Name _____ Date _____ Period _____

Worksheet: Circuits & Ohm's Law

CHAPTER 35: SERIES AND PARALLEL CIRCUITS

Directions: *Answer the following questions based on reading from Chapter 23 (pgs. 531-550) and/or from notes in class.*

Equations:

$$\text{Electric Potential} = \frac{\text{electric potential energy}}{\text{amount of charge}} \qquad 1 \text{ volt} = \frac{1 \text{ joule}}{\text{coulomb}}$$

GENERAL EQUATIONS

$$I = \frac{V}{R} \qquad \boxed{\text{Current} = \frac{\text{voltage}}{\text{resistance}}} \qquad \boxed{\text{Amperes} = \frac{\text{volts}}{\text{ohms}}} \qquad P = IV$$

SERIES CIRCUITS

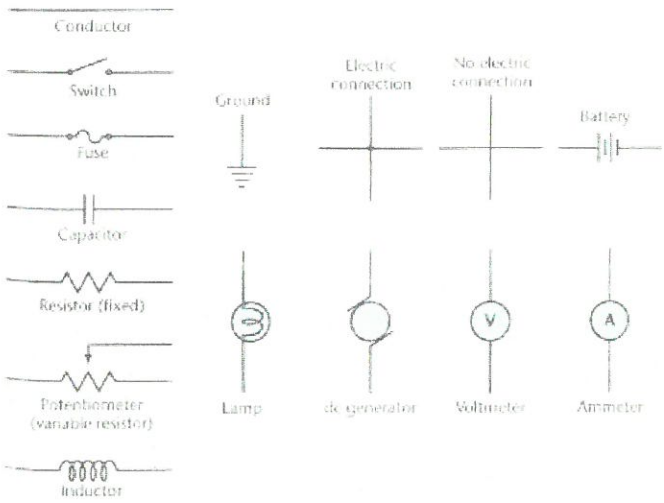
$$I = \frac{Vs}{R} \qquad R = R_A + R_B + \ldots.. \qquad Vs = V1 + V2 + V3 + V4 + \ldots..$$

PARALLEL CIRCUITS

$$I_A = \frac{V}{R_A} \qquad I = I_A + I_B + I_C \qquad \frac{1}{R} = \frac{1}{R_A} + \frac{1}{R_B} + \frac{1}{R_C}$$

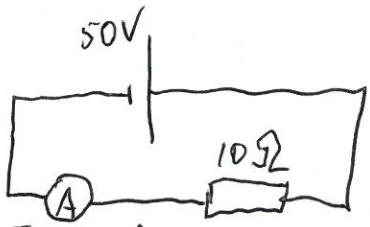
$$Vs = V_1 = V_2 = V_3 = V_4 + \ldots..$$

ELECTRICAL CIRCUIT SYMBOLS



QUESTIONS:

1. ***Draw a circuit schematic*** *(diagram) to include a* ***50.0 V*** *battery, an ammeter, and a resistance of* ***10.0 Ω*** *in series.*



a. What is the reading on the ***ammeter***?

$I = \frac{V}{R} = \frac{50}{10} = 5A$

b. In which ***direction*** is the ***current*** flowing?

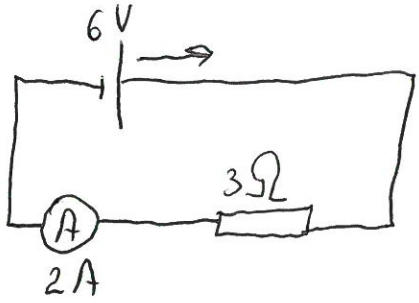
clockwise

2. How much ***current*** flows through a radio speaker that has a resistance of ***4.0 Ω*** when ***16 V*** is impressed across the speaker?

