Physics 142 - September 29, 2005

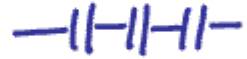
Electrostatic Energy, Current, dielectrics, Kirchoff's Laws

Exam in 1 wk - Oct 6 at 0800 - B+L 109

Review session?, Math handbook, Material Covered

Last Time -

$Q = CV$

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

Review M 7:30

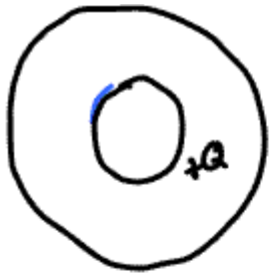
in parallel  $C = \sum_i C_i$

Energy stored in capacitor

$$U = \frac{1}{2} C V^2 = \frac{1}{2} \frac{Q^2}{C}$$

Energy density in electric field

$$u = \frac{\epsilon_0}{2} E^2$$

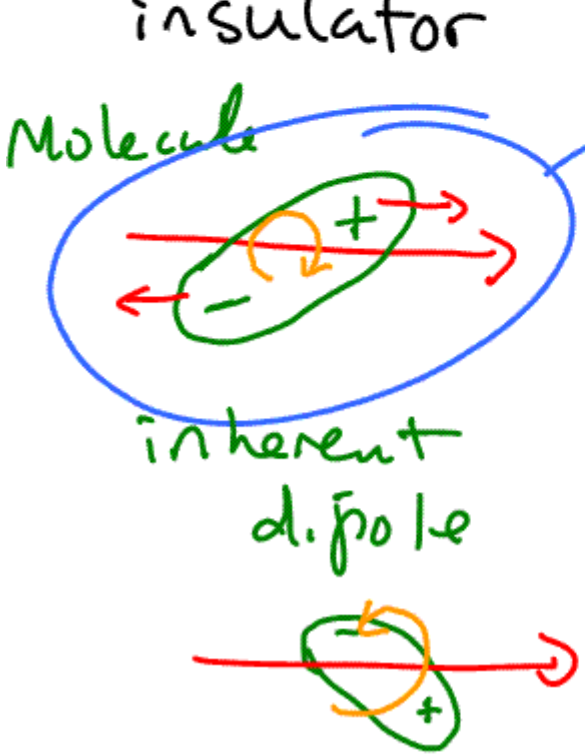


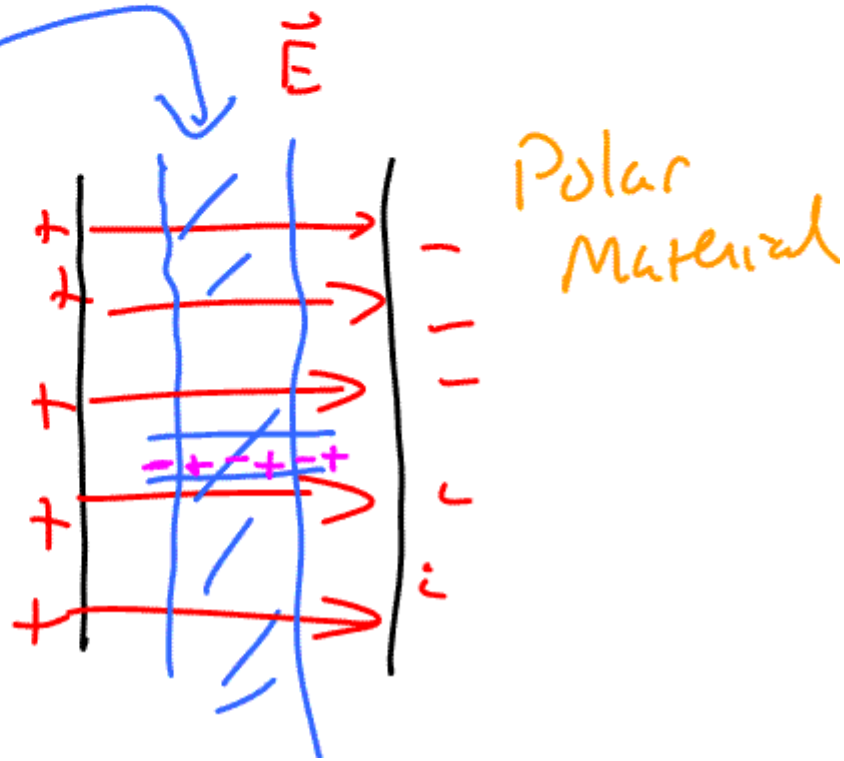
Energy stored

$$U = \int_{Vol} u \, dV$$

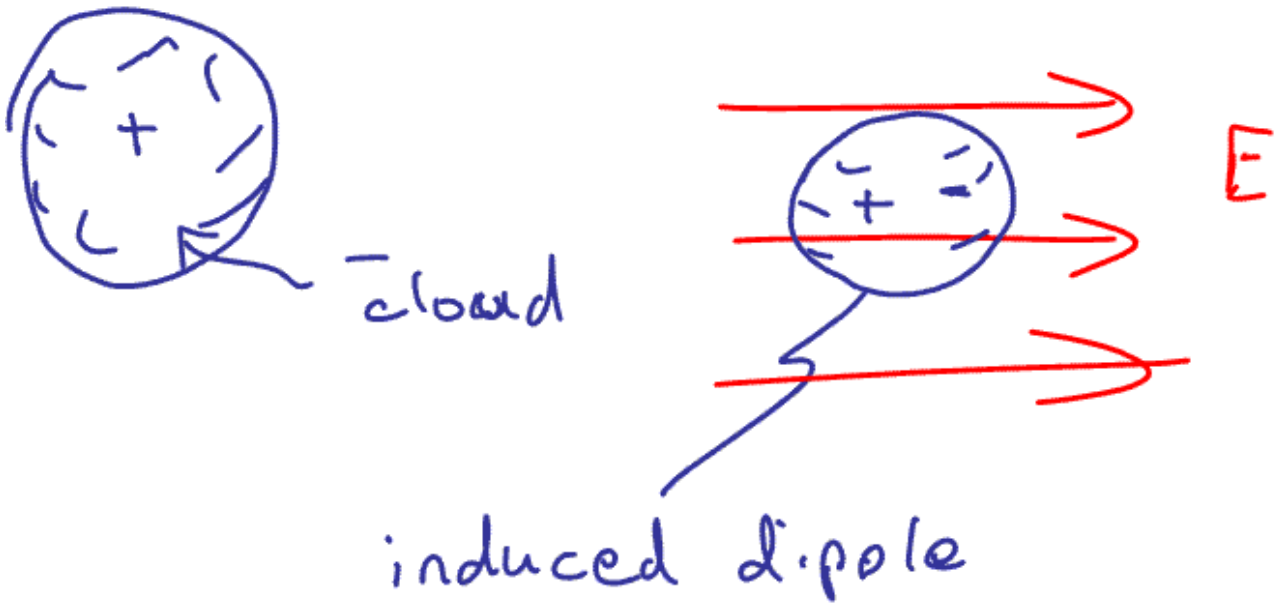
nonconductor ≡ Dielectric

insulator

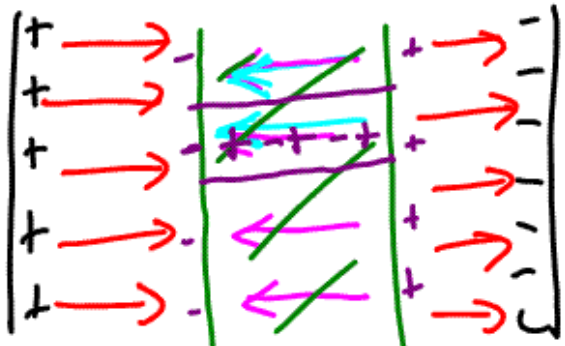




different Materials may allow this Polarization easier than others



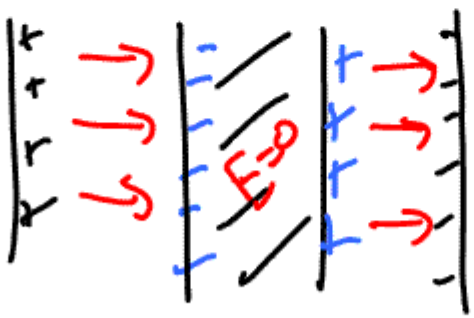
Amt of Polarization $\sim |\vec{E}|$



Vacuum Dielectric

$E < E_0$

conductor



inside material

$E = \frac{E_0}{\kappa}$

Material dependent

dielectric CONSTANT

