Answer on Question #43978, Physics, Electrodynamics

Two metal spheres of radii 'a and 'b are far apart but are connected by a wire. Their combine charge is Q. Determine the charge on each of the conductor and also shows that the potential on each of the conductor is V= Q / (a+b).

Solution

A potential of sphere is given by

$$V = k\frac{Q}{r}$$

where r is its radius. We know, that potential on each sphere must be equal each to other, because if not, the current will start to flow. Hence, we have equations

$$V_a = k\frac{Q_a}{a} = V_b = k\frac{Q_b}{b}$$

$$Q_a + Q_b = Q$$

From this we find that

$$Q_a = \frac{Q}{1 + b/a}, \qquad Q_b = \frac{Q}{1 + a/b}$$

Potential is

$$V_a = V = k\frac{Q_a}{a} = k\frac{Q}{a(1 + a/b)} = k\frac{Q}{a+b}$$