

Chapter 16

ELECTRICITY

Chapter 16 Assessment

Vocabulary

Select the correct term to complete the sentences.

ampere	insulator	potentiometer
battery	Kirchoff's current law	resistance
charged	Kirchoff's voltage law	resistor
closed circuit	multimeter	semiconductor
conductor	negative	series circuit
coulomb	ohm	short circuit
electric circuit	Ohm's law	static electricity
electric current	open circuit	switch
electrically neutral	parallel circuit	volt
electricity	positive	voltage
		voltage drop

Section 16.1

- The unit in which charge is measured is the ____.
- An object is ____ when it has an equal number of positive and negative charges.
- All atoms have protons, which carry a(n) ____ charge.
- All atoms have electrons, which carry a(n) ____ charge.
- ____ is caused by a tiny imbalance of charge.
- A(n) ____ object is not electrically neutral.
- ____ is what flows and carries energy in a circuit.
- A(n) ____ is used to create a break in a circuit.
- A(n) ____ has a complete path for the current.
- A light bulb, motor, or speaker can act as a(n) ____ in a circuit.

- A circuit diagram uses electrical symbols to represent a(n) ____.
- ____ is the science of electric current and charge.
- When a light switch is in the off position, you have a(n) ____.

Section 16.2

- The unit for current is the ____.
- A(n) ____ provides voltage for a circuit.
- ____ is a measure of electric potential energy.
- Use a(n) ____ to measure current or voltage in a circuit.
- The ____ is the unit for measuring voltage.

Section 16.3

- The ____ is the unit for measuring resistance.
- ____ explains the relationship between current, voltage, and resistance in a circuit.
- Wires in a circuit are made of a material that is a(n) ____, such as copper.
- ____ is the measure of how strongly a material resists current.
- A(n) ____ such as rubber or plastic has high electrical resistance.
- Silicon is an example of a(n) ____.
- A(n) ____ is a type of variable resistor.

Section 16.4

- In a(n) ____, there is one path for current and the value for current is the same everywhere.
- ____ states that the sum of the voltage drops in a circuit must equal the battery voltage.

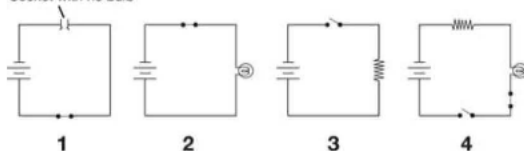
28. The ____ is the difference in voltage across an electrical device that has current flowing through it.
29. ____ states that all current entering a branch point in a circuit must exit.
30. In a(n) ____, there is more than one path or branch for current, and the voltage is the same everywhere.
31. A branch in a circuit with zero or very low resistance is a(n) ____.

Concepts

Section 16.1

1. Like charges ____ and opposite charges ____.
2. What does it mean to say an object is electrically neutral?
3. Is an object's net charge positive or negative if it loses electrons?
4. Why don't you usually notice electric forces between objects?
5. What unit is used for measuring charge, and where did the name come from?
6. Why do clothes sometimes stick together when you pull them out of a clothes dryer?
7. Use the illustrations (below) to answer the following questions.

Socket with no bulb



- a. Which of the circuit(s) is/are closed?
- b. Which circuit(s) will *not* light a bulb?
- c. For any open circuits shown, explain why the circuit is open.

8. Why are symbols used in circuit diagrams? Draw the electrical symbol for each of the following devices.
 - a. battery
 - b. resistor
 - c. switch
 - d. wire

Section 16.2

9. How does voltage cause current to do work?
10. Explain how a battery in a circuit is similar to a water pump.
11. What are the differences between a multimeter, an ammeter, and a voltmeter?
12. Suppose you have a closed circuit containing a battery that is lighting a bulb.
 - a. Explain how you would use a multimeter to measure the voltage across the bulb.
 - b. Explain how you would use a multimeter to measure the current in the circuit.
13. What should you do to protect the multimeter when you measure current?

Section 16.3

14. What does it mean to say that current and resistance in a circuit are inversely related?
15. What does it mean to say that current and voltage in a circuit are directly related?
16. According to Ohm's law, the current in a circuit increases if the ____ increases. The current decreases if the ____ increases.
17. A battery is connected to a light bulb, creating a simple circuit. Explain what will happen to the *current* in the circuit if
 - a. the bulb is replaced with a bulb having a higher resistance.
 - b. the battery is replaced with a battery having a greater voltage.

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18. Explain why electrical wires are made of copper covered in a layer of plastic. Use the terms *insulator* and *conductor* in your answer.

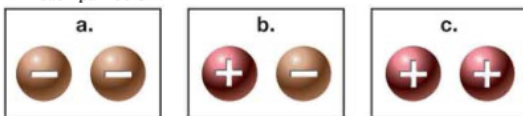
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19. Draw a circuit diagram for a circuit containing a battery and two bulbs in series.
20. As more bulbs are added to a series circuit, what happens to the resistance of the circuit? What happens to the current? What happens to the brightness of the bulbs?
21. How is Kirchhoff's voltage law useful for analyzing series circuits?
22. A parallel circuit contains two bulbs in parallel. Why do the bulbs have the same voltage?
23. Draw the circuit diagram for a circuit containing two bulbs in parallel.
24. List two advantages of parallel circuits over series circuits.
25. What happens to the total resistance of a parallel circuit as more branches are added? Why?
26. What is a short circuit, and why can it be dangerous?

