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19/SC119/013
Architecture
PHY 102 (Assignment)

Section (A)

(a) Charging by Induction: This is the process where objects gain electric charge by touch and the process is called electrostatic induction.

(b) $K = 9 \times 10^9$

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

$F = 1$ N

$d = 2$ m

charge on each sphere = ?

$$F = \frac{K q_1 \cdot q_2}{r^2}$$

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

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

$4 = 4.5 \times 10^6\ q_1 + 9 \times 10^9\ q_2$

$9 \times 10^9\ q_2 - 4.5 \times 10^5\ q_1 + 4 = 0$

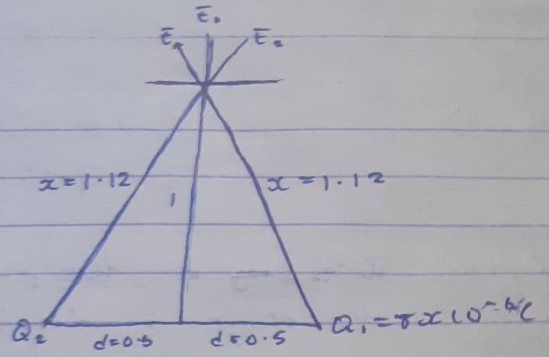
$q_1 = 0.0000111C \simeq 1.11 \times 10^{-5}$ C

$q_2 = 0.000038_C \simeq 3.8 \times 10^{-5}$ C

(c) $Q_1 = Q_2 = 8$ C

$d = 0.5$ m

Q1 If electric field at a point P is zero (6)



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

$x^2 = \sqrt{1.25}$

$x = \sqrt{1.25}$

$x = 1.12$

$\text{Tan}\,\theta = \frac{\text{OPP}}{\text{Adj}}$

$\text{Tan}\,\theta = \frac{1}{0.5}$

$\theta = \text{Tan}^{-1}(2$

$\theta = 63.4$

$\bar{E}_1 = \frac{Kq_1}{r^2} = \frac{9\times10^9 \times 8\times10^{-6}}{(1.12)^2} = 57397.9598$

$\bar{E}_2 = \frac{Kq_2}{r^2} = \frac{9\times10^9 \times 8\times10^{-6}}{(1.12)^2} = 57397.9598$

$\bar{E}_3 = \frac{Kq_3}{r^2} = \frac{9\times10^9 \times q}{(1.12)^2} = 9\times10^9 q$

Vector	Angle	x-Component	y-Component
$E_1 = 57397.9598$	$63.4°$ ~~63.4°~~	$E_1 \cos\theta = 25670.046796$	$E_1 \sin\theta =$ [illegible]
$E_2 = 57397.9598$	$63.4°$	$E_2 \cos\theta = 25670.045996$	$E_2 \sin\theta =$ [illegible]
$E_q = 9 \times 10^9 q$	$90°$	$E_q \cos\theta = 0$ $E_x = 0$	$E_q = 9 \times 10^9 q$ $E_y = 10264.52568$

Magnitude $= \sqrt{(E_x)^2 + (E_y)^2}$

$E_q = \sqrt{(0)^2 + (10264.32568)^2}$

Since $E_q = 0$

$0 = 9 \times 10^9 q + 10264.32568$

$q = \dfrac{10264.52568}{9 \times 10^9}$

$q = 1.14050285 3 \times 10^{-16}$

$q = 11.4\ \mu C$

(3) i, Volume charge density $\rho = \dfrac{dQ}{dv}$ in $dQ = \rho\, dv$

ii, Surface charge density $\sigma = \dfrac{dQ}{dA}$ in $dQ = \sigma\, dA$

iii, Linear charge density, $\lambda = \dfrac{dQ}{dL}$, in $dQ = \lambda\, dL$

(b) Electric ~~elec~~ potential difference: The electric potential difference between two points in an electric field can be defined as the work done per unit charge against electric forces when a charge is transported from one point to another

Section (B)

(a) Magnetic flux is defined as the strength of the magnetic field which can be represented by lines of forces.

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

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

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

Cyclotron frequency = angular speed

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

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

$$\omega = 6.22 \times 10^{10}\ rad^{-1}$$

(c) mass of electron $= 9.11 \times 10^{-31}\ kg$

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

magnetic field $= 3.5 \times 10^{-1}\ weber/meter^2$

~~Cyclotron frequency can be called Angular speed~~