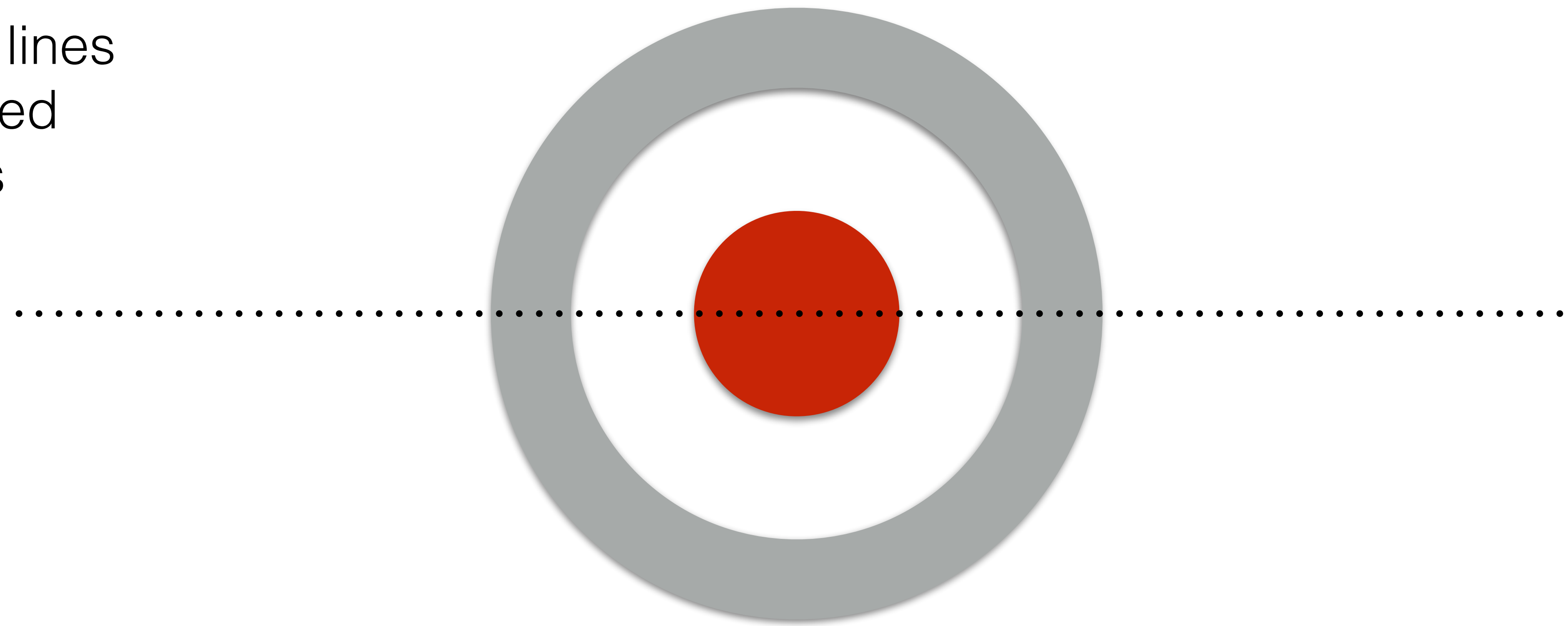
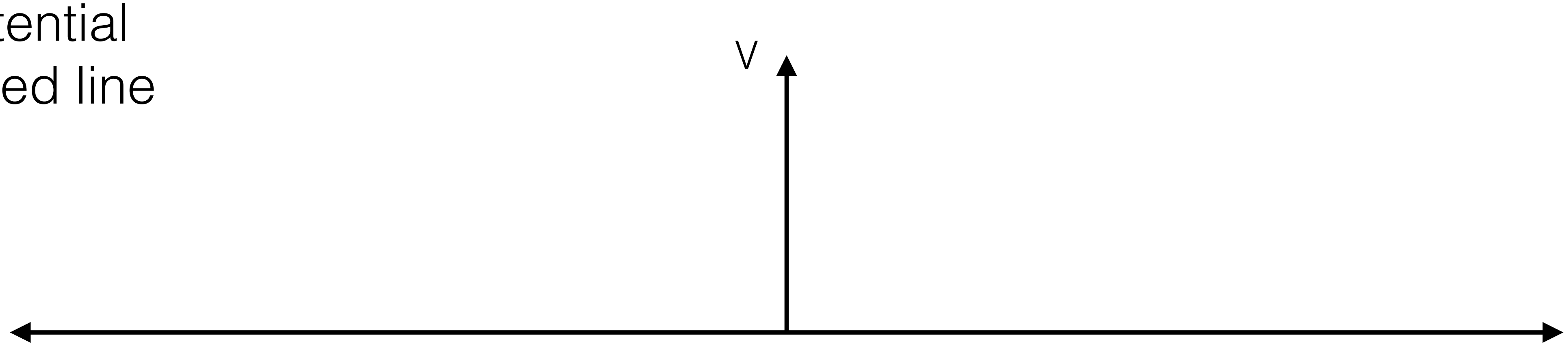
Spherical, charged conducting sphere inside neutral conducting shell (with air gap)

