The force between two identical spheres each having charge q at some distance apart is F. Third identical sphere is brought firstly in contact with A and then with B finally removed. What is the force between the first two spheres?

Solution:

The Coulomb's law

$$F = k\frac{q_1 q_2}{r^2} = k\frac{q^2}{r^2}$$

When a third sphere (no charged) is brought in contact with A sphere having charge q, the both spheres will have same charge $\frac{q+0}{2} = q/2$.

So new charge of the sphere A is $q_1' = q/2$.

When a third sphere (with charge q/2) is brought in contact with B sphere having charge q, the both spheres will have same charge $\frac{q+\frac{q}{2}}{2} = \frac{3q}{4}$.

So new charge of the sphere B is $q_2' = 3q/4$.

Finally the force between the first two spheres

$$F' = k\frac{q_1' q_2'}{r^2} = k\frac{3q^2}{8r^2} = \frac{3}{8}F$$

Answer: $F' = \frac{3}{8}F$