

Chapter 12 – Electric Circuits

Section Review 12.1

1. List one way electric current is similar to water current and one way it is different.
2. Draw a circuit diagram for the circuit shown in Figure 12.5 on page 297.
3. What is the difference between an open circuit and a closed circuit? Which has a lit bulb?

Section Review 12.2

1. List the unit names and unit abbreviations for current and voltage.
2. When does a meter display a reading of 0 volts?
3. What does a 1.5-V battery give to each amp of current in a circuit?
4. What actually *flows* and *does work* in an electric circuit? Explain.
5. Draw a circuit diagram in which a meter is used to measure current.

Section Review 12.3

1. What happens to the current if a circuit's resistance increases? What happens to the current if the voltage increases instead?
2. List the units used to measure resistance, voltage and current. Then give the abbreviation for each unit:
 - a. Resistance:
 - b. Voltage:
 - c. Current:
3. A hair dryer uses a current of 10 A when plugged into a 120-V outlet. What is the resistance of the hair dryer?
4. Classify each of the following as a *conductor*, *semiconductor*, or *insulator*:
 - a. Air
 - b. Gold
 - c. Silicon
 - d. Rubber
 - e. Aluminum

Chapter 12 Review

Understanding Vocabulary

Select the correct term on page 310 to complete the sentences.

1. A _____ is what flows and carries energy in a circuit.
2. A(n) _____ has a break in it, so there is no current.
3. _____ explains the relationship between current, voltage and resistance in a circuit.

4. _____ is the difference in the amount of energy carried by current at two points in a circuit.
5. Wires in a circuit are made of a material that is a(n) _____, such as copper.
6. A(n) _____ has a higher resistance than a(n) _____.

Reviewing Concepts

Section 12.1

1. Give one example of a circuit found in nature and one example of a circuit created by people.

2. Why are symbols used in circuit diagrams?

3. Draw the electrical symbol for each of the following devices:
 - a. Battery

 - b. Resistor

 - c. Switch

 - d. Wire

4. List three devices that could be a resistor in a circuit.
 - a.
 - b.
 - c.

5. List two sources of energy that a circuit might use, and give an example of a circuit that uses each type.
 - a.
 - b.

6. Will a bulb light if it is in an open circuit? Explain.

7. Is flipping a switch the only way to create an open circuit? Explain.

Section 12.2

8. The direction of electric current in a circuit is away from the _____ end of the battery and toward the _____ end.

9. How are voltage and energy related?

10. A voltage of 1 volt means 1 _____ of _____ does 1 _____ of work in 1 second.

11. Explain how a battery in a circuit is similar to a water pump.

12. What are the differences between a *multimeter*, a *voltmeter*, and an *ammeter*?

13. Suppose you have a closed circuit containing a battery and a bulb. Why must you first create a break in the circuit before using an ammeter to measure the current?

Section 12.3

14. The greater the resistance in a circuit, the less the _____.

15. A circuit contains one light bulb and a battery. What happens to the total resistance in the circuit if you replace the one light bulb with a string of four identical bulbs? Why?

16. What does it mean to say that current and resistance in a circuit are inversely related?
17. What does it mean to say that current and voltage in a circuit are directly related?
18. According to Ohm's law, the current in a circuit increases if the _____ increases. The current decreases if the _____ increases.
19. A battery is connected to a light bulb, creating a simple circuit. Explain what will happen to the current in the circuit if
- The bulb is replaced with a bulb having a higher resistance.
 - The bulb is replaced with a bulb having a lower resistance.
 - The battery is replaced with a battery having a greater voltage.
20. Why does a light bulb's resistance increase if it operates for a long period of time?
21. Why can you safely handle a 1.5-V battery without being electrocuted?
22. What is the difference between a conductor and an insulator?
23. Why is it important to always have dry hands when working with electric circuits?

24. Explain why electrical wires are made of copper covered in layers of rubber insulation.

25. What is a *semiconductor*?

26. Classify each of the following as *conductor*, *semiconductor*, or *insulator*.

a. Ice

b. Plastic

c. Carbon

d. Iron

e. Glass

f. Silver

27. What is the difference between a *fixed* resistor and a *variable* resistor?

28. What is another name for a variable resistor?

Solving Problems

Section 12.1

1. Draw a circuit diagram of a circuit with a battery, three wires, a light bulb and a switch.

Section 12.2

2. What voltage would the electrical meter show in each of the diagrams at bottom of page 311?

a.

b.

3. Which of the diagrams at top of page 311 shows the correct way to measure current in a circuit?

- A portable radio that runs on 1.5-V batteries needs 6 V to work properly. How many batteries does it use?

Section 12.2

- What happens to the current in a circuit if the *resistance* triples? What happens to the current if the *voltage* triples?
- A hair dryer draws a current of 10 A when plugged into a 120-V outlet. What is the resistance of the hair dryer?
- A television runs on 120-V and has a resistance of 60 Ω . How much current does it use?
- A digital camera uses one 6-V battery. The circuit that operates the flash and takes the pictures has a resistance of 3 Ω . What is the current of the circuit?
- The motor in a toy car has a resistance of 3 Ω and needs 1.5 A of current to run properly.
 - What battery voltage is needed?
 - How many 1.5-V batteries would the car require?
- Find the current in each of the circuits shown at the bottom of page 311.
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- Household circuits in the US operate at 120-V. Circuit breakers and fuses commonly break such a circuit if the current is greater than 15 A. What is the minimum amount of resistance needed in a circuit to prevent the circuit breaker from tripping?

12. A flashlight bulb has a resistance of about $6\ \Omega$. It works in a flashlight with two 1.5-V batteries. How much current is in the flashlight's circuit when the bulb is lit?

Test Practice

Section 12.1

1. Which of the following will light the bulb as shown in the circuit diagram on page 312?
- a. Switches 1 and 2 both closed
 - b. Switches 1 and 2 both open
 - c. Switch 1 open and switch 2 closed
 - d. Switch 1 closed and switch 2 open
2. Which of the following devices is used to create an open circuit?
- a. Switch
 - b. bulb
 - c. battery
 - d. resistor
3. Which device in a circuit has the most similar function to a bulb?
- a. Battery
 - b. switch
 - c. resistor
 - d. wire

Section 12.2

4. Which device in a circuit transforms chemical energy into electrical energy?
- a. battery
 - b. bulb
 - c. meter
 - d. wire
5. The battery in a circuit is changed from 1.5 V to 4.5 V. What happens to the power in the circuit?
- a. It stops
 - b. It decreases
 - c. It does not change
 - d. It increases
6. What does voltage measure?
- a. electrical potential energy
 - b. Gravitational potential energy
 - c. Current
 - d. The flow of charge

Section 12.3

7. What is the current of a circuit with a resistance of $3\ \Omega$ and a voltage of 6 V?
- a. 0.5 A
 - b. 1 A
 - c. 2 A
 - d. 18 A
8. What is the voltage of the battery in the circuit shown on page 313?
- a. 0.33 V
 - b. 3 V
 - c. 8 V
 - d. 12 V
9. Which material would be classified as a conductor?
- a. silicon
 - b. glass
 - c. water
 - d. air
10. Four blocks with the same dimensions are made of different materials. Which block has the highest resistance?
- a. copper
 - b. silver
 - c. glass
 - d. aluminum