



# PHYS 1444 – Section 02

## Lecture #9

*Tuesday Feb 22, 2011*

*Dr. Andrew Brandt*

- Chapter 24
  - Dielectrics
- Chapter 25
  - Electric Current
  - Resistance
  - The Battery
  - Ohm's Law: Resistors
  - Resistivity
  - Electric Power

HW4 Ch 24 due Sat Feb. 26<sup>th</sup>

Mar 3 will be 1/2 period review

HW5 Ch 25 will be due Fri. Mar. 4

March 4: deadline to receive credit for late HW  
so solutions can be posted

\*\*\*Test 1 will be Tues. Mar. 8 on ch 21-25\*\*\*



# Effect of a Dielectric Material on Field

- What happens to the electric field within a dielectric?

- Without a dielectric, the field is

$$E_0 = \frac{V_0}{d}$$

- What are  $V_0$  and  $d$ ?

- $V_0$ : Potential difference between the two plates
- $d$ : separation between the two plates

- For the constant voltage case, the electric field remains the same

- For the constant charge: the voltage drops to  $V=V_0/K$ , thus the field in the dielectric is

- Reduced.

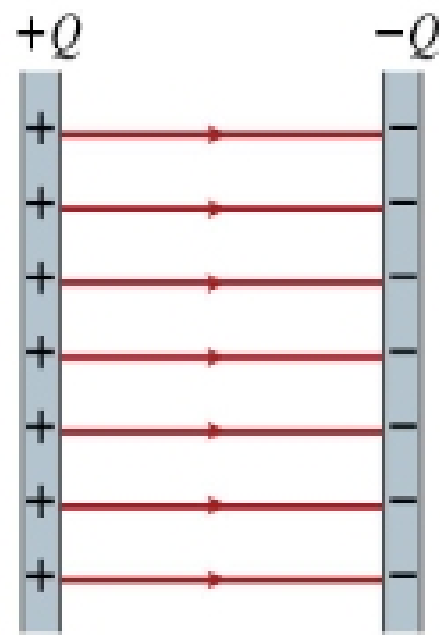
$$E_D = \frac{E_0}{K}$$

$$E = E_D = \frac{V}{d} = \frac{V_0}{dK} = \frac{E_0}{K}$$



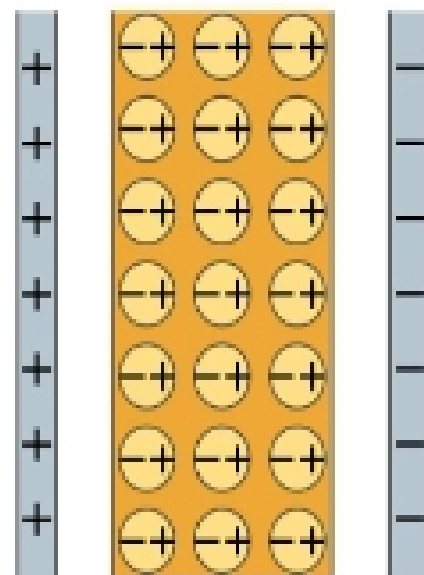
# Molecular Description of Dielectric

- So what makes dielectrics behave the way they do?
- We need to examine this on a microscopic scale.
- Let's consider a parallel plate capacitor that is charged up  $+Q(=C_0V_0)$  and  $-Q$  with air in between.
  - Assume that charge cannot flow in or out



(a)

Tuesday, Feb. 22, 2011



(b)

PHYS 1444-02 Dr. Andrew Brandt

- Now insert a dielectric
  - Dielectrics can be polar → may have a permanent dipole moment.
  - Due to the electric field molecules may be aligned.