$\qquad$

## Chapter 13

$\qquad$
Chemical Bonding

## 13.1 - Electrons \& Chemical Bonding

$\square$ Directed Reading Worksheet
$\square \quad$ "Comparing Integers on a Number
Line" WS
$\square \quad$ "Arithmetic w/ Positive \& Negative
Numbers" WS
$\square \quad$ Section Review p. 331
$\square$ Quiz

## 13.2 - Types of Chemical bonds

$\square$ Directed Reading Worksheet
$\square$ Math Break p. 334
$\square \quad$ Section Review p. 335
$\square \quad$ "Is It an Ion" WS
$\square \quad$ Self Check p. 337
$\square \quad$ Section Review p. 341
$\square$ "Covalent Marshmallows" Lab
$\square \quad$ "Interview w/ an Electron" WS
$\square$ Quiz

## Conclusion

> "Bonding Puzzle" WS
> $\square \quad$ Chapter Review WS
> $\square$ Exam
$\qquad$ Date $\qquad$ Class $\qquad$

## CHAPTER

13 DIRECTED READING WORKSHEET

## Chemical Bonding

As you read Chapter 13, which begins on page 326 of your textbook, answer the following questions.

## Section 1: Electrons and Chemical Bonding ${ }_{(p .328)}$

5. Every substance in the world can be made out of about 100
elements. True or False? (Circle one.)
$\qquad$ Date $\qquad$ Class $\qquad$

## Atoms Combine Through Chemical Bonding (p. 328)

6. Sugar is made from atoms of which of the following elements? (Circle all that apply.)
a. carbon
c. hydrogen
b. nitrogen
d. oxygen
7. A chemical bond is the $\qquad$ of attraction that holds a pair of atoms together.

Electron Number and Organization (p. 329)
8. In order to make the overall charge of an atom zero, there must be an
equal number of negatively charged $\qquad$ and positively charged $\qquad$ .
9. Valence electrons are the electrons in an atom's innermost energy level. True or False? (Circle one.)

Look at Figure 3 on page 330. Write the number of valence electrons for each of the following elements:
10. $\qquad$ oxygen
11. $\qquad$ sodium
12. $\qquad$ chlorine
13. $\qquad$ helium

To Bond or Not to Bond (p. 330)
14. Which electrons determine whether or not an atom will form bonds?
a. the electrons in the nucleus
b. the electrons in the innermost energy level
c. the electrons in the outermost energy level
d. None of the above
15. An atom will not normally form a chemical bond if it has
$\qquad$ valence electrons.
16. Which of the following does NOT describe how atoms can fill their outermost energy level?
a. by sharing electrons with other atoms
b. by losing electrons to other atoms
c. by gaining electrons from other atoms
d. by gaining kinetic energy from other atoms
$\qquad$ Class $\qquad$

Chapter 13, continued
17. Why does a helium atom need only two valence electrons?
$\qquad$
$\qquad$
$\qquad$

## NO CALCULATOR! !

Name $\qquad$ Date $\qquad$ Class $\qquad$

## WORKSHEET

## 9 MATH SKILLS

## Comparing Integers on a Number Line

An integer is any whole number ( $0,1,2,3, \ldots$ ) or its opposite. A good way to compare integers is with a number line, which is used to represent positive and negative numbers in order. A number line looks like this


The farther a number is to the right on a number line, the greater the number. The farther a number is to the left on a number line, the smaller the number.

PROCEDURE: To compare integers on a number line, simply place your values on the line, with positive numbers to the right of zero and negative numbers to the left of zero. The number that is the farthest to the right is the greatest number. The number that is the farthest to the left is the smallest number.

SAMPLE PROBLEM: Which is greater, -8 or -3 ?
Step 1: Draw your number line and select a point for 0 . Then fill in the integer values on the line.

Step 2. Place the integers you are comparing on the number line. Because both numbers are negative, they will both be to the left of zero.


