



2nd Set of exercises

Exercise 1:

We consider a positive point charge Q placed at the center of a hollow conducting sphere, of internal radius R_{int} and external radius R_{ext} .

1-Determine the charge on the interior and exterior surfaces of the sphere in each of the following

cases:

- The sphere is initially neutral and is connected to earth.
- The sphere is initially isolated and neutral.
- The sphere is initially isolated and carries a charge q .

Exercise 2:

Consider a conducting sphere A of radius a carrying a positive charge $+2Q$. We place it at the center of a conducting spherical shell B with inner radius b and outer radius c , and initially carrying a charge $-Q$.

- Calculate the charges Q_{Bint} and Q_{Bext} of the inner and outer surfaces of the spherical shell B at electrostatic equilibrium.
- We connect the spherical shell B to the ground by a conductive wire. What are the new charges Q_{Bint} and Q_{Bext} after returning to electrostatic equilibrium.
- Using the GAUSS theorem calculate the electric field at any point in space.
- Deduce the electric potential at any point in space (knowing that it is zero at infinity).

5. Calculate the capacitance of the spherical capacitor consisting of the sphere of radius a and the interior face of the spherical shell (radius b).

Exercise 3:

Consider the electric circuit of four capacitors $C_1 = 1.0 \text{ pF}$, $C_2 = 0.5 \text{ pF}$, $C_3 = 1.5 \text{ pF}$ and $C_4 = 2.0 \text{ pF}$, connected to a battery of $\Delta V = 2.0 \text{ V}$, as shown in Fig.

- Calculate the charge stored in each capacitor and the voltage across capacitors.

