MARKING SCHEME

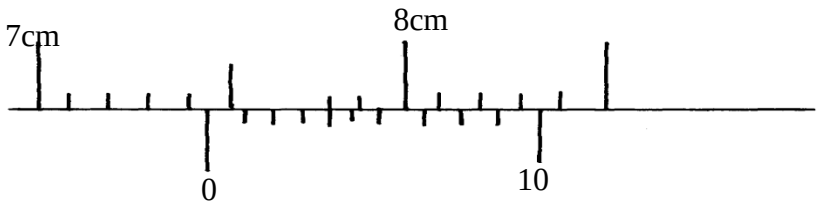
OPENER EXAMINATION: TERM 1 2024

PHYSICS FORM 3

Time: 2 Hours 30 mins

SECTION A (40 MARKS)

1. The figure below shows part of scale of vernier calipers.



What is the reading indicated on the scale (1mk)

Main scale reading = 7.4cm
Vernier scale reading = 4x0.01 = 0.04cm
Total reading = 7.4 + 0.04 = 7.44 cm

2. Distinguish between mass and weight of a body in terms of definition, stating the S.I units for each. (2mks)

Mass is the quantity of matter in a body while weight is the measure of the pull of gravity on the body.
Weight S.I unit Newtons (N) (½mk)
Mass S.I unit Kilogram(kg) (½mk)

3. $180cm^3$ of fresh water of density $100kg/m^3$ is mixed with $2200cm^3$ of sea water of density $1025kg/m^3$.

Calculate the mass of fresh and sea water. (2mks)

Mass of fresh water = 1800 x 1 =1800g
Mass of sea water = 2200 x 1.025 = 2255g

Calculate the density of the mixture (2mks)

Density of mixture = $\frac{\text{mass of mixture}}{\text{Volume of mixture}}$

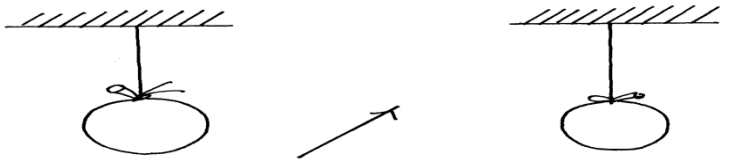
$= \frac{2255 + 1800}{1800 + 2200}$

$= 1.01375 g/cm^3$

4. Explain why fish can survive under water when the surface is already frozen (2mks)

Ice being less dense than water, floats on water. Water at 4°C being the most dense, remains at the bottom of the lake and aquatic life survives.

5. Two inflated balloons are at the same level while suspended from threads a short distance apart as shown below;



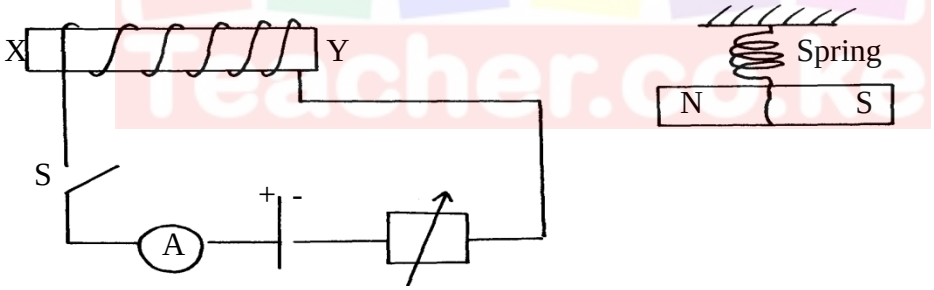
Some air is blown gently in the space between the balloons in horizontal direction. Explain What happens to the balloons (2mks)

The two balloons move towards each other. On blowing air between the balloons, the speed of air increases and pressure reduces. The high atmospheric pressure on the sides pushes the balloons towards each other.

