Answer on Question #79372- Physics- Electric Circuits

Question: *Two charges , q1=-8μC and q2=+12μC, are at a 12cm of distance. Find the resultant force and direction over a charge q3=-4μC, located in the middle between the other two forces.*

Answer:

Since $q_1 < 0$, $q_2 > 0$ and $q_3 < 0$, the charge q_1 repulses q_3 whereas q_2 attracts q_3. Hence, both Coulomb forces point towards the charge q_2 (see figure 1 for details). The net force is just a vector sum of these two separate forces, and it points also towards the charge q_2. In order to find its magnitude, one should sum the absolute values of these two forces (this procedure is equivalent to making projection along the x-axis):

$$F_{net} = |F_{13}| + |F_{23}|. \quad (1)$$

According to the Coulomb's law:

$$|F_{13}| = k\frac{|q_1||q_3|}{r_{13}^2} = k\frac{4|q_1||q_3|}{d^2}, \quad (2)$$

$$|F_{23}| = k\frac{|q_2||q_3|}{r_{23}^2} = k\frac{4|q_2||q_3|}{d^2}, \quad (3)$$

where $r_{13} = r_{23} = d/2$ according to the initial conditions.

As a result,

$$F_{net} = 4k\frac{|q_3|(|q_1| + |q_2|)}{d^2}. \quad (4)$$

Substituting numerical values into (4), we obtain:

$$F_{net} = 4 \cdot 9 \cdot 10^9 \frac{4 \cdot 10^{-6}(8+12) \cdot 10^{-6}}{(12 \cdot 10^{-2})^2} = 200\ N. \quad (5)$$

Finally, one can conclude that the resultant force is equal to 200 N and point towards the charge q_2.

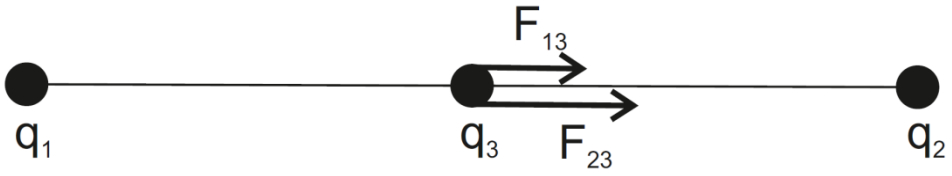

Figure 1.

Answer provided by https://www.AssignmentExpert.com