Because -3 is farther to the right than $-8,-\mathbf{3}$ is greater than -8 .

## Practice Your Skills!

1. Locate the following integers on the number line. Then list them in order from smallest to greatest on the line below.

$$
4,12,-2,7,-5,2,-7,9,-13
$$


2. Use a number line to correctly place the sign $>$ (greater than) or $<$ (less than) between the numbers in each of the following pairs.
a. 89 $\qquad$ 98
b. -89 $\qquad$ -98
c. -98 $\qquad$ $-69$
3. This table shows estimates of the mean temperatures on the surface of nine planets. List the planets on the line below in order from hottest to coldest.

| Earth | Jupiter | Mars | Mercury | Neptune | Pluto | Saturn | Uranus | Venus |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $8^{\circ} \mathrm{C}$ | $-150^{\circ} \mathrm{C}$ | $-37^{\circ} \mathrm{C}$ | $179^{\circ} \mathrm{C}$ | $-225^{\circ} \mathrm{C}$ | $-236{ }^{\circ} \mathrm{C}$ | $-185^{\circ} \mathrm{C}$ | $-214^{\circ} \mathrm{C}$ | $453^{\circ} \mathrm{C}$ |

$\qquad$
$\qquad$ Class $\qquad$

## 10 MATH SKILLS

## Arithmetic with Positive and Negative Numbers

The absolute value of a number is its distance from zero on the number line For example, -7 (a negative number) and 7 (a positive number) are the same distance from zero on the number line, and both have an absolute value of 7 . Using absolute values simplifies the process of doing arithmetic with positive and negative numbers

1. Find the absolute value of the following numbers:
a. -7 $\qquad$ b. 14 $\qquad$
c. 325,000
d. -475 $\qquad$
e. 230 $\qquad$ f. -52 $\qquad$

## Part 1: Adding Positive and Negative Numbers

PROCEDURE: Determine if you are adding numbers that have the same or different signs. Then follow the appropriate set of directions below.

| Adding same signs | Example <br> $-\mathbf{3}+\mathbf{( - 5 )}$ | Adding <br> opposite signs | Example <br> $\mathbf{- 3}+\mathbf{5}$ |
| :--- | :--- | :--- | :---: |
| Step 1: Add their <br> absolute values. | $3+5=8$ | Step 1: Subtract <br> the smaller <br> absolute value <br> from the larger. | $5-3=2$ |
| Step 2: Make the <br> sign of the answer <br> the same as the <br> sign of the orig- <br> inal numbers. | Because -3 and <br> -5 are both <br> negative, the <br> answer will be <br> negative. <br> Answer: <br> $-3+(-5)=-8$ | Step 2: Choose <br> the sign of the <br> number with the <br> greater absolute <br> value. | Because 5 has a <br> greater absolute <br> value than 3, and <br> 5 is positive, your <br> answer will also be <br> positive. <br> Answer: <br> $-3+5=2$ |

## Add It Up!

2. Complete the following equations. When finished, go back and check your signs.
a. $14+(-17)=$ $\qquad$
b. $-9+(-23)=$ $\qquad$
c. $-16+21=$ $\qquad$
d. $-12+12=$ $\qquad$
f. $-7+(-7)=$ $\qquad$
e. $15+(-4)=$ $\qquad$
$\qquad$ D ate $\qquad$ Class $\qquad$

## Part 2: Subtracting Positive and Negative Numbers

PROCEDURE: To subtract integers, find the opposite of the number you are subtracting. Then add this opposite to the number you are subtracting from. The result is your answer.
SAMPLE PROBLEM: $-3-(-5)=$ $\qquad$
NO CALCULATOR!!
Step 1: Find the opposite of the number you want to subtract.
The opposite of -5 is 5 .
Step 2: Add this opposite to the number you are subtracting from.

