QUES 03:-

a. Two insulated charged copper spheres A and B have their centres separated by a distance of 50 cm. What is the mutual force of electrostatic repulsion if the charge on each is $6.5 \times 10^{-7}C$? The radii of A and B are negligible compared to the distance of separation.

b. What is the force of repulsion if each sphere is charged double the above amount, and the distance between them is halved?

Sol.

a. $q_1 = q_2 = 6.5 \times 10^{-7}C$

r = 50 cm = 0.50 m

$k = \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2C^{-2}$

F = ?

According to Coulomb's law, electrostatic force of attraction is given by;

$F = k\frac{q_1q_2}{r^2}$

$= \frac{9 \times 10^9 \times 6.5 \times 10^{-7} \times 6.5 \times 10^{-7}}{(0.50)^2}$

$F = 1.5 \times 10^{-2}N$

b. Now, if each sphere is charged double, and the distance between them is halved then the force of repulsion is:

$F = k \cdot \frac{2q_1 2q_2}{\left(\frac{r}{2}\right)^2}$

$F = 16k \cdot \frac{q_1q_2}{r^2}$

$= 16 \times 1.5 \times 10^{-2} = 24 \times 10^{-2}$

F = 0.24 N