(PHYSICS)
FORM: 4
TERM 1 2025
OPENER EXAMINATION

INSTRUCTIONS: ***Answer all the Questions*** **TIME: 1 HR 30 MIN**

1. (a) Define electric resistance. (1mk)

Opposition to the flow of current.

(b) Figure below shows a network of three resistors

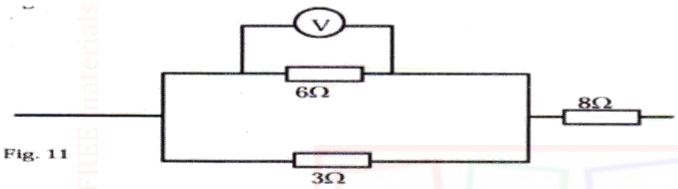


Fig. 11

$\frac{6\times3}{6+3} = \frac{18}{9} = 2\Omega$

$R_T = (2+8)\Omega = 10\Omega$

If the voltmeter reads 4V, find the

(i) Effective resistance (2mks)

$\frac{6\times3}{6+3} = \frac{18}{9} = (2+8)\Omega = 10\Omega$

(ii) Current through the 3Ω resistor (3mks)

$V_{6\Omega} = V_{3\Omega}$ | 1·333 A

$V = IR$

$\frac{4}{3} = \frac{I\times3}{3}$

(iii) Potential difference across the 8Ω resistor. (3mks)

Current through $6\Omega = \frac{V}{R} = \frac{4}{6} = 0.6667\,A$

Total current = 1·333 + 0·6667

= 2A

$V = IR = 2\times8 = 16V$

(c) Explain the difference between **pd** and **emf** (2mks)

P·D : Voltage across the terminals of a cell when supplying current

E.m.f : voltage across a cell in an open circuit.

2. (a) State the basic law of electrostatics. (1mk)

It states that like charges repel while unlike charges attract each other.

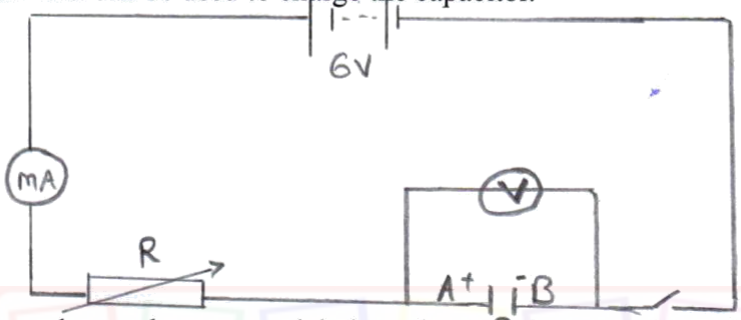
(b) The distance of separation between the plates of a certain capacitor is reduced. Explain how this affects the capacitance of a capacitor. (2mks)

When the distance of seperation ~~of~~ between the plates of a capacitor is reduced the divergence also reduces. This affects the capacitance of a capacitor in such away that the potential difference dereases hence increasing the capacitance.

c) You are provided with the following apparatus used for studying charging of a capacitor. An uncharged capacitor, voltmeter, milliammeter, 6V battery, connecting wires, a switch and a load resistor R.

(i) Draw a circuit diagram that can be used to charge the capacitor. (3mks)

Capacitor ✓
Voltemetre ✓
Milliammeter ✓
6V battery ✓
Connecting wires ✓
Switch ✓
load resistor R. ✓



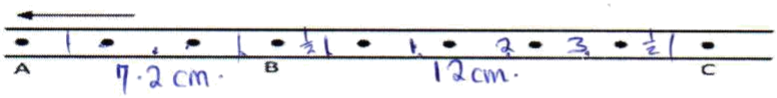
(ii) Use the circuit diagram drawn above to explain how the capacitor gets charged. (3mks)

When the capacitor is connected to the battery, negative charges flows from the negative terminal of a battery to plate B of the capacitor. At the same rate, negative charges flow from the other plate A of the capacitor towards the positive terminal of the battery. For this reason equal positive and negative charges appear on the plates and oppose the flow of electrons which causes them. The charging current drops to zero when the capacitor is fully charged.

(iii) State the purpose of resistor R. (1mk)

The purpose of the resistor is to ~~oppos~~ offer an opposition force to the flow of current.

3. (a) The figure below shows dots which were made by a ticker timer – tape attached to a trolley. The trolley was moving in the direction shown.