$$
-3-(-5)=-3+5=\mathbf{2}
$$

## Take It Away!

3. C omplete the following subtraction problems Remember to check your work.
a. $5-(-7)=$ $\qquad$ b. $-11-5=$ $\qquad$
c. $-1-1=$ $\qquad$ d. $22-(-8)=$ $\qquad$
e. $14-(-3)=$
f. $-9-4=$ $\qquad$

## Part 3: Multiplying and Dividing Positive and Negative Numbers

PROCEDURE: To multiply or divide two integers, multiply or divide their absolute values Then apply the following rule to determine if the answer is positive or negative:

- The product or quotient of two same-sign numbers is positive
- The product or quotient of two opposite-sign numbers is negative.

SAMPLE PROBLEM A: $-7 \times 11=$ $\qquad$ ?

Step 1: Multiply the absolute values to find the absolute value of the product.

$$
7 \times 11=77
$$

Step 2: Apply the rule of signs Because you are finding the product of oppositesign numbers, the product will be negative.

$$
-7 \times 11=-77
$$

SAMPLE PROBLEM B: $-12 \div(-4)=$ $\qquad$
Step 1: Divide the absolute values to find the absolute value of the quotient.

$$
12 \div 4=3
$$

Step 2: Apply the rule of signs: Because you are finding the quotient of same-sign numbers, the quotient will be positive.

$$
-12 \div(-4)=\mathbf{3}
$$

## NO CALCULATOR!!

$\qquad$ Date $\qquad$ Class $\qquad$

## Challenge Yourself: Multiply Your Way up the Pyramid!

4. Each brick's number is the product of the two numbers under it. Starting on the bottom row, multiply to complete the empty bricks.


## Divide Your Way down Again!

5. Each brick's number is the quotient of the two numbers above it. Starting from the top left brick, divide each brick by the number on its right side. Place the quotient in the empty brick below. Continue until all the bricks are filled.


### 13.1 Section Review

(Page 331)
$\qquad$ Date $\qquad$ Class $\qquad$

## Section 2: Types of Chemical Bonds ${ }_{(p .332)}$

1. Three types of chemical bonds are $\qquad$ —,
$\qquad$ , and $\qquad$ .

Ionic Bonds (p. 332)
2. Describe how two atoms can become ions.
$\qquad$
$\qquad$
$\qquad$
3. An atom that loses one or more electrons from its outermost energy level becomes a positively charged ion. True or False? (Circle one.)
4. Which of the following elements give up electrons to other atoms? (Circle all that apply.)
a. sodium
c. chlorine
b. aluminum
d. oxygen
5. Why do the elements in Groups 1 and 2 react so easily?
$\qquad$
$\qquad$
$\qquad$
6. Atoms of nonmetals lose one or more protons when they form ionic bonds. True or False? (Circle one.)
$\qquad$ Date $\qquad$ Class $\qquad$

Chapter 13, continued
7. The names of negative ions that form when atoms gain electrons have the ending $\qquad$ .
8. A large amount of energy is released when atoms of Group 17
elements lose electrons. True or False? (Circle one.)
9. Which of the following are common properties of an ionic compound? (Circle all that apply.)
a. Its solid form is a crystal lattice.
b. It contains alternating positive and negative ions.
c. It is soft and pliable at room temperature.
d. Its positive and negative ions repel each other.
e. It has a low melting point.
f. It has a high boiling point.
g. It is neutral.
10. Look at Figure 8 on page 335 . What force causes both the formation of ionic bonds and static cling?
a. the Earth's gravity
b. the repulsion of like charges
c. the attraction of opposite charges
d. a magnetic pole

## Review (p. 335)

Now that you've finished the first part of Section 2, review what you learned by answering the Review questions in your ScienceLog.

Covalent Bonds (p. 336)
11. Covalent bonds form between atoms that require a large amount of energy in order to lose an electron. True or False? (Circle one.)
12. In a covalent bond, neither atom loses or gains an electron.

