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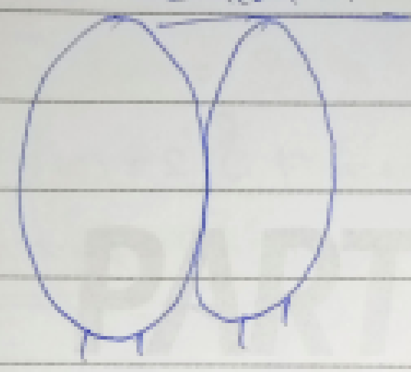
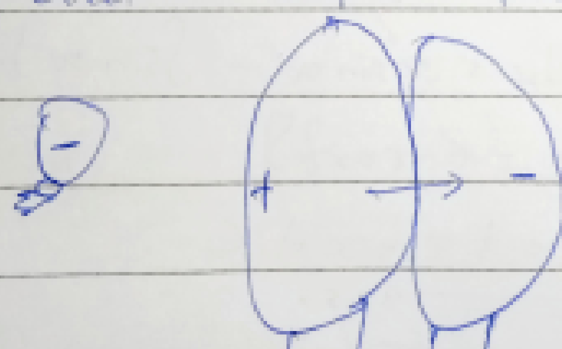
MATRIC NO: 19/ENG09/014
Course Code: Phy 102

Section A

1a)



two neutral conducting spheres are touching one another, thus allowing for free movement of electrons between them



when negatively charged balloon is brought near, Partner Évolution

5) Biot - saivant law states that the magnet field is directly proportional to the product permeability of free space (μ), the current (I) the change in lenght, the radius and inversly proportional to the square of radius (r^2).

4a) Magnetic flux is defined as the strength of the magnetic field which can be represented by line of force. It is represented by the symbol Φ mathematically given as $\Phi = B \cdot dA$

4b) $m = 9 \times 10^{-31}$ kg

$r = 1.4 \times 10^{-7}$ m

$B = 3.5 \times 10^{-1}$ weber/m^{-2}

Cyclotron frequency = angular speed

$\omega = \frac{v}{r} = \frac{qB}{m}$

$\omega = \frac{qB}{m} = \frac{1.6 \times 10^{-19} \times 3.5 \times 10^{-1}}{9 \times 10^{-31}}$

$\omega = 6222222222.22222 s^{-1}$

4c) I was asked to find the cyclotron frequency (i.e angular speed). Cyclotron frequency being equivalent to angular speed.

$\therefore$ angular speed = $62222222222.22222 s^{-1}$

ans.

3i) Volume charge density, $\rho = \frac{q}{v}$, where q is the charge and v is the volume of distribution. The S.I unit is Cm^{-3}

3ii) Surface Charge density, $\sigma = \frac{q}{A}$, where q is the charge and A is the area of the surface. The S.I unit is Cm^{-2}

3iii) linear charge density, $\lambda = \frac{q}{l}$ where q is the charge and l is the length over which it is distributed. The S.I unit is Cm^{-1}

3b) The potential difference between point A and B, $V_B - V_A$ is defined to be the change in potential energy of a charge q moved from A to B, is equal to the change in potential energy divided by the charge. potential difference is commonly called voltage, represented with the symbol

ΔV: $\Delta V = \frac{\Delta PE}{q}$, $\Delta V = \Delta PE\,q$ and $\Delta PE = q$.

magnitude = $\sqrt{(\Sigma x)^2 + (\Sigma y)^2}$

$\Sigma = 0$

$0 = 9 \times x^9 q + 10264.53568$

by making q the subject of the formula

$q = \frac{-10269.53568}{9 \times 10^9}$

$q = 1.1405028 56 \times 10^{-6}$

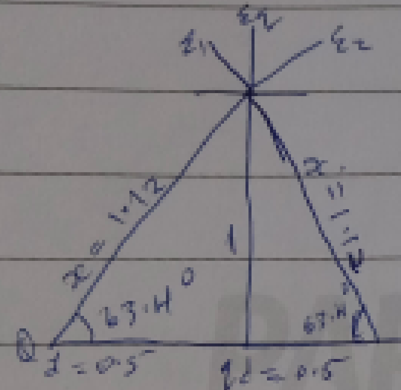
$\therefore q = 11.94 C$

$q_1 = 1.11 \times 10^{-5} C$

$\Rightarrow q_2 = 3.8 \times 10^{-5} C$

1c) $Q_1 = Q_2 = 8 \mu C$

$d = 0.5m$



$\tan\theta = \frac{opp}{Adj}$

$\tan\theta = \frac{1}{0.5} = 2$

$\theta = \tan^{-1} 2$

$\theta = 63.4^0$

$x^2 = 1^2 + 0.5^2$

$\sqrt{x^2} = \sqrt{1.25}$

$x = 1.12$

$E_1 = \frac{kq_1}{r_1^2} = \frac{9 \times 10^9 \times 8 \times 10^{-6}}{(1.12)^2} = 5739.7959$

$E_2 = \frac{kq_2}{r^2} = \frac{9 \times 10^9 \times 8 \times 10^{-6}}{(1.12)^2} = 5739.7959$

$E_q = \frac{kq}{r^2} = \frac{9 \times 10^9 \times q}{1} = 9 \times 10^9 q$

Vector	Angle	x component	y component
$E_1 = 5739.7959$	63.4^0	-2570.0458	5132.2628
$E_2 = 5739.7959$	63.4^0	2570.0458	5132.2628
$E_q = 9 \times 10^9 q$	90^0	0	$9 \times 10^9 q$
		$\Sigma x = 0$	$\Sigma y = 10264.5256 k$

Result:- If a negatively-charged balloon is used to charge the left sphere by induction, then the left sphere becomes positively-charged. The right sphere becomes negatively-charged.

1b) $k = 9 \times 10^9$

$q_1 + q_2 = 5 \times 10^{-5} C$

$f = 1N$

$d = 2m$

calculate the charge on each sphere.

Recall, $k = 9 \times 10^9$

$$f = \frac{kq_1 q_2}{r^2}$$

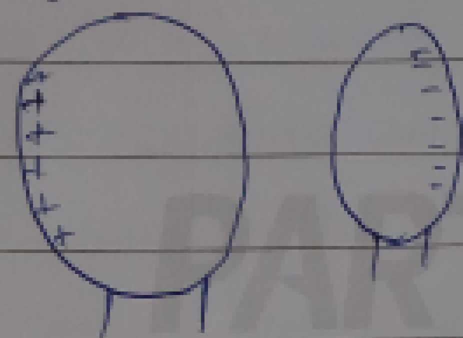
$$1 = \frac{9 \times 10^9 \times (q_1 q_2 \cdot 5 \times 10^{-5})}{2^2}$$

$4 = 9 \times 10^9 \times 5 \times 10^{-5} q_1 + 9 \times 10^9 q_2$

$4 = 45 \times 10^5 q_1 + 9 \times 10^9 q_2$

$9 \times 10^9 q_2 - 45 \times 10^5 q_1 + 4 = 0$

Electrons move from the left sphere to the right sphere. This leaves an unbalanced charge on the two spheres (positive on the left and negative on the right). The presence of the charged balloon has induced a ~~sep~~ seperation of charge.



The next step of the induction process involves separating the spheres. The right sphere is grabbed by the insulator stand and pulled away.