6. State **one** advantage of an alkaline battery over a lead acid battery. (1mk)

Large currents can be drawn from them
They can be kept in a discharged condition for a very long time before the cells are ruined
They require very little attention to maintain
They are lighter (portable) than lead-acid accumulators

7. The diagram below shows a permanent magnet suspended by a spring. State with reason the behaviour of the magnet when the switch is closed. (2mks)

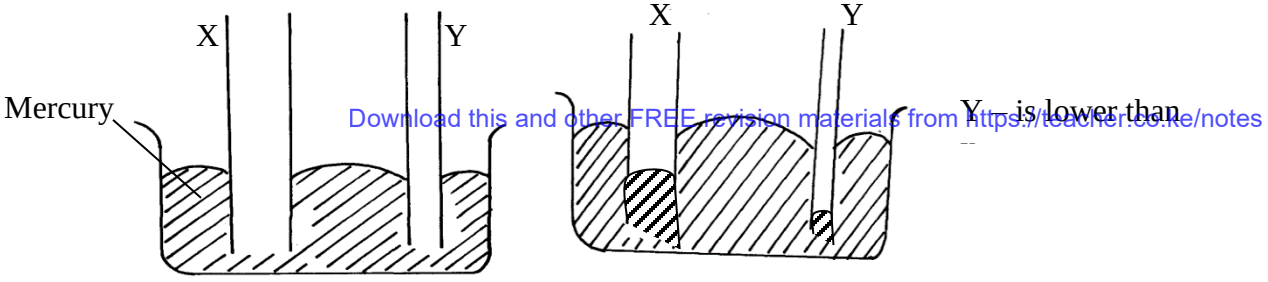


The magnet towards on passing the current on the coil, the core XY is magnetized with the South Pole on Y thus attracting the North Pole of the permanent magnet.

8. Convection and diffusion both involve motion of fluids. Distinguish between the two. (2mks)

Convection is the transfer of heat through fluids
Diffusion – is the process by which particles spread from regions of high concentration to those of low concentration.

9. Indicate on the diagram below, the level of mercury in the tubes **X** and **Y** (2mks)



10. An object weighs 1200N on a certain planet. What is the gravitational field strength of this planet if the object is 60kg? (3mks)

w-Mg
1200 = 60xg
g = $\frac{1200}{60}$ = 20N/Kg

11. State **two** properties of a thermometric liquid. (2mks)

Easily visible
-Expand or contract uniformly
-Have a wide range of temperature
-Not stick to the walls of the glass

12. The figure below, ammonia gas and an acid gas diffuse and react to form a white deposit on the walls of the glass tube, the deposit forms nearer end B.

a. State which gas diffused faster. (1mk)
Ammonia gas

b. Explain how the rate of diffusion depends on the density of a gas. (2mks)
The denser the heavier the particles and hence the slower the gas.

c. Explain the effect of performing the experiment above at a higher temperature. (2mks)
The rate at which Ammonia gas travels towards B will be higher hence less time taken to form the white deposit.

13. What is the purpose of a translucent screen on the:
a. Pinhole camera. (1mk)
It act as a screen
b. Give two characteristics of image formed by a pinhole camera. (2mks)

- Its inverted
- Its real
- The size of image size depends on object distance from pihole

c. The distance between the pinhole and screen of a pinhole camera is 10cm. the height of the screen is 20cm. at what minimum distance from the pinhole must a man 1.6m tall stand if a full length image is required? (3mks)

v/u = hi/ho

10/20 = hi/160

=80cm

14. State any two forces that acts between two objects not in contact. (2mks)

Centripetal force

Friction force

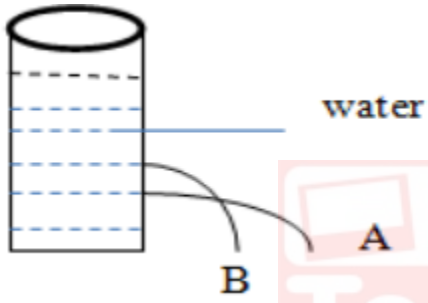
Surface tension

15. State two physical characteristics that change when a metal cube is heated. (2mks)

Mass remains the same.

