Lecture 14 outline:

- Capacitance Clicker Questions
- Laplace's Equation
  - Extrema are at edges (boundaries)
  - Every point has the average value of its neighborhood
- Relaxation method

Conductors a and b are insulated from each other, forming a capacitor. You increase the charge on a to $+2Q$ and increase the charge on b to $-2Q$, while keeping the conductors in the same positions.

What effect does this have on the capacitance C?

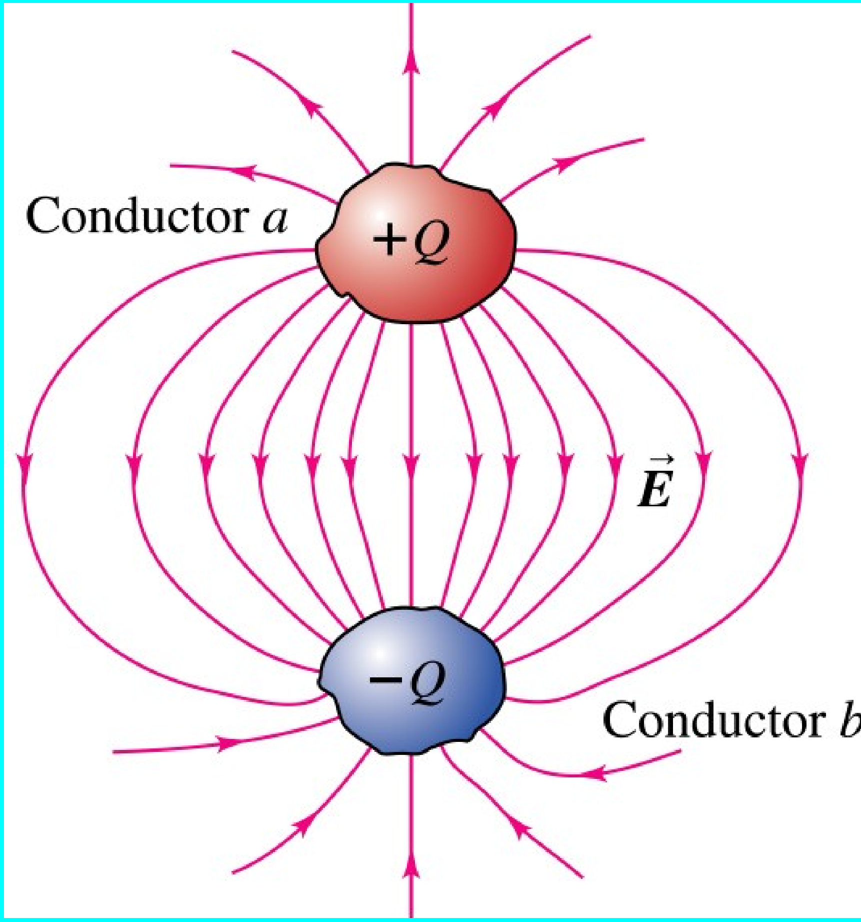
A) C is multiplied by 4

B) C is multiplied by 2

C) C remains the same

D) C is multiplied by ½

E) C is multiplied by ¼



You reposition the two plates of a capacitor so that the capacitance doubles. The charges $+Q$ and $-Q$ on the two plates are kept constant in this process.

What happens to the potential difference V between the two plates?

A) V is multiplied by 4

B) V is multiplied by 2

C) V remains the same

D) V is multiplied by ½

E) V is multiplied by ¼

Conducting sphere of radius r_0 has surface charge density σ_0.

