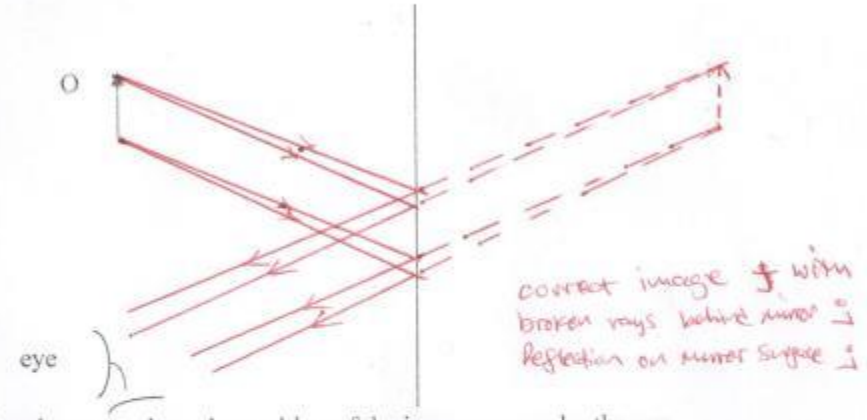
FORM 3 PHYSICS 232/2
MARKING SCHEME

SECTION A (25 MARKS)

1. What property of light is suggested by the formation of shadows? (1 mk)

– Light travels in a straight line
– rectilinear propagation of light. Any one 1

2. The figure below shows an object O placed in front of a plane mirror.



correct image 1 with broken rays behind mirror 1
Reflection on mirror surface 1

On the same diagram, sketch rays to show the position of the image as seen by the eye. (2 mks)

3. State two uses of a charged gold leaf electroscope. (2 mks)

– Test conductors and insulators
– Detect charge
– Detect type of charge

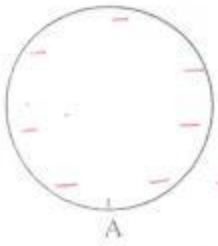
4. The figure below shows two spherical materials, one an insulator and the other a conductor. Negative charges are introduced at point A in each case.

Insulator

1

charge concentrated at one point

conductor



charge evenly distributed.
1

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

- It is light in weight
- can stay in discharged state for long without getting damaged
- Large current can be drawn from it.

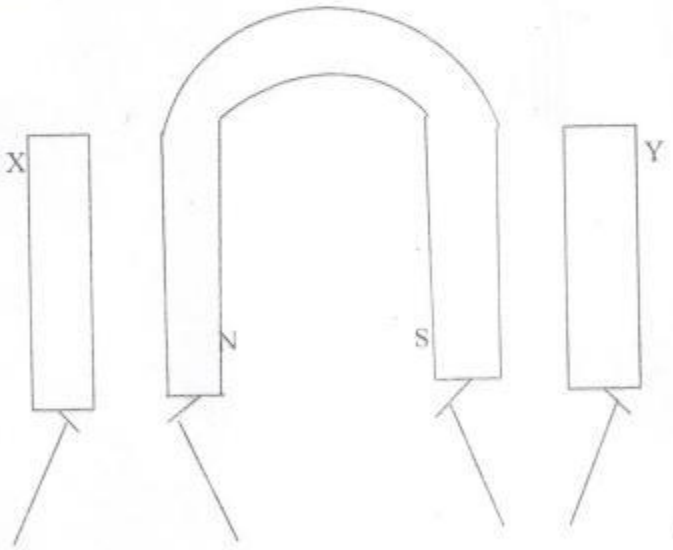
any two ½ ½

6. State the purpose of manganese IV oxide in a dry battery. (1 mk)

- To oxidise hydrogen to form water
- Depolariser / depolarising agent.

any one ½

7. The figure shows a U- shaped magnet whose poles are labelled and two magets near it. Iron nails are attracted to the lower ends of the magnets as shown.

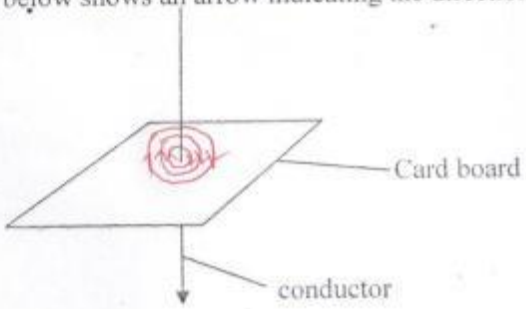


Identify the poles marked X and Y (2 mks)