Density decreases

16. The diagram below shows jets from two holes at the side of a tank filled with water. Explain why Jet A is longer than B (2mks)



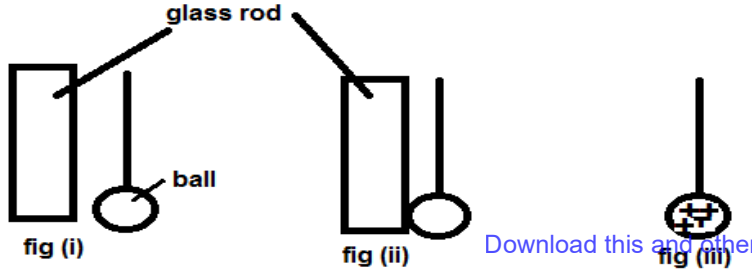
Pressure at the bottom is higher than at the top hence jetting further.

SECTION B (60 MARKS)

17. (a) State the basic law of electrostatic charges (1mk)

Like charges repel and unlike charges attract each other

(b) A form 2 student charged a polystyrene ball positively by contact method as shown.



Indicate the charges on glass rod and ball (2mks)

(c) State two (2) uses of an electroscope (2mks)
To detect the presence of charge on a body
To test the quantity of charge on a charged body
To test for the insulation properties of a material
To test the sign of charge on a charged body
(Any 2)

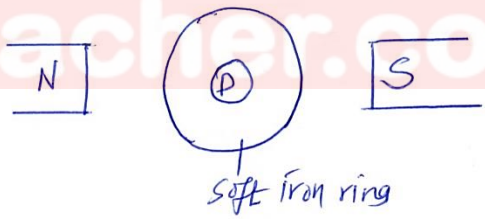
18. (a) Define ELECTRIC CURRENT , stating its SI units (2mks)
Electric current is the rate of flow of charge, expressed in amperes (A)
Or electric current is charge per unit time expressed in amperes (A)

(b) A battery circulates charge Round a Circuit for 1.5 Minutes. If The Current Is Held at a Current of 2.5 A, determine the quantity of charge passing through the wire. (3mks)
R = it
=2.5 x (1.5 x 60)c
=225colombs

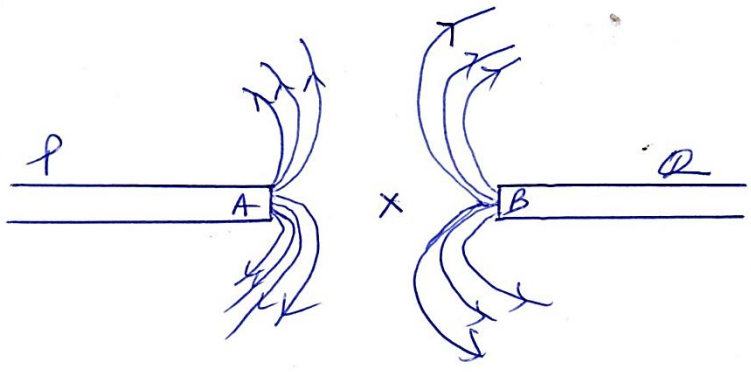
(c) State two (2) disadvantages of alkaline accumulators over lead acid accumulators (2mks)
They are very expensive
They have a lower EMF per cell

(d) What do you understand by a closed circuit? (1mk)
A circuit in which current is flowing

19. (a) A soft iron ring is placed between a north and a south pole of two bar magnets as shown. Show by drawing how the magnetic lines of force between the N and S Poles Interact With The Soft Iron Ring (2mks)



(b) The diagram below shows the magnetic field pattern between two magnets P and Q
(i). Identify poles A and B (2mks)