Draw E-field lines and induced charges

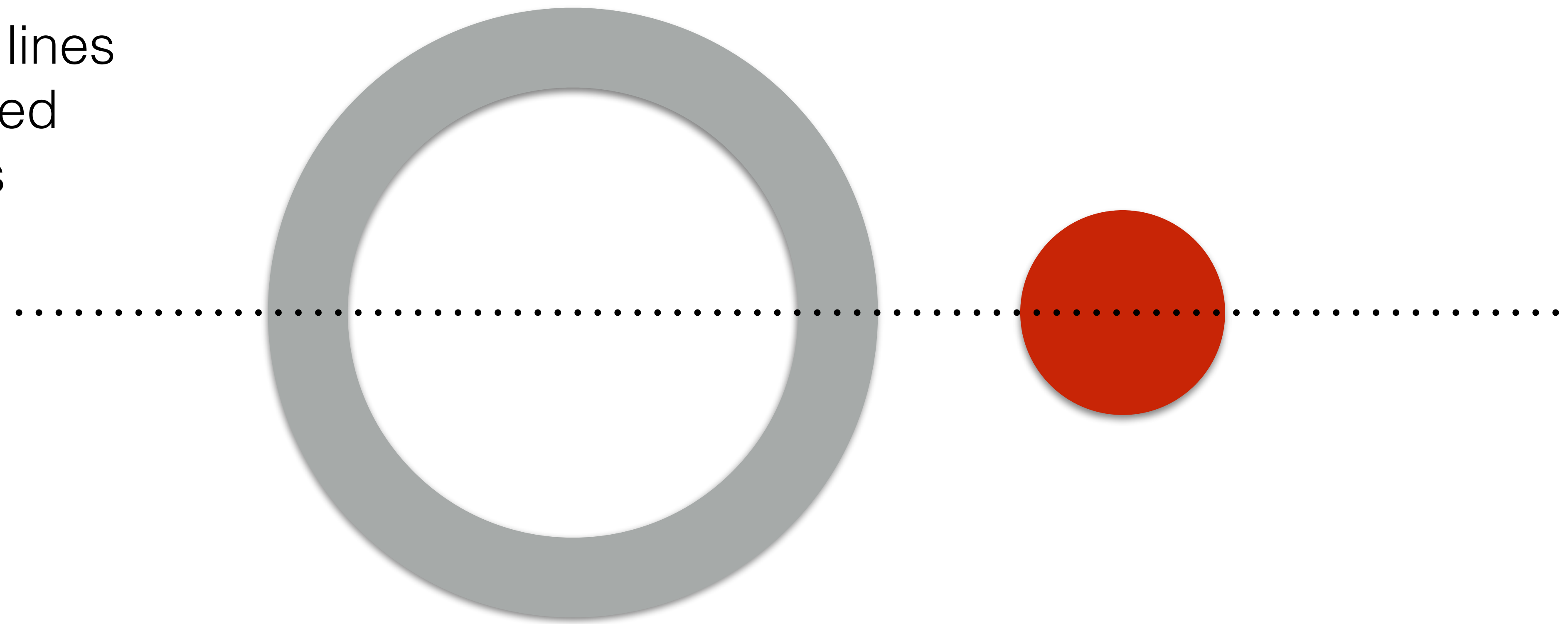


Graph Potential along dashed line

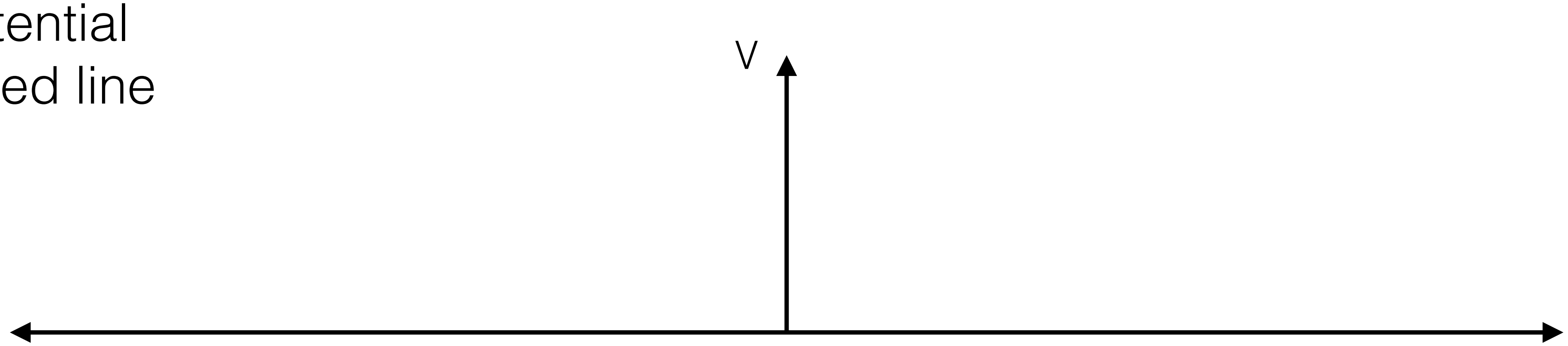


Spherical, charged conducting sphere next to a neutral conducting shell

Draw E-field lines and induced charges

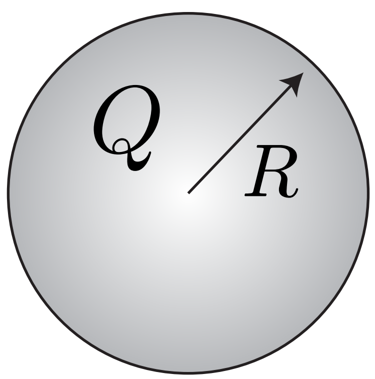


