

Answer on Question #41899 – Physics - Electric Circuits

The force between two point charges in air is 100N. Calculate the force if the distance between them is increased by 50% .

Solution:

$F_1 = 100\text{N}$ – initial force;

The force between two point charges q_1 and q_2 separated a distance r has a magnitude given by the Coulomb's Law:

$$F_1 = k \frac{q_1 \cdot q_2}{r_1^2} \quad (1)$$

Force after changing the distance between charges:

$$F_2 = k \frac{q_1 \cdot q_2}{r_2^2}$$

Distance between them is increased by 50%:

$$r_2 = 1.5r_1 \Rightarrow F_2 = k \frac{q_1 \cdot q_2}{r_2^2} = k \frac{q_1 \cdot q_2}{(1.5r_1)^2} = k \frac{q_1 \cdot q_2}{2.25 \cdot r_1^2} \quad (2)$$

(2) \div (1):

$$\frac{F_2}{F_1} = \frac{k \frac{q_1 \cdot q_2}{2.25 \cdot r_1^2}}{k \frac{q_1 \cdot q_2}{r_1^2}} = \frac{kq_1 \cdot q_2}{2.25 \cdot r_1^2} \frac{r_1^2}{kq_1 \cdot q_2} = \frac{1}{2.25}$$

$$F_2 = \frac{F_1}{2.25} = \frac{100\text{N}}{2.25} = 44.4\text{N}$$

Answer: force after changing the distance between charges is equal to 44.4N