

Chapter 13 – Electrical Systems

Section Review 13.1

1. What do you know about the current at different points in a series current?
2. Three bulbs are connected in series with a battery and a switch. Do all the bulbs go out when one bulb is removed? Explain.
3. What happens to a circuit's resistance as more resistors are added in series?
4. A series circuit contains a 9-volt battery and three 1- Ω bulbs. What is the voltage drop for each bulb?

Section Review 13.2

1. Is the voltage for each branch of a parallel circuit the same? Explain.
2. Is the current in each branch of a parallel circuit the same? Explain.
3. Why do home electrical systems use parallel wiring?
4. What happens to the total current in a parallel circuit as more branches are added? Why?

5. What is the total resistance of two 12-ohm resistors in parallel? What is the total resistance of three 12-ohm resistors in parallel?

Section Review 13.3

1. How is an appliance's power related to the amount of energy it uses?
2. How many watts or joules are a horsepower? Kilowatt? Kilowatt-hour?
3. What does the electric utility company charge you for each month?
4. What is the difference between direct current and alternating current?

Chapter 13 Review

Understanding Vocabulary

Select the correct term on page 334 to complete the sentences.

1. A(n) _____ contains only one path for the current.
2. There is a(n) _____ across each resistance in a series circuit when current is flowing.
3. _____ states that all the current entering a point in a parallel circuit must also leave that point.
4. A(n) _____ contains multiple paths or branches for the current.
5. The _____ is a unit used by electric utility companies to measure the electrical energy your home uses each month.
6. Electrical appliances in your home use _____ current.

Reviewing Concepts

Section 13.1

1. Draw a circuit diagram for a circuit containing a battery and two bulbs in series.
2. Is the current at every point in a series circuit the same? Explain.
3. One of the bulbs burns out in a string of lights. What happens to the current in the circuit? What happens to the brightness of the bulbs?
4. Explain how to calculate the total resistance in a series circuit.
5. As more bulbs are added to a series circuit, what happens to the resistance of the circuit? What happens to the brightness of the bulbs?
6. Explain Kirchhoff's voltage law.

Section 13.2

7. What is a parallel circuit?
8. Draw the circuit diagram for a circuit containing two bulbs in parallel.

9. What does Kirchhoff's current law say about the current entering any point in a circuit?
10. Each branch in a parallel circuit has the same _____.
11. List two advantages of parallel circuits over series circuits.
- a.
 - b.
12. Does the wiring in your home connect the appliances in series or parallel? How could you prove this?
13. What happens to the total resistance of a parallel circuit as more branches are added? Why?
14. How do you calculate the total resistance of two resistances that are wired in parallel?
15. What is a short circuit?
16. Why can short circuits be dangerous?

Section 13.3

17. A light bulb has a power of 60 W. Explain what this means in term of energy and time?
18. Explain how to calculate the power of an electrical appliance.

19. What is the meaning of the kilowatt-hour?
20. What is the difference between direct current and alternating current?
21. How frequently does the alternating current used in the United States reverse direction?
22. Do thinner or thicker wires have more resistance? Why?
23. Do longer or shorter wires have more resistance? Why?
24. Why can it be dangerous to connect several extension cords to make one long cord?

Solving Problems

Section 13.1

1. A series circuit contains 5- Ω , 3- Ω , and 8- Ω resistors. What is the total resistance of the circuit?
2. A circuit contains a 9-V battery and two identical bulbs. What is the voltage drop across each bulb?
3. A circuit contains a 12-V battery and two 3- Ω bulbs in series. Draw a circuit diagram and use it to find the current in the circuit and the voltage drop across each bulb.
4. A circuit contains a 12-V battery and three 1- Ω bulbs in series. Draw a circuit diagram and use it to find the current in the circuit.

5. Calculate the total resistance of each circuit as shown on #5 on page 335. Then, calculate the current in each.
- A.
- B.
- C.
6. A circuit contains two $1\text{-}\Omega$ bulbs in series. The current in the circuit is 1.5 A . What is the voltage provided by the batteries?
7. A circuit contains two identical resistors in series. The current is 3 A , and the batteries have a total voltage of 24-V . What is the total resistance of the circuit? What is the resistance of each device?

Section 13.2

8. Find the amount and direction of the current through point P in each of the circuits as shown on #8 on page 335.

A.

B.

C.

