Physics 142 - October 2, 2006

- Exam 1 - Tuesday, 0800, B+L 109
- Q+A session latish Monday Afternoon TBA

Last time

$$Q = CV$$

Capacitance - depends only on geometry

For example, // plate configuration

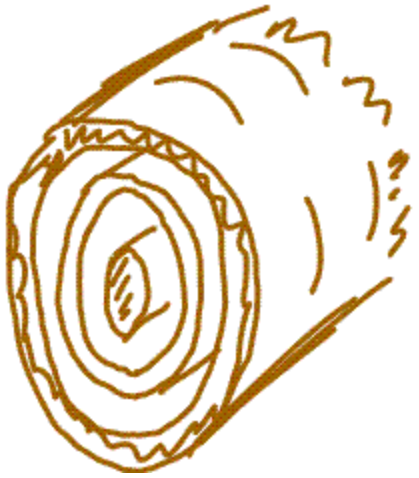
$$C = \frac{A\epsilon_0}{d}$$

Multiple capacitors: in parallel $C = \sum_i C_i$

in series $\frac{1}{C} = \sum_i \frac{1}{C_i}$

Energy stored in a capacitor (To charge) $U = \frac{1}{2}CV^2$

Energy density in Electric field $\mathcal{U}_E = \frac{\epsilon_0}{2}|\vec{E}|^2$