If the frequency used was 60Hz, distance AB = 7.2cm and BC = 12cm, determine

(i) The velocities between AB and BC (2mks)

AB

Velocity = $\frac{\text{displacement}}{\text{time}}$ $= \frac{0.072}{0.033}$

Time = 0.0167s × 2 $= 2.16 m/s$

= 0.0333

BC

Velocity = $\frac{0.12}{0.0167 \times 4}$

1m = 100cm

$\frac{1 \times 12}{100} = 0.12m$

$= 1.8 m/s$

(ii) The acceleration of the trolley. (2mks)

acceleration = $\frac{V - U}{t}$

$= \frac{1.8 - 2.16}{0.0167 \times 7}$ $= -3.0857 m/s^2$

(b) An object is projected horizontally with a velocity of 40m/s at the top of a cliff 100m from the ground. (Take g = 10m/s2)

(i) Calculate the time taken for the object to hit the ground (2mks)

$h = \frac{1}{2}gt^2$ $\sqrt{t^2} = \sqrt{20}$

$100 = \frac{1}{2} \times 10 \times t^2$ $t = 4.47s$

$\frac{100}{5} = \frac{5t^2}{5}$

(ii) What is the range of the object from the foot of the cliff (2mks)

Range = ut

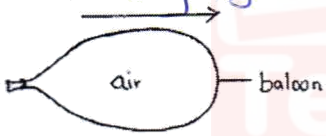
$= 40 \times 4.47$

$= 178.89m$

4. (a) Explain the reason why the inside of a helmet is lined with sponge. (2mks)

The inside of a helmet is lined with sponge so as to protect the rider of a motor bike, for example, from senous injuries in the head incase of an accident. This is achieved in such a way that when the rider is hit on the head, the impulsive force acting on the head is greately reduced by the increased time of impact due to increase in the distance between the head and the hitting object.

(b) The figure below shows a balloon filled with air.



When the mouth is suddenly opened, the balloon moves in the direction shown above by the arrow. Explain that observation. (2mks)

When the mouth of the balloon is suddenly opened, air moves out with a high velocity. This creates an equal and opposite force of the balloon, the reaction force, hence causing the balloon to move in the opposite direction with the air moving out.

(c) A rock of mass 150kg moving at 10m/s collides with a stationary rock of mass100kg. They fuse after collision. Determine the:

(i) Total momentum before collision. (2mks)

Total momentum = Mass x Velocity.

$= 150 \times 10$

$= 1500\ kgms^{-1}$

(ii) Total momentum after collision. (2mks)

$M_1V_1 + M_2V_2 = (M_1 + M_2)V_c$.

$(150 \times 10) + (100 * 0) = (100 + 150)V_c$.

$\frac{1500}{250} = \frac{250V_c}{250}$

$V_c = 6m/s$.

Momentum = $m \times v$.

$= 250 \times 6$.

$= 1500kgms^{-1}$

(Momentum before collision = Momentum after collision).

(iii) Their common velocity after collision. (2mks)

$M_1V_1 + M_2V_2 = (M_1 + M_2)V_c$

$(150 \times 10) + (100 \times 0) = (150 + 100)V_c$

$\frac{1500}{250} = \frac{250V_c}{250}$

Velocity common = 6m/s.

5.(a) Distinguish between evaporation and boiling (1mk)

Evaporation of a liquid subjected to heat takes place at every point of heating. Boiling of a certain liquid takes place at a specific temperature depending on the type of the liquid.

(b) A jet delivering 0.44g of dry steam per second, at 100°C is directed on to crushed ice at 0.0° C contained in an unlagged copper can which has a hole in the base. 4.44g of water at 0.0°C flow out of the hole per second

(i) How many joules of heat are given out per second by condensing steam and cooling to 0.0oC of water formed? (Latent heat of vaporization of steam = 2.26 x 106JKg-1, c for water = 4200JKg-1K-1) (3mks)

$M = 0.44g$ steam.

$T_1 = 100°C$

$T_2 = 0.0°C$

$Q = mL_v$

$Q = \frac{0.44}{1000} \times 2.26 \times 10^6$

$Q = 994.4J$

(ii) How much heat is taken in per second by the ice which melts? (2mks)

~~Heat lost by steam = heat gained by ice.~~

~~$= 994.4J$~~

(iii) Suggest why these amounts above are different (2mks)

(c) Form three students carried out an experiment to determine the specific heat capacity of a metal block using mixture method. Explain three measures they can take in order to enhance accurate findings (3mks)