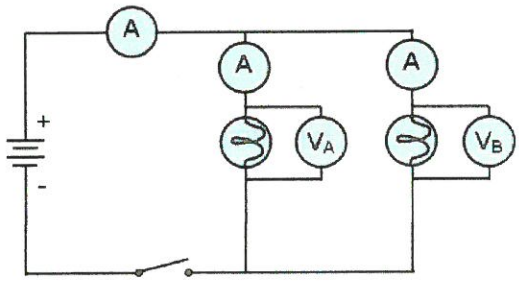
$$I = \frac{16}{4} = 4\ A$$

3. Draw a ***circuit diagram*** of the circuit described in the question above. Include a ***6 V*** *battery, an* ***ammeter*** *(labeled with value of* ***current****), and a* ***resistance*** *of* ***3.0 Ω*** *(the speaker). Also label the direction of the conventional (+) current.*

$$I = \frac{6}{3} = 2\ A$$



4. The following questions pertain to the circuit diagramed to the right.



a. ***Lamp*** A reads a voltage of ***12 V***. What is the voltage of ***lamp B***?

12 V

b. If the ammeters on both branches read the same amount, what does this tell you about the ***resistance*** of the two branches?

It is the same.

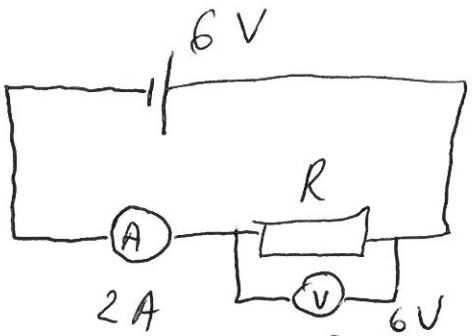
c. If the current flowing in the first branch was ***4.0 A*** and ***6.0 A*** in the second branch, what would the ***total current*** in the circuit be?

$$4 + 6 = 10\ A$$

5. Draw a series ***circuit diagram*** showing a ***6.0 V*** battery, a ***resistor***, & an ***ammeter*** reading of ***2.0 A***.

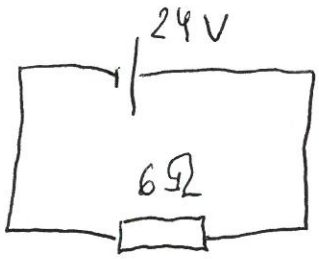
a. Label: the size of the resistor, the direction of conventional current, the (+) and (-) terminals of the battery.

b. Add a voltmeter to you diagram and indicate the ***potential difference*** across the resistor.



$$R = \frac{6}{2} = 3\ \Omega$$

6. Draw a *circuit diagram* showing a heater with a resistance of ***6 Ω***, and a potential difference source of ***24.0 V***.



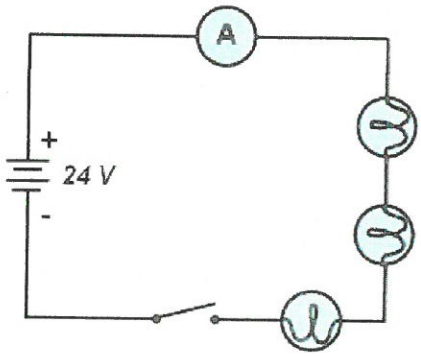
a. Calculate the ***current*** through the resistance

$$I = \frac{24}{6} = 4\ A$$

b. What ***thermal energy*** is supplied by the heater in 10 seconds? (HINT- use the equation $E = I^2Rt$ to determine energy)

$$E = 4^2 \times 6 \times 10 = 960\ Wt$$

7. Use the ***circuit diagram*** to the right to answer the following questions.



a. What is the ***current*** flowing through this series circuit if the total resistance is ***20 Ω***?

$$I = \frac{24}{20} = 1.2\ A$$

b. What would the ***voltage*** across each of the three bulbs be? What could you say about the ***brightness*** of each of the bulbs?

$$V = \frac{24}{3} = 8V$$

c. If two of the bulbs had a total resistance of ***15 Ω***, what would the ***resistance*** of the third bulb be?

