NAME: AKOMOLEDE MATTHEW GBENGA

DEPARTMENT: PETROLEUM ENGINEERING

MATRIC NO: 19/ENG07/005

COURSE CODE: PHY 102

(1) If a negatively charged object is used to charge a neutral object by induction, then the neutral object will acquire a positive charge. And is a positively charged object is used to charge. If you understand the inductio charging process, you can see why this would always be the case. The th object that is brought near will always repel like charges and attract opposit charges. Either way, the object being charged acquires a charges that i opposite the charge of the object used to induce the charge. To further illustrate this, the diagram below shows how a positively charged balloon will charge a sphere negatively by induction.

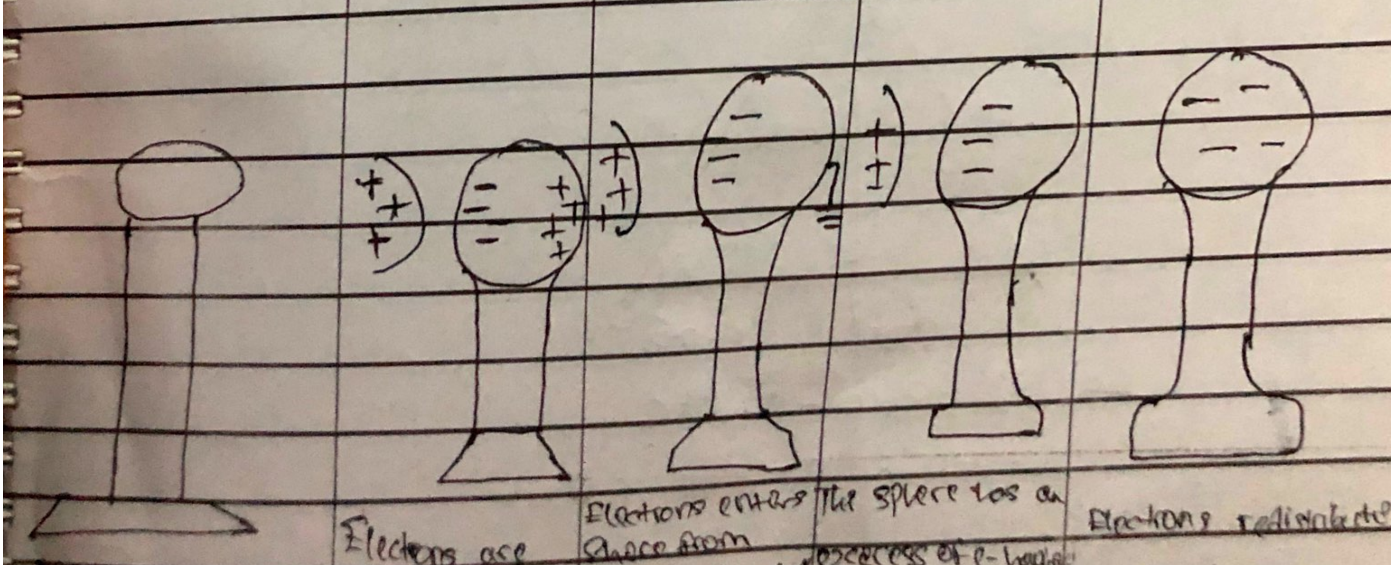


Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5
A neutral sphere	Electrons are attracted to the positive balloon	Electrons enters sphere from ground, attracted to the +charge in the sphere	The sphere has an excess of e- having entered from the ground	Electrons redistribute uniformly.

(B) $q_1 q_2 = 5.0\times10^{-5}C$, $F = 1.0N$, $r = 2.0m$

$F = 1.0$

$F = \frac{kq_1q_2}{r^2}$

$q_1q_2 = \frac{Fr^2}{k}$

$q_1q_2 = \frac{1.0\times 2.0}{9\times10^9}$

$q^2 = 2.22\times10^{-10}$

$q = \sqrt{2.22\times10^{-10}}$

$q = 1.48\times10^{-5}$

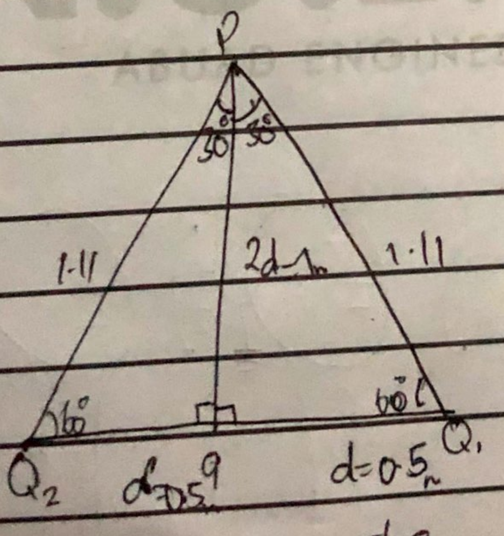
$(5.0\times10^{-5}) - (1.48\times10^{-5}) = 3.52\times10^{-5}$

$q_1 = 1.48\times10^{-5}C$, $q_2 = 3.52\times10^{-5}C$

or

$q_1 = 3.52\times10^{-5}C$, $q_2 = 1.48\times10^{-5}C$

(C)