Graph Potential along dashed line



Capacitance

- ***Capacitance***: *Capacity (or efficiency)* of conductor to hold charge at a potential difference.



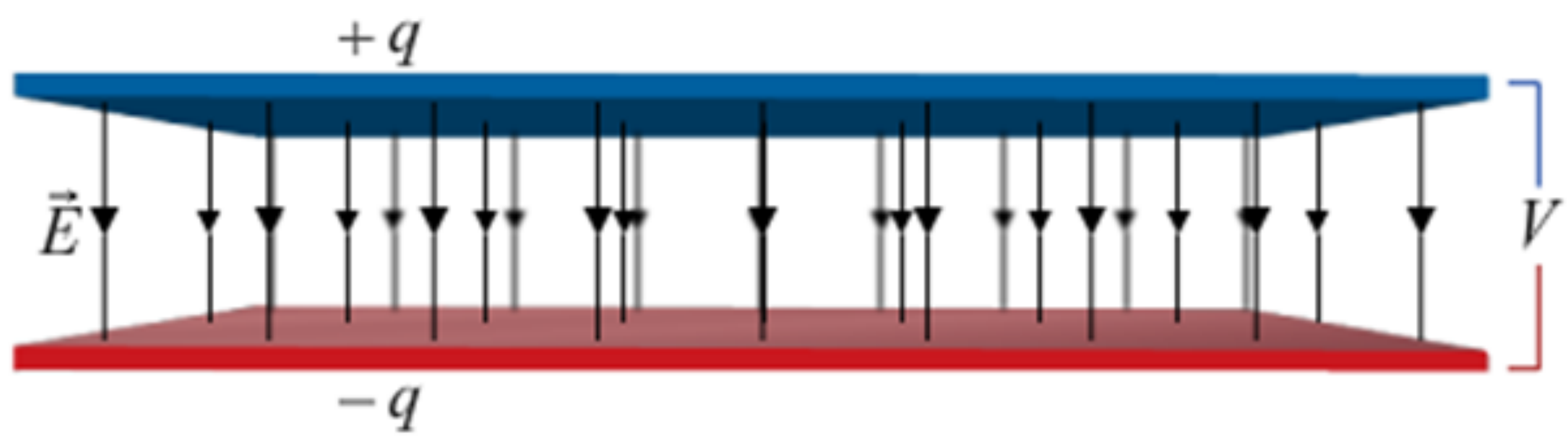
$$V(R) = \frac{kQ}{R}$$

- In general, we always find that whatever the geometry of the conductor:

