CHAPTER RESOURCES

Chapter 5 Combining Atoms and Molecules

Includes:

LEVELED ASSESSMENT

Chapter Review

Chapter Tests

- Test A (Below Level) BL
- Test B (On Level) OL
- Test C (Advanced Learner) AL

LABS

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Lab worksheets from Student Edition Labs

- MiniLab
- Lab: Version A (Below Level) BL
- Lab: Version B (On Level) OL
  (Advanced Learner) AL

UNIVERSAL ACCESS/LEVELED RESOURCES

Target Your Reading

Chapter Content Mastery English (Below Level) BL

Chapter Content Mastery Spanish (Below Level) BL

Reinforcement (On Level) OL

Enrichment (Advanced Learner) AL

READING SUPPORT

Content Vocabulary

Chapter Outline

TEACHER SUPPORT AND PLANNING

Chapter Outline for Teaching

Teacher Guide and Answers

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Date of Approval

Student Lab/Activity Safety Form

Student Name: _____

Date: _____

Lab/Activity Title: _____

In order to show your teacher that you understand the safety concerns of this lab/activity, the following questions must be answered after the teacher explains the information to you. You must have your teacher initial this form before you can proceed with the activity/lab.

1. How would you describe what you will be doing during this lab/activity?

2. What are the safety concerns associated with this lab/activity (as explained by your teacher)?

- _____
- _____
- _____
- _____
- _____

3. What additional safety concerns or questions do you have?

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Name _____ Date _____ Class _____

MiniLab How can you model molecules?

CHAPTER 5

Many atoms bond to one, two, three, or four other atoms. Use your hands and feet as bonds to act like an atom.

Procedure

1. Read and complete a lab safety form.
2. Clear a space in which to move around. Make sure there are no objects anyone can trip over or bump into.
3. In your Science Journal, create a chart in which to draw Lewis dot diagrams for the first 18 elements. Determine the number of bonds each atom can form.
4. Sort the first 18 elements into a Venn diagram similar to the one in your textbook. Write elements that do not form compounds below the diagram.
5. Make a chart like the one shown below in your Science Journal that lists the elements that form one, two, three, four, and zero bonds.
6. Brainstorm how to model covalent bonds and ionic bonds. Choose the best way to model both types of bonds.
7. Choose one element. As an atom of that element, form bonds with students representing other atoms.

Data and Observations

Elements that Form One Bond	Elements that Form Two Bonds	Elements that Form Three Bonds	Elements that Form Four Bonds

Analysis

1. **Describe** how the ionic bonds behaved differently from the covalent bonds.

_____

_____

2. **Describe** any problems you had with this modeling activity.

_____

_____

Name _____ Date _____ Class _____

Lab

Growing Crystals

CHAPTER 5
VERSION A

Problem Crystals of ionic compounds can be made to grow from supersaturated solutions.

Form a Hypothesis Read the procedure. What conditions do you think will produce the best crystals? Write a hypothesis to explain your prediction.

Materials

alum
distilled water
salt
sugar
filter paper
string
hot plate
beaker
spatula
hand lens

Safety Precautions

Procedure

Directions: *Check the boxes below as you complete each step of the procedure.*

☐ **1.** Read and complete a lab safety form.

☐ **2.** Thoroughly clean and rinse all equipment with distilled water before starting. Impurities from dirty equipment might prevent the crystals from growing.

☐ **3.** Create your framework.
- ☐ Cut a 7 cm length of string. Tie the string to the middle of a pencil.
- ☐ This will be the framework for growing crystals. Make sure the framework is very clean.
- ☐ Do not use metal, which could react with the crystal compound.
- ☐ Once you have made your solution, you may want to put a seed crystal, a small crystal of the same chemical, on the string.
- ☐ Dangle the framework into the supersaturated solution.

☐ **4.** A supersaturated solution can be made by stirring as much solute, or dissolving substance, as possible into boiling water.
- ☐ Measure 100 mL of water. Boil the water.
- ☐ Choose a solute from the list. Add the solute to the water one spoonful at a time until it no longer dissolves.
- ☐ When undissolved solute settles on the bottom, your solution is supersaturated. Carefully pour your solution into a clean beaker.

