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Skill Sheet 8-C Electrical Power and Ohm's Law

In this skill sheet you will review the relationship between electrical power and Ohm's law. As you work through the problems, you will practice calculating the power used by common appliances in your home.

1. How do you calculate electrical power?

During everyday life we hear the word *watt* mentioned in reference to things like light bulbs and electric bills. The watt is the unit that describes how much power is used when electricity flows. Therefore, the definition of power is the "rate at which energy is flowing." And since energy is measured in joules, power is measured in joules per second. In fact, one joule per second is equal to one watt.

You may also have heard of the word kilowatt. A kilowatt is 1,000 watts or 1,000 joules of energy flowing in one second. This term kilowatt is most often used with electrical use in houses and other large facilities. And on an electric bill you may have noticed the term kilowatt-hour. A kilowatt-hour means that one kilowatt of power has been used for one hour.

We can calculate the amount of electrical power by an appliance or other electrical component by multiplying the voltage by the current.

$$\text{Current} \times \text{Voltage} = \text{Power, or } P = I\,V$$

2. Solving problems

Solve the following problems using the power equation and Ohm's law.

$$\text{Current (amps)} = \frac{\text{Voltage (volts)}}{\text{Resistance (ohms)}}$$

Remember, power is measured in watts.

1. Your hair dryer has a power rating of 1,200 watts.
   a. How many kilowatts is this?

   b. If the hair dryer is used for 20 minutes per day, how many kilowatt-hours (kWh) per day is this? (Hint: convert 20 minutes to hours.)

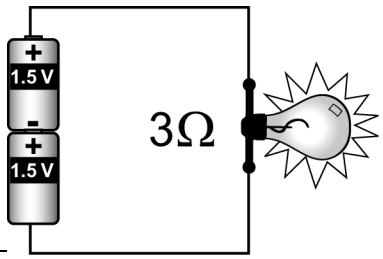
   c. Find the kilowatt-hours used by the hair dryer each month (assume 30 days/month).

   d. If your town charges $0.15/kWh, what is the cost to use the hair dryer per month?

2. Using the formula for power, calculate the amount of current through a 75-watt light bulb that is connected to a 120-volt circuit in your home.

3. What is the power rating of a home appliance (in kilowatts) that uses 8 amps of current when plugged into a 120-volt outlet.

4. The following questions refer to the diagram.



   a. What is the total voltage for the circuit?

   b. What is the total resistance for the circuit in ohms (Ω)?

   c. What is the current that will flow through the circuit?

   d. What is the power (in watts) for this circuit?

5. A toaster is plugged into a 120-volt household circuit. It draws 5 amps of current.

   a. What is the resistance of the toaster in ohms (Ω)?

   b. What is the power (in watts) of the toaster? What is this power in kilowatts?

6. A clothes dryer in a home has a power of 4,500 watts and runs on a special 220-volt household circuit.

   a. What is the current traveling through the dryer?

   b. What is the resistance of the dryer in ohms (Ω)?

7. A hair dryer is connected to a 120-volt household circuit. The current through the dryer is 10 amps.

   a. What is the resistance of the hair dryer?

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   b. What is the power rating (in kilowatts) of the dryer?

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   c. If the dryer is used for 30 minutes per day, how many kilowatt-hours are used by the dryer each day?

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   d. How many kilowatt-hours are used per month? (Assume 1 month = 30 days)

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   e. If the town charges 14 cents per kWh, what is the cost to run the hair dryer per month?