9. Find the following for each of the three circuits shown at the top of page 335:

	A	B	C
a. The voltage across each resistor	_____	_____	_____
b. The current through each resistor	_____	_____	_____
c. The total current in the circuit	_____	_____	_____
d. The total resistance of the circuit	_____	_____	_____

10. A parallel circuit contains a 6-V battery and two $6\text{-}\Omega$ bulbs.

a. Draw the circuit diagram for this circuit.

b. Calculate the current through each branch.

c. Calculate the total current.

- d. Use Ohm's law to calculate the total resistance of the circuit.
- e. Use the formula for combining parallel resistors to calculate the total resistance of the circuit.

11. A parallel circuit contains a 24-V battery, a 4- Ω bulb and a 12- Ω bulb.

- a. Draw the circuit diagram for this circuit.
- b. Calculate the current through each branch.
- c. Calculate the total current in the circuit.
- d. Use Ohm's law to calculate the total resistance of the circuit.
- e. Use the formula for combining parallel resistors to calculate the total resistance of the circuit.

12. Find the unknown quantities in each of the circuits shown at the bottom of page 335.

Figure A

$$I =$$

$$V =$$

Figure B

$$R_1 =$$

$$R_2 =$$

Figure C

$$I =$$

$$R =$$

Section 13.3

13. Calculate the power of each of the following appliances when plugged into a 120-V outlet.

- a. An iron that uses 10 A of current
- b. A stereo that uses 2 A of current
- c. A light bulb that uses 0.5 A of current

14. Calculate the current each of the following appliances uses when plugged into a 120-V outlet.

- d. A 100-W computer
- e. A 1,200 W microwave
- f. A 30-W radio

15. A portable MP3 player requires 1.5 A of current and has a power of 15 W. What is the voltage of the rechargeable battery it uses?

16. A flashlight contains a 6-W bulb that uses 2-A of current. How many 1.5- V batteries does it use?

17. Alex uses a 1,000-W heater to heat his room.

- g. What is the heater's power in kilowatts?
- h. How many kilowatt-hours of electricity does Alex use if he runs the heater for 8 hours?
- i. If the utility company charges \$0.15 per kilowatt-hour, how much did it cost to run the heater for 8 hours?

18. You watch a movie on a 300-W television for two hours.

- j. What is the television's power in kilowatts?
- k. How many kilowatt-hours of electricity did you use?
- l. If the utility company charges \$0.15 per kilowatt-hour, how much did it cost to watch the movie?

Test Practice

- _____ states that the sum of the voltage drops in a series circuit must equal the circuit's total voltage.
 - Ohm's Law
 - Ampere's Law
 - Coulomb's Law
 - Kirchhoff's Law
- The current for the circuit shown for #2 on page 336 is
 - 0.5Ω
 - 2Ω
 - 0.5 A
 - 2 A
- A series circuit contains a 3-V battery and three identical light bulbs. What is the voltage drop for each light bulb?
 - $1/3 \text{ V}$
 - 1 V
 - 3 V
 - 9 V
- If the current in the circuit shown for #4 on page 336 is 1.5 A , what is the battery voltage?
 - 4 V
 - 6 V
 - 9 V
 - 12 V
- Which formula is used for calculating the total resistance (R_{total}) when given the individual resistances in a **parallel** circuit? (*Write correct formula below.*)
 -
 -
 -
 -
- What is the current at point A shown in the circuit for #6 on page 337?
 - 2 A
 - 6 A
 - 8 A
 - 10 A
- What is the total current in the circuit for #7 on page 337?
 - 2 A
 - 6 A
 - 12 A
 - 24 A
- Calculate the total resistance of the circuit for #8 on page 337?
 - $1 \frac{1}{3} \Omega$
 - 2Ω
 - 4Ω
 - 6Ω
- A stereo uses 2 A of current when plugged into a 120-V outlet. What is its power?
 - 240 W
 - 200 W
 - 120 W
 - 60 W
- Kilowatt-hours is a unit of:
 - power
 - current
 - energy
 - voltage
- You watch a 10-hour science fiction movie marathon. The power rating of your TV is 300 W and your utility company charges $\$0.15$ per kilowatt-hour. How much did it cost to watch the marathon?
 - 4.5 ¢
 - 20 ¢
 - 45 ¢
 - $\$450$
- How much current is used by a 2,400-W electric oven operating on a 120-V circuit?
 - 2 A
 - 20 A
 - 200 A
 - $2,000 \text{ A}$