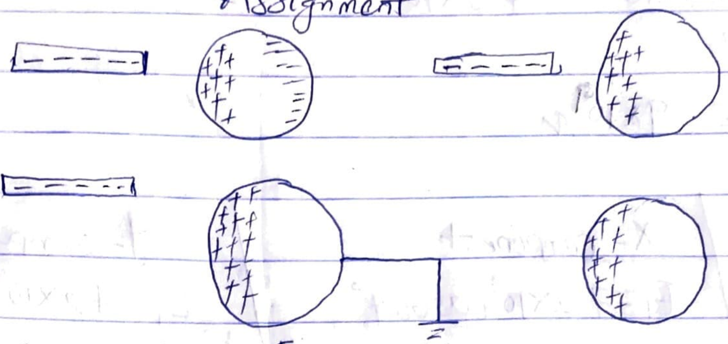
Name: Anochirionye Oreofe Ijeoma
Course: PHY 102
Dept: Nursing
Matric no: 19/mhs 02/025

Assignment

1 a)



b) $q + q_2 = 5.0 \times 10^{-5}$

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

$q_1 = 5.0 \times 10^{-5} + q_2$

$1 = \frac{9 \times 10^9 (5.0 \times 10^{-5} - q_2) q_2}{2^2}$

$1 = \frac{9 \times 10^9 \times (5.0 \times 10^{-5} - q_2) q_2}{4}$

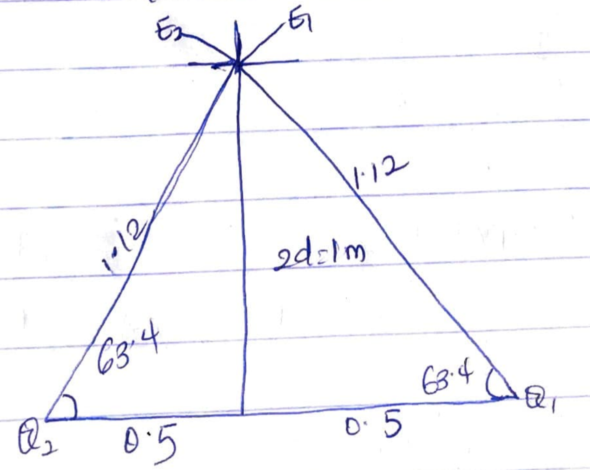
$4 = 4.5 \times 10^5 q - 9 \times 10^9 q_2$

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

quadratic equation

$q_1 = 3.84 \times 10^{-5}$ or 1.15×10^{-5} c

c



$Q_1 = Q_2 = 8\times10^{-6}C$

$E_p = E_1 + E_2 + E_q$

$E_1 = \frac{kq_1}{r^2} = \frac{9\times10^{-9}\times8\times10^{-6}}{1^2} = 7.2\times10^4$

$E_2 = \frac{kq_2}{r^2} = \frac{9\times10^9\times8\times10^{-6}}{1^2} = 7.2\times10^4$

$E_q = \frac{9\times10^9\times q}{1} = 9\times10^9 q$

Vector	Angle	X- component	Y- component
$E_1 = 7.2\times10^4$	$63.4°$	$E_1 = 7.2\times10^4 \cos 63.4°$ $= -32,238.65$	$E_1 = 7.2\times10^4 \sin 63.4°$ $= 64379.10$
$E_2 = 7.2\times10^4$	$63.4°$	$E_2 = 7.2\times10^4 \cos 63.4$ $= 32238.65$	$E_2 = 7.2\times10^4 \sin 63.4$ $= 64379.10$
$E_q = 9\times10^9 q$	$90°$	$E_q = 9.2\times10^9 \cos 90$ $= 0°$	$E_q = 9.2\times10^9 q \cos 90$ $= 9.2\times10^9 q$
		$\Sigma f_x = 0$	$\Sigma f_y = 128758.2$