$\kappa > 1$ BUT → depends on Material

water $\kappa = 80.4$

Air $\kappa = 1.00054$

Vacuum $\kappa = 1$

Oil $\kappa = 4.5$

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

w/dielectric

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

$Q = CV$ NO dielectric

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

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

$C \rightarrow CK = \frac{K\epsilon_0 A}{d}$

↑ add dielectric

instead of K $=$ Maximal confusion

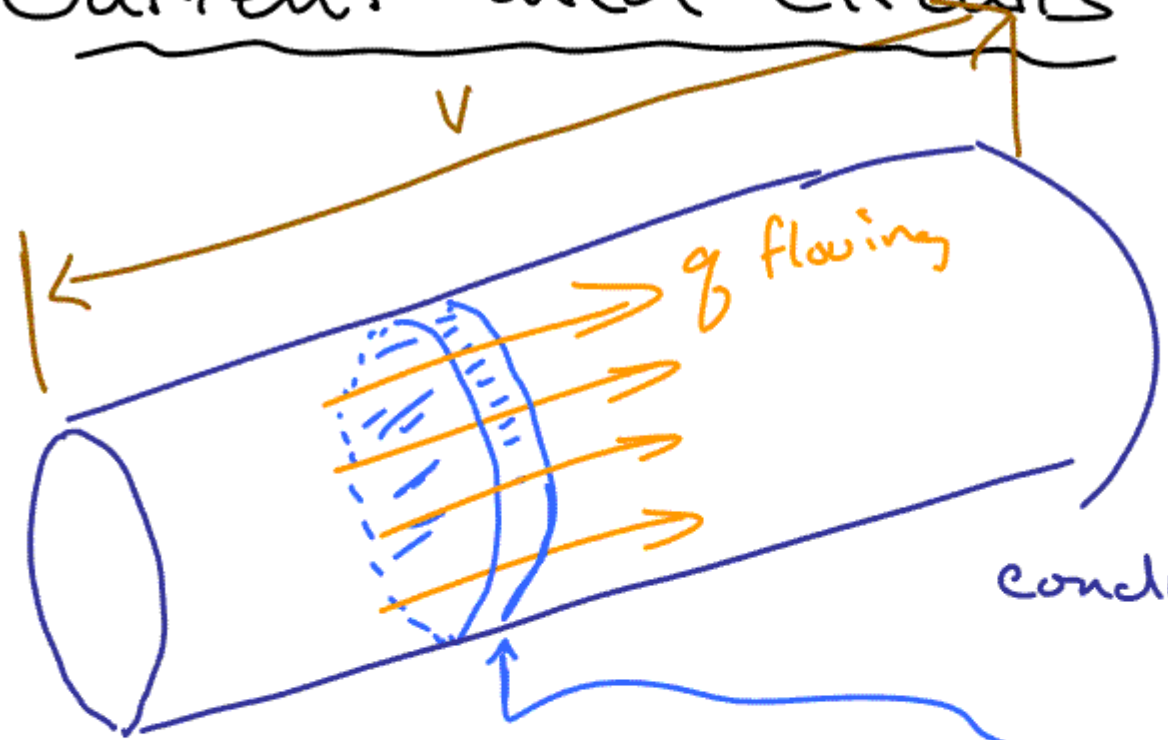
dielectric const.

