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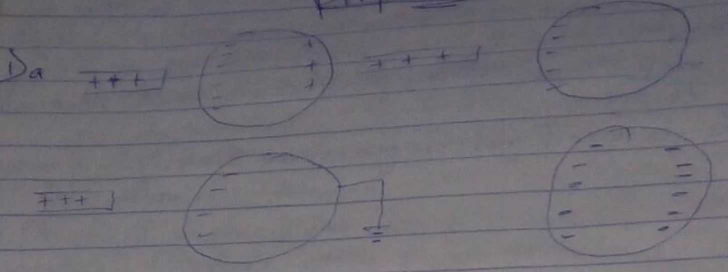
Phy 102

1a



b $K = 9 \times 10^9$

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

$F = 1N$

$d = 2m$

Calculate the charge on each sphere

$K = 9 \times 10^9$

$$1 = \frac{9 \times 10^9 \times (q_1 q_2 \times 5 \times 10^{-5})}{2^2}$$

$4 = 9 \times 10^9 \times 5 \times 10^{-5} q_1 + 9 \times 10^9 q_2$

$4 = 4.5 \times 10^5 q_1 + 9 \times 10^9 q_2$

Using quadratic equation

$9 \times 10^9 q_2 - 4.5 \times 10^5 q_1 + 4 = 0$

$q_1 = 0.0000111 C$

$q_2 = 0.000038 C$

$\simeq q_1 = 1.11 \times 10^{-5} C$

$\simeq q_2 = 3.8 \times 10^{-5} C$

c $Q_1 = Q_2 = 8 \mu C$

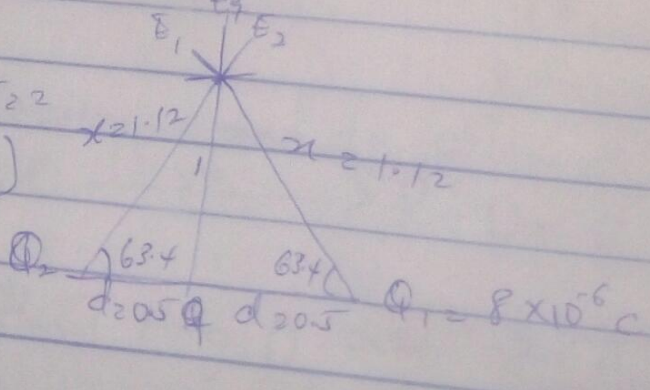
$d = 0.5 m$

θ_2:

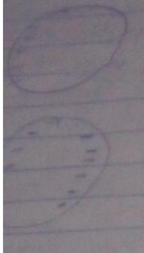
$\tan\theta = \frac{1}{0.5} = 2$

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

$\theta = 63.4$



... Belinda



...phere

...$0^9 q_2$

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

$x^2 = 1.25$

$x = \sqrt{1.25} = 1.12$

$E_1 = \frac{kq_1}{r_1^2} = \frac{9\times10^9 \times 8\times10^{-6}}{(1.12)^2} = 5739.796918$

$E_2 = \frac{kq_1}{r_1^2} = \frac{9\times10^9 \times 8\times10^{-6}}{(1.12)^2} = 5739.796918$

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

Vector	angle	x - comp	y - comp
$E_1 = 5739.795918$	$63.4°$	$E \times \cos\theta$	
	θ	$= -2570.045785$	5132.262839
$E_2 = 5739.795918$	$63.4°$	2570.045785	5132.262839
$E_q = 9\times10^9 q$	$90°$	$E_q \cos\theta = 0$	$9\times10^9 q$
		$\Sigma_x = 0$	$\Sigma_y = 10264.52568$

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

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

$E_q = 0$

i.e. if E_q; $0 = 9\times10^9 q + 10264.52568$

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

$q = 1.140502853\times10^{-6}$

$\Rightarrow q = 1.14\mu C$

3a i. Volume charge density

ii. Surface charge density

iii. Linear charge density

3b. The electric potential difference between two points in an electric field can be defined as the work done per unit charge against electrical forces when a charge is transported from one point to the other. It is measured in volt or Joules per Coulomb. Electric potential difference is a scalar quantity.

Section B

4a Magnetic flux is defined as the strength of the magnetic field which can be represented by line of forces.

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

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

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

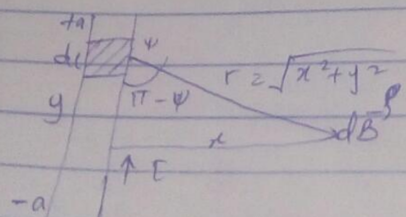
$$w = 62222222222.222 T^{-1}$$

c Mass of the electron $= 9 \times 11 \times 10^{-31}$ kg
radius $= 1.4 \times 10^{-7}$ m
Magnetic field $= 3.5 \times 10^{-1}$ weber/m^2

$$w = \frac{1.6 \times 10^{-10} \times 3.5 \times 10^{-10}}{9.11 \times 10^{-31}}$$

5a 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 square of radius (r^2).

5b



When the length of the conductor is very great in comparison to its distance from point P, we consider it infinitely long. That is, when is 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. Equation defines the magnitude of the magnetic field of flux density B near a long, straight current carrying conductor