



Energy Stored & Dielectrics

*"I think there is a world market for
maybe five computers." -- Thomas
Watson, chairman of IBM, 1943.*

Energy Stored

- Calculate the work required to move charge onto the plate of a capacitor.
- What are three equations for U ?

$$\Delta V = \frac{Q}{C} \quad \& \quad \Delta V = \frac{dU}{dq} \quad \xrightarrow{dq} \text{---| |}$$

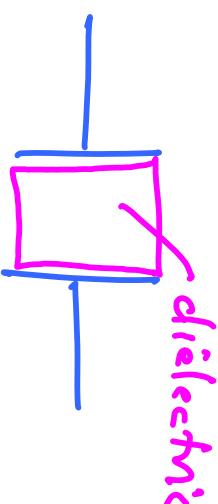
$$\int dU = \int_0^Q \Delta V dq = \int_0^Q \frac{Q}{C} dq$$

$$\Delta U = \frac{Q^2}{2C} \Big|_0^Q = \frac{Q^2}{2C}$$

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

$$C = \frac{Q}{\Delta V}$$

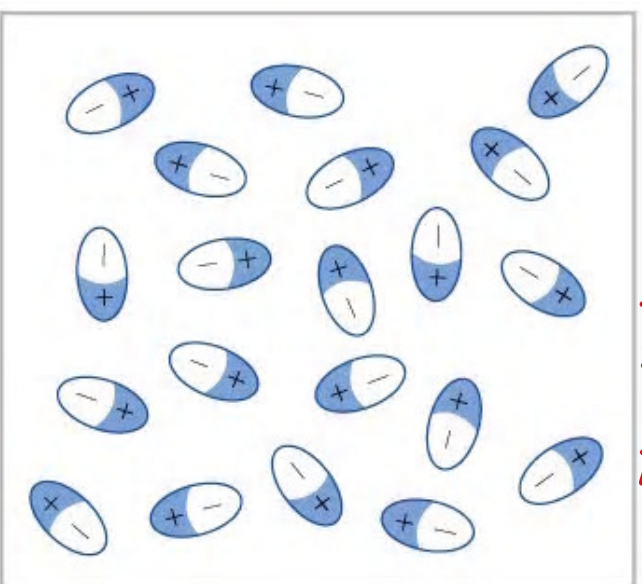
Dielectric



- What is a dielectric? a non conducting material in a capacitor
- $C = \kappa C_0$
- Page 819 has dielectric constants. κ
- Dielectric Strength E_{max} occurs before conduction
- Atomic model of dielectric.
- Geometry of dielectric combinations.

Dielectric Diagrams

dielectric

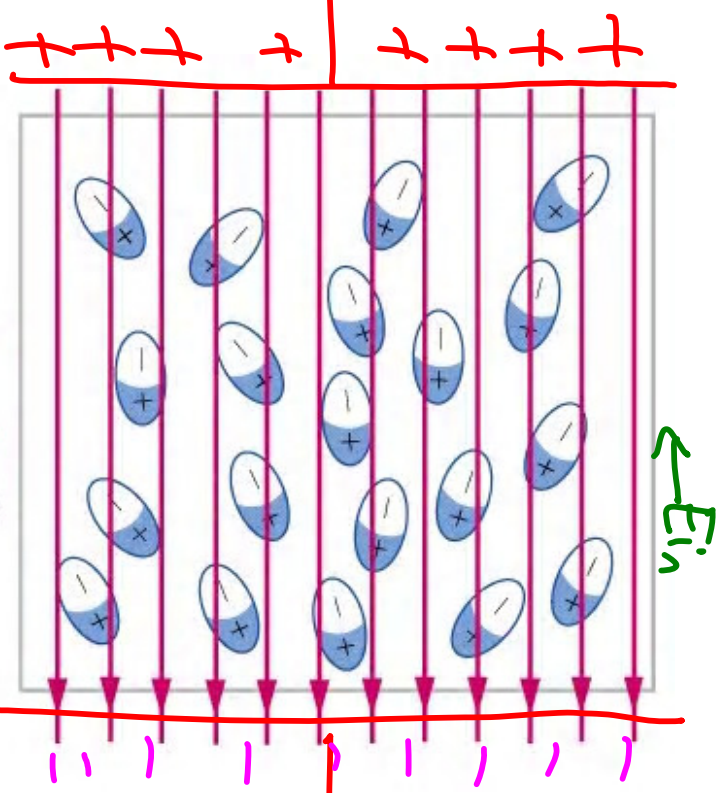


(a)

$E_{TOT} \downarrow$

$$\Delta V = E \cdot X \quad \downarrow$$

$$C = \frac{Q}{\Delta V} \quad \uparrow$$



(b)

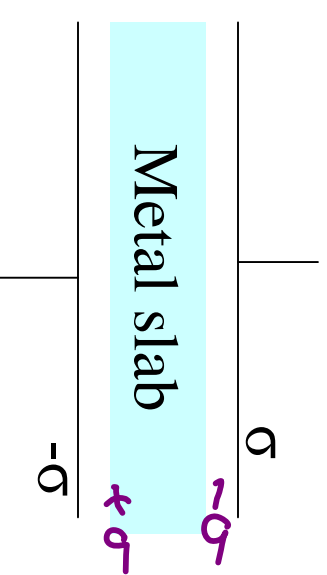
\vec{E}_0

\vec{E}_in

Example

1. A metal slab is placed in between two parallel metal plates that are each charged to σ , as shown below. Find the capacitance of the arrangement.

2 Capacitors in Series



2. Conceptual examples with concentric shells and parallel plates.

2 cap. in