X ..... South ..... ½

Y ..... South ..... ½

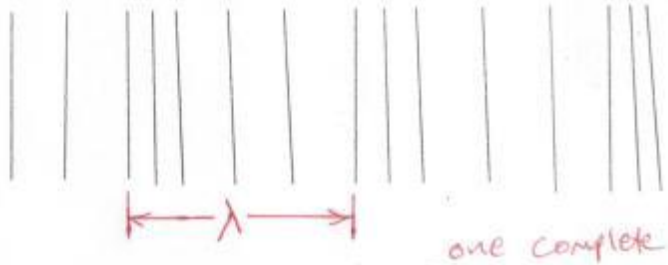
8. The figure below shows an arrow indicating the direction of a current in conductor.



correct pattern ✓
correct direction ✓

Sketch on the diagram the magnetic field pattern due to the current. (2 mks)

9. The figure below shows a longitudinal wave.



one complete compression and rarefaction. ✓

On the same diagram, indicate the wavelength of the wave. (1 mk)

10. State two factors that affect the speed of sound in air. (2 mks)

- Temperature
- humidity
- wind.

any two correct ✓✓

11. An observer watching a fireworks display sees the light from an explosion and he hears the sound 2 seconds later. If the speed of sound in air is 330m/s. how far is the explosion from the observer? (2 mks)

$d = vt$
$= 330 \times 2$ ✓
$= 660M.$ ✓

12. A wave with a periodic time of 0.2 seconds is travelling at a speed of 50cms^{-1}. What is the wavelength of the wave? (3 mks)

$V = f\lambda$ ✓

$\lambda = \frac{0.5}{5}$

$= 0.1M$. ✓

$f = \frac{1}{T} = \frac{1}{0.2} = 5Hz$ ✓

$V = \frac{50}{100} = 0.5ms^{-1}$

13. State one advantage and one disadvantage of a convex mirror when used as a driving mirror. (2 mks)

Advantage: has a wide field of view ✓

Disadvantage: difficult to estimate distance ✓

14. A girl holds a large concave mirror of focal length 1m, at a distance of 80 cm from her face. State two characteristics of her image in the mirror. (2 mks)

- behind the mirror
- ~~upside~~ upright/erect
- Magnified / bigger than object

any two correct ✓✓

- Virtual

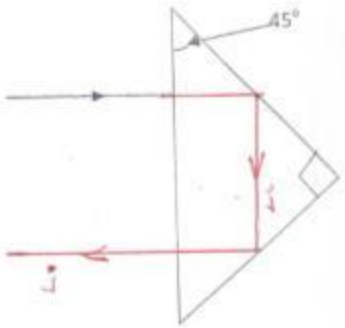
15. State one application of a parabolic mirror. (1 mk)

- solar concentrator
- headlamp reflector

any one correct ✓

SECTION B (55MARKS)

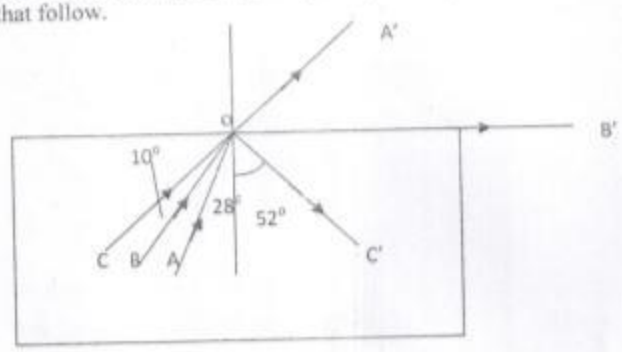
16. a) The diagram below shows a ray of light incident on a glass prism. If the critical angle of the glass is 42°, draw the path of the ray through the prism (2mks)



b) State two conditions necessary for total internal reflection to occur. (2mks)

(a) The critical angle must be exceeded. ✓
(b) Light must travel from an optically more dense medium to an optically less dense medium. ✓

c) The figure below shows rays of light AO, BO and CO incident on a glass air interface. OA', OB' and OC' are the corresponding emergent rays. Study the diagram and answer the questions that follow.



Determine:

i) The critical angle of the glass. (1mk)

$C = 52 - 10 = 42°$ ✓

ii) The refractive index of the glass. (3mks)

$n = \frac{1}{\sin C}$ ✓

$= \frac{1}{\sin 42}$ ✓

$= 1.49$ ✓

d) If the speed of light in air is $3.0 \times 10^8 ms^{-1}$, determine the speed of light in water o refractive index 1.33. (3mks)

$n = \frac{c}{c'}$ ✓

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

$= \frac{3.0 \times 10^8}{1.33}$ ✓

$= 2.26 \times 10^8 ms^{-1}$ ✓

c) A pin is placed at the bottom of a beaker of depth 11.5cm. The beaker is then filled with paraffin. By using another pin on the side of the beaker and observing from the top, the distance of the image of the pin in the beaker is found to be 3.5cm from the bottom. Determine the refractive index of paraffin. (4mks)