Instead, one or more electrons are $\qquad$ by the atoms. (shared or created)
13. Look at Figure 11 on page 336. The electrons that are shared by two atoms spend most of their time
a. near the smallest of the two atoms.
b. near the largest of the two atoms.
c. between the nuclei of the two atoms.
d. in the nuclei of the two atoms.
14. A group of atoms held together by covalent bonds is a neutral particle called a $\qquad$ -.
$\qquad$ Date $\qquad$ Class $\qquad$
15. Draw the electron-dot diagram for water.
16. Draw the electron-dot diagram for krypton.
17. In an electron-dot diagram, each dot represents one proton.

True or False? (Circle one.)
18. Diatomic molecules are the simplest kinds of molecules. They consist of two atoms bonded together. True or False?
(Circle one.)
19. Give three examples of complex molecules.
$\qquad$
$\qquad$
20. Carbon is known as the building block of life. Which of the following is a property of this important element? (Circle all that apply.)
a. Each of its atoms needs to make four bonds.
b. It is found in all proteins.
c. It can bond with other elements and form long chains.
d. It is in a water molecule.

Metallic Bonds (p. 339)
21. In a metal, "swimming" protons surround the metal ions. True or False? (Circle one.)
22. What are three properties of metals that are a result of metallic bonding?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$ Date $\qquad$ Class $\qquad$

Chapter 13, continued
23. Because ions in a metal can be easily rearranged without breaking the metallic bonds, metals tend to be easily
a. shattered.
c. reshaped.
b. crystallized.
d. broken.
24. Which of the following is NOT a typical property of a metal?
a. malleability
c. conductivity
b. ductility
d. brittleness
25. Besides being valuable in the jewelry industry, gold is special because it can be hammered into a very thin foil. This property is called
a. malleability.
c. conductivity.
b. ductility.
d. brittleness.

Identify each of the following substances as containing mostly ionic, mostly covalent, or mostly metallic bonds. Refer back to the earlier parts of Section 2 as needed. Write $I$ for ionic, $C$ for covalent, and $M$ for metallic.
26. $\qquad$ copper wire
27. $\qquad$ water
28. $\qquad$ table salt
29. $\qquad$ sugar
30. $\qquad$ carbon dioxide
31. $\qquad$ plaster of Paris
32. $\qquad$ aluminum foil
33. $\qquad$ gold jewelry
34. $\qquad$ sea shells

### 13.2 Math Break

(Page 334)

### 13.2 Section Review

(Page 335)
$\qquad$ Date $\qquad$ Class $\qquad$

CHAPTER

## 13 REINFORCEMENT WORKSHEET

## Is It an Ion?

Complete this worksheet after you finish reading Chapter 13, Section 2.
Answer the following questions based on the accompanying models. Protons are shown in gray, neutrons are shown in white, and electrons are shown in black.
Answer Questions 1-6 based on Figure 1.

1. How many protons are shown? $\qquad$
2. In the periodic table, elements are ordered by atomic number, the number of protons in an atom's nucleus. Using the periodic table in your textbook, identify the element shown.
3. How many electrons are shown? $\qquad$
4. How many electrons are in the outermost energy level?

Figure 1

5. If the number of electrons equals the number of protons, then there is no charge, and the model shows a neutral atom. If the numbers are not equal, then you have an ion. Use this reasoning to determine if Figure 1 shows an ion or a neutral atom.
6. To determine a particle's charge, you must compare the number of protons with the number of electrons. Use the spaces to the right to subtract the number of electrons from the number of protons. (Remember, if the number of electrons is greater than the number of protons, the charge will be negative.)