if know $\vec{E}$

$$U = \int_{Vol} \mathcal{U}_E \, dV$$

$\vec{E}$ in Materials – dielectrics

Polar

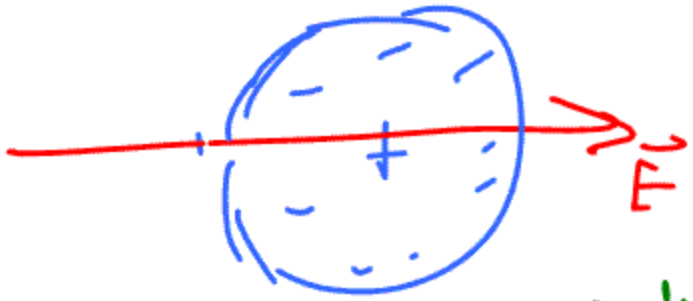
inherent dipoles

Random orientations

Net torque → align particles along $\vec{E}$

nonpolar

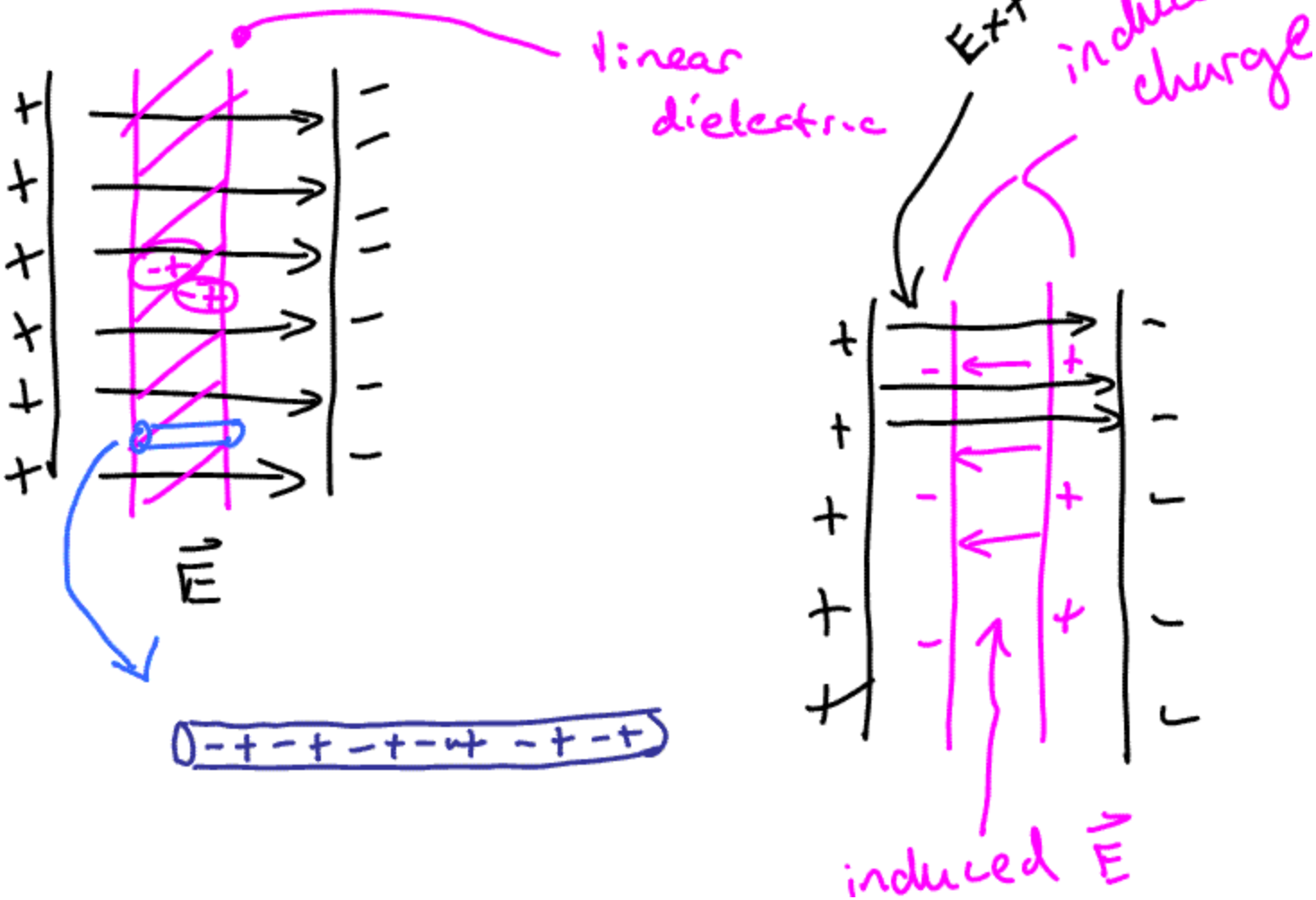
indiv. Atoms/molecules no net dipole



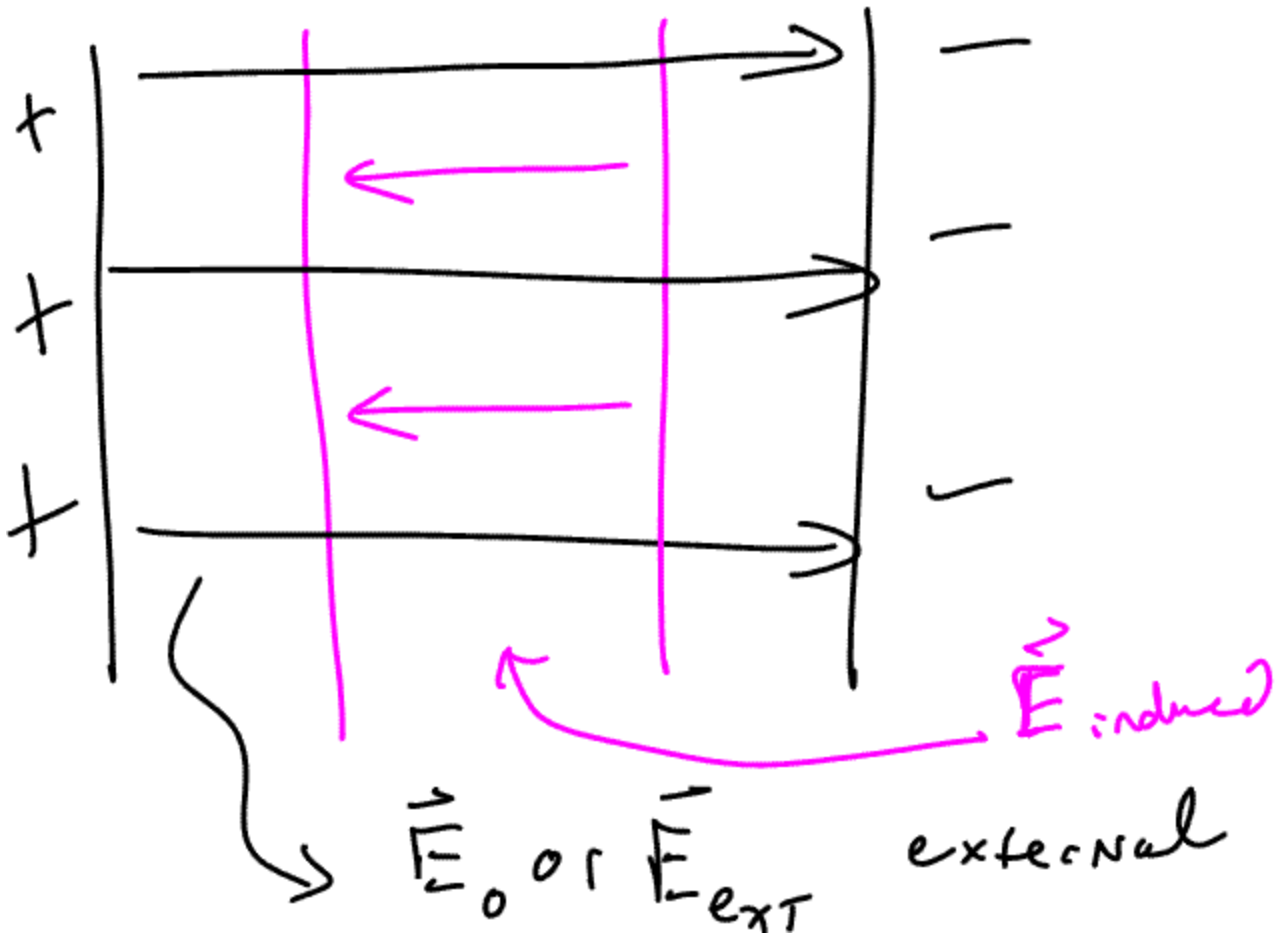
induced dipole

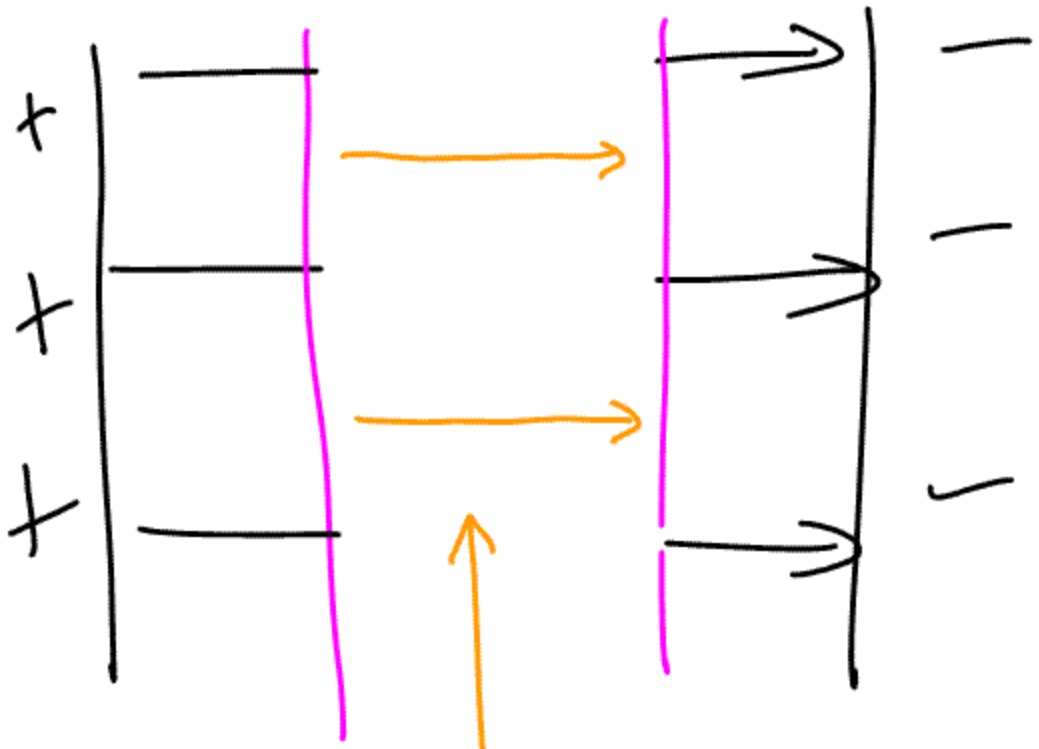
Dipoles Aligned $\propto |\vec{E}|$

"Linear dielectrics"



