Name Answer Key Date _____

Honors Physics Electric Circuits WS #9H

Period _____ Mrs. Nadworny

# Combined Circuits

**Directions:** Read online textbook pages 746 – 751. Solve the following problems using the GUESS method and proper significant figures. Be sure to show ALL work.

1. A capacitor is made of two charged parallel plates of area A that are separated by a distance d, and it has a capacitance of C.
   a. What happens to the capacitance when the area of the plates is tripled?

$$C \propto \frac{A}{d} = \frac{3}{1} = 3$$

   b. What happens to the capacitance when the distance is doubled?

$$C \propto \frac{A}{d} = \frac{1}{2} = 1/2$$

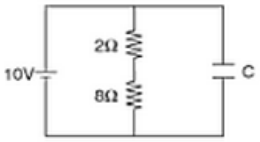
2. A 12 V battery is connected in series to a 3 ohm resistor and an initially uncharged capacitor.
   a. Determine the current in the circuit immediately after the battery is connected to the resistor and capacitor.

$$I = \frac{V}{R} = \frac{12V}{3\Omega} = 4A$$

   b. Determine the current in the circuit a long time later.

   A long time later the capacitor is fully charged and acts like a broken wire – current will not flow in a series circuit with a broken wire.

3. A circuit is set up so a 2 ohm and an 8 ohm resistor are in series with each other and in parallel with a capacitor and a 10 volt cell, as shown.




   a. Determine the current in the 2 ohm resistor immediately after the battery is connected to the circuit.

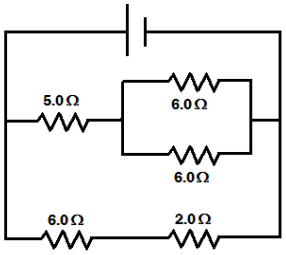
   An empty capacitor acts like a wire – in a parallel circuit it is a short circuit – current will not flow through the other segment – so there is no current through the 2 ohm resistor.

   b. Determine the current in the 2 ohm resistor a long time later.

$$R_{eq} = R_1 + R_2 = 2\Omega + 8\Omega = 10\Omega \qquad I_T = \frac{V_T}{R_{eq}} = \frac{10V}{10\Omega} = 1A$$

Continued on next page

4. A circuit contains five resistors as shown. The total current flowing through the circuit is 3.71 A.




a. Calculate the equivalent resistance of the circuit.

- Step 1:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{6.0\Omega} + \frac{1}{6.0\Omega} = \frac{2}{6.0}$$
$$R_{eq} = \tfrac{6}{2} = 3.0\Omega$$

- Step 2:

$$R_{eq} = R_1 + R_2 = 5.0\Omega + 3.0\Omega = 8.0\Omega$$

- Step 3:

$$R_{eq} = R_1 + R_2 = 2.0\Omega + 6.0\Omega = 8.0\Omega$$

- Step 4:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{8.0\Omega} + \frac{1}{8.0\Omega} = \frac{2}{8.0}$$
$$R_{eq} = \tfrac{8}{2} = 4.0\Omega$$

b. Calculate the total voltage provided by the cell.

$$V_T = I \bullet R = (3.71A)(4.0\Omega) = 15V$$

Answers in size order: 0, 0, ½, 1, 3, 3.0, 4, 4.0, 8.0, 8.0, 15