

Name: _____

Discussion Instructor: Battelino Bruno DeSisto Gehrke Izatt

Roshko Sawyer Shastry

ans = 15.94

Number = 152

UNCLEAR
SLOW
SIGNS

~~Answer:~~
~~15.94~~
~~152~~

PROBLEM 4B

Two charges q_1 and q_2 when combined give a total charge of $6\mu\text{C}$. When they are separated by 3 m , the force exerted by one charge on the other has the magnitude $8 \times 10^{-3}\text{ N}$. Find q_1 and q_2 if (a) both are positive so that they repel each other; (b) one is positive and the other negative so that they attract each other.

(a) $q_1 + q_2 = Q = 6 \times 10^{-6}\text{ C}$

(b) $k \frac{q_1 q_2}{r^2} = F = 8 \times 10^{-3}\text{ N}, r = 3\text{ m}$

$q_1, q_2 = 6 \times 10^{-6} \rightarrow q_1 q_2 = \frac{r^2 F}{k} = q_1 (Q - q_1) \Rightarrow q_1^2 - q_1 Q + \frac{r^2 F}{k} = 0$

$q_1^2 - 6 \times 10^{-6} q_1 + \frac{8(9 \times 10^{-3})}{9 \times 10^9} = 0 \Rightarrow q_1^2 - 6 \times 10^{-6} q_1 + 8 \times 10^{-12} = 0$

$q_1 = \frac{6 \times 10^{-6} \pm \sqrt{36 \times 10^{-12} - 4(8 \times 10^{-12})}}{2} = \frac{6 \times 10^{-6} \pm 2 \times 10^{-6}}{2}$

$q_1 = 4 \mu\text{C} \quad \& \quad q_2 = 2 \mu\text{C}$

(b) $q_1 - q_2 = Q, -k \frac{q_1 q_2}{r^2} = -F \Rightarrow q_1 q_2 = \frac{r^2 F}{k} = q_2 (q_1 + Q) = q_2^2 + q_2 Q$

$q_1^2 + q_1 Q - \frac{r^2 F}{k} = 0 \Rightarrow q_1^2 + 6 \times 10^{-6} q_1 - 8 \times 10^{-12} = 0$

$q_1 = \frac{-6 \times 10^{-6} \pm \sqrt{36 \times 10^{-12} + 4(8 \times 10^{-12})}}{2} = \frac{-6 \times 10^{-6} \pm \sqrt{64 \times 10^{-12}}}{2} = -3 \pm \sqrt{17} \mu\text{C}$

q_1 cannot > 0 in calculation. Let's pl. sign. change

\Rightarrow neg. charge: $-(\sqrt{17} - 3) \mu\text{C} = -1.12 \mu\text{C}$

pos. charge: $(3 + \sqrt{17}) \mu\text{C} = 7.12 \mu\text{C}$