$\epsilon_0 \rightarrow \epsilon$

Permitivity

Permitivity of free space

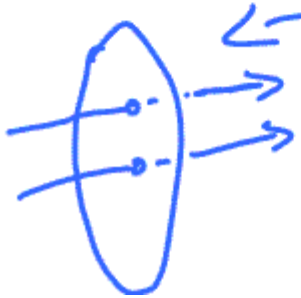
Current and Circuits

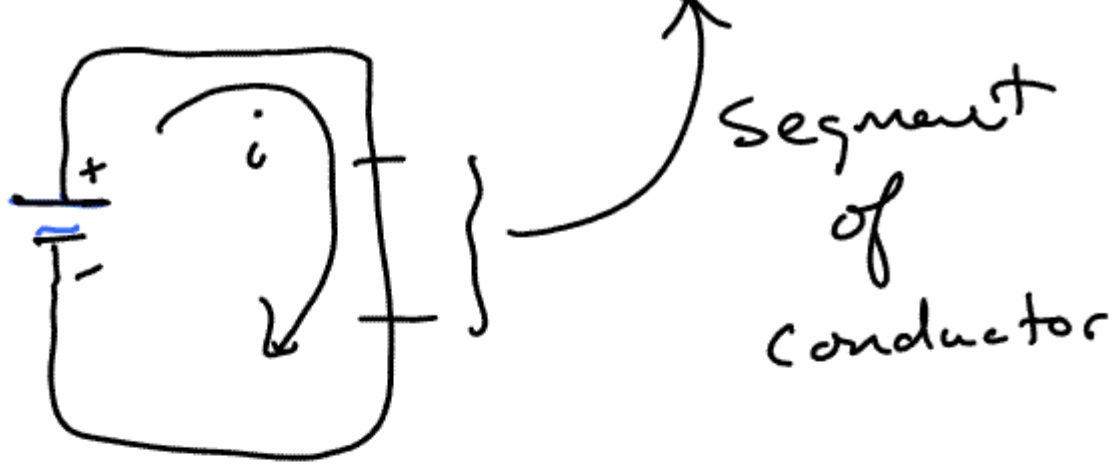


$$-\frac{dV}{dx} = E$$

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

. Electric

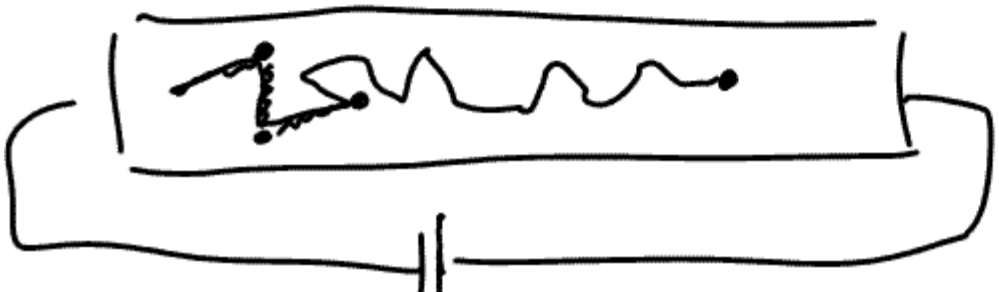




$+i \equiv$ direction ⊕ chgs would go

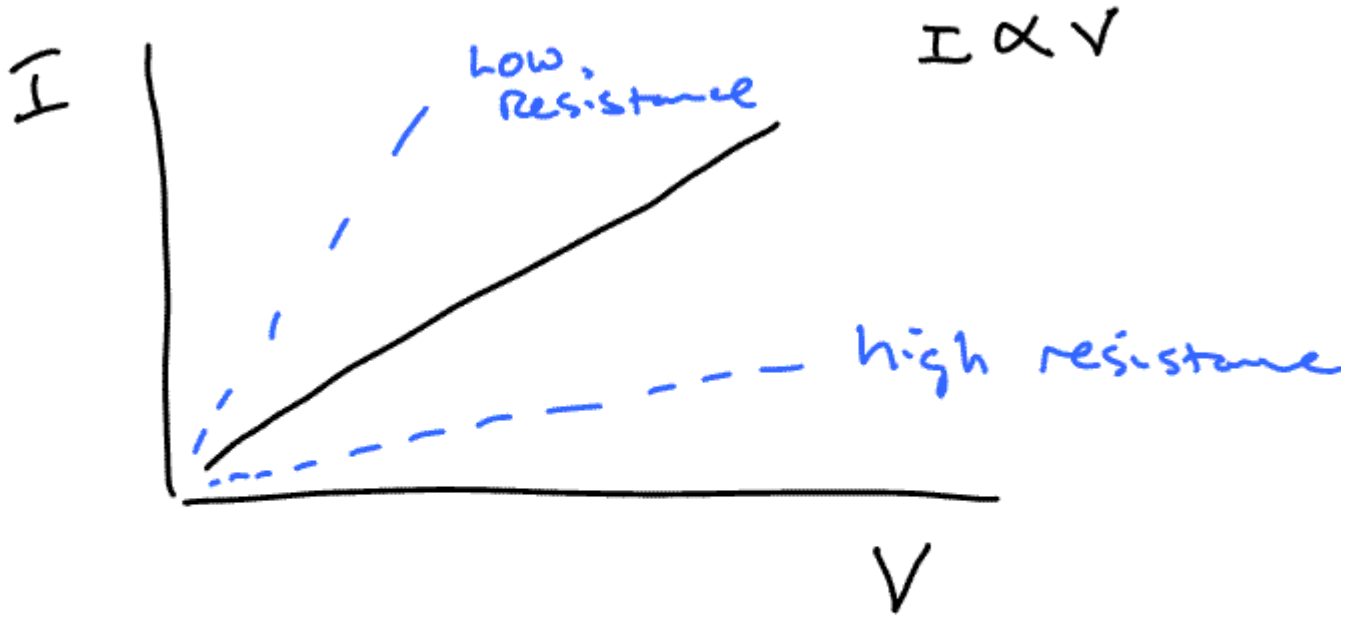