$\vec{E}_{induced} \propto \vec{E}_{external}$ linear dielectrics





linear dielectric

$$\vec{E} = \frac{\vec{E}_0}{\kappa}$$

↑ NET $\vec{E}$ in material

κ = Dielectric CONSTANT $\kappa > 1$

$$\vec{E} = \vec{E}_{ext} + \vec{E}_{ind}$$

$\kappa > 1$

water	$\kappa = 80.4$
Air	1.00054
Vacuum	1
Oil	4.5

$$\vec{E}_0 = \frac{\sigma}{\epsilon_0}$$

$$\vec{E} = \frac{\sigma}{\kappa \epsilon_0}$$

ϵ_0 ← permittivity of free space

$\kappa \epsilon_0 \longrightarrow \epsilon \equiv$ permittivity

$$Q = CV$$

Not Attached to Battery

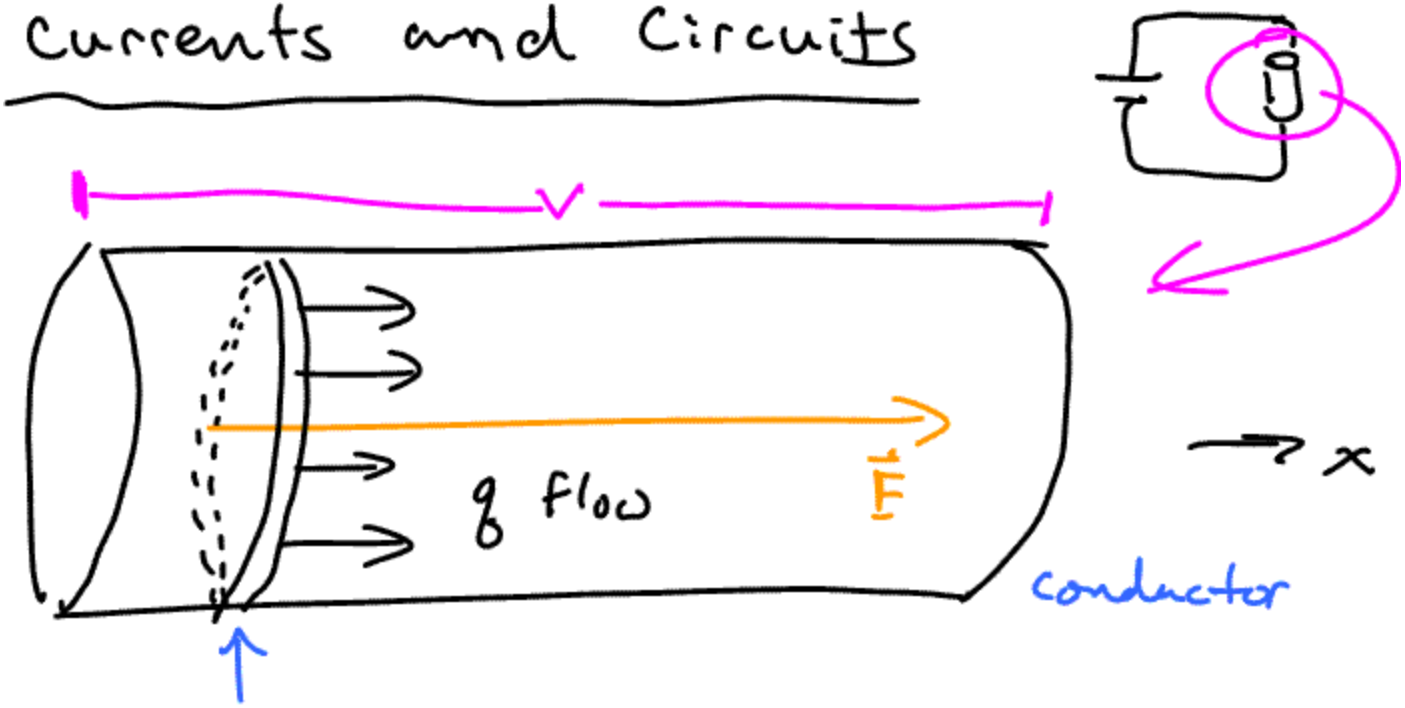
$$V \rightarrow \frac{V}{K}$$

Dielect

No Dielect

$$C \rightarrow KC = K\frac{\varepsilon_0 A}{d}$$

Currents and Circuits

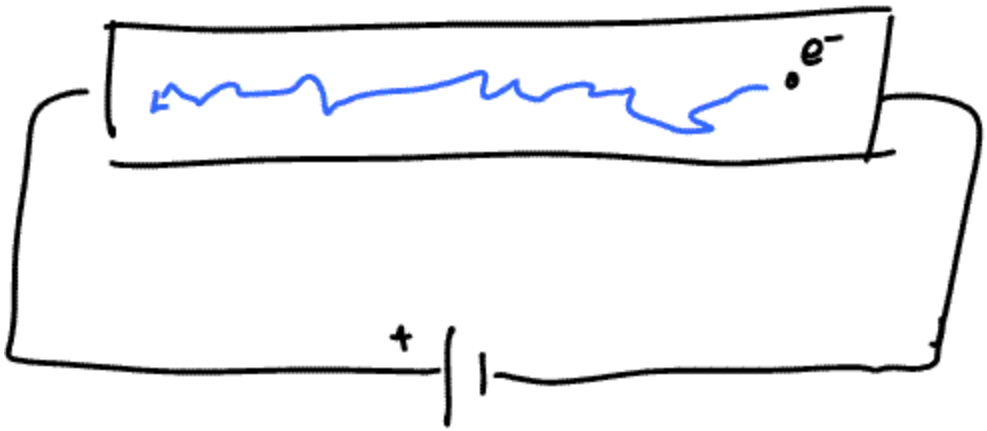


$$E = -\frac{dv}{dx}$$

$$\frac{dq}{dt} = i \equiv \text{current}$$

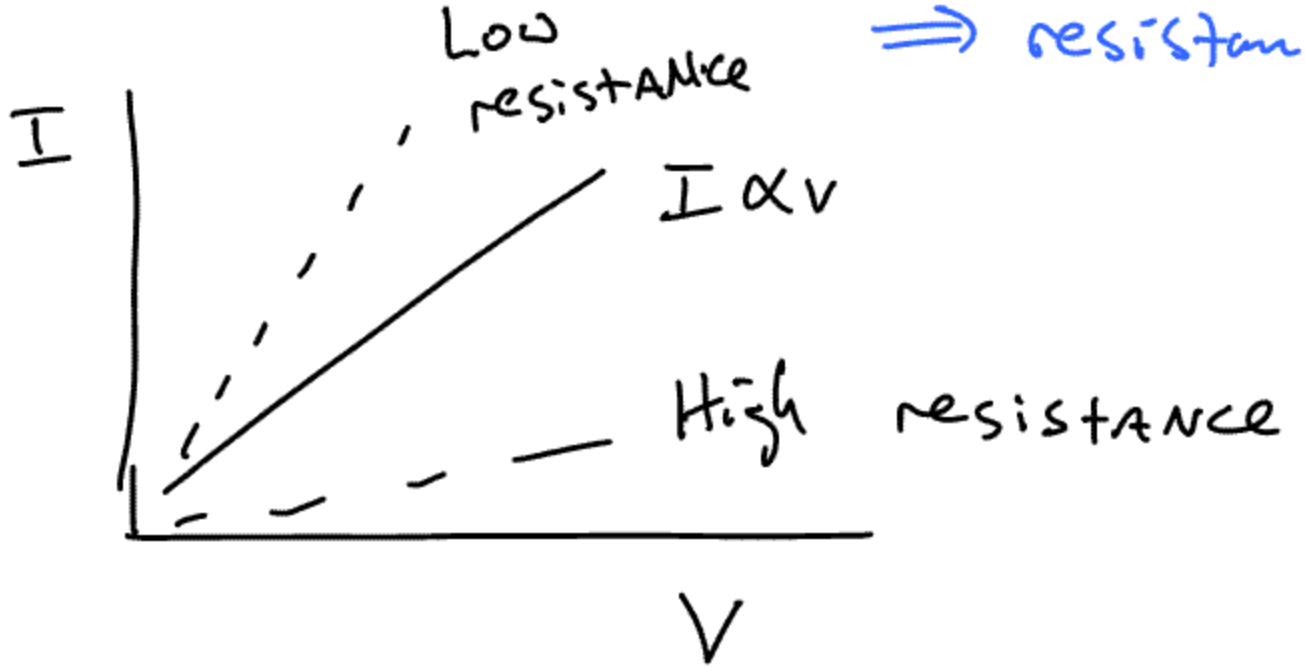
Also "I"

Units $\frac{\text{Coulombs}}{\text{Sec}} \equiv$ Ampere



electron looking for love

Collisions $\Rightarrow$ resistance



$I \propto V$

$V = IR$ Ohm's Law