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

$d = 0.5m$ $r = \frac{d}{2} = 0.25$

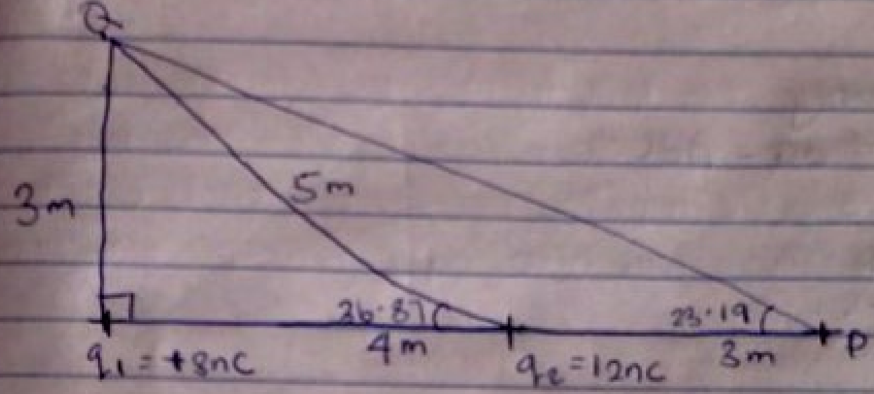
$F = \frac{kq_1q_2}{r} = \frac{(9\times10^9)\times(8\times10^{-6})\times(8\times10^{-6})}{(0.25)^2}$

(2a) [illegible] field : It is a region of space in which an electric charge will experience an electric force.

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

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

(b)



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

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

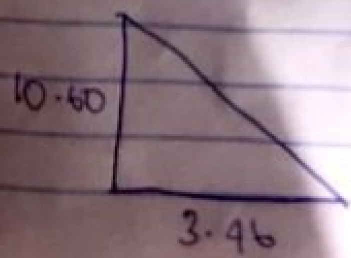
$+$

$= 13.47 N/C$

(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
$8\times\cos(90)$	$8\times\sin 90$
$= 0$	8
$4.32\times\cos(36.87)$	$4.32\times\sin(36.87)$
$= 3.46$	2.60
3.46	10.60



$x = \sqrt{10.6^2 + 3.46^2} = 11.15 N/C$

1) 1

Scanned with CamScanner

③a)

i) Volume charge density.

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

ii) Surface charge density

$$\sigma = \frac{dQ}{dA} \rightarrow dQ = \sigma dA.$$

iii) Linear charge density

$$\lambda = \frac{dQ}{dL} \rightarrow dQ = \lambda dL.$$

(b). $dW = F \cdot dL.$

$$F = -q_0 E.$$

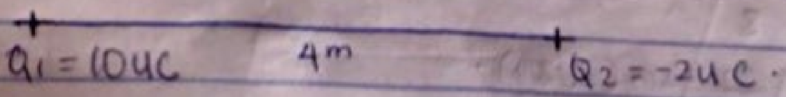
$$dW = -q_0 E dL.$$

$$W(A \rightarrow B)_{Ag} = -q_0 \int_A^B E dL.$$

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

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

3c).



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

$$V = \frac{1}{4\pi\varepsilon_0}\left[\frac{Q_1}{r_1} \times \frac{Q_2}{r_2}\right].$$

$$\frac{0}{9\times10^9} = \frac{10\times10^{-6}}{r_1} - \frac{2\times10^{-6}}{r_2}$$

$$2r = 10r_2 \;;\; r_1 = 5r_2$$

Referring to the diagram above, the position along the 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 be ~~represented~~ represented by line of forces. It is represented by the symbol Φ mathematically given as $\Phi = B \cdot dA$.

b) $m = 9.11 \times 10^{-31} kg$. $r = 1.4 \times 10^{-7} m$ $B = 3.5 \times 10^{-1}$ weber/meter^2

cyclotron frequency = angular speed

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

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

$$w = 62222.2222 T^{-1}$$

c) We were given parameters such as

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

ii) A radius of $1.4 \times 10^{-7} m$.

iii) Magnetic field of 3.5×10^{-1} weber/meter square.

and we were asked to find the cyclotron frequency which is equal the same thing as angular speed. It is called cyclotron frequency because it is a frequency of an accelerator called ~~cyc~~ Cyclotron. Recall that angular speed is given as w = substituting we have $w = 1.6 \times 10^{-10} \times 3.5 \times 10^{-10} / 9 \times 10^{-31}$

$= 622222.222 T^{-1}$

change in length, the radius and ...
radius (r^2). It can be represented mathematically by where
called permeability of free space. The unit of is weber/metre

$$B = \frac{\mu_0 I}{4\pi} \frac{dl \times r}{r^2}.$$

(5) Biot savart law is an equation that describes the magnetic fi
by a current - carrying wire, and allows you to calculate it
at various points ... And we replace the electric field E
magnetic field element dB because a moving charge produc
field not an electric field.