☐ **5.** When growing crystals, it is best to leave them undisturbed in an area with no vibrations.
- ☐ Cover the beaker with a filter to protect the growing crystals from dust.
- ☐ You may choose to grow your crystals at room temperature or in a refrigerator or freezer.

☐ **6.** Leave your crystal setup for several hours or overnight.
- ☐ When you return to the lab, make a drawing of your crystals and those of other lab groups.

Lab: Version A CONTINUED

Analyze and Conclude

1. **Identify** the compound that grew the best crystals.

2. **Describe** which condition grew the best crystals.

3. **Describe** your experiment and those of your classmates. Make note of the similarities and differences in procedures and results. Explain how you think that each of the changes in procedure affected the product.

4. **Infer** Do you think there is a difference in the way crystals in the sugar (molecular compound) and the salts (ionic compounds) grew? Explain, using your observations.

5. **Draw a diagram** on how you think the crystals grow on a molecular level.

Name _____ Date _____ Class _____

Lab: Version A CONTINUED

6. Describe the errors that were made. How could the procedures have been improved?

_____

_____

_____

Communicate

Write a procedure for growing crystals of rock candy at home. Imagine that your procedure would be part of a book of fun experiments to be done in the kitchen.

Name _____ Date _____ Class _____

Lab

Growing Crystals

CHAPTER 5
VERSION B

Problem Crystals of ionic compounds can be made to grow from supersaturated solutions.

Form a Hypothesis Read the procedure. What conditions do you think will produce the best crystals? Write a hypothesis to explain your prediction.

Materials

alum
distilled water
salt
sugar
filter paper
string
hot plate
beaker
spatula
hand lens

Safety Precautions

Procedure

Directions: *Check the boxes below as you complete each step of the procedure.*

☐ **1.** Read and complete a lab safety form.

☐ **2.** Thoroughly clean and rinse all equipment with distilled water before starting. Impurities from dirty equipment might prevent the crystals from growing.

☐ **3.** Use a pencil with a 7-cm string attached as the framework for growing crystals. Dangle the framework into the supersaturated solution. You may want to put a seed crystal, a small crystal of the same chemical, on the string. Make sure that you do not use metal, which could react with the crystal compound. Make sure the framework is very clean.

☐ **4.** A supersaturated solution can be made by stirring as much solute, or dissolving substance, as possible into boiling water. Add solute spoonful by spoonful to 100 mL of boiling water until it no longer dissolves. If undissolved solute settles on the bottom, carefully pour your solution into a clean beaker.

☐ **5.** When growing crystals, it is best to leave them undisturbed in an area with no vibrations. Cover the beaker to protect the growing crystals from dust. You may choose to grow your crystals at room temperature or in a refrigerator or freezer.

☐ **6.** Leave your crystal setup for several hours or overnight. When you return to the lab, record observations about your own crystals and those of other lab groups.

Analyze and Conclude

1. Identify the compound that grew the best crystals.

_____

2. Describe which condition grew the best crystals.

_____

Lab: Version B CONTINUED

3. **Describe** your experiment and those of your classmates. Make note of the similarities and differences in procedures and results. Explain how you think that each of the changes in procedure affected the product.

4. **Infer** Do you think there is a difference in the way crystals in the sugar (molecular compound) and the salts (ionic compounds) grew? Explain, using your observations.

5. **Draw a diagram** on how you think the crystals grow on a molecular level.

6. **Describe** the errors that were made. How could the procedures have been improved?

Lab: Version B CONTINUED

Going Further

Challenge

7. Elena went on a cave tour where she observed stalactites growing from the ceiling of the cave. The tour guide told Elena the stalactites formed when lime dissolved out of the ground and mixed with rain water. The rain water seeped through the cave wall and dripped from the ceiling. **Compare** the growth of stalactites to the growth of crystals in your class.

_____

_____

8. **Imagine** one of your classmates tried to grow crystals at home. However, he only mixed the alum and water together, rather than making a supersaturated solution. **Predict** the results.

_____

_____

9. Did you choose to use a seed crystal to help grow your crystals? **Consider** the role a seed crystal played or did not play in your crystal growth.

_____

_____

_____

10. Will wants to test to see if crystal growth will be better on a smooth surface or a rough surface. He is pouring a supersaturated solution onto a glass pie plate. In another glass pie plate, he has placed a sponge and poured an equal amount of supersaturated solution. **Predict** which surface will promote the growth of the crystals. Think about where crystals grew in your tube.

