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PHY 102 ASSIGNMENT

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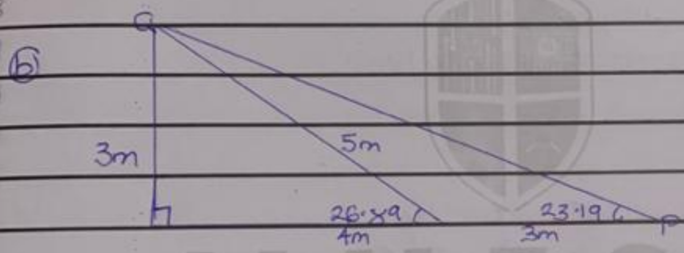
✓ PHY 102 Assignment

(2) Electric Field: It is a region of space in which an electric charge will experience an electric force.

(a) Electric field intensity: It can be defined as the force per unit charge.

$$E = \frac{F(N)}{q_0(C)}$$

(b)



$q_1 = +8nC \qquad q_2 = 12nC$

(I) $E_1 = \frac{KQ_1}{x^2} = \frac{9\times10^9 \times 8\times10^{-9}}{7^2} = 1.47$

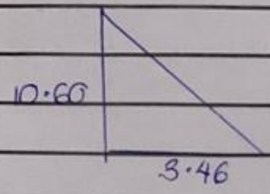
$E_2 = \frac{KQ_2}{x^2} = \frac{9\times10^9 \times 8\times10^{-9}}{3^2} = 12$

$E_1 + E_2 = 1.47 + 12 = 13.47 N/C$

(II) $E_1 = \frac{9\times10^9 \times 8\times10^{-9}}{9} = 8$

$E_2 = \frac{9\times10^9 \times 12\times10^{-9}}{5^2} = 4.32$

x	y
$8 \times \cos 90^\circ = 0$	$8 \times \sin 90 = 8$
$4.32 \times \cos 36.87^\circ = 3.46$	$4.32 \times \sin 36.87 = 2.60$
3.46	10.60



$$x = \sqrt{10.60^2 + 3.46^2}$$
$$= 11.15 N/C$$

3a) I. volume charge density

$$\rho = \frac{dQ}{dv} \longrightarrow dQ = \rho\, dv$$

II. surface charge density

$$\sigma = \frac{dQ}{dA} \longrightarrow dQ = \sigma\, dA$$

III. linear charge density

$$\lambda = \frac{dQ}{dl} \longrightarrow dQ = \lambda\, dl$$

b. $dW = F \cdot dL$

$F = -q_0 E$

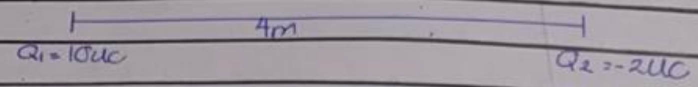
$dW = -q_0 E\, dl$

$$W(A \to B)_{Ag} = -q_0 \int_A^B E\, dl$$

$V_B - V_A = \frac{W(A \to B)_{Ag}}{q_0}$ it follows the definition

$$V_B - V_A = -\int_A^B E\,dL$$

(3c).



$$Q_1 = 10\mu C \quad Q_2 = 2\mu C$$

$$V = \frac{1}{4\pi E_0}\left[\frac{Q_1}{x_1} \times \frac{Q_2}{x_2}\right.$$

$$\frac{0}{9\times10^9} = \frac{10\times10^{-6}}{x_1} - \frac{2\times10^{-6}}{x_2}$$

$$2x = 10x_2$$

$$x_1 = 5x_2$$

~~Refer~~ Defining to the diagram above, the position along x-axis where $V = 0$ is 5m from $Q_1 = 10UC$ and 1m from $Q_2 = -2UC$.

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

(b) $m = 9.11\times10^{-31}$ kg, $r = 1.4\times10^{-7}$m, $B = 3.5\times10^{-1}$ weber/meter^2

cyclotron frequency = angular speed

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

$$\omega = \frac{1.6\times10^{-19}\times3.5\times10^{-1}}{9\times10^{-31}}$$

$$\omega = 62222.2222T^{-1}$$

c. we were given parameters such as

I. mass of the electron = 9.11×10^{-31} kg

II. a radius of 1.4×10^{-3}m

III. magnetic field of 3.5×10^{-1} weber/meter^2

and we were asked to find the cyclontron frequency which is equal or the same thing as angular speed. It is called cyclontron freqeuency because it is a frequency of an accelerator called cyclotron. Recall that angular speed is given as w = substituting we have;

$$w = \frac{1.6\times10^{-19}\times3.5\times10^{-1}}{9\times10^{-31}}$$

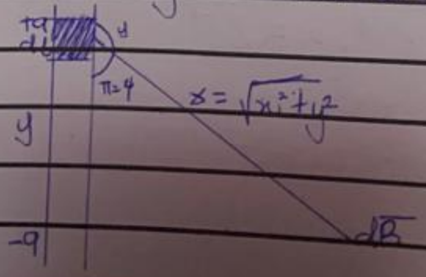
$$w = 62222.222T^{-1}$$

(5a) Biot - Savart law is an equation that describes the magnetic field created by a current-carrying wire and allows you to calculate its strength at various points.... And we replace the electric field E with a magnetic field element dB because a moving charge produces a magnetic field not an electric field

$$B = \frac{\overbrace{\mu_0}^{\text{Permeability of free space}} I}{4\pi}\int \frac{\overbrace{d\vec{s}}^{\text{length of segment}} \times \underbrace{\hat{r}}_{\text{radical direction}}}{\underbrace{r^2}_{\text{distance}}}$$

$$\mu_0 = 4\pi\times10^{-7}\ \text{T.m/A}$$

(b) Section of a straight current carrying conductor



$$B = \frac{\mu_0 I}{4\pi x}\left(\frac{2a}{(x^2+a^2)^{1/2}}\right)$$

when the length 2a of the conductor is very great in comparison to a distance x from point P, we consider it infinitely long. That is, when a is much larger than x.

$$(x^2 + a^2)^{1/2} \cong a, \text{as } a \to \infty$$

$$\therefore B = \frac{\mu_0 I}{2\pi x}$$

In a physical situation, we have axial symmetry about the y-axis. Thus, at all points in a circle of radius x, around the conductor, the magnitude of B is

$$B = \frac{\mu_0 I}{2\pi x}$$

The equation above defines the magnitude of the magnetic field of flux density B near a long, straight current carrying conductor.