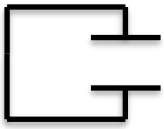
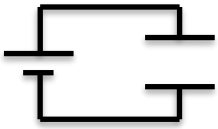
CONCEPT: INTRO TO DIELECTRICS

● **Dielectric:** Insulator between charged plates **[INCREASES | DECREASES]** capacitance: $C = \kappa C_0$

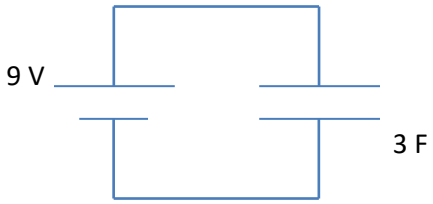
- DIELECTRIC CONSTANT $\kappa \geq 1$ (no units!)
- Always **[STRENGTHEN | WEAKEN]** Electric Fields $\rightarrow E = E_0/\kappa$

CONSTANT CHARGE (Q)	CONSTANT VOLTAGE (V)
- *No battery connected*	- *Inserted when battery still connected*
- $Q = C \quad V$ $\rightarrow$ V _____	- $V = Q \ / \ C$ $\rightarrow$ Q _____
- $U = \frac{1}{2}Q^2 \ / \ C$ $\rightarrow$ U _____	- $U = \frac{1}{2}C \quad V^2$ $\rightarrow$ U _____
- $u = \frac{1}{2}\epsilon_0 E^2$ $\rightarrow$ u _____	- $u = \frac{1}{2}\epsilon_0 E^2$ $\rightarrow$ u _____





EXAMPLE: A capacitor is connected to a battery as shown below. What is the charge on the capacitor after a dielectric ($\kappa = 2$) is inserted into the capacitor while it is *still* connected to the battery?



EXAMPLE: CAPACITOR WITH A DIELECTRIC

A capacitor in a vacuum is charged to 64V between its plates, then disconnected. Initially, each plate has 32μC. An insulating slab of dielectric glass with $\kappa = 3$ is placed between the plates. a) What is the capacitor's new capacitance? b) What is the new voltage across the capacitor?

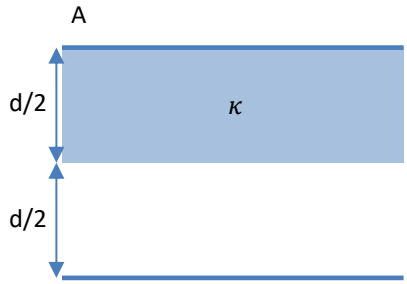
PRACTICE: CIRCULAR PLATE CAPACITOR WITH DIELECTRIC

A parallel plate capacitor is formed by bringing two circular plates, of radius 0.5 cm, to a distance of 2 mm apart. The capacitor is made so that it has a dielectric of constant κ between the plates. When the charge on the capacitor is 3 nC, the voltage of the capacitor is 5000 V. What is the dielectric constant?

EXAMPLE: CAPACITORS PARTIALLY FILLED WITH DIELECTRIC

What is the new capacitance of the two capacitors that are partially filled with dielectrics shown in the following figure?

(a)



(b)