Answer Questions 7-11 based on Figure 2.
7. How many protons are shown? $\qquad$
8. What element is it? $\qquad$
9. How many electrons are shown? $\qquad$
10. How many electrons are in the outermost energy level? $\qquad$
11. Is this an ion? If it is, calculate and record the charge.
$\qquad$
$\qquad$

| Number <br> of protons <br> Number <br> of electrons - <br> ol <br> Charge <br> of model$\quad$ |
| :--- | ---: |

Figure 2


### 13.2 Self Check

(Page 337)

### 13.2 Section Review

(Page 341)
$\qquad$ Date $\qquad$ Class $\qquad$

## Covalent Marshmallows

A hydrogen atom has one electron in its outer energy level, but two electrons are required to fill its outer level. An oxygen atom has six electrons in its outer energy level, but eight electrons are required to fill its outer level. In order to fill their outer energy levels, two atoms of hydrogen and one atom of oxygen can share electrons, as shown below. Such a sharing of electrons to fill the outer level of atoms is called covalent bonding. When hydrogen and oxygen bond in this manner, a molecule of water is formed. In this lab you will build a three-dimensional model of water in order to better understand the covalent bonds formed in a water molecule.

## MATERIALS

- marshmallows (2 of one color, 1 of another color)
- toothpicks


A Model of a Water Molecule

## Procedure

1. Using the marshmallows and toothpicks, create a model of a water molecule. Use the diagram above for guidance in building your model.
2. Draw a sketch of your model in the space below. Be sure to label the hydrogen and oxygen atoms on your sketch.
$\qquad$ Date $\qquad$ Class $\qquad$

## Covalent Marshmallows, continued

3. In the space below, draw an electron-dot diagram of the water molecule. (Refer to the chapter text if you need help drawing an electron-dot diagram.)

## Analysis

4. What do the marshmallows represent? What do the toothpicks represent?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
5. Why are the marshmallows different colors?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$ Date $\qquad$ Class $\qquad$

Covalent Marshmallows, continued
6. Compare your model with the picture on page 102. How might your model be improved to more accurately represent a water molecule?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
7. Hydrogen in nature can covalently bond to form hydrogen molecules $\mathrm{H}_{2}$. How could you model this using the marshmallows and toothpicks?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
8. In the space below, draw an electron-dot diagram of an $\mathrm{H}_{2}$ molecule.
$\qquad$ Date $\qquad$ Class $\qquad$

## Covalent Marshmallows, continued

9. Which do you think would be more difficult to create-a model of an ionic bond or a model of a covalent bond? Explain your answer.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## Going Further

Create a model of a carbon dioxide molecule, which consists of two oxygen atoms and one carbon atom. The structure is similar to the structure of water, although the three atoms bond in a straight line instead of at angles. The bond between each oxygen atom and the carbon atom in a carbon dioxide molecule is a "double bond," so use two connections. Do the double bonds in carbon dioxide appear stronger or weaker than the single bonds in water? Explain your answer.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$ Class $\qquad$

## Interview with an Electron

Complete this worksheet after you finish reading Chapter 13, Section 2.
The following descriptions are from the point of view of electrons that are participating in three different types of bonds-ionic, metallic, and covalent. Identify the type of bond that each electron describes. At the bottom of the page is a list of characteristics of bonds and substances containing the bonds. Match each characteristic with the corresponding bond, and write the characteristic in the space provided.

1. My buddies and I do not feel bound to the energy level of one atom in particular, so we can swim freely throughout the substance.

Type of bond: $\qquad$
Characteristics: $\qquad$

$\qquad$
$\qquad$
2. I might change sides at the start, but once I end up on one side or the other I stick to my decision.

Type of bond: $\qquad$
Characteristics: $\qquad$
$\qquad$

3. I do not feel partial to either of the atoms in my bond. To be fair, the other bonding electron and I divide our time between the bonded atoms.

Type of bond: $\qquad$
Characteristics: $\qquad$

$\qquad$

## Characteristics

- Compounds have a crystal-lattice structure.
- Substances are good conductors of electric current.
- There's an attraction between nuclei and shared electrons.
- There's a transfer of electrons.
- Two or more nonmetals are involved.
- There's an attraction of positive ions and free-moving electrons.
- A metal reacts with a nonmetal.
$\qquad$ Date $\qquad$ Class $\qquad$


## 13 VOCABULARY REVIEW WORKSHEET

## Bonding Puzzle

## After completing Chapter 13, give this puzzle a try!

Fill in the blanks in the clues below. Then use the clues to complete the puzzle on the next page.