Problems

Section 16.1

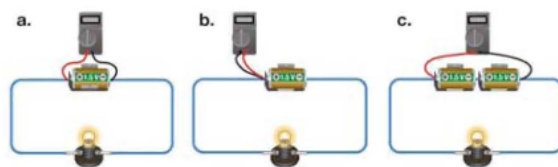
1. Describe the forces between the positive and negative electric charges in each pair below.



2. Draw a circuit diagram of a circuit containing a battery, three wires, a light bulb, and a switch.

Section 16.2

3. What voltage would the multimeter show in each of the diagrams below?



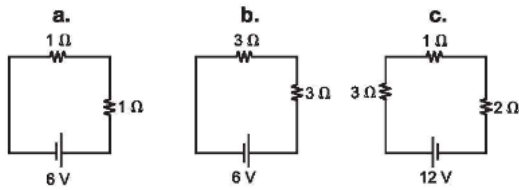
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4. What happens to the current in a circuit if the resistance triples? If the voltage triples?
5. A hair dryer draws a current of 10 A when plugged into a 120-V outlet. What is the resistance of the hair dryer?
6. A digital camera uses one 6-V battery. The circuit that runs the flash and takes the pictures has a resistance of 3 Ω . What is the current in the circuit?

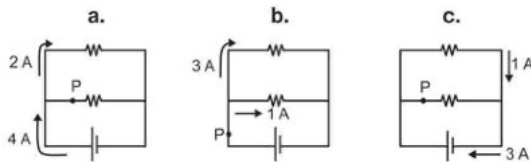
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7. A circuit contains a 5- Ω , a 3- Ω , and an 8- Ω resistor in series. What is the total resistance of the circuit?
8. A circuit contains a 9-V battery and two identical bulbs. What is the voltage drop across each bulb?
9. A circuit contains a 12-V 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.
10. A circuit contains a 12-V battery and three 1- Ω bulbs in series. Draw the circuit diagram and find the current in the circuit.

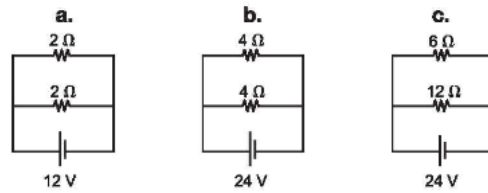
11. Calculate the total resistance of each circuit shown below and calculate the current in each.



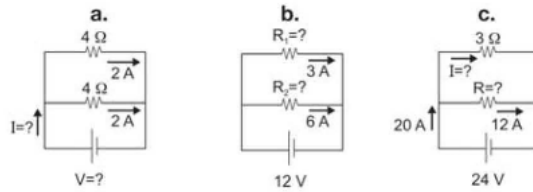
12. A circuit contains two 1- Ω bulbs in series. The current in the circuit is 1.5 A. What is the voltage provided by the batteries?
13. A circuit contains two identical resistors in series. The current is 3 A, and the batteries have a total voltage of 24 V. What is the total resistance of the circuit? What is the resistance of each resistor?
14. Find the amount and direction of the current through point P in each of the circuits shown below.



15. A parallel circuit contains a 24-V battery, a 4- Ω bulb and a 12- Ω bulb.
- Draw the circuit diagram for this circuit.
 - Calculate the current through each branch.
 - Calculate the total current in the circuit.
 - Use Ohm's law to calculate the total resistance of the circuit.



16. Do the following for each of the three circuits shown above.
- Find the voltage drop across each resistor.
 - Use Ohm's law to find the current through each resistor.
 - Find the total current in the circuit.
 - Find the total resistance of the circuit.
17. Find the unknown quantity in each of the circuits below.



Applying Your Knowledge

Section 16.1

- On very dry days, when you use a comb or a brush, your hair sometimes stands on end and maybe even sticks to the comb or brush. Explain why this happens in terms of electric charge.
- A wire carrying an electric current is often likened to a pipe carrying water. What part of this analogy is incorrect?

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Section 16.2

3. Study the illustration below. Name the parts of the circuit that are analogous to the parts of the water system.
4. Design an experiment to determine whether more expensive household batteries last longer than cheaper ones. Don't forget to carefully select your controls! With your teacher's approval, try your experiment and report your findings.
5. Standard voltage for electrical circuits in the United States is 120 volts. Is this the standard voltage in other countries? Do some research and report your findings.

Section 16.3

6. Why can't you use an electric blender purchased in the U.S. in another country, such as Spain or China?

Section 16.4

7. Some appliances contain devices that are connected in series. For example, many microwave ovens have a light that turns on while the microwave is running. List appliances in your house that use series circuits.

