Ah' mean? (2 mark) The battery will supply current of 2A for 25 hours.

(ii) State two advantages of lead acid cell over a dry cell. (2 marks)

Draws larger current.

Has Low internal resistance.

14. The graph below shows the results obtained when a pin was viewed through different sizes of glass of same material.



A graph of apparent depth against real depth

(a)Calculate the: (i) gradient of the graph. (2mks)

$$\text{The gradient of the line} = P\left(\frac{Apparent\ depth}{Real\ depth}\right)$$

$$\text{The gradient of the line} = \frac{18-6}{27-9} = 2/3$$

$$efractive\ index, \eta = \left(\frac{3}{2}\right) = 1.5$$

(ii) refractive index of the glass. (2mks)

$$Refractive\ index, \eta = \left(\frac{3}{2}\right) = 1.5$$

(b)i) Define the term critical angle(1mk)

The critical angle is the angle of incidence in a denser medium for which the angle of refraction is 90º in the rarer medium.

ii)State two conditions for total internal reflection to occur(2mks)

1. Light must travel from a denser medium to a rarer medium.
2. The angle of incidence in the denser medium must be greater than the critical angle

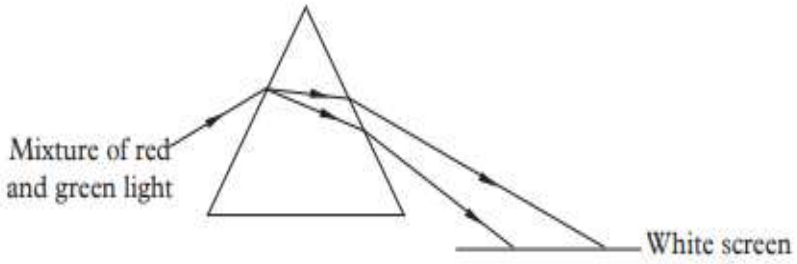
iii)Calculate the critical angle at the water-air interface if the refractive index of water is 1.33(3mks)

$\eta_{glass} = 1 / \sin c$,

$\sin c = 1/ \eta_g = 1/ 1.33 = 0.75188$

$c = \sin^{-1} 0.75188 = 48.75°$

(c)A beam of light made of a mixture of red and green light is shone through a prism as shown in the figure below.



(i)What name is given to the 'bending' of light as it enters the glass prism? (1mk)

refraction

ii)Why does light 'bend' as it enters glass prism? (1mk)

Light is refracted because its speed changes when it enters another medium.

iii)Why do the two colours of light bend by different amount inside the prism? (1mk)

Because the refractive index of glass is different for each colour

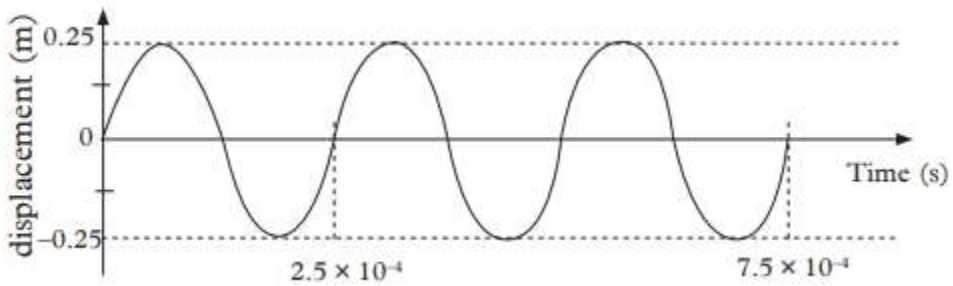
iv)Which colour 'bends' the least? (1mk)

green

15 a) What is the difference between longitudinal and transverse waves? (2mks)

In longitudinal waves, motion of the medium particles is displaced in the same direction as that of the travel of wave. In the transversal waves motion of the medium particles are displaced perpendicular to the direction of the travel of the wave.

b) The figure below shows a displacement-time graph for a certain wave.



i)State the Amplitude of the wave(1mk)