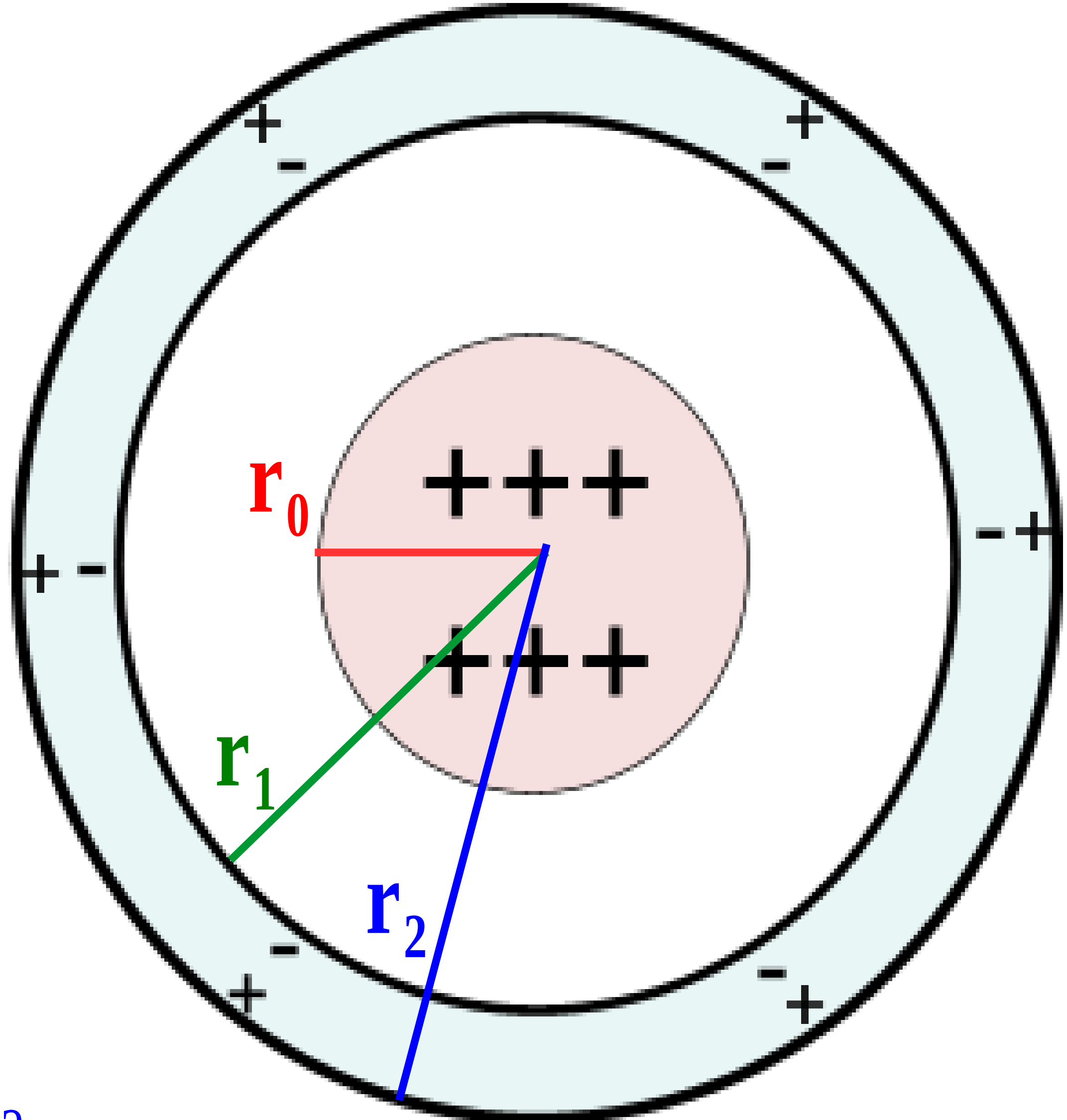
It is then surrounded by a neutral spherical conductor. What are the charge densities at r_1 and r_2

(A) σ_0 and σ_0

(B) $\sigma_0 r_0/r_1$ and $\sigma_0 r_0/r_2$

(C) $\sigma_0 r_1^2/r_0^2$ and $\sigma_0 r_1^2/r_0^2$

(D) $\sigma_0 r_0^2/r_1^2$ and $\sigma_0 r_0^2/r_2^2$



Laplace's Equation (1D)

- Extrema are at edges (boundaries)
- Every point has the average value of its neighborhood

Laplace's Equation (3D)

- Every point has the average value of its neighborhood
- Is this surprising? Imagine a charge Q 1 meter from a sphere with R=3.
- $$V_{AVG}(\vec{r}) \stackrel{\text{def}}{=} \frac{1}{4\pi R^2} \int V(R,\theta,\phi)\, da$$