4a) Magnetic flux is defined as the strength of magnetic field represented by lines of forces It is Usually represented by the symbol ϕ

Mathematically

$$\Phi = B - dA$$

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

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

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

$$\therefore \omega = 6.22 \times 10^{10} T^{-}$$

4c The Unit of Cyclotron frequency is equal to the Unit of frequency dimensionally

3a) i) Volume charge density $\rho = \frac{dQ}{dV}$ in $dQ = \rho\, dV$

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

iii) linear charge density $= \lambda = \frac{dQ}{dL}$ in $dQ = \lambda\, dL$

b) Electrical Potential difference:

Electrical Potential difference is the work done per unit charge against electrical forces when a charge is transported from one point to another. It is measured in volts (V) or Joules per coulomb (J/C). It is a scalar quantity

$$dW = F \cdot dL \quad \ldots \ldots (1)$$

But

$$F = -q_0 E \quad \ldots (2)$$

∴ substituting equation (1) & (2) yield

$$dW = -q_0 E\, dL$$

Total work done in moving the test charges from A to B is

$$W(A \rightarrow B)_{AB} = -q_0 \int_A^B E\, dL \quad \ldots (A)$$

From the definition of electric potential differen[ce]
It follows that

$$V_B - V_A = \frac{W(A \rightarrow B)_{Ag}}{q_0}$$

Putting equation (4) in (5) yields

$$V_B - V_A = -\int_A^B \varepsilon \, dl.$$

2a] Electric field is a region around a charge in which it exerts electrostatic force on another charges. Electric field Intensity is the strength of electric field at any Point in space

b] $E_1 = \frac{Kq_1}{(x-x_1)^2}$

$E_2 = \frac{Kq_2}{(x-x_2)^2}$

$E = E_1 + E_2 = K\left(\frac{q_1}{(x-x_1)^2} + \frac{q_2}{(x-x_2)^2}\right)$

$= \frac{1}{4\pi\varepsilon_0}\left(\frac{8\times10^{-9}}{(7-0)^2} + \frac{12\cdot10^{-9}}{(7-4)^2}\right)$

$= 13.5 N/C$

(ii) $E = K\left(\frac{q_1}{(y)^2} + \frac{q_2}{\sqrt{x_2^2+y^2})^2}\right)$

$\frac{1}{4\pi\varepsilon_0}\left(\frac{8\times10^{-9}}{9} + \frac{12\cdot10^{-9}}{\sqrt{16+9})^2}\right) = 12 N/C$

$$\varepsilon_1 = \frac{kq_1}{r^2} = \frac{9\times10^9 \cdot \times 8\times10^8}{(1.12)^2}$$
$$= 57397.95918$$

$$\varepsilon_2 = \frac{kq_2}{r^2} = \frac{9\times10^9 \times 8\times10^8}{(1.12)^2}$$
$$= 57397.95918$$

$$\varepsilon_q = \frac{kq}{r^2} = \frac{9\times10^9 \times q}{1} = 9\times10^9 q$$

Vector	Angle	x-component	y-component
$\varepsilon_1 = 57397.95918$	63.4	$\varepsilon\cos\theta = 2570.05$	$\varepsilon\sin\theta$ $= 5132.26$
$\varepsilon_2 = 57397.95918$	63.4	2570.05	$= 5132.26$
$\varepsilon_q = 9\times10^9 q$	90°	0	$9\times10^9 q$
		$\varepsilon_x = 0$	$\varepsilon_y = 10264.52$

$$\text{Magnitude} = \sqrt{(\varepsilon_x)^2 + (\varepsilon_y)^2}$$
$$\varepsilon_q = \sqrt{0^2 + (10264.52)^2}$$
$$\text{Since} = \varepsilon_q = 0$$
$$0 = 9\times10^9 q + 1024.52$$
$$q = \frac{10264.52}{9\times10^9} = 1.140502853\times10^{-16}$$
$$q = 11.4\,NC$$

1b Each of two small spheres is charged Positively the combined charge being $5.0 \times 10^{-5}C$. If each sphere is repelled from the other by a force of 1.0N when the sphere are 2.0m apart, calculate the charge on each sphere

