3a.) Volume charge density
Surface charge density
Linear charge density

3b). Electric potential difference

The electric p.d between two points in an electric field is the work done per unit charge against electrical forces when a charge is transported from one point to another. it is measured in volt or Joules per coloumb, Electric p.d is a scalar quantity

Section B

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

4b) $M = 9 \times 10^{-31}$ kg

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

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

Cycloton frequency = angular speed

$$W = \frac{v}{f} = \frac{qB}{m}$$

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

$$W = 62222222222,22222\ T^{-1}$$

4c) mass of electron = 9.11×10^{-31} kg (constant)

Radius = 1.4×10^{-7} m

magnetic field = 3.5×10^{-1} weber / meter^2

Cycloton frequency = ?
(angular speed)

angular speed = ω, Substituting we have $\omega = \frac{1.6 \times 10^{\wedge} - 10 \times 3}{1.6 \times 10^{\wedge} - 10 \times 3 \times 10}$

4c contd.)

Substituting we have $\omega = 1.6\times10^{-20} \times 3.5\times10^{-10}$

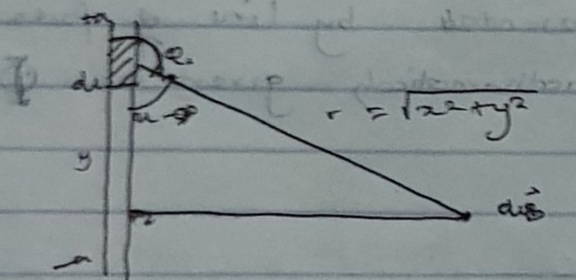
$= 9.11\times10^{-31}$

$= 6222222222.22222T^{-1}$

So since cyclotron frequency = angular speed and is equal to $6222222222.22222T^{-1}$, having a unit as T^{-1} which is equal to the unit of frequency dimensionally

5b.) Biot - Savart law states that the magnetic field is directly proportional to the product permeability of free space (μ) the current (I), the change in length, the radius and inversely proportional to the square of radius (r^2). It can be represented mathematically by where a constant called permeability of free space. The Unit is weber/meter^2

5b.)



A section of a straight current carrying conductor applying the Biot-Savart law, we find the mag. of the field from the diagram.

Recall

Using special integral:

Eqn. therefore becomes when the length of the conductor is very great in comparison to its distance from point p, we consider it indefinitely long. That is, when its much larger than. In a physical situation, we have axial symmetry about the y axis, thus at all points in a circle of radius around the conductor, the magnitude of B is the equation defining the magnitude of the magnetic field of flux density B near a long, straight current carrying conductor.

1c.) $Q_1 = Q_2 = 8\mu C$

$d = 0.5m$

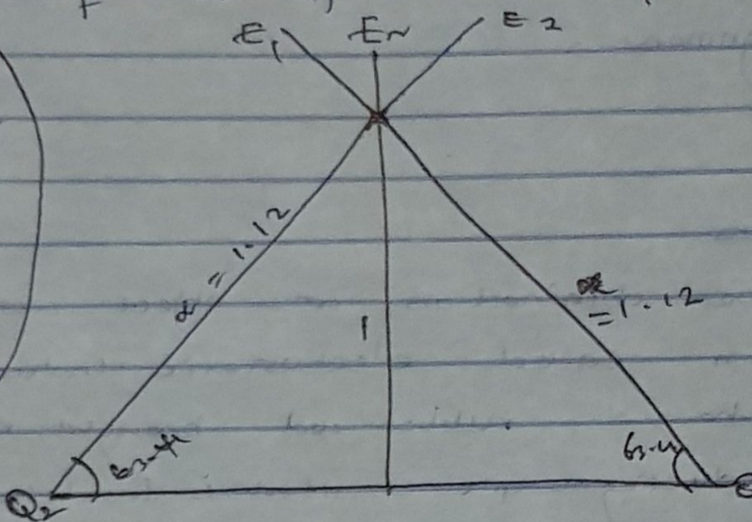
determine Q if electric field at a point p is zero (0)