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

$= \frac{11.5}{9}$ ✓

$= 1.28$ ✓

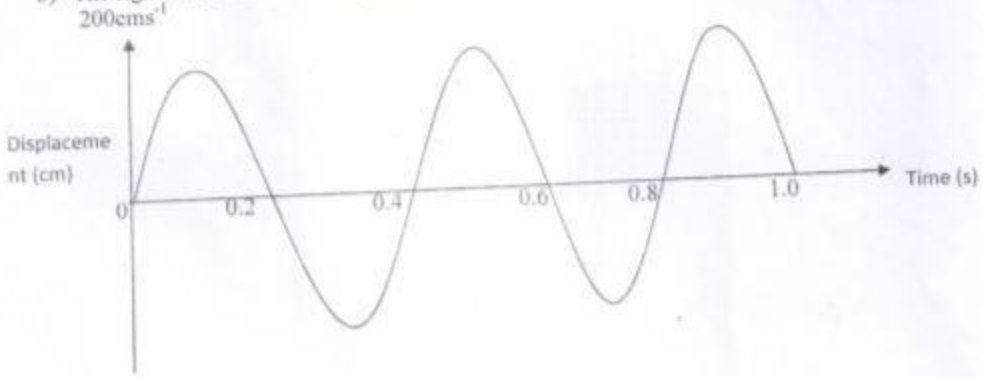
Apparent depth $= 11.5 - 3.5$

$= 9\text{cm}$ ✓

17. a) Distinguish between longitudinal and transverse waves. (2mks)

- In longitudinal waves, the direction of the wave is in the same direction as the vibrations ✓.
- In transverse waves, the direction of the wave is perpendicular to the direction of the vibrations ✓

b) The figure below shows a displacement-time graph for a progressive wave travelling at 200cms^{-1}



Determine:

i) The periodic time. (1mk)

$T = 0.45$ ✓

ii) The frequency of the wave. (2mks)

$f = \frac{1}{T}$ ✓ $= \frac{1}{0.4} = 2.5\text{Hz}$ ✓

iii) The wavelength of the wave. (3mks)

$V = f\lambda$ j

$\lambda = \frac{V}{f}$

$= \frac{2}{5}$ j

$= 0.4M$ j

$200 cms^{-1} = \frac{200}{100} = 2ms^{-1}$

c) Two vertical cliffs are x distance apart. A mine-worker stands between the two vertical cliffs, 400m from the nearest cliff. Every time he strikes the rock once, he hears two echoes; the first one after 2.5 seconds, while the second follows 2 seconds later. From this information, calculate:

i) The speed of sound in the mine. (2mks)

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

$= \frac{2 \times 400}{2.5}$ j $= 320ms^{-1}$ j

ii) The value of x. (3mks)

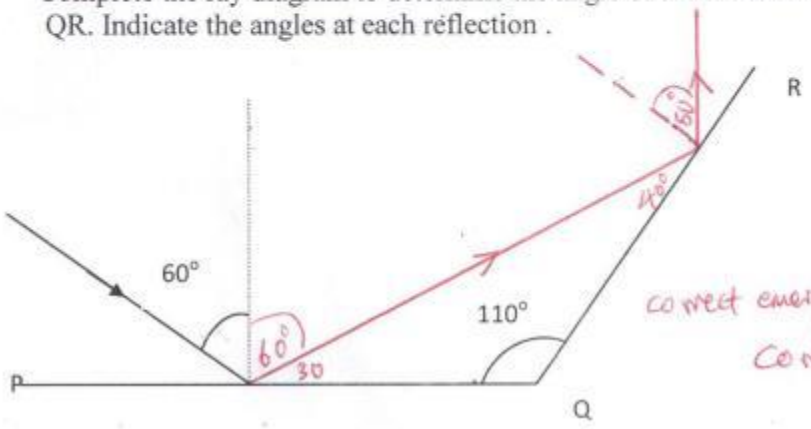
$x - 400 = \frac{320 \times 4.5}{2}$

$x - 400 = 720$

$x = 720 + 400$

$= 1120M$

18. a) The figure below shows two mirrors PQ and PR inclined at an angle of 110°. A ray of light is incident on mirror PQ at an angle of 60°.
Complete the ray diagram to determine the angle of reflection of the ray in the mirror QR. Indicate the angles at each reflection . (3mks)



