Phy 4B 5/16

Tuesday, May 16, 2017 5:32 PM

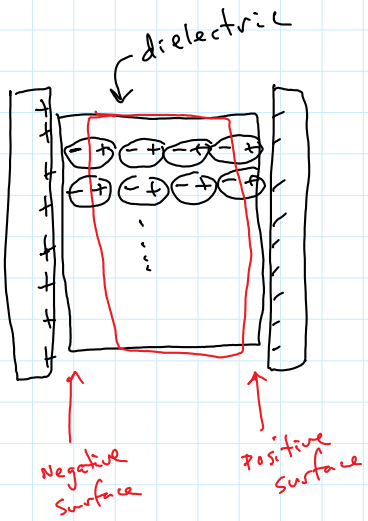
Capacitors:

Electric Potential Energy: $U = \frac{Q^2}{2C} = \frac{1}{2} Q \Delta V = \frac{1}{2} C (\Delta V)^2$

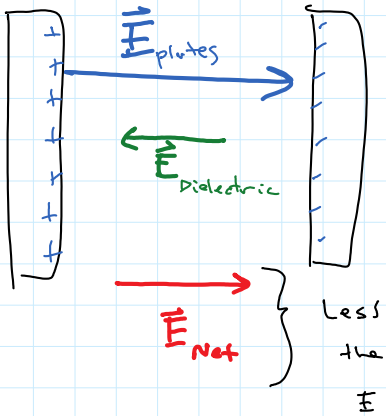
for any capacitor

since $Q = C \Delta V$

Dielectrics – electrical insulator



Lets Look at the $\vec{E}$ fields:



Less than the original E field due to the plates

for parallel plate capacitor:

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

κ = Dielectric constant

$\kappa \geq 1$

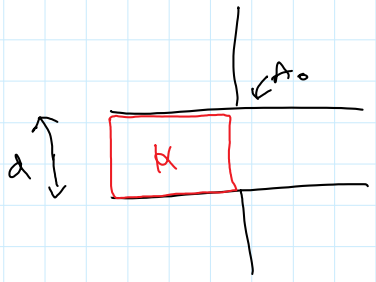
in general: $C = \kappa C_0$

C ← Capacitance with dielectric completely filling volume between plates

κ ← Dielectric constant

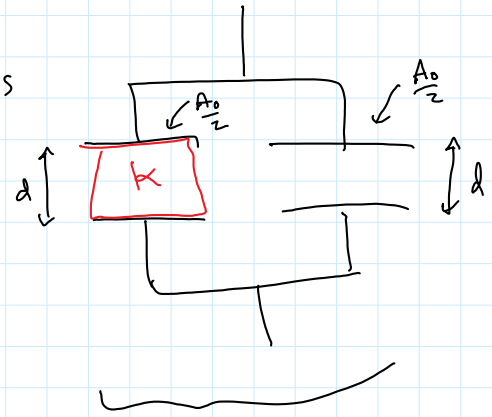
C_0 ← Capacitance without dielectric

Parallel plate: $C = \frac{\kappa \varepsilon_0 A}{d}$



original capacitance with No dielectric is $C_0 = \frac{\varepsilon_0 A_0}{d}$

Like 2 capacitors in parallel



Let C_1 = capacitance of left cap.

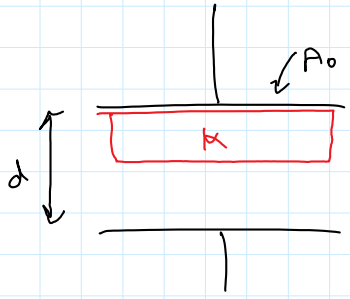
C_2 = " " Right cap

$C_1 = \frac{\kappa \varepsilon_0 \frac{A_0}{2}}{d}$ $\quad C_2 = \frac{\varepsilon_0 \frac{A_0}{2}}{d}$