Amplitude=0 .25m

ii)Identify the type of wave. (1mk)

transverse waves

(iii) State the period of the wave(1mk)

period = $(7.5 - 2.5)10^{-4}$seconds

$period = 5.0x10^{-4} seconds$

(iv) Determine the frequency of the wave. (2mks)

$$Frequenc = 1/5(10)^{-4}$$

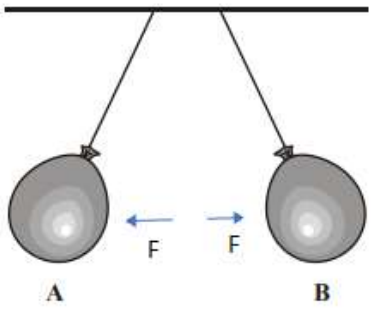
Frequency=$2.0x10^{3}$Hz

(iv) If the wave has a wavelength of 3.5 cm, what is its velocity? (2mks)

V=λf =$2.0x10^{3}$Hz x3.5=7.0m/s

16.The diagram shows two charged balloons hanging from a support on nylon threads.

i)Draw an arrow on each balloon to show the directions of the forces which make the balloons move apart. (1mk)



(ii) Balloon A is positively charged. What is the sign of the charge on balloon B? Explain your answer. (2mks)

positive; because like charges repel;

(iii) One way of charging a balloon is by rubbing it on a woollen jumper. An aluminium rod held in the hand cannot be charged in this way. Explain why not. (2mks)

Aluminum is a conductor hence charge would flow to earth

c) (i) State two ways in which static electricity can be put to good use. (2mks)

lightning conductor photocopiers / spray painter / precipitator (smoke cleaning) / insecticide sprays / particle accelerators / inkjet printers;

(ii) State two ways in which static electricity can be harmful or annoying (2mks)

shocks / collection of dust / electronic circuit damage / hair standing on end / explosions (fuel tank) / could turn pace maker off / tumble dryer / lighting;

state three factors that affects the capacitance of parallel plates capacitor. (3mks)

(i) Distance between plates .
(ii) Area of of overlap of the plates
(iii) Presences of a medium(dielectric material)

17. An 'ideal' voltmeter is connected across the terminals of a cell. The voltmeter reads 1.5 V when the switch is open and 1.3 V when the switch is closed.

(a) What is the e.m.f of the cell? (1mk)

e.m.f of the cell = 1.5 V (no current is drawn from the cell).

(b) What is the terminal voltage of the cell? .(1mk)

Terminal voltage of the cell = 1.3 V (the cell is in use).

(c) Calculate:(i) the current in the circuit. (2mks)

p.d across the resistor = terminal voltage of the cell
V = 1.3 V; R = 2.6 Ω
From Ohm's law, V = IR, I = 1.3/26 =0.5A
Current in the circuit is 0.5 A.

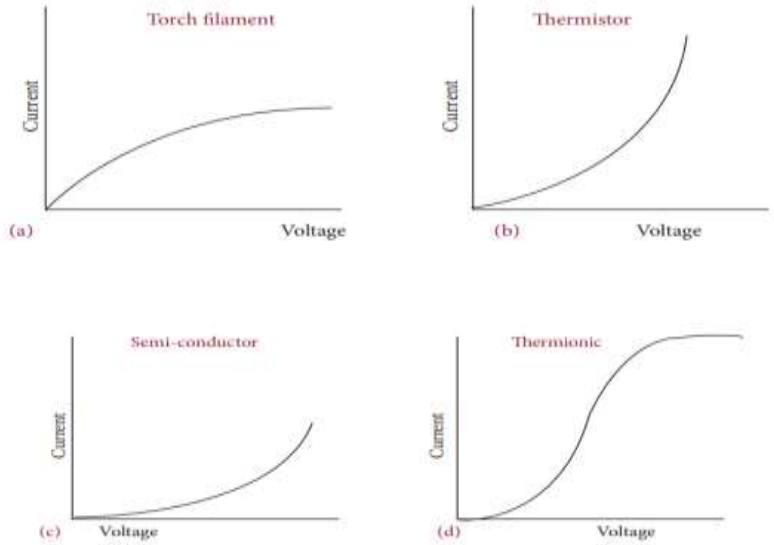
(ii) the internal resistance of the cell. .(2mks)

Lost voltage inside = 1.5 V – 1.3 V = 0.2 V
V = Ir r = V I = 0.2 x.5 = 0.4 Ω
The internal resistance of the cell is 0.4 Ω

d)Differentiate between Fixed resistors and variable resistors. (1mk)

In a fixed resistor, the resistance is almost a constant while in variable resistor the resistance can be varied.

f) Sketch a graph of current against voltage for non- non-ohmic conductor(1mk)
(any of the following)



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