

354.

Problem 30.53 (RHK)

We consider two widely separated conducting spheres, 1 and 2, the second having twice the diameter of the first. The smaller sphere initially has a positive charge q and the larger one is initially uncharged. The spheres are connected with a long thin wire. (a) We have to answer how the final potentials V_1 and V_2 are related.

(b) We have to find the final charges q_1 and q_2 on the spheres in terms of q .



Solution:

It is given that the conducting sphere, 1, has initially charge q . The conducting sphere, 2, is initially uncharged. Let R be the radius of the sphere 1. The radius of the sphere 2 is $2R$.

After the conducting spheres have been connected with a long thin wire, there will be transfer of charge from 1 to 2 till the two become equipotential. Let the distributed charge on the conducting spheres when the two are equipotential be q_1 and q_2 . We have the condition

$$\frac{q_1}{4\pi\epsilon_0 R} = \frac{(q - q_1)}{8\pi\epsilon_0 R}.$$

Therefore,

$$q_1 = \frac{q}{3}, \text{ and } q_2 = \frac{2q}{3}.$$