$\theta \quad \tan\theta = \frac{Opp}{Adj}$

$= \frac{1}{0.5}$

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

$\theta = 63.4$



$= 8 \times 10^{-6} C$

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

$\sqrt{x^2} = \sqrt{1.25}$

$x = \sqrt{1.25}$

$x = 1.12$

$$E_1 = \frac{kQ_1}{r_1^2} = \frac{9\times10^9 \times 8\times10^{-6}}{(1.12)^2} = 5739.795918$$

$$E_2 = \frac{kQ_1}{r^2} = \frac{9\times10^9 \times 8\times10^{-6}}{1.12^2} = 5739.795918$$

$$E_Q = \frac{kQ}{r^2} = \frac{9\times10^9 \times Q}{1} = 9\times10^9 Q$$

Vector	angle	x-comp	y-comp
$E_1 = 5739.795918$	63.4 $\theta\, t$	$E_1 = \cos\theta$ -2570.045785	5132.262839
$E_2 = 5739.795918$	63.4	2570.045785	5132.262831.

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

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

since $E_0 = 0$

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

making Q subject of formula

$$Q = \frac{-10264.52568}{9\times10^9}$$

$$Q = 1.140502853\times$$

$\therefore Q = 11.4\mu C$

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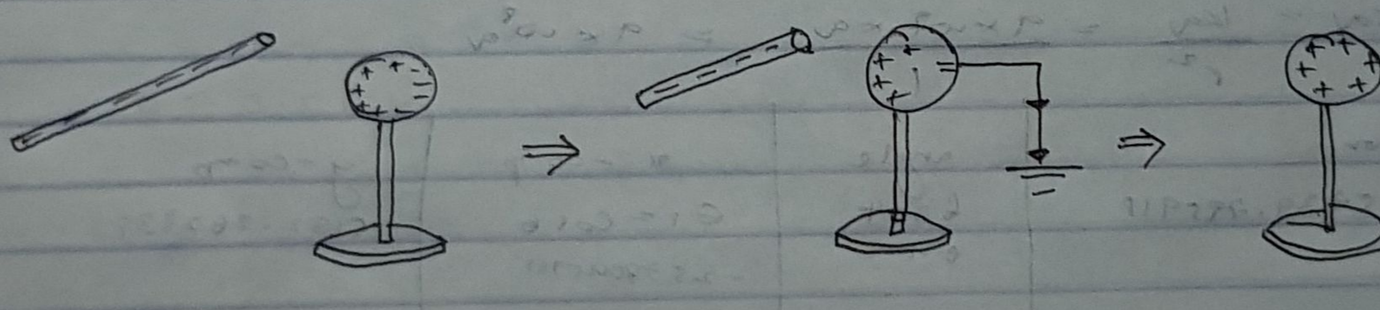
19/SCI14/005
Geology
PHY102 COVID-19 Assignment.

Answer: Section A

1) Charging by Induction

Electric charges can be obtained on an object without touching it, by a process called electrostatic Induction, Consider a positively charged rubber rod brought near a neutral (uncharged) Conducting sphere that is insulated so that there is no conducting path to ground as shown in the figure below

Finally when the rubber rod is removed from the vicinity of the sphere, the induced negatively charge remains on the ground sphere and becomes uniformly distibuted over the surface of the sphere.



1b.) $k = 9\times10^9$

$q_1 + q_2 = 5\times10^{-5}c$

$F = 1N$

$d = 2m$

Calc. the charge on each sphere

Recall;

$k = 9\times10^{-9}$

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

$1 = \frac{9\times10^9 \times (q_1 q_2 5\times10^{-5})}{2^2}$

$4 = 9\times10^9\times5\times10^{-5}q_1 \; 9\times10^9 q_1$

$4 = 4.5\times10^5 q_1 + 9\times10^9 q_1^2$

it's a quadratic eqn.

$9\times10^9 q_2 - 4.5\times10^5 q_1 + 4 = 0$

$q_1 = 0.00001\text{lc}$

$q_2 = 0.0000038c$

$\therefore q_1 = 1.11\times10^{-5}c$

$\therefore q_2 = 3.8\times10^{-6}c.$