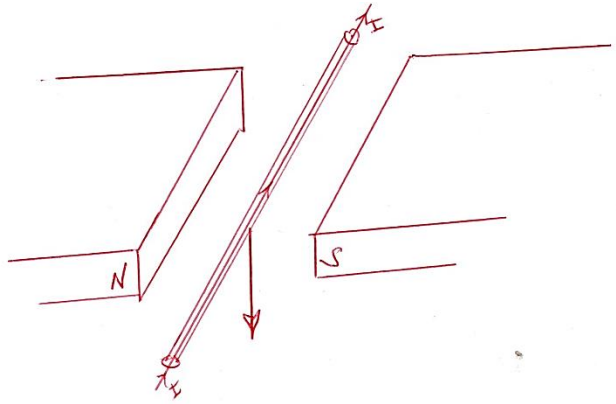


A is north pole
B is north pole

(ii).State which of the two magnets P and q is stronger and explain (2mks)
Magnet P is stronger, it has more field lines.

20. (a) The figure below shows a current carrying conductor in a magnetic field

(i). Mark on the figure the direction of the forces acting on the conductor (1mks)



(ii).State two ways of increasing the force on the conductor. (2mks)

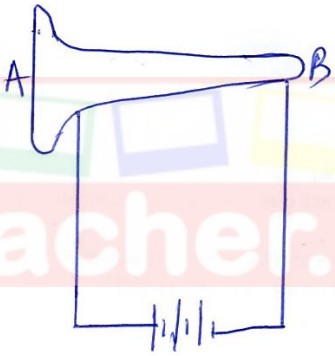
Increasing the current

Increasing number of turns making the coil

Increasing magnetic field strength (any 2)

(c) The figure below shows a nail on which a wire is to be wound to make an electromagnet.

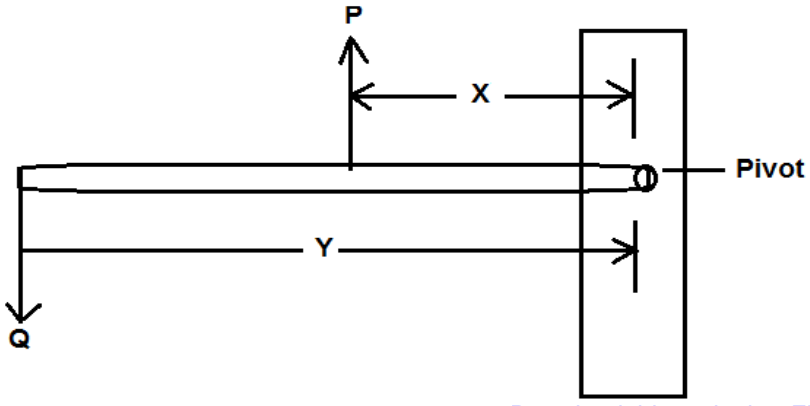
By drawing, show how the wire should be wound around the nail so that the ends A becomes a north pole and end B South Pole (1mk)



21. (a) Define moment of a force (1mk)

Moment of a force is the product of the force and the perpendicular distance between the point of support and the line of action of the force

(b) The figure below shows a beam of negligible weight balanced by constant forces P and R.



Derive the relationship between X and Y (2mks)

At equilibrium

Sum of clockwise moment about the pivot= sum of anticlockwise moment above the pivot
Force x distance = force x distance
P x X = Q x Y

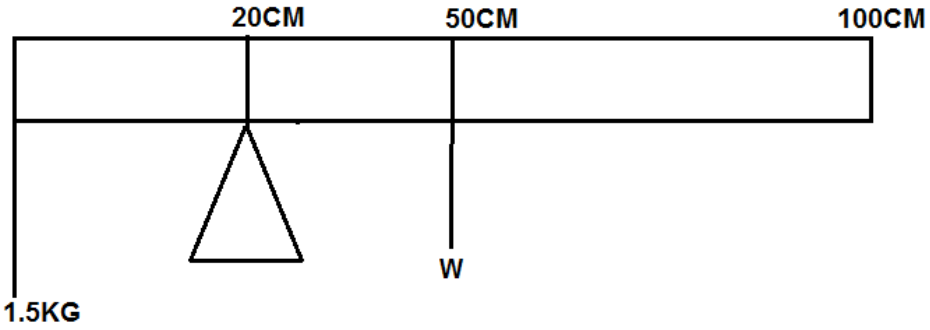
22. (a) State what is meant by centre of gravity of a body (1mk)

Centre of gravity is the point of application of resultant force due to earth's attraction on the body

(b) State the principle of moment (1mk)

The principal of moment states that for a system in equilibrium, the sum of clockwise moments about a point must be equal to the sum of the anticlockwise moments about the same point.

