Show all of your work! Label all units!

1. A battery is connected in series with a variable resistor and an ammeter. When the resistance of the resistor is 10 Ω the current is 2.0 A. When the resistance is 5 Ω the current is 3.8 A. Find the emf and the internal resistance of the battery. 10 pts.

2. A copper wire has a cross-sectional area of 5.0×10^{-7} m^2 and a length of 10.0 m. An aluminum wire of exactly the same dimensions is welded to the end of the copper wire. the ends of this long copper-aluminum wire are connected to a 3.0-volt battery. Neglect the resistance of any other wires in the figure.
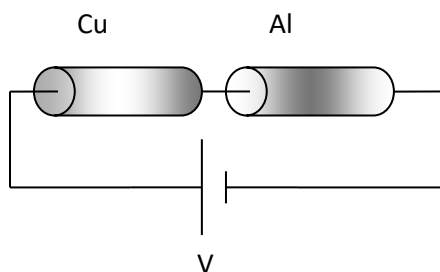
Cu   Al

V

Figure not drawn to scale

Determine
(a) the total resistance of the circuit. 3 pts.
(b) the total current in the wire. 2 pts.

3. Which of the following wires is likely to have the greatest resistance? 5 pts.
   a. A copper wire 0.2 mm thick and 10 cm long
   b. A Nichrome wire 0.2 mm thick and 10 cm long
   c. A Nichrome wire 0.1 mm thick and 15 cm long
   d. A copper wire 0.3 mm thick and 5 cm long.

4. In the diagram below, determine the value in each of the below parts of the problem
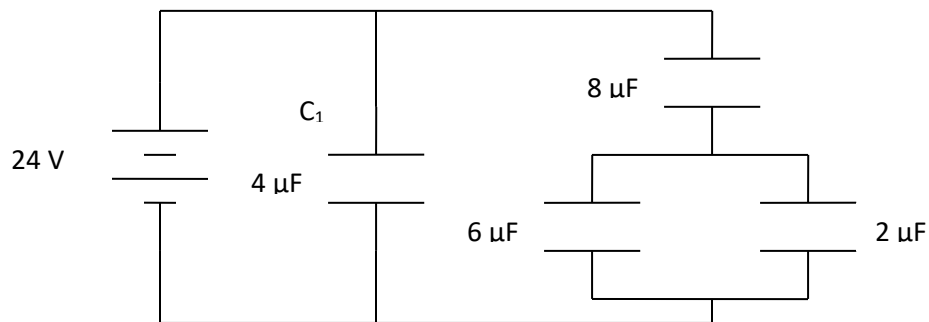
   a. Find the equivalent capacitance of the capacitors above. 4 pts

   b. Determine the total charge in the circuit. 2 pts.

   c. Determine the charge on one plate of C_1. 2 pts.

   d. Determine the electrical energy stored in C_1. 2 pts.

5. A light bulb oven is left on for 3 hrs and consumes 18 Watt hours of electricity. If the bulb draws a current of 0.3A, what is the resistance of the bulb? 5 pts.

6. The ammeter shown has a meter resistance of 100[Ω].   Resistor R_4 has been adjusted so that the ammeter will read zero. Find the value of R_X for this situation. 5 pts.
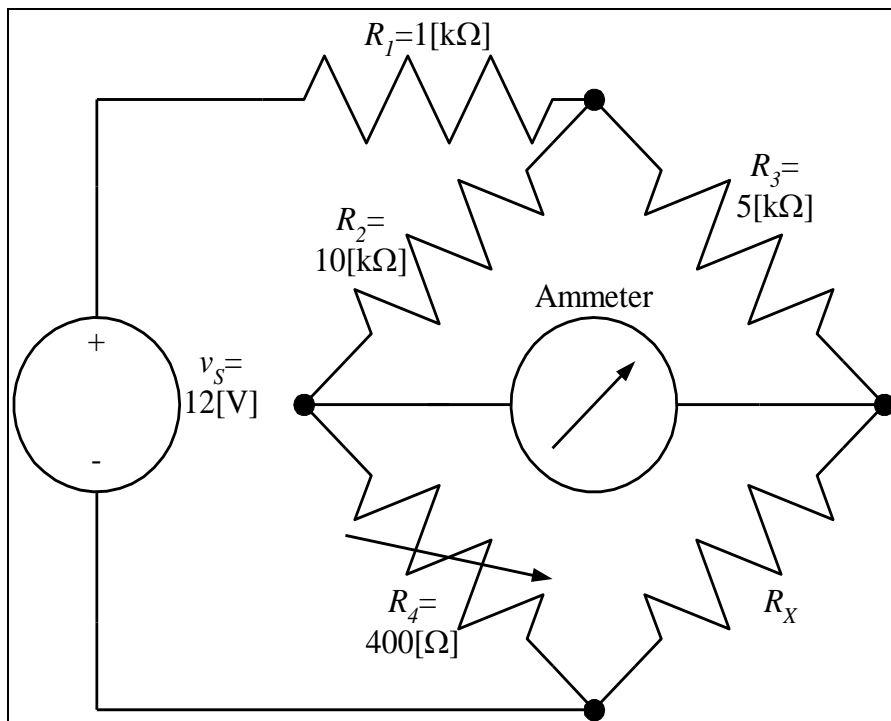
7. RC circuit: Show all of your work and label all units. 10 pts.

*Analyze the circuit below to find the charge stored on each capacitor at steady state.

120V

A

2000 Ω

3000 Ω

2 μF

3 μF