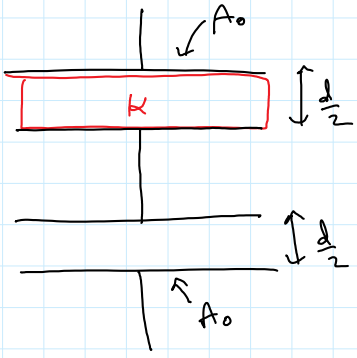
$C = C_1 + C_2$ Parallel

$= \kappa \frac{C_0}{2} + \frac{C_0}{2}$

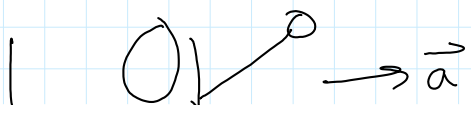
$= \left(\frac{\kappa+1}{2}\right) C_0$

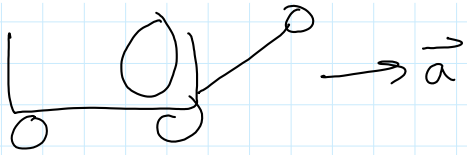


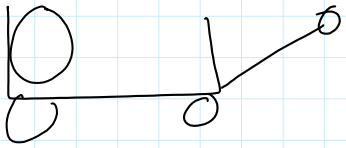
Like 2 in series

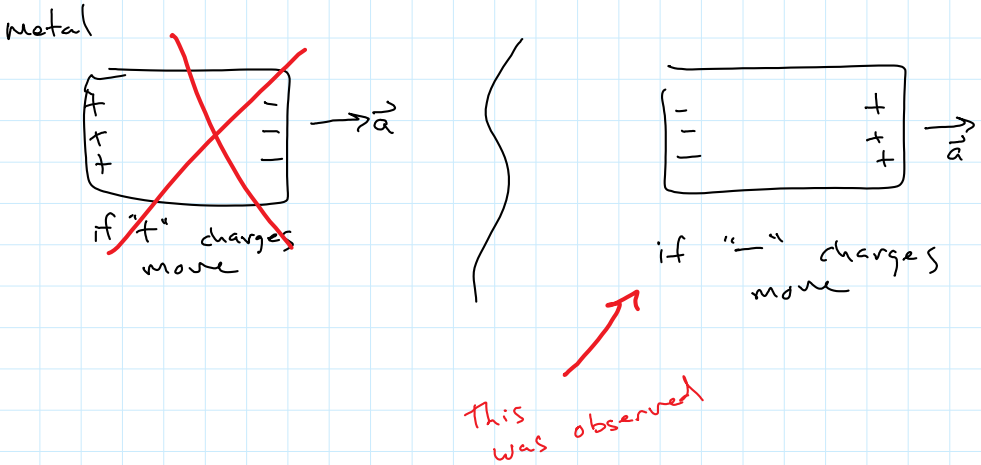


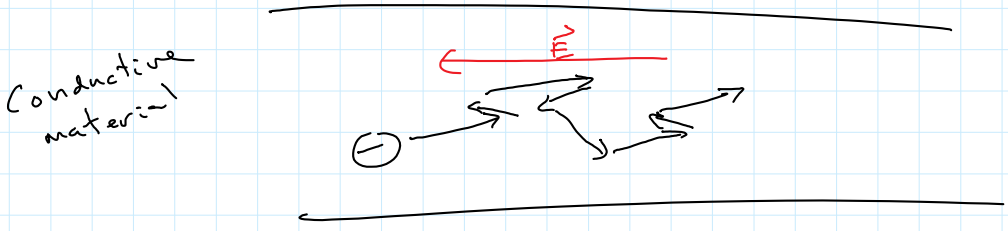
Current: Moving charges











Worksheet q. (0)

A) Same

same current

B) 1) $R_x < R_y$

2) Same

3) same

3) same

$P = IV = I^2R = \frac{V^2}{R}$

$V = IR$

c) $B_2 > B_1 > B_3$

Resistor:

$V = IR$ ohm's Law

p. 102 A) same $V_{bat} = V_{bulb} = 3.2\ V$

B) $I_1 = I_2 = \frac{I_{single}}{2}$ $V_{bat} = 3.6\ V$

$V_1 = V_2 = 1.8\ V$

1) $(V_{bat})_1 = (V_{bat})_2$

2) $V_{single} > V_1 = V_2$

C) same as $V_{battery}$

p. 103 D) $I_1 = I_2$

$I_1 + I_2 = I_{battery}$

1) $V_{Bat} = V_1 = V_2 = V_{single}$

3) same

E) 1) yes

2) NO → constant ΔV

A) $V_{battery} > V_1 > V_2 = V_3$

7.7 V 5.9 V 1.7 V

7.7 ≃ 7.6 V

P. 104

B) $I_{battery} > I_1 > I_2 = I_3$

$V_{battery} = V_1 > V_2 = V_3$

$V_1 = 2V_2$

C)