(c) A uniform metal bar 100cm balances at 20cm when the mass of 1.5kg is attached at 0cm mark as shown below. Determine the weight of the bar. (Take g = 10N/kg) (3mks)



Weight, w, acts at the COG of bar i.e. 50cm mark.
Anticlockwise moments = clock wise moments

$(1.5 \times 10) \times \frac{20}{100} = w \times \frac{30}{100}$

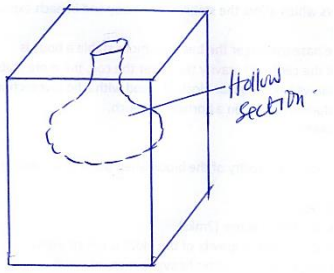
$W = \frac{15 \times 20}{30}$

= 10N

(d) State two (2) factors which affect the stability of a body (2mks)

(i). The area of the base.
(ii). The position of the centre of gravity.

(e) The figure below shows a rectangular block of wood with a hollow section (inside) at the position shown. The block is resting on a horizontal bench.



(iii). State the effect on the stability of the block when the hollow section is filled with water (1mk)

Stability is reduced

(iv). Explain your answer in (i) above (2mks)

The position of the centre of gravity of the block is raised when water is added because the upper (hollow) section becomes heavy or more massive

23. (a) Define the following terms as used in curved mirrors:

(v). The POLE (1mk)

Pole is the centre of the curved mirror

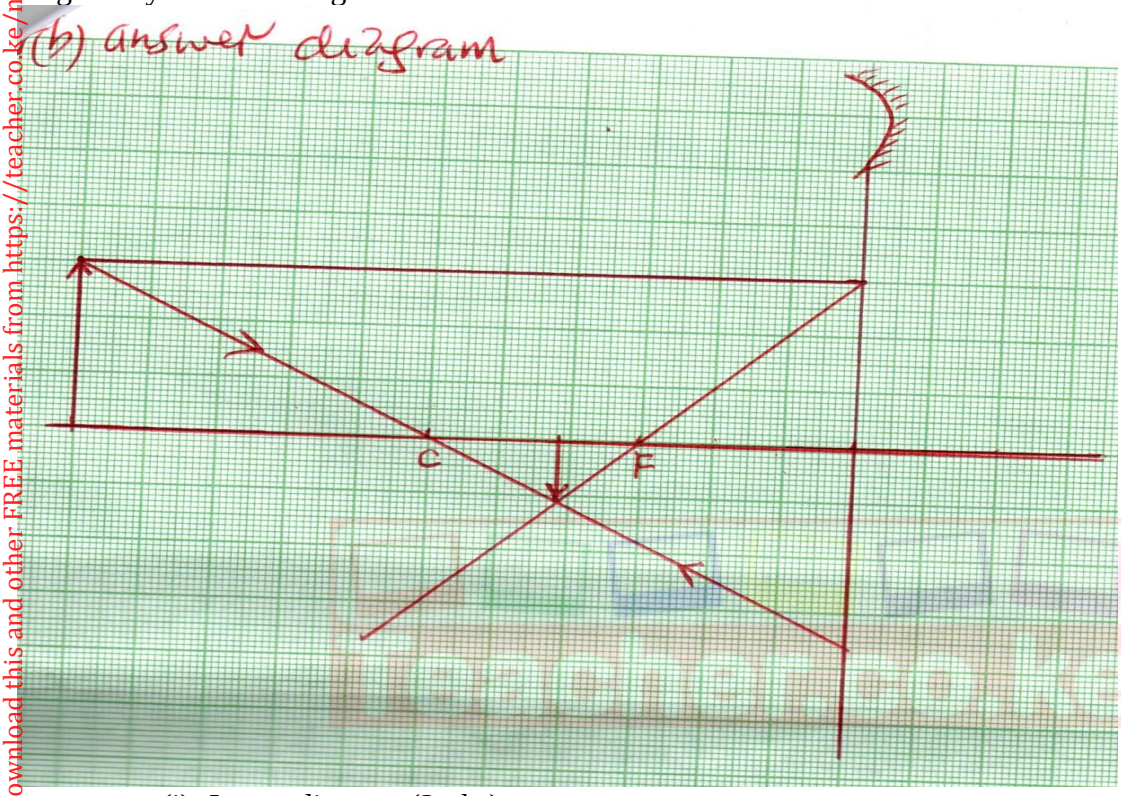
(vi). Centre of CURVATURE (1mk)

