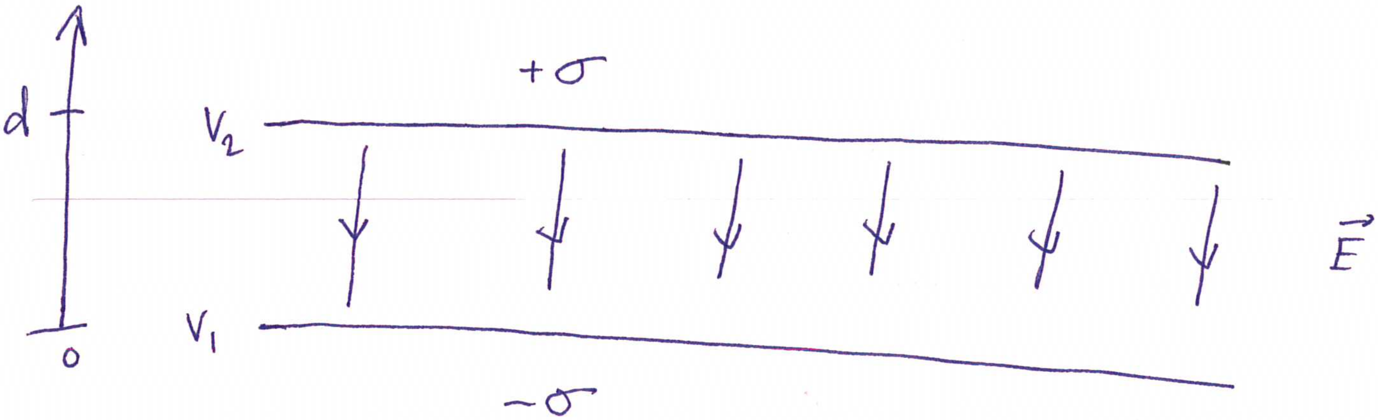
Phys 122 Wi 15 Lecture 10.



$V_2 > V_1$

$$E = \cancel{2} \times \left(\frac{\sigma}{\cancel{2}\varepsilon_0} \right) (-\hat{j})$$

one from each plate

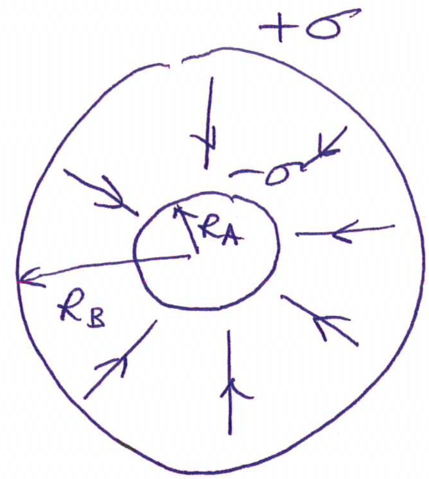
direction between the plates

$$\Delta V = -\int_1^2 \vec{dl} \cdot \vec{E}$$

$$= \int_0^d dx\, (-\hat{j})\cdot(-\hat{j})\, \frac{\sigma}{\varepsilon_0} = \frac{d\sigma}{\varepsilon_0} = \frac{dQ}{A\,\varepsilon_0}$$

$$\boxed{\frac{Q}{\Delta V} = \frac{A\varepsilon_0}{d}}$$

Concentric Spheres.



$$V(r) = \frac{Q}{4\pi \varepsilon_0 r}$$

$$V_B - V_A = \frac{(-Q)}{4\pi \varepsilon_0 R_B} - \frac{(-Q)}{4\pi \varepsilon_0 R_A}$$

$$= \frac{Q}{4\pi \varepsilon_0}\left[\frac{R_B}{R_B R_A} - \frac{R_A}{R_B R_A}\right]$$

$$\boxed{= \frac{Q}{4\pi \varepsilon_0} \frac{R_B - R_A}{R_B R_A}}$$

$$C \equiv \frac{4\pi R_B R_A}{R_B - R_A.} \varepsilon_0$$

consider limit that

$$\delta R \equiv R_B - R_A \ll R_A.$$

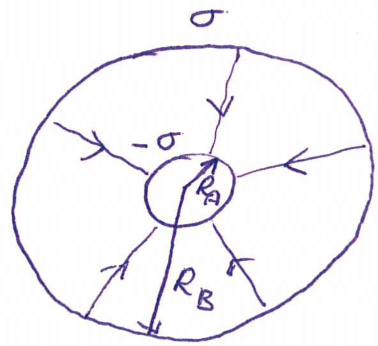
$$R \equiv \tfrac{1}{2}(R_A + R_B)$$

$$\hat{=} \frac{4\pi R^2 \varepsilon_0}{\delta R} = \frac{A \varepsilon_0}{\delta R}$$

same as plate capacitor.

Phys 122 Wi 15 Lecture 10

Concentric Cylinders (Capacitor)



$$\Delta V = - \int_{R_A}^{R_B} dr \, (\hat{r} \cdot \vec{E})$$

$$\vec{E}(\vec{r}) = \frac{-|\lambda|}{2\pi \varepsilon_0 r} \hat{r}$$

$$-|\lambda| = -\sigma \cdot 2\pi R_A$$

$$-|\lambda| = -\frac{Q}{L}$$

$$V(R_B) - V(R_A) = + \int_{R_A}^{R_B} dr \, \frac{Q R_A}{\underbrace{2\pi L R_A}_{A_{int.}} \varepsilon_0} \frac{1}{r}$$

negative signs cancel

$$\Delta V = \frac{Q R_A}{A_{int.} \varepsilon_0} \log \frac{R_B}{R_A}$$

$$Q = C \, \Delta V \qquad C = \frac{A_{int.} \varepsilon_0}{R_A \log \frac{R_B}{R_A}}$$

Consider the limit that $\delta R \equiv R_B - R_A \ll R_A$.

$$R \equiv \frac{1}{2}(R_A + R_B)$$

$$C \simeq \frac{A \varepsilon_0}{R \log \left[\frac{1 + \frac{\delta R}{2R}}{1 - \frac{\delta R}{2R}} \right]} = \frac{A \varepsilon_0}{\delta R} \checkmark$$

same as plate capacitor