_____

_____

_____

Extension

Did anyone in your class choose to place his or her solution in the refrigerator? How do you think this influenced the growth of the crystals? Design an experiment to test the growth of crystals in the refrigerator. Do you think the temperature will affect the growth? What will your independent variables be? What will your control variables be? Conduct your investigation, and share your crystals with your class.

Communicate

Write a procedure for growing crystals of rock candy at home. Imagine that your procedure would be part of a book of fun experiments to be done in the kitchen.

Name _____ Date _____ Class _____

Target Your **Reading**

Combining Atoms and Molecules

CHAPTER 5

Use this to focus on the main ideas as you read the chapter.

1. **Before you read** the chapter, respond to the statements below on your worksheet or on a numbered sheet of paper.
   - Write an **A** if you **agree** with the statement.
   - Write a **D** if you **disagree** with the statement.
2. **After you read** the chapter, look back to this page to see if you've changed your mind about any of the statements.
   - If any of your answers changed, explain why.
   - Change any false statements into true statements.
   - Use your revised statements as a study guide.

Before You Read A or D	Statement	After You Read A or D
	1. Compounds have properties very similar to the properties of the elements they contain.	
	2. A compound always has the same formula showing the same elements in the same ratios.	
	3. All elements can form both covalent and ionic bonds.	
	4. An atom that transfers an electron becomes a negative ion.	
	5. Covalent bonds can be single, double, or triple.	
	6. Some of the electrons in metals are free to move from atom to atom.	
	7. All crystals are held together with ionic bonds.	
	8. In a sodium chloride crystal, sodium ions surround chloride ions.	
	9. A polymer is a stringlike compound made of repeating unit cells.	

Name _____ Date _____ Class _____

Chapter Content **Mastery**

How Atoms Form Compounds

CHAPTER 5
LESSON 1

Directions: *Use the periodic table to complete the Lewis dot diagrams below.*

1. H

2. Cl

3. P

4. Ne

Directions: *Answer each question about elements, compounds, and the periodic table.*

5. Does neon combine easily with other elements? Explain your answer.

_____

_____

_____

6. Nitrogen has the same number of electrons in its outer energy level as which element above (from questions 1–4)?

_____

7. What specific name is given to a chemical bond in which atoms share electrons?

_____

8. Which elements have properties similar to calcium?

_____

Name _____ Date _____ Class _____

Chapter Content **Mastery**

Forming Solids

CHAPTER 5
LESSON 2

Directions: *Circle the two terms in each group that are related. Then explain how the terms are related.*

1. copper, iron, table salt

_____

2. diamond, oil, table salt

_____

3. mixture, monomer, polymer

_____

4. ductility, malleability, viscosity

_____

Directions: *Circle the term that correctly completes each sentence.*

5. A crystal is made up of a repeating pattern of (unit cells/atoms).

6. One property of metals, (malleability/ductility), is the ability of a metal to be hammered or rolled into sheets.

7. Ethene is one example of a (polymer/monomer).

8. If a polymer is made up of molecules containing (oxygen/carbon), it is called an organic polymer.

9. In metals, (protons/electrons) are free to move between atoms throughout the piece of metal.

10. The arrangement of unit cells in a crystal is most like the arrangement of stamps in a (book/roll).

11. (Quartz/Polystyrene) is one example of a crystal.

12. Copper is often used for telephone wiring because it is (ductile/malleable).

Nombre _____ Fecha _____ Clase _____

Dominio del contenido

Cómo los átomos forman compuestos

CAPÍTULO 5
LECCIÓN 1

Instrucciones: *Usa la tabla periódica para completar los diagramas.*

1. H

2. Cl

3. P

4. Ne

Instrucciones: *Contesta las siguientes preguntas acerca de los elementos, los compuestos y la tabla periódica.*

5. ¿Se combina el neón fácilmente con otros elementos? Explica tu respuesta.

_____

_____

_____

6. ¿El nitrógeno tiene el mismo número de electrones en su nivel exterior de energía comparadocon cuál elemento de los de arriba (de las preguntas 1–4)?

_____

7. ¿Qué nombre especifico se da a una unión química en cual los átomos comparten electrones?

