**6.** Two tiny conducting spheres are identical and carry charges of -20.0 µC and +50.0 $\mu$C. They are separated by a distance of 2.50 cm. **(a)** What is the magnitude of the force that each sphere experiences, and is the force attractive or repulsive? **(b)** The spheres are brought into contact and then separated to a distance of 2.50 cm. Determine the magnitude of the force that each sphere now experiences, and state whether the force is attractive or repulsive.

$$F_a = k\frac{q_{1a}q_{2a}}{d^2} = \left(8.99\ x\ 10^9\ {Nm^2}/{C^2}\right)\frac{(-20.0\ x\ 10^{-6}C)(50.0\ x\ 10^{-6}C)}{(2.50\ cm)^2\left(\frac{10^{-2}m}{cm}\right)^2}$$

$$F_a = -1.44\ x\ 10^4\ N$$

**- sign indicates attractive. Note: oppositely signed charges again attractive force.**

**When the two spheres touch the charge is equilibrated. Since the conducting spheres are identical, it is just the numerical average.**

$$q_b = \frac{q_{1a} + q_{2a}}{2} = \frac{-20.0\ \mu C + 50.0\ \mu C}{2} = \frac{30.0\ \mu C}{2} = 15.0\ \mu C$$

**Force now that the charge is equilibrated is**

$$F_b = k\frac{q_b q_b}{d^2} = k\left(\frac{q_b}{d}\right)^2 = \left(8.99\ x\ 10^9\ {Nm^2}/{C^2}\right)\left(\frac{15.0\ x\ 10^{-6}C}{2.50\ x\ 10^{-2}\ m}\right)^2$$

$$F_b = \left(8.99\ x\ 10^9\ {Nm^2}/{C^2}\right)\left(3.60\ x\ 10^{-7}\ {C^2}/{m^2}\right) = 3.236\ x\ 10^3\ N$$

**Since the charge is now both positive, the force will be repulsive.**

$F_a = -1.44\ x\ 10^4\ N$, **- Sign indicates attractive.**
$F_b = +3.24\ x\ 10^3\ N$, **+ Sign indicates repulsive.**