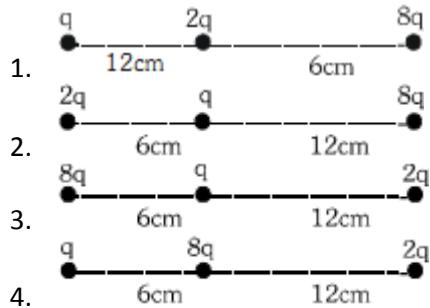


Answer on Question #41702, Physics, Electrodynamics

How three charges (q , $2q$, $8q$) are placed on a line of length 18 cm. So the potential energy of system is minimal:



Solution

The potential energy of three charges is

$$U = \frac{kq_1q_2}{r_{12}} + \frac{kq_1q_3}{r_{13}} + \frac{kq_3q_2}{r_{32}}$$

1.

$$U = \frac{kq(2q)}{12cm} + \frac{kq(8q)}{18cm} + \frac{k(8q)(2q)}{6cm} = \frac{59kq^2}{18cm}.$$

2.

$$U = \frac{kq(2q)}{6cm} + \frac{kq(8q)}{12cm} + \frac{k(8q)(2q)}{18cm} = \frac{34kq^2}{18cm}.$$

3.

$$U = \frac{kq(2q)}{12cm} + \frac{kq(8q)}{6cm} + \frac{k(8q)(2q)}{18cm} = \frac{43kq^2}{18cm}.$$

4.

$$U = \frac{kq(2q)}{18cm} + \frac{kq(8q)}{6cm} + \frac{k(8q)(2q)}{12cm} = \frac{50kq^2}{18cm}.$$

So the potential energy of system is minimal in second case.

Answer: the potential energy of system is minimal in second case.