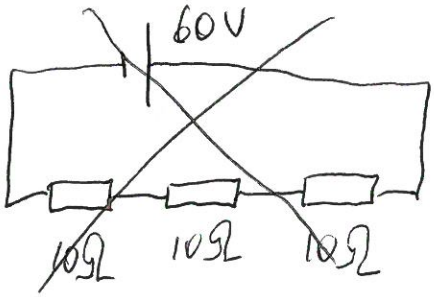
$R_{total} = 20\ \Omega \quad R_3 = 20 - 15 = 5\ \Omega$

d. What would be the ***current*** flowing through the circuit be is the voltage source was ***6.0 V***, and each of the lamps had a resistance of ***2 Ω***?

$$R_{total} = 2 \times 3 = 6\ \Omega$$

$$I = \frac{6}{6} = 1\ A$$

8. Draw a ***circuit diagram*** showing three ***10 Ω*** resistors connected in parallel and placed across a ***60.0 V*** battery.



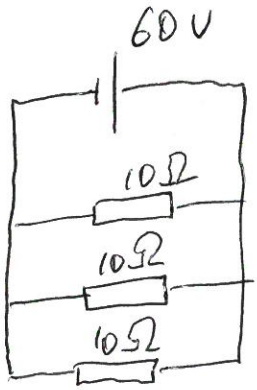
a. What is the ***equivalent resistance*** of the parallel circuit?

$10 \div 3 = 3.33\ \Omega$

$R_t = \frac{10}{3} = 3.33\ \Omega$

b. What is the ***current*** through the ***entire circuit***?

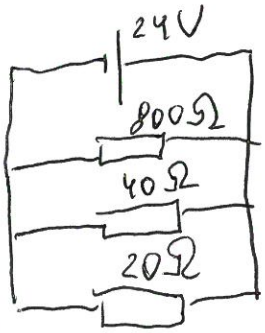
$I = \frac{60}{10/3} = 18\ A$



c. What is the ***current*** through each ***branch*** of the circuit?

$18 \div 3 = 6\ A$

9. Draw a ***circuit diagram*** showing the following: a ***800.0 Ω*** resistor, a ***40 Ω*** resistor, and a ***20 Ω*** resistor connected in parallel and connected across a ***24.0 V*** battery.



a. What is the ***equivalent resistance*** of the parallel circuit?

$\frac{1}{R} = \frac{1}{800} + \frac{1}{40} + \frac{1}{20} = \frac{1+20+40}{800} = \frac{61}{800}$ $R = \frac{800}{61} = 13.1\ \Omega$

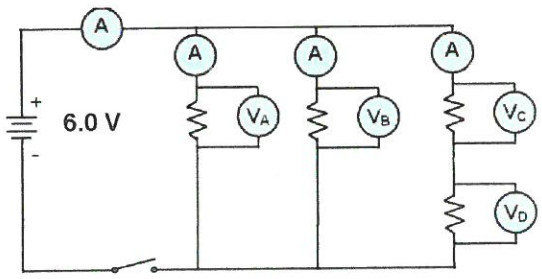
b. What is the ***current*** through the ***entire circuit***?

$I = \frac{24}{800/61} = \frac{24 \times 61}{800} = 1.8\ A$

c. What is the ***current*** through each ***branch*** of the circuit?

$\frac{24}{800} = 0.03\ A$ $\frac{24}{40} = 0.6\ A$ $\frac{24}{20} = 1.2\ A$

10. Answer the following questions about the circuit to the right.



a. What do each of the 4 ***voltmeters*** read?

$V_A = V_B = 6\ V$

$V_C = V_D = \frac{6}{2} = 3\ V$

b. If each of the resistors are identical, and the ***total current*** flowing through this parallel circuit is ***12.0 A***, what is the ***total resistance*** of this circuit?

$R = \frac{V}{I} = \frac{6}{12} = 0.5\ \Omega$