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COVID-19 HOLIDAY ASSIGNMENT

SECTION A

2a) Electric field is a region or space in which an electric charge is felt or experienced. WHILE Electric field intensity can be defined as the force (F) per unit charge (q).

b) $E = \frac{kq}{r^2}$

For 8nc

$E = \frac{9\times10^9 \times 8\times10^{-9}}{7^2}$

$= \frac{9\times8}{49} = 1.47N/C$

For 12nc $\quad r = 1m - 4m = -3m$

$E = \frac{9\times10^9 \times 12\times10^{-9}}{3^2}$

$= \frac{9\times12}{9} = 12N/C$

Net electric field of point P $= 12N/C + 1.47N/C$
$= 13N/C$

For 8nc

ii) $E = \frac{kq}{r^2} = \frac{9\times10^9 \times 8\times10^9}{3^2}$

$E = 8N/C$

For 12nc

$r = 4m + 3m$

$= 7m$

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 (fig. 1.3a). 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, as in (fig. 1.3b), some of the electrons leave the sphere and travel to the earth. If the wire to ground is then removed (fig 1.3c), the conducting sphere is left with an excess of induced positive charge.

Finally, when the rubber rod is removed from the vicinity of the sphere (fig. 1.3d), the induced positive charge remains on the ungrounded sphere and becomes uniformly distributed over the surface of the sphere.

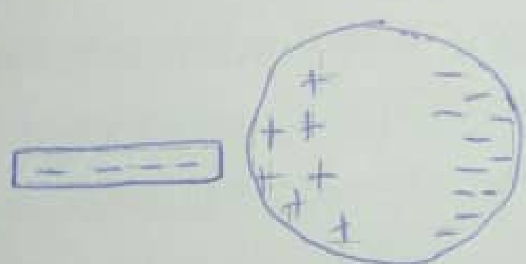


fig 1.3a

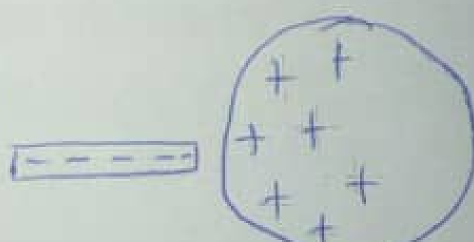


fig 1.3c

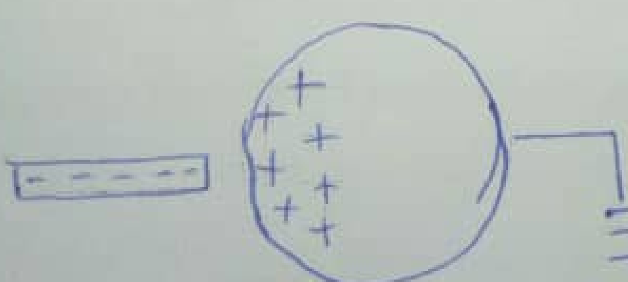


fig 1.3b

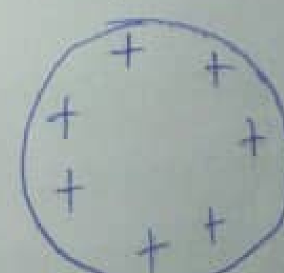


fig 1.3d

1b) $k = 9 \times 10^9$

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

$F = 1N$

$d = 2m$

Calculate the charge on each sphere

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

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

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

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

Its a quadratic equation

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

$q_1 = 0.0000111 C$

$q_2 = 0.000038 C$

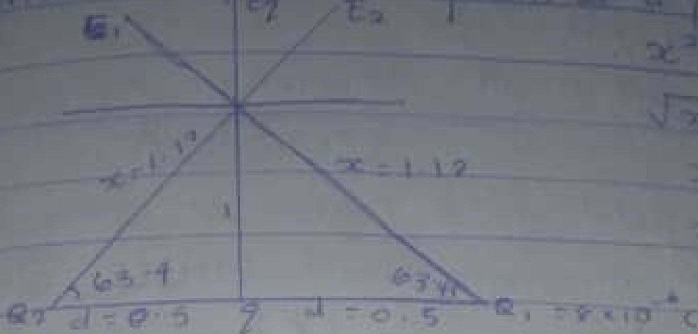
$\simeq q_1 = 1.11 \times 10^{-5} C$

$\simeq q_1 = 3.8 \times 10^{-5} C$

Q

$d = 0.5m$

determine Q if electric field at a point p



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

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

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

$\theta = 63.4$

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

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

$x = \sqrt{1.25}$

$x = 1.12$

$$E_1 = \frac{kq_1}{r_1^2} = \frac{9\times10^9 \times 8\times10^{-6}}{(1.12)^2} = 5739.795918$$

$$E_2 = \frac{kq_2}{r_2^2} = \frac{9\times10^9 \times 8\times10^{-6}}{1.12^2} = 5739.795918$$

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

vector	angle	x-comp	y-comp
$E_1 = 5739.795918$	$E_1 = 63.4°$	$E_1 \times \cos\theta$ -2570.045785	5132.262839
$E_2 = 5739.795918$	$63.4°$	2570.045785	5132.262839
$E_q = 9\times10^9 q$	$90°$	$E_q \cos\theta = 0$ $\Sigma x = 0$	$9\times10^9 q$ $\Sigma y = 10264.52568$

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

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

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

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

$q = 1.140502853 \times 10^{-6}$

$\simeq q = 11.4 \mu C$

2b continues

$E = \frac{kq}{r^2} = \frac{9 \times 10^9 \times 12 \times 10^{-9}}{7^2}$

$= \frac{9 \times 12}{49} = 2.20 \, N/c$

The net electric field at point Q $= 8 + 2.20 \, N/c$

$= 10.2 \, N/C$