_____

8. ¿Cuáles elementos tienen propiedades similares al calcio?

_____

Nombre _____ Fecha _____ Clase _____

Dominio del contenido

Formando sólidos

CAPÍTULO 5
LECCIÓN 2

Instrucciones: *Circula los dos términos en cada grupo que están relacionados. Entonces explica por qué están relacionados.*

1: cobre, hierro, sal de mesa

_____

2: sal de mesa, aceite, diamante

_____

3: mezcla, monómero, polímero

_____

4: viscosidad, ductilidad, maleabilidad

_____

Instrucciones: *Circula el término que correctamente completa la oración.*

5. Un cristal es hecho de un patrón repitiendo de (unidades de células/átomos).

6. Una propiedad de los metales, (maleabilidad/ductilidad), es la característica de un metal que se puede martillar o laminar en láminas.

7. Etileno es un ejemplo de un (polímero/monómero).

8. Si un polímero es hecho de moléculas que contienen (oxígeno/carbono), se llama un polímero orgánico.

9. En los metales, los (protones/electrones) están libres para moverse entre los átomos en el pedazo de metal.

10. El arreglo de células unitarias en un cristal es como el arreglo de estampillas en un(a) (libro/rollo).

11. El (cuarzo/poliestireno) es un ejemplo de un cristal.

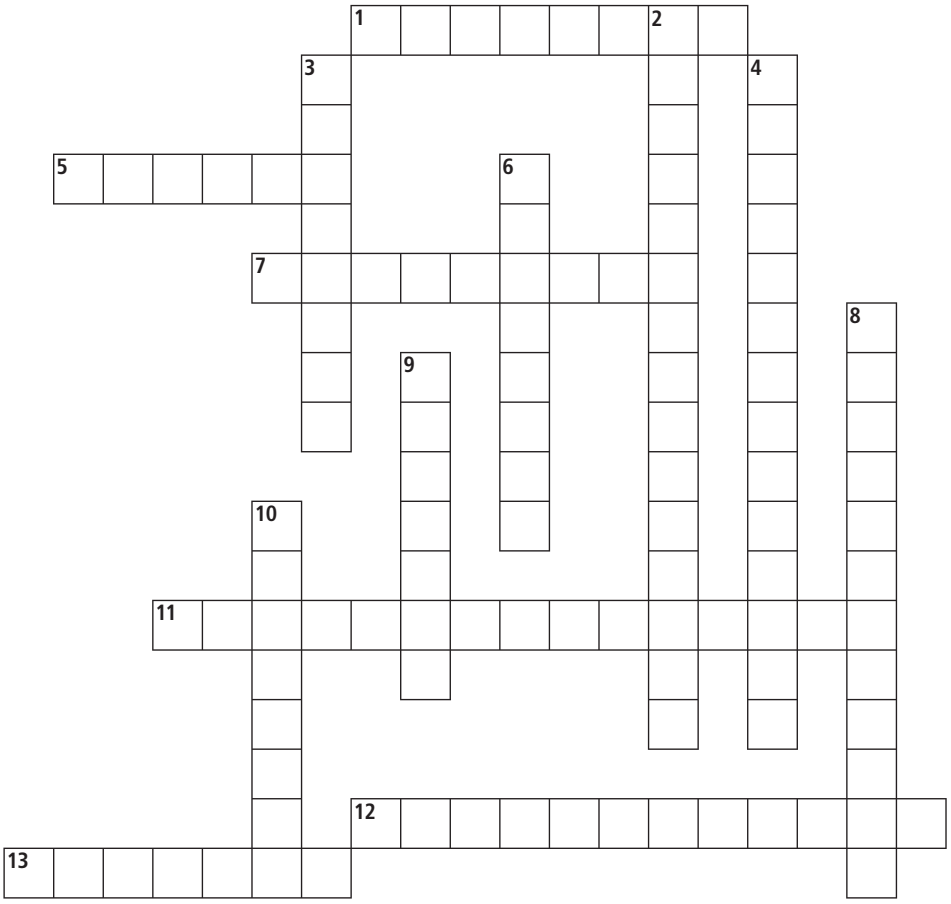
12. El cobre se usa frecuentemente para alambras de teléfonos porque es (dúctil/maleable).

