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Matric number: 19/mhs01/110

Covid 19 Holiday Assignment

Section A

1a. CHARGING BY INDUCTION: Electric charges can be transferred from an object to another without contact this is due to a process known as electrostatic induction. Consider a positively charged rubber rod placed near a neutral sphere that is insulated so that there is no charge going to the ground. The repulsive force between the protons on the sphere and that on the rod causes a redistribution of charges in the sphere and the protons converge at the part of the sphere farthest from the rod making that part of the sphere positively charged and the one closer to the rod positively charged. If a ground conducting wire is connected to the sphere the protons get conducted to the ground leaving the sphere negatively induced. If the rod is removed the negative charges are distributed round the sphere.

3a. Volume charge density

Surface charge density

Linear charge density

3b. ELECTRIC POTENTIAL DIFFERENCE between two points in an electric field is the work done in carrying a unit charge from a place to another in the electric field. Its a scalar quantity and measured in volts or joules per columb

4a. MAGNETIC FLUX is what generates the field around a magnetic material.

5b. Boit savart law States that the magnetic field is directly proportional to the product permeability of free space. The current (I), the change in length and the radius are inversely proportional to the square of the radius. The unit is Weber/meter .

16) $K = 9 \times 10^9$

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

$f = 1N$

$d = 2m$

Calculate the charge on each sphere

Recall that

$K = 9 \times 10^9$

$f = K \frac{q_1 q_2}{r^2}$

$1 = \frac{(9 \times 10^9) \times (q_1 \times q_2 \times 5 \times 10^{-5})}{4}$

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

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

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

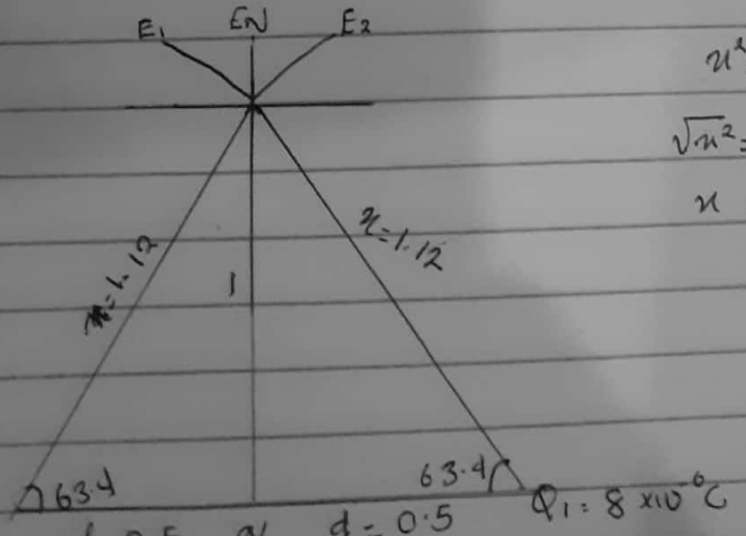
$q_1 = 0.000111\ C \approx 1.11 \times 10^{-5}$

$q_2 = 0.000038\ C \approx 3.8 \times 10^{-5}\ C$

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

$d = 0.5m$

determine Q if electric field at point P is zero



$r^2 = 1^2 + 0.5^2$

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

$r = 1.12$

$\tan\theta = O/A$

$\tan\theta = 1/0.5$

$\tan\theta = 2$

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

$\theta = 63.4$

$E_1 = \frac{kq_1}{r^2} = \frac{(9\times10^9)\times(8\times10^{-6})}{(1.12)^2} = 5739.795$

$E_2 = \frac{kq}{r^2} = \frac{(9\times10^9)\times(8\times10^{-6})}{1.12^2} = 5739.795$

$E_{qv} = \frac{kqv}{r^2} = \frac{9\times10^9 \times qv}{1} = 9\times10^9\, qv$

Vector	angle	x component	y component
$E_1 = 5739.79591$	63.4°	$E_1 \times \cos\theta$	
		-2570.045785	5132.262839
$E_2 = 5739.795$	63.4	2670.045785	5132.26283
$E_{qv} = 9\times10^9\, qv$	90	$\Sigma x \cos\theta = 0$	$9\times10^9\, qv$
		$\Sigma x = 0$	$\Sigma y = 10.266 = 52568$

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

$2q = \sqrt{(0)^2 + (10264.525)^2}$

$0 = 4\times10^9 q + 10264.525$

$q = -\frac{10264.525}{9\times10^9}$

$q = 1.140\times10^{-6}$

$q = 11.4\,\mu C$

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

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

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

cyclotron frequency = angular speed

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

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

$\omega = 6.2 \times 10^{10}$ i^{-1}

4c. Parameters given

i) mass of electron - 9.11×10^{-31} kg

ii) radius of 1.4×10^{-7} m

iii) magnetic field of 3.5×10^{-1} weber / meter^2

So to find the cyclotron freq which is equal to angular speed. (ω)

So :. $\omega = 1.6 \times 10^{-10} \times 3.5 \times 10^{-10}$

$\omega = 9.11 \times 10^{-31}$

Since cyclotron speed : angular speed

So cyclotron frequency = $1/9.11 \times 10^{-31}$

$= 6.22 \times 10^{10}$ i^{-1}