Chapter 16 & 18 XtraWrk – capacitors and RC circuits

16.26) A 9-V battery generates 27 microCoulombs of charge on the plates of a capacitor.
    a.) What's the capacitance?
   b.) What charge would be stored if you used a 12-V battery instead?

16.29) Consider the capacitor shown to the right. Given that information:
    a.) What's the electric field between the plates?
   b.) What's the capacitance?
    c.) What's the charge on each plate?

$A = 7.6 \text{ cm}^2$

$d = .18 \text{ cm}$

$V = 120 \text{ volts}$
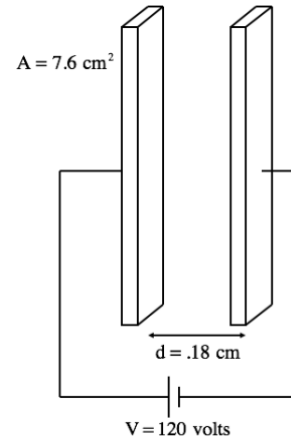
16.31) Consider the capacitor shown to the right. Given that information:
    a.) What's the capacitance?
    b.) What's the charg eon each plate?
    c.) What's the electric field between the plates?
    d.) What's the charge density on each plate?
   e.) If the distance between the plates decreases, how will all your answers above change?

$A = .2 \text{ m}^2$

$d = .003 \text{ m}$

$V = 6 \text{ volts}$
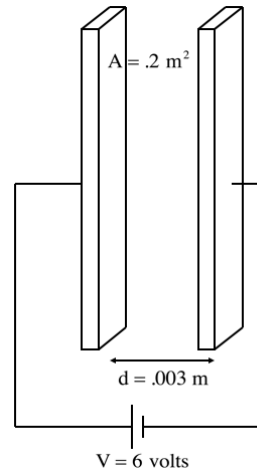
16.42) a.) Find the equivalence capacitance for the circuit shown to the right.
    b.) What charge is stored on either of the 5 microfarad capacitors if the voltage across the entire system is 60 V?

$5 \times 10^{-6} \text{ f}$ $5 \times 10^{-6} \text{ f}$

$2 \times 10^{-6} \text{ f}$

10^{-5} f 10^{-5} f

10^{-5} f 10^{-5} f
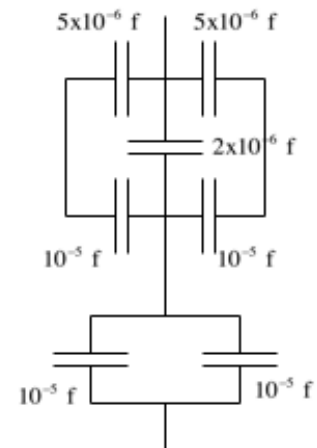
16.49) The voltage across an air-filled capacitor is 85 V. With a dielectric between the plates, the voltage is 25 V.

  a.) What is the dielectric constant? Can you tell what the dielectric is?

  b.) If the dielectric doesn't completely fill the space, what does that tell you about the voltage across the plates?

18.20) For the circuit shown to the right, I_1 is known to be 3.0 A but the values of ε and R are unknown. What are the currents I_2 and I_3? Solve using Kirchhoff's Laws.
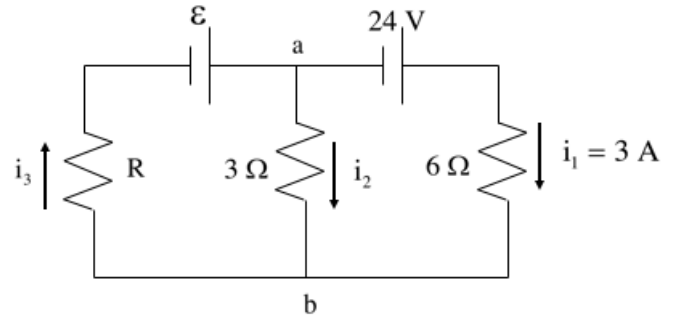
18.23) For the circuit to the right:

  a.) How many nodes are there?

  b.) How many branches are there?

  c.) How many independent node equations can you write for the circuit? . . . independent loop equations?

  d.) Derive an expression (then put in the numbers) for each meter reading.
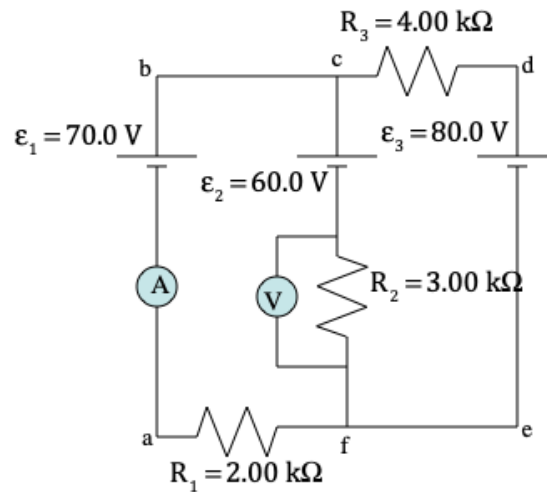
18.30) Show that the time constant has the units of seconds.

18.32) An uncharged capacitor (C = 20 microfarads) and resistor (R = 100 ohms) are in series with an EMF of 9 V (if there is no internal resistance mentioned in the battery/power supply, you may assume it is ideal).

  a.) What's the time constant?

  b.) What's the maximum charge on the capacitor?

  c.) What's the charge on the capacitor after one time constant?

18.36) An RC circuit with unknown capacitance and unknown resistance is powered by a 48 V battery with a maximum current of 0.5 mA. If the time constant is 0.96 seconds and the switch is closed at t = 0 sec:

  a.) What's the capacitance?

  b.) What's the charge on the capacitor after 2 time constants have elapsed?