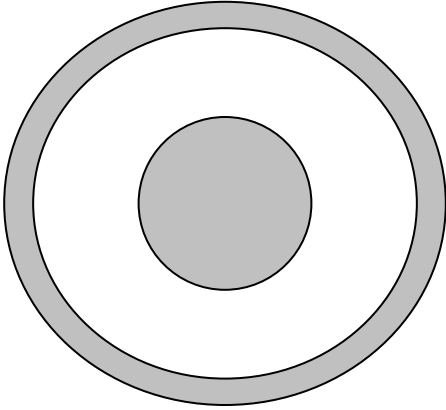


Chapter 25 Examples, Capacitance

- 1) Calculate the capacitance of a spherical capacitor with inner radius a and outer radius b .



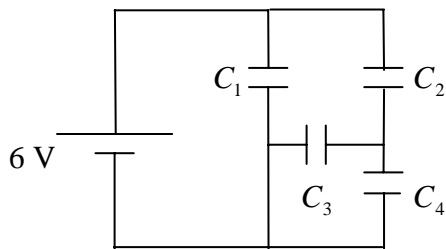
Using the same technique as in problem # 1, the capacitance of a parallel plate capacitor is found to be $C = \frac{\epsilon_0 A}{d}$, where A = the area of one plate (both plates are assumed to have the same area) and d = the distance between the plates. [Note: Now it may be useful to write $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m} = 8.85 \text{ pF/m}$ rather than as $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 / \text{N} \cdot \text{m}$ as we have done previously.]

2) A parallel-plate, air-filled capacitor having an area of 40 cm^2 and a plate spacing of 1.0 mm is charged to a potential difference of 600 V . Using the boxed equation above, find (a) the capacitance (b) the magnitude of the charge on each plate, (c) the stored energy, (d) the electric field between the plates and (e) the energy density between the plates.

3) The charged capacitor described in # 2, is disconnected from the battery and the region between the plates is now filled with a material having a dielectric constant of 5.6 . (a) What is the capacitance? (b) What is the electric field between the plates? (c) What is the magnitude of the charge on each plate? (d) What is the voltage between the plates? (e) How is the stored energy and energy density affected, if at all? (f) How would the above values change, if the capacitor remained connected to the battery while the dielectric was inserted?

- 4) Use Gauss' Law to determine the magnitude of the electric field a distance r away from the center of a point charge, $+Q$, that is submerged in transformer oil, $\kappa = 4.5$.

- 5) Four capacitors ($C_1 = 1\mu F$, $C_2 = 2\mu F$, $C_3 = 3\mu F$ and $C_4 = 4\mu F$) are connected to a 6.0 volt battery as shown below.



- Determine the equivalent capacitance.
- Determine the charge stored on $C_2 = 2\mu F$.
- How much energy is stored in the $2\mu F$ capacitor?