correct emergence of two rays j j

Correct angles j

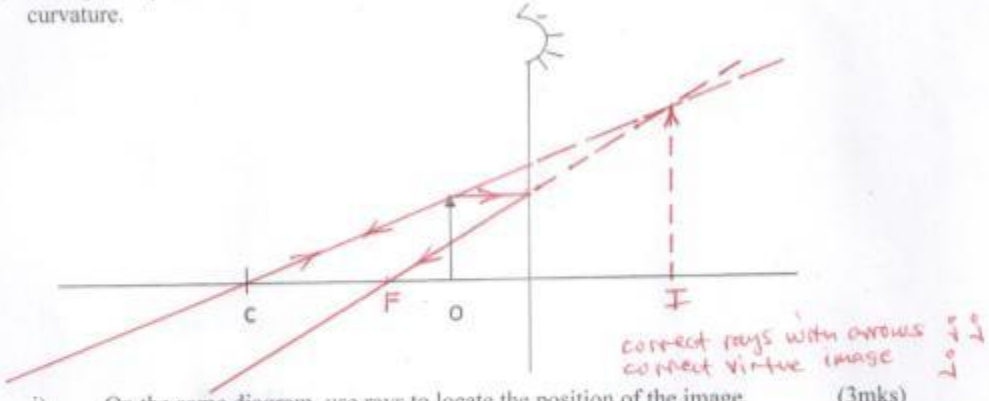
b) Two plane mirrors are inclined at an angle P and forms 5 images. Determine angle P. (3mks)

$N = \frac{360}{P} - 1$;

$5 = \frac{360}{P} - 1$;

$P = \frac{360}{6} = 60^\circ$;

c) An object is placed in front of a concave mirror as shown below. C is the centre of curvature.



correct rays with arrows ; ;
correct virtue image ;

i) On the same diagram, use rays to locate the position of the image. (3mks)

ii) Determine the magnification of the image. (3mks)

$M = \frac{V}{U}$;

$= \frac{2.5}{1.4}$;

$= 1.79$

d) A building standing 200m from a pinhole camera produces on the screen of the camera an image 2.5cm high, 5.0cm behind the pinhole. Determine the actual height of the building . (3mks)

$\frac{H_I}{H_O} = \frac{V}{U}$;

$\frac{2.5}{H_O} = \frac{5}{20000}$;

$H_O = \frac{20000 \times 2.5}{5}$

$= 10000\text{cm or } 100\text{M}$. ;

19. a) A current of 0.5A flows in a circuit. Determine the quantity of charge that crosses a point in 4 minutes. (3mks)

$Q = It$ ✓

$= 0.5 \times 4 \times 60$ ✓

$= 120C$ ✓

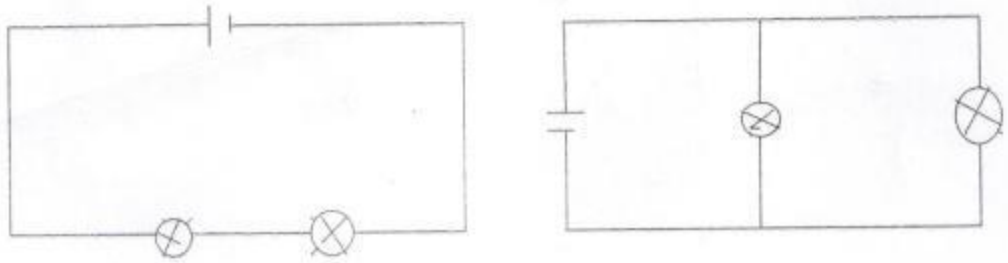
b) i) What is polarization in a simple cell? (1mk)

Accumulation of hydrogen bubbles around the copper ~~elect~~ plate/electrode. ✓

ii) How is the defect in b(i) above minimized? (1mk)

By adding potassium ~~fe~~ dichromate solution.

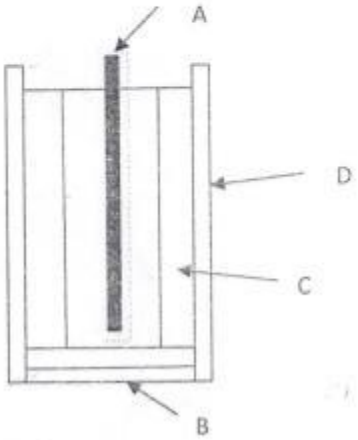
c) In the circuit diagrams shown below, the cells and bulbs are identical



Explain with a reason which of the bulbs in circuit (a) or (b) is brighter. (2mks)

circuit (b). ✓ This is due to less combined resistance in the circuit.

d) The figure below shows the features of a dry leclanche cell.



i) State the polarities of the parts labelled A and B . (2mks)

A.....positive.....½

B.....negative.....½

ii) Name the chemical substances in parts labelled C and D. (2mks)

C...Ammonium chloride ½

D...Zinc Metal ½

e) State a reason why the caps of the cells of a lead-acid battery are opened when charging the battery. (1mk)

To allow escape of oxygen and hydrogen gases during recharging. ½