Solution

$$f = \frac{Kq_1q_2}{d^2}$$

$F = 1.0N$

$d = 2m$

$K = 9.0 \times 10^9$

$$1.0 = \frac{9 \times 10^9 q_1 q_2}{2^2}$$

$$4 = 9 \times 10^9 q_1 q_2$$

$$q_1q_2 = \frac{4}{9 \times 10^{-9}} = \frac{4}{9} \times 10^{-9}$$

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

then

$$= (5 \times 10^{-5} - q_2)q_2 = 4/9 \times 10^{-9}$$

$$5 \times 10^{-5} q_2 - q_2^2 = \frac{4}{9} \times 10^{-9}$$

$$q_2^2 - 5 \times 10^{-5} q_2 + 4/9 \times 10^{-9} = 0$$ (Using formula method)

$$q_2 = \frac{-(-5\times10^{-5}) \pm \sqrt{(-5\times10^{-5})^2 - 4(1)\,4/9\times10^{-9}}}{2(1)}$$

$$= \frac{5\times10^{-5} \pm \sqrt{25\times10^{-10} - 16/9\times10^{-9}}}{2}$$

$$= \frac{5\times10^{-5} \pm \sqrt{10^{-10}(7.2)}}{2}$$

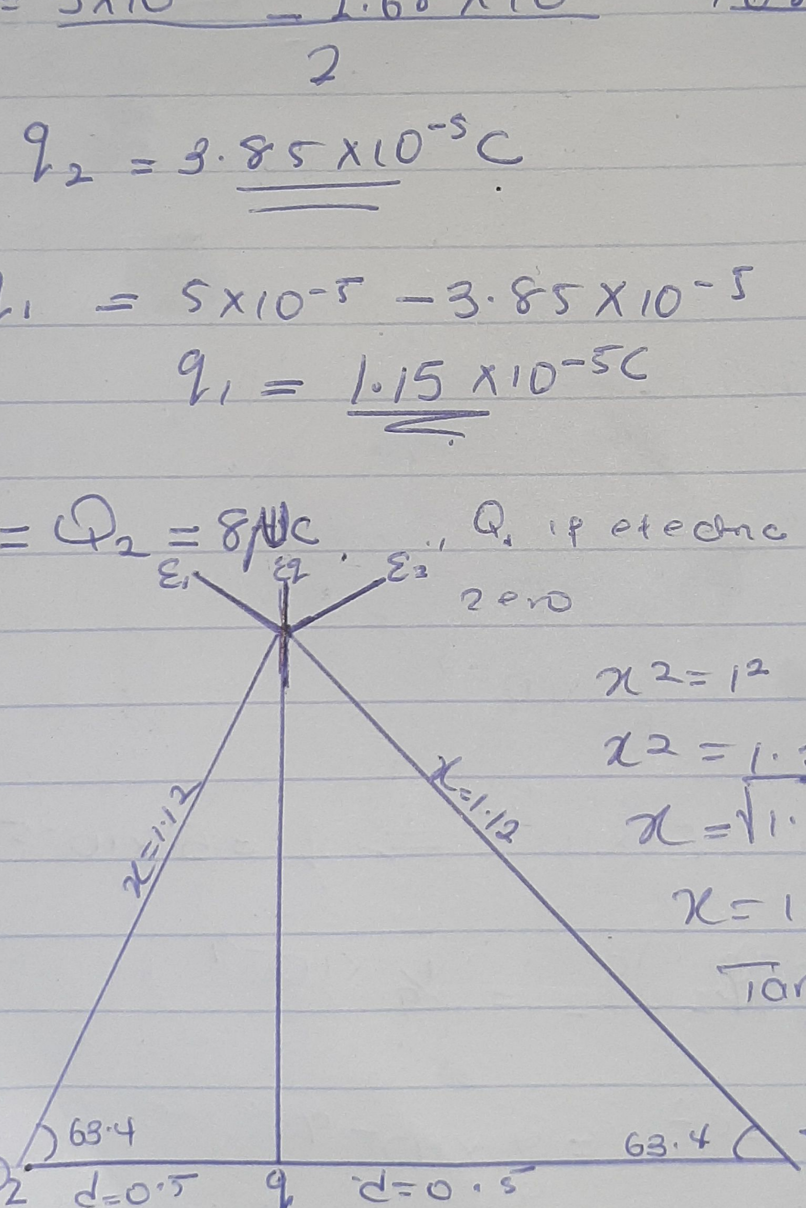
$$q_2 = \frac{5\times10^{-5} \pm 2.68\times10^{-5}}{2} \qquad \frac{7.68\times10^{-5}}{2}$$