current units $\frac{dq}{dt}$ $\frac{\text{coulombs}}{\text{seconds}}$

$\equiv$ Amperes



lots of little collisions

Bigger V Bigger i

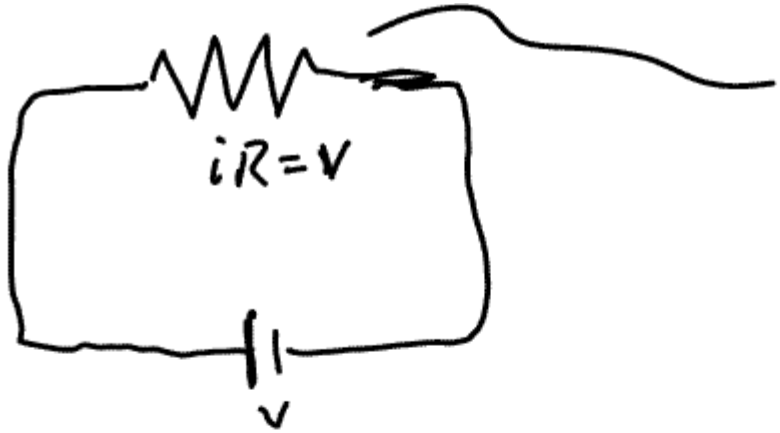


$I \propto V$

Material dependent

$IR = V$

$\equiv$ Resistance



Symbol for resistor

$\frac{W}{q} = V$ across resistor

$W = qV$

$\frac{dW}{dt} = \frac{dq}{dt} V = iV$

$\frac{dW}{dt}$ = Power

$\frac{dq}{dt} = i$

$P = iV$

$V = iR$

$P = i^2 R$