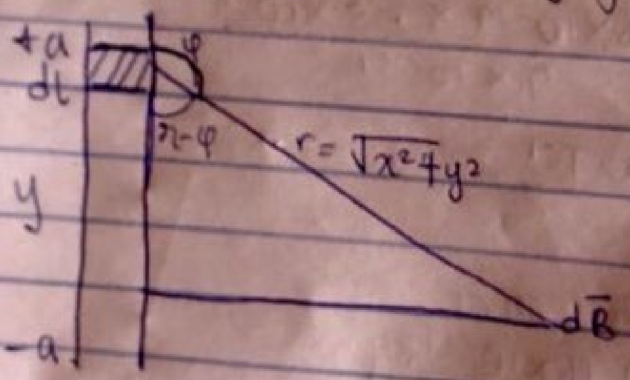
Permeability of free space — length of segment

$$B = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{s} \times \hat{r}}{r^2}$$

— Radical direction
— Distance.

$$\mu_0 = 4\pi \times 10^{-7}\ T \cdot m/A.$$

(6) 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 compa
distance x from point P, we consider it infinitely long. That
a is much larger than x,

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

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

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

$$B = \frac{\mu_0 I}{2\pi r} \quad \dots (1)$$

Equation (1) defines the magnitude of the magnetic ~~field~~ field of flux B near a long, straight current carrying conductor.

16

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

$$F = \frac{k q_1 q_2}{r^2} \qquad q_1 = 5 \times 10^{-5} C - q_2$$

$$\cancel{q_1 q_2} = \cancel{\frac{Fr^2}{k}} = \cancel{\frac{1 \times 2^2}{9 \times 10^9}} = \cancel{\frac{4}{9} \times 10^{-9}}$$

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

$$4 = 4.5 \times 10^5 q_2 - 9 \times 10^9 q_2^2$$

$$9 \times 10^9 q_2^2 - 4.5 \times 10^5 q_2 + 4 = 0$$

Using : $q_2 = -b \pm \sqrt{b^2 - 4ac} / 2a \quad a = 9 \times 10^9 \quad b = -4.5 \times 10^5 \quad c = 4$

$$q_2 = \frac{4.5 \times 10^5 \pm \sqrt{(-4.5 \times 10^5)^2 - 4(9 \times 10^9 \times 4)}}{2(9 \times 10^9)}$$

$$q_2 = \frac{4.5 \times 10^5 \pm \sqrt{5.85 \times 10^{10}}}{1.8 \times 10^{10}}$$

$q_2 = 3.84 \times 10^{-5} C \quad$ OR $\quad q_2 = 1.16 \times 10^{10} C$

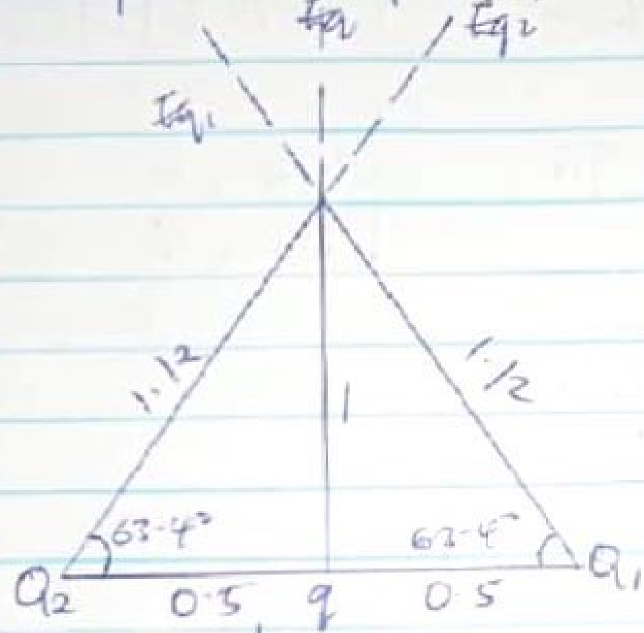
Scanned with CamScanner

$q_2 = 0.0000338C \simeq 3.8\times10^{-5}C.$

c. $Q_1 = Q_2 = 8\mu C.$

$d = 0.5m$

If electric field at a point p is zero.



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

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

$x = 1.12$

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

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

$\tan\theta = 2$

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

$\theta = 63.4$

$E_{q_1} = \frac{kq_1}{r^2} = \frac{9\times10^9\times8\times10^{-6}}{(1.12)^2}$

$E_{q_1} = E_{q_2} = 57397.95918.$

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

Vector	Angle	x - component	Y-compon
E_{q_1} = 5739795918	63.4°	2570.046785	5132.268
E_{q_2} = 5739795918	63.4°	2570.045785	5132.268
$E_q = 9\times10^9 q$	90°	$E_q\cos\theta = 0$ $E_x = 0$	$9\times10^9 q$ $E_y = 10$

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

$$E_q = \sqrt{(0)^2 + (10264.52568)^2}$$

Since $E_q = 0$

$$0 = 9\times10^9 q + 10264.52568$$

Making q subject of formula.

$$q = \frac{10264.52568}{9\times10^9}$$

$$q = 1.140502853\times10^{-16}$$

$$q = 11.4\,\mu C$$

Scanned with CamScanner