## Clues

1. An arrangement of ions bonded in a repeating threedimensional pattern is a $\qquad$ .
2. A positive particle in the nucleus that attracts electrons is a
$\qquad$ .
3. A unifying explanation for a broad range of hypotheses and observations that have been supported by testing is called a
$\qquad$ .
4. The force of attraction that holds two atoms together is called a(n) $\qquad$ .
5. An electron in the outermost energy level of an atom is called a
$\qquad$ .
6. The force of attraction between oppositely charged ions is $a(n)$
$\qquad$ .
7. The $\qquad$ is a chart that displays all elements by atomic number, and can be used to determine the number of valence electrons for some elements.
8. A $\qquad$ is an element composed of molecules consisting of two atoms of that element.
9. The joining of atoms to form new substances is called
$\qquad$ .
10. The force of attraction between the nuclei of atoms and the shared electrons is called a(n) $\qquad$ .
11. A $\qquad$ is a neutral group of atoms held together by covalent bonds.
12. The force of attraction between a positively charged metal ion and the electrons in a metal is called $a(n)$
$\qquad$ .
13. A(n) $\qquad$ is a charged particle that forms when one or more valence electrons are transferred from one atom to another.

| P | T | E | A | R | B | 1 | L | 0 | E | 0 | M | 1 | D | C | 1 | A |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| T | C | H | E | M | 1 | C | A | L | B | $\bigcirc$ | N | D | 1 | N | G | T |
| $\bigcirc$ | N | R | Y | B | 0 | N | T | M | L | 1 | C | E | D | N | O | 1 |
| L | O | E | Y | E | C | M | E | E | N | T | C | H | N | E | M | 1 |
| C | R | A | M | S | B | L | C | B | 0 | I | N | D | O | N | D | G |
| M | T | T | E | E | T | U | A | 1 | O | N | 1 | C | B | $\bigcirc$ | N | D |
| C | C | R | T | Y | L | A | S | T | A | L | L | C | L | M | O | L |
| E | E | C | A | E | N | E | L | L | A | V | L | 1 | A | $\bigcirc$ | B | L |
| P | L | R | L | O | C | T | C | L | N | N | T | H | C | E | T | O |
| R | E | Y | L | O | C | H | E | 1 | A | $\bigcirc$ | T | Y | 1 | A | N | M |
| 1 | E | C | 1 | O | C | B | 0 | N | M | T | R | C | M | A | E | L |
| B | C | 1 | C | O | N | D | V | P | R | O | T | 1 | E | N | L | B |
| D | N | O | B | M | E | T | A | L | E | R | T | 1 | H | C | A | E |
| M | E | T | O | L | 1 | C | 1 | H | A | P | L | A | C | E | V | N |
| E | L | E | N | E | N | M | T | C | E | E | L | E | 1 | E | 0 | C |
| T | A | R | D | O | N | S | I | B | O | O | N | D | I | D | C | C |
| M | V | O | L | E | L | B | A | T | C | 1 | D | 0 | 1 | R | E | P |


$\qquad$ Date $\qquad$ Class $\qquad$

## CHAPTER

## 13 CHAPTER REVIEW WORKSHEET

## Chemical Bonding

## USING VOCABULARY

To complete the following sentences, choose the correct term from each pair of terms listed below, and write the term in the space provided.