$$V = Q/C$$

- where the **capacitance C** depends on the geometry

Compute C for a plate capacitor…

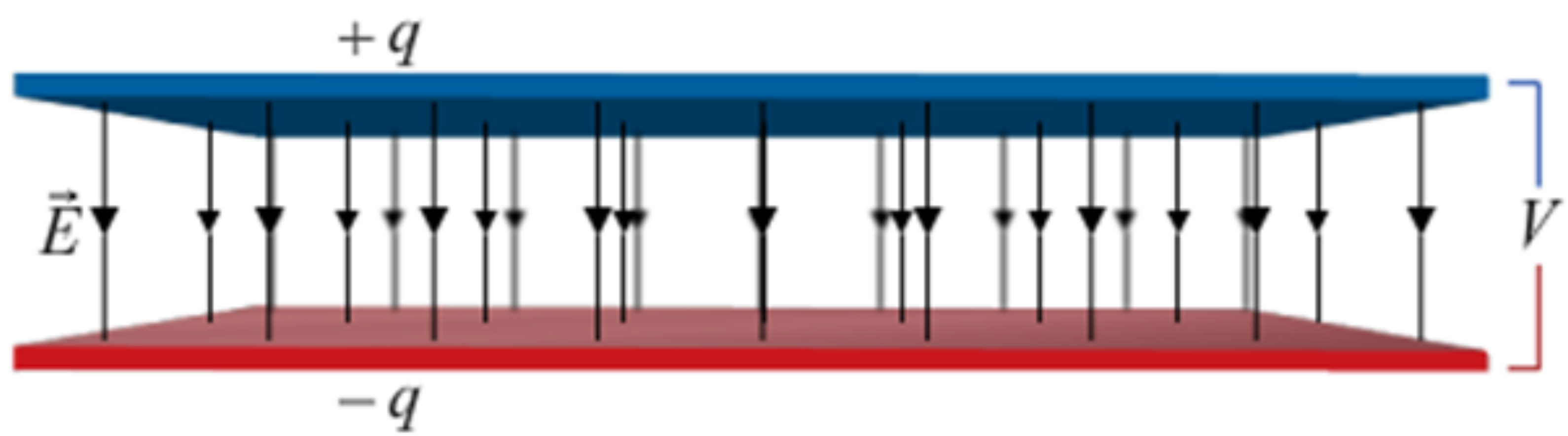


$$Q = CV$$

work it out…

$$C = \frac{A\epsilon_0}{d}$$

Compute C for a plate capacitor…



$$Q = CV \qquad C = \frac{A\epsilon_0}{d}$$

Intuitive meaning…

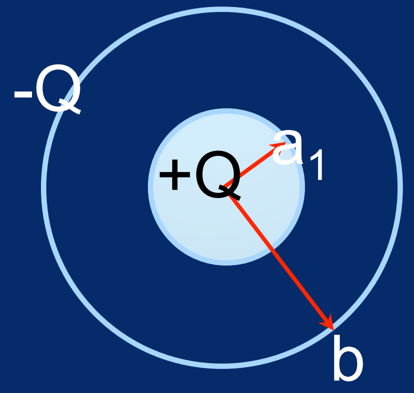
In each case below, a charge of +Q is placed on a solid spherical conductor and a charge of -Q is placed on a concentric conducting spherical shell.

