

## Chapter 14 – Electrical Charges and Forces

### Section Review 14.1

1. Explain how there can be charge inside matter, yet the matter is electrically neutral.
2. According to Coulomb's law, what happens to the force between two charges if the distance between them is tripled?
3. When you charge a balloon by friction, why can it stick to a wall but not to a doorknob?

### Section Review 14.2

1. Why is conventional current flow defined as moving from positive to negative when current in a wire is actually a flow of electrons from negative to positive?
2. If electron drift velocity is so slow, why does a bulb light immediately upon closing a switch?
3. What is it about an insulator's atoms that causes it to have such high resistance?
4. What is a volt in terms of joules and coulombs?

### Section Review 14.3

1. What is the purpose of the parallel plates in a simple capacitor?
2. Suppose a capacitor is charged by a 1.5-V battery. When will the capacitor have stored as much charge as it can?
3. After a capacitor is fully charged, what happens to its current over time? What happens to its voltage over time?
4. What happens to a capacitor's capacitance if the plate area is increased? Why?

5. Why can capacitors be dangerous?

## Chapter 14 Review

### Understanding Vocabulary

Select the correct term on page 356 to complete the sentences.

1. \_\_\_\_\_ exists when there is an excess of one type of charge on an object.
2. \_\_\_\_\_ explains the relationship between electric force, charge, and distance.
3. A(n) \_\_\_\_\_ can be used to tell whether an object has a net charge.
4. A(n) \_\_\_\_\_ carries electrical current with zero resistance.
5. A(n) \_\_\_\_\_ is used to store electrical energy by separating charge.
6. Capacitance is measured in \_\_\_\_\_.

### Reviewing Concepts

#### Section 14.1

1. Protons are \_\_\_\_\_ charged, and electrons are \_\_\_\_\_ charged.
2. Like charges \_\_\_\_\_ and opposite charges \_\_\_\_\_.
3. What does it mean to say an object is electrically neutral?
4. Is an object's net charge positive or negative if it loses electrons? Why?
5. How many protons are needed to make 1 C of charge?
6. How does the charge of an electron compare to the charge of a proton?
7. Why don't you usually notice electric forces between objects?

8. What two factors determine the amount of electrical force between two charged objects?
9. What happens to the electric force between two charges as they are moved closer together?
10. Explain what happens to the force between two protons if each of the following occurs. Consider each one individually.
- a. The distance between them is cut in half.
  - b. The distance between them is doubled.
  - c. The distance between them is tripled.
  - d. One of the protons is replaced with an electron.
  - e. The two protons are replaced with two electrons.
11. Compare Coulomb's law to Newton's law of gravitation.
12. Explain what happens inside an electroscope if a positively-charged object is held above it without touching.
13. What happens to the charges in your hair and a balloon if you rub them together? What is this called?
14. Explain how to charge an electroscope positively through induction.

### **Section 14.2**

15. How are the units *ampere* and *coulomb* related?

16. Ben Franklin defined current as going from \_\_\_\_\_ to \_\_\_\_\_ . Now we know that electrons in a circuit move from \_\_\_\_\_ to \_\_\_\_\_ .
17. Do all electrons in a wire move to make the current in a circuit? Explain.
18. Does a battery supply the electrons to a circuit that create a current? Explain.
19. Why can current easily be created in a conductor but not in an insulator?
20. One volt equals 1 \_\_\_\_\_ of energy per \_\_\_\_\_ of charge. A volt is also equal to 1 \_\_\_\_\_ of power per \_\_\_\_\_ of current.

### Section 14.3

21. What is a capacitor? What are some uses of capacitors?
22. What does it mean to say a capacitor is charged?
23. What happens to the current in a circuit as a capacitor charges? Why?
24. List the three factors that affect a capacitor's capacitance.
- a.
  - b.
  - c.

### Solving Problems

#### Section 14.1

1. What is the charge of 1,000 electrons, measured in coulombs?

2. Find the net charge of an atom that contains
  - a. 5 protons and 3 electrons.
  - b. 7 electrons and 6 protons.
  - c. 8 electrons and 8 protons.
  
3. Two charged objects, each with a charge of  $2.5 \times 10^{-6}$  C, are separated by 2 m. Calculate the electric force between the objects.
  
  
  
  
  
4. Two charged objects have equal charge. The electric force between the objects is 9 N when they are held 3 m apart. What are the charges of the objects?

### Section 14.2

5. Six coulombs of charge pass through a wire in a time of 2 s. What is the current in the wire?
  
  
  
  
  
6. A wire carries a current of 2 A. How many coulombs of charge pass through the wire in 10 s?

### Section 14.3

7. Draw a circuit diagram containing a 3-V battery, a  $12\text{-}\Omega$  resistor, a capacitor and a switch.
  
  
  
  
  
8. One plate of a charged capacitor has a charge of -1 C. What is the charge of the second plate? What is the net charge on the whole capacitor?

## Test Practice

### Section 14.1

1. You rub a balloon on your hair. The balloon gains electrons. Which of the following is a *true* statement?
  - a. Your hair is electrically neutral.
  - b. Your hair is negatively charged.
  - c. Your hair is positively charged.
  - d. Your hair and the balloon have the same charge.

2 The electric force between two charges is  $F$ . If you double the distance between the two charges, what would the new electric force be?

- a.  $\frac{1}{4} F$                       b.  $\frac{1}{2} F$                       c.  $F$                       d.  $2 F$

3. When an electroscope is negatively charged, the two thin “leaves” of metal will

- a. stay together as the negative charges repel each other.  
b. stay together as the negative charges attract each other.  
c. separate as the negative charges repel each other.  
d. separate as the negative charges attract each other.

4. An object is \_\_\_\_\_ when the positive and negative charges are separated.

- a. neutral                      b. polarized                      c. static                      d. charged

### Section 14.2

5. If the current in a wire is 1 A, 1 \_\_\_\_\_ of charge passes by a point in the wire in 1 s.

- a. farad                      b. coulomb                      c. volt                      d. newton

6. Current in a copper wire is the movement of

- a. electrons.                      b. protons.                      c. atoms.                      d. fluid.

7. Materials where electrons are tightly bound inside atoms are called

- a. conductors.                      b. semiconductors.                      c. superconductors.                      d. insulators.

8. A joule per coulomb is 1

- a. watt.                      b. volt.                      c. amp.                      d. newton.

### Section 14.3

9. The graph on page 358 shows current versus time for

- a. a capacitor charging.                      b. a capacitor discharging.  
c. a conductor charging.                      d. a conductor discharging.

10. Capacitance is measured in

- a. ohms.                      b. coulombs.                      c. farads.                      d. amps.

11. The capacitance of a capacitor is determined by all of the following *except*

- a. the insulating material between the plates.  
b. the area of the plates.  
c. the distance between the plates.  
d. the flexibility of the plate material.