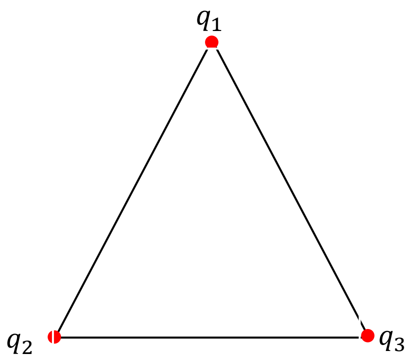
Answer on Question#62124 – Physics – Electric Circuits

Two positive charges each 4.18μC,and negative charge -6.36μC,are fixed at vertices of an equilateral triangle of side 13cm.Find the electric force on the negative charge.

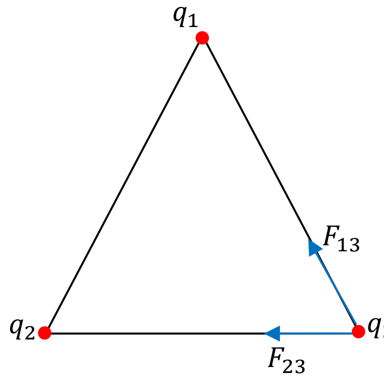
Solution. According to Coulomb's law the magnitude of force of interaction of point charges is equal to $F = \frac{k \cdot q_1 \cdot q_2}{r^2}$, where $k = 9 \cdot 10^9 \frac{N \cdot m^2}{C^2}$, r distance between charges, q_1, q_2 – magnitude of charges. Like charges repel, unlike charges attract. The charges are located as shown in figure.



According to the conditions of the problem $q_1 = q_2 = 4.18 \cdot 10^{-6}C$, $q_3 = -6.36 \cdot 10^{-6}C$, $r_{12} = r_{13} = r_{13} = 0.13m$. Positive charges attract negative with a force magnitude equal to the

$$F_{13} = F_{23} = \frac{k \cdot |q_1| \cdot |q_3|}{r_{13}^2} = \frac{9 \cdot 10^9 \cdot 4.18 \cdot 10^{-6} \cdot 6.36 \cdot 10^{-6}}{0.13^2} \approx 14.16N$$

The force of attraction of positive charges to the negative directed as shown in the picture



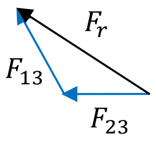
Electric force on the negative charge equal to the geometric sum of the forces F_{13} and F_{23}.

Resultant force acting on a negative charge equal to

$$\vec{F}_r = \vec{F}_{13} + \vec{F}_{23}$$

Charges fixed at vertices of an equilateral triangle.

Using the theorem of cosines will get



$$F_r^2 = F_{13}^2 + F_{23}^2 - 2F_{13} \cdot F_{23} \cdot \cos 120.$$

$$F_r^2 = 2F_{13}^2 - 2F_{13} \cdot F_{13} \cdot \left(-\frac{1}{2}\right)$$

$$F_r^2 = 3F_{13}^2 \rightarrow F_r = \sqrt{3}F_{13} = \sqrt{3} \cdot 14.16 \approx 24.5N$$

Answer. $F_r = 24.5N$.