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

$E_q = \sqrt{(0)^2 + (128758.2)^2}$

$= \sqrt{(128758.2)^2}$

$= 128758.2$

Since $E = 0$

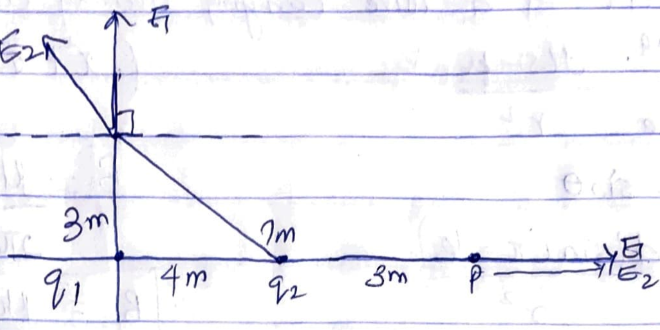
$0 = 9.2\times10^9 q + 128758.2$

$\frac{-9.2\times10^9 q}{-9.2\times10^9} = \frac{-128758.2}{-9.2\times10^9}$

$|q| = 41.3\times10^{13}$

2a) Electric field is a region of space in which the impact of an electric charge is felt while, electric field intensity, is defined as the force per unit charge.

(b) $Q_1 = 8nC$ $Q_2 = 12nC$ $x = 4m$



$E_1 = \frac{Kq}{r^2} = \frac{9\times10^9 \times 8\times10^{-9}}{7^2} = 1.46 N/C$

$E_2 = \frac{Kq}{r^2} = \frac{9\times10^9 \times 12\times10^{-19}}{3^2} = 12 N/C$

Vector	Angle	x-comp	y-comp
$E_1 = 1.46 N/C$	0	$E_{1x} = E_1 \cos\theta$	~~$E_{1y} = E_1 \sin\theta$~~
$E_2 = 12 N/C$	0	$E_{2x} = E_2 \cos\theta$	~~$E_{2y} = E_2 \sin\theta$~~

Vector	Angle
8 N/C	90°
4.32 N/C	37°

3a) Magnetic flux is also known as magnetic field which is the area in which the impact of a magnetic force is felt.

b) $m = 9.11\times10^{-31} kg$ $r = 1.4\times10^{-7} m$ $B = 3.5\times10^{-1}$ $q = 1.6\times10^{-19}$

$W = \frac{qB}{m} = \frac{1.6\times10^{-19} \times 3.5\times10^{-1}}{9.11\times10^{-31}}$

$W = 6.15\times10^{18} m/s$

To find Freq = $W = 2\pi f = 2\times3.142 f$

$\frac{6.15\times10^{-18}}{6.283 f} = \frac{6.283 f}{6.283 f}$ $f = 9.788\times10^{-9} Hz$

5a) Biot - Savart law state that at point p, there is a followed observations for the magnetic field $d\vec{B}$ which is associated with a length element $d\hat{l}$ of a wire carrying steady current I.

5b) $$B = \frac{\mu_0 I}{4\pi}\int_{-a}^{a} \frac{dl \sin p}{r^2}$$

$(x^2 + a^2)^{1/2}$

$\sin(\pi - \varphi) = \sin\theta$

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

$$B = \frac{\mu_0 I}{4\pi}\int_{-a}^{a} \frac{dl \sin(\pi - \varphi)}{r^2}$$

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

$$B = \frac{\mu_0 I}{4\pi}\int_{-a}^{a} \frac{dl \sin(\pi - \varphi)}{x^2 + y^2} \quad \text{—— (i)}$$

But $\sin(\pi - \varphi) = \frac{x}{\sqrt{x^2+y^2}} = \frac{x}{(x^2+y^2)^{1/2}}$ —— (ii)

Substitute (ii) into (i)

$$B = \frac{\mu_0 I}{4\pi}\int_{-a}^{a} dl \frac{x}{(x^2+y^2)(x^2+y^2)^{1/2}}$$

$$B = \frac{\mu_0 I}{4\pi}\int_{-a}^{a} dl \frac{x}{(x^2+y^2)^{3/2}}$$

Recall $dl = dy$; $B = \frac{\mu_0 I}{4\pi}\int_{-a}^{a} \frac{x}{(x^2+y^2)^{3/2}} dy$

$$\int \frac{dy}{(x^2+y^2)^{3/2}} = \frac{1}{x^2} \frac{y}{(x^2+y^2)^{1/2}}$$

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

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

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