1. The force of attraction that holds two atoms together is a
$\qquad$ . (crystal lattice or chemical bond)
2. Charged particles that form when atoms transfer electrons are
$\qquad$ . (molecules or ions)
3. The force of attraction between the nuclei of atoms and shared electrons is a(n) $\qquad$ . (ionic bond or covalent bond)
4. Electrons free to move throughout a material are associated with $a(n)$
$\qquad$ . (ionic bond or metallic bond)
5. Shared electrons are associated with a $\qquad$ . (covalent bond or metallic bond)

## UNDERSTANDING CONCEPTS

## Multiple Choice

6. Which element has a full outermost energy level containing only two electrons?
a. oxygen (O)
c. fluorine (F)
b. hydrogen (H)
d. helium (He)
7. Which of the following describes what happens when an atom becomes an ion with a 2 - charge?
a. The atom gains 2 protons.
b. The atom loses 2 protons.
c. The atom gains 2 electrons.
d. The atom loses 2 electrons.
8. The properties of ductility and malleability are associated with which type of bonds?
a. ionic
b. covalent
c. metallic
d. None of the above
9. In which area of the periodic table do you find elements whose atoms easily gain electrons?
a. across the top two rows
b. across the bottom row
c. on the right side
d. on the left side
$\qquad$ Date $\qquad$ Class $\qquad$
10. What type of element tends to lose electrons when it forms bonds?
a. metal
b. metalloid
c. nonmetal
d. noble gas
11. Which pair of atoms can form an ionic bond?
a. sodium ( Na ) and potassium (K)
b. potassium (K) and fluorine ( F )
c. fluorine (F) and chlorine $(\mathrm{Cl})$
d. sodium $(\mathrm{Na})$ and neon $(\mathrm{Ne})$

## Short Answer

12. List two properties of covalent compounds.
$\qquad$
$\qquad$
$\qquad$
13. Explain why an iron ion is attracted to a sulfide ion but not to a zinc ion.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
14. Using your knowledge of valence electrons, explain the main reason that so many different molecules are made from carbon atoms.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$ Date $\qquad$ Class $\qquad$

## Chemical Bonding, continued

15. Compare the three types of bonds based on what happens to the valence electrons of the atoms.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## CONCEPT MAPPING

16. Use the following terms to create a concept map: chemical bonds, ionic bonds, covalent bonds, metallic bonds, molecule, ions.
$\qquad$ Date $\qquad$ Class $\qquad$

## CRITICAL THINKING AND PROBLEM SOLVING

17. Predict the type of bond each of the following pairs of atoms would form:
a. zinc ( Zn ) and zinc ( Zn )
b. oxygen (O) and nitrogen (N)
c. phosphorus ( P ) and oxygen ( O )
d. magnesium ( Mg ) and chlorine $(\mathrm{Cl})$
18. Draw electron-dot diagrams for each of the following atoms, and state how many bonds it will have to make to fill its outer energy level.
a. sulfur (S)
b. nitrogen ( N )
c. neon $(\mathrm{Ne})$
$\qquad$ Date $\qquad$ Class $\qquad$

## Chemical Bonding, continued

d. iodine (I)
e. silicon (Si)
19. Does the substance being hit in the picture below contain ionic or metallic bonds? Explain.


## MATH IN SCIENCE

20. For each atom below, write the number of electrons it must gain or lose to have 8 valence electrons. Then calculate the charge of the ion that would form.
a. calcium (Ca)
$\qquad$ Date $\qquad$ Class $\qquad$
b. phosphorus ( P )
$\qquad$
c. bromine ( Br )
$\qquad$
d. sulfur (S)

## INTERPRETING GRAPHICS

Look at the picture of the wooden pencil below, and answer the following questions.

21. In which part of the pencil are metallic bonds found?
$\qquad$
$\qquad$
22. List three materials composed of molecules with covalent bonds.
23. Identify two differences between the properties of the metallically bonded material and one of the covalently bonded materials.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## NOW WHAT DO YOU THINK?

Take a minute to review your answers to the ScienceLog questions at the beginning of this chapter. Have your answers changed? If necessary, revise your answers based on what you have learned since you began this chapter. Record your revisions in your ScienceLog.