$$q_2 = \underline{\underline{3.85\times10^{-5}C}}$$

$$q_1 = 5\times10^{-5} - 3.85\times10^{-5}$$

$$q_1 = \underline{\underline{1.15\times10^{-5}C}}$$

4c) $Q_1 = Q_2 = 8\mu C$, Q_1 if electric field is at point P is zero



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

$$x^2 = 1.25$$

$$x = \sqrt{1.25}$$

$$x = 1.12$$

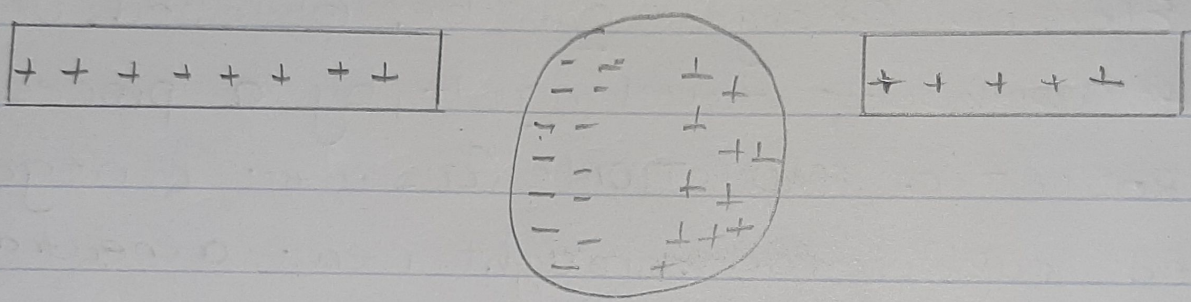
$$\tan\theta = \frac{opp}{adj}$$

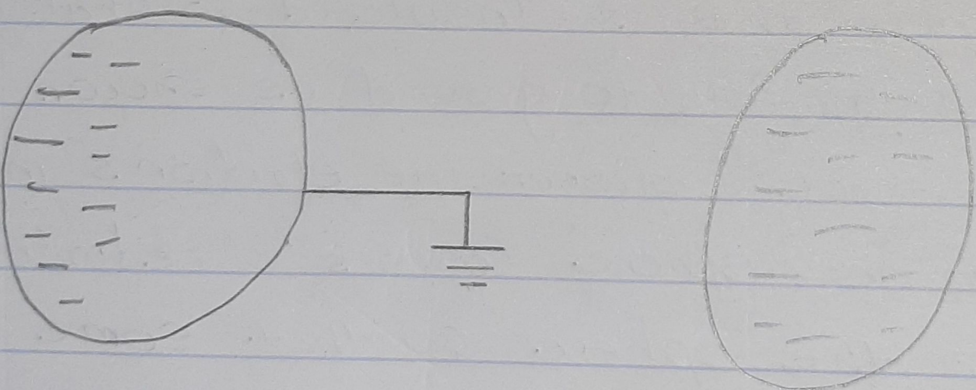
$$\tan\theta = \frac{1}{0.5}$$

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

$$\theta = 63.4$$

the Vicinity of the sphere, the Induced Positive charge remains on the Ungrounded sphere and becomes Uniformly distributed over the surface of the sphere





NAME: PHILIP - UGBODAGA - O. VANESSA
MATRIC NO: 19/MHS01/384
DEPARTMENT: MEDICINE AND SURGERY
COURSE CODE: PHYSICS 102

1 a) CHARGING OF INDUCTION:

Electric charges can be obtained on an object without touching it, by a process called ELECTROSTATIC INDUCTION. Consider a negatively charged rubber rod brought near a neutral (uncharged) Conducting sphere that is Insulated so that there is no conducting Path to ground as shown below: The repulsive force between the electrons in the rod and those in the sphere Causes a redistribution of charges on the sphere so that some electrons move to the side of the sphere farthest away from the rod. The region of the sphere nearest the negatively charged rod has an excess of Positive charge because of the migration of electrons away from this location. If a grounded Conducting Wire is then connected to the sphere, some of the electrons leave the sphere and travel to the earth if the wire to ground is then removed. The Conducting sphere is left with an excess of Induced Positive charge.

Finally, when the rubber rod is removed from