Centre of curvature is the centre of the sphere of which the mirror is part.

(vii). PRINCIPAL FOCUS for a concave mirror (1mk)

It is the point at which all rays parallel and close to the principal axis converge after reflection.

(b) An object pin of height 3cm is placed 11 cm in front of a concave mirror of focal length 3cm. make a ray diagram by scale drawing and from it determine



(i). Image distance (2mks)

42cm

(ii). Height of the image (2mks)

1.1 cm

(iii). Magnification of the image (2mks)

$= \frac{HI}{H0} = \frac{1.1}{3}$

$= 0.37$

$= \frac{V}{U} = \frac{4.2}{11}$

$= 0.38$

(c) Give two advantages of convex mirror (2mks)

They form an upright image

Provide a wide field of view

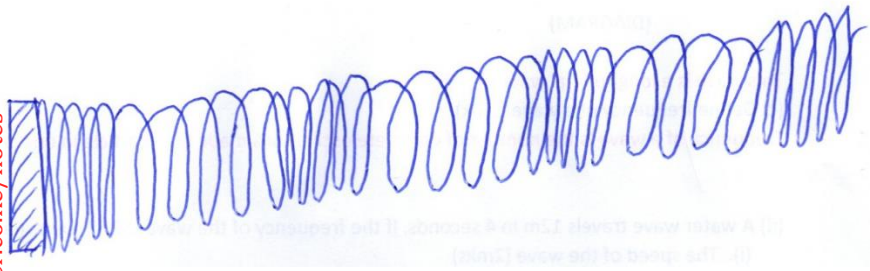
24. (a) Differentiate between electromagnetic waves and mechanical waves (1mk)

Electromagnetic waves do not require material medium for transmission, while mechanical waves require material medium for transmission.

b) A long slinky spring is attached to a vibrating blade as shown in the figure below.

(i) State the type of mechanical wave generated by the set up (1mk)

(ii) mark alongside the coil, the length corresponding to the wavelength of the wave (1mks)



This wave is a longitudinal wave

(c) Define frequency of a wave (1mk)

Frequence of a wave is the number of complete oscillations made by a particle in one second.

(d) A water wave travels 12m in 4 seconds. If the frequency of the wave is 2HZ. Determine:

(viii). The speed of the wave (2mks)

Speed $= \frac{dist}{time} = \frac{12}{4} = 3m/s$

(ix). The wavelength of the wave (2mks)

V = fx

$X = \frac{v}{f} = \frac{3}{2} = 1.5m$

25. (a) State two (2) sources of sound (2mks)

Vibrating object
Tuning fork
Vibrating air column
Air siren
Cogwheel and car

(b) A girl standing 600m away from a cliff bangs two pieces of wood together and hears an echo 3.5 seconds later. Determine the speed of sound in air at that place. (3mks)

Speed $= \frac{distance\ covered}{time\ taken}$

$= \frac{2\ x\ 600}{3.5}$

= 342.86 m/s

(c) State one factor that affects the speed of sound in a solid (1mk)

- Temperature
- Density