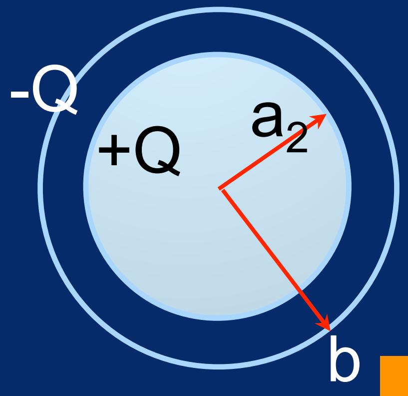
- Let V_1 be the potential difference between the spheres with (a_1, b).
- Let V_2 be the potential difference between the spheres with (a_2, b).
- What is the relationship between V_1 and V_2?

(a) $V_1 < V_2$

(b) $V_1 = V_2$

(c) $V_1 > V_2$

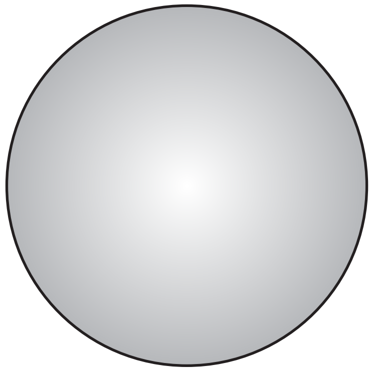




Clicker 11-1

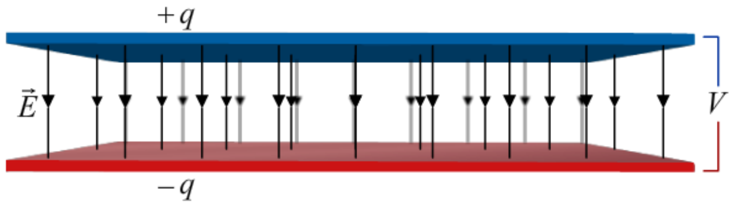
Capacitors

- Not just planes…
  spheres, cylinders, plates,
  isolated conductor…



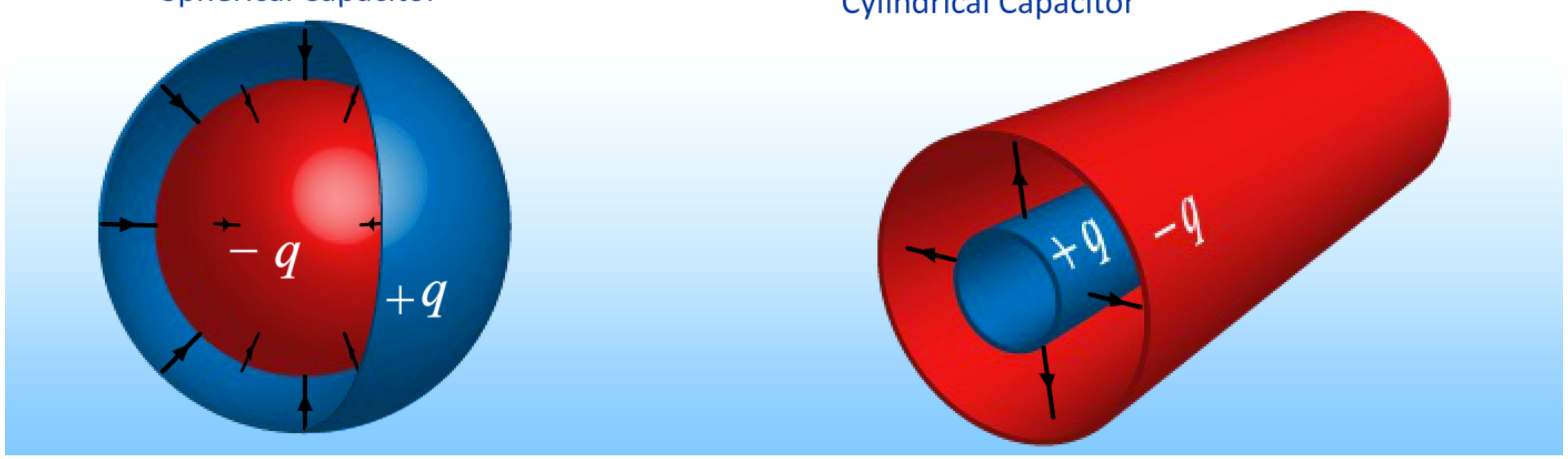
Capacitance depends only on geometry (not charge).

Parallel-Plate Capacitor



Spherical Capacitor

Cylindrical Capacitor



Adding capacitors (pictorially)