18th March-2010

NC Manahil Zahid

BESE-15A

Physics- Quiz #1 (Chapter #27)

Physics R/V

Q11) $q_1 = ?$

$q_2 = ?$

$F = 0.108\ N$

$d = 50\ cm = 0.5\ m$

Given Data

What time do I find d?

A/c to coulomb's law;

a) $F = \frac{k q_1 q_2}{d^2}$ (For magnitude calculation)

$\Rightarrow q_1 q_2 = \frac{F d^2}{k}$

$= 0.108 \times (0.5m)^2$

$q_1 q_2 = 3 \times 10^{-12}\ C^2$

$q_1 = \frac{3 \times 10^{-12}\ C^2}{q_2}$ — (1)

Good Attempt

b) when the spheres are connected, the charge on each sphere becomes q i.e

$q = \frac{q_1 - q_2}{2}$

$2q = q_1 - q_2$ — (2)

5/5

$F' = 0.036\ N$

$d = 0.5\ m$

Now; $F' = \frac{k q^2}{d^2}$

$q^2 = \frac{F' d^2}{k}$

$q^2 = \frac{0.036 \times (0.5m)^2}{9 \times 10^9}$

$q^2 = 1 \times 10^{-12}\ C^2$

$\Rightarrow q = 1 \times 10^{-6}\ C$

putting in eq ① ;

$2(1 \times 10^{-6}) = q_1 - q_2$

$2 \times 10^{-6} C = q_1 - q_2$

$q_1 = 2 \times 10^{-6} + q_2 \quad -③$

Using ③ in ① ;

$2 \times 10^{-6} + q_2 = \frac{3 \times 10^{-12}}{q_2}$

$q_2^2 + 2 \times 10^{-6} q_2 - 3 \times 10^{-12} = 0$

By quadratic formula ;

$$q_2 = \frac{-2 \times 10^{-6} \pm \sqrt{(2 \times 10^{-6})^2 - 4(1)(-3 \times 10^{-12})}}{2(1)}$$

$q_2 = -2 \times 10^{-6} \pm 4 \times 10^{-6}\ C$

$q_2 = -3 \times 10^{-6} C$ or $q_2 = 1 \times 10^{-6} C$

when $q_2 = -3 \times 10^{-6} C$ in eq ① ;

$q_1 = \frac{3 \times 10^{-12}}{-3 \times 10^{-6}}$

$q_1 = -1 \times 10^{-6}$

when $q_2 = 1 \times 10^{-6} C$ in eq ①

$q_1 = \frac{3 \times 10^{-12}}{1 \times 10^{-6}} C$

$q_1 = 3 \times 10^{-6} C$

Ans ;

$q_1 = 3 \times 10^{-6} C$

$q_2 = -1 \times 10^{-6} C$ ✓

or

$q_1 = -1 \times 10^{-6} C$

$q_2 = 3 \times 10^{-6} C$ ✓

$$2\pi\epsilon_0 r^2$$

$$E = \frac{\lambda}{2\pi\epsilon_0 r^2} \quad \because \lambda = q/\theta$$

$$\Rightarrow E = \frac{q/\theta}{2\pi\epsilon_0 r^2}$$

here, $\theta = \pi/2$

$$E = \frac{2q/\pi}{2\pi\epsilon_0 r^2}$$

Good

$$\boxed{E = \frac{q}{\pi^2\epsilon_0 r^2}}$$