

Answer on question #83171, Physics Electric Circuits

two charges $-q$ and $-3q$ are separated by a distance l . these two charges are free to move but do not because there is a third charge nearby. what must be the charge and placement of the charge for the first two to be in equilibrium?

Solution

Suppose, that between the negative charges q and $3q$ is the positive charge q_x and the distance from the charge q to the charge q_x is l_1 , and the distance from the charge $3q$ to the charge q_x is l_2 .

Using Coulomb's law, we draw up and solve a system of equations:

$$\left\{ \begin{array}{l} k \frac{[-q]q_x}{l_1^2} = k \frac{[-q][-3q]}{(l_1 + l_2)^2} \\ k \frac{[-3q]q_x}{l_2^2} = k \frac{[-q][-3q]}{(l_1 + l_2)^2} \end{array} \right\}$$

Hence $l_2 = \sqrt{3} \cdot l_1$; $q_x = 0.4 q$

Answer: $l_2 = \sqrt{3} \cdot l_1$; $q_x = 0.4 q$

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