Name _____ Date _____ Class _____

Reinforcement How Atoms Form Compounds

CHAPTER 5
LESSON 1

Directions: *Complete the crossword puzzle using the clues below.*



Across

1. a neutral particle that forms as a result of electron sharing
5. the lightest noble gas
7. an electrical attraction between positively and negatively charged ions in an ionic compound
11. a notation using atomic symbols and subscripts to show the elements and the number of atoms of each element in a compound
12. a chemical bond formed when atoms share electrons
13. a pure substance made of only one kind of atom

Down

2. a diagram that represents an atom and its electrons
3. a pure substance that contains two or more elements
4. an ionic compound that consists of only two different ions
6. a gas in the rightmost column of the periodic table with a full outer energy level
8. a force that holds atoms together to form a compound
9. the number of electrons in the outermost energy level of an atom
10. negatively charged particle that is one of the three basic building blocks of atoms

Name _____ Date _____ Class _____

Reinforcement Forming Solids

CHAPTER 5
LESSON 2

Directions: *In the space provided, write all terms from the list below that describe each substance named.*

covalent bond	**crystal**	**ductile**	**element**	**ionic bond**
malleable	**metal**	**metallic bond**	**polymer**	

1. gold

_____

2. polystyrene

_____

3. table salt

_____

4. steel

_____

5. diamond

_____

Directions: *Write the missing word in each statement to describe different types of solids.*

6. A regular, repeating arrangement of atoms, ions, or molecules is a _____.

7. Metal atoms combine in regular patterns in which _____ are free to move from atom to atom.

8. Monomers called amino acids make up proteins, one type of organic _____.

9. Organic polymers, such as the carbohydrates used in our bodies, always contain the element _____.

10. A _____ is the smallest repeating pattern that shows how atoms, ions, or molecules are arranged in a crystal.

Name _____ Date _____ Class _____

Enrichment Phlogiston or Oxygen?

CHAPTER 5
LESSON 1

Before the oxygen theory of burning and rusting was developed, most scientists believed in the phlogiston (floh JIHS tuhn) theory. These two theories are described briefly below.

Phlogiston Theory—Wood is made of ash and a substance called phlogiston. When wood burns, it gives off phlogiston in the air, leaving the ash. Iron is made up of metallic ash (now called iron oxide) and phlogiston. When iron rusts, it releases phlogiston into the air, leaving the metallic ash.

Oxygen Theory—When wood burns, it combines with the oxygen in the air to form new substances—carbon dioxide, water, and ash. When iron rusts, it combines with the oxygen in the air to form a new substance—iron oxide. In both cases, the total mass of the original substance and the oxygen with which it combines equals the total mass of the resulting substances.

Directions: *Respond to each statement using complete sentences.*

1. Scientists tested the phlogiston and oxygen theories by burning wood in a closed container filled with either pure nitrogen or pure oxygen instead of air. (Air consists of 78% nitrogen, 21% oxygen, and 1% other gases.) The wood did not burn in nitrogen, but it burned vigorously in oxygen. **Formulate** an argument supporting one of these theories based on these observations.

_____

_____

_____

2. When iron rusts, the resulting substance has a greater mass than the original iron. **Incorporate** this evidence into the argument you made above.

_____

_____

_____

Name _____ Date _____ Class _____

Enrichment Carbon Crystals

CHAPTER 5
LESSON 2

Carbon, the central element for life on Earth, is remarkable for many reasons. Because it has four unpaired electrons in its valence layer of electrons, carbon can form up to four different covalent bonds. This allows it to form a wide variety of different compounds with other atoms and molecules.

The Basis of Life

As the basis of most biological molecules, carbon forms many compounds called organic compounds. The word *organic* comes from a Latin root word meaning "life." All life scientists have discovered on Earth relies on carbon-based molecules.

Polymer Molecules

If carbon atoms have attached hydroxyl (OH^-) groups when they form a polymer molecule, that molecule will be a lipid—an oil or a fat. However, if the carbon atoms have bonded nitrogen atoms when they form a polymer, they form proteins instead of lipids. The building blocks of proteins, called amino acids, combine in a nearly infinite number of ways to form genes, chromosomes, and DNA. Together, these organic polymers combine the information that controls what we look like and how our bodies work.

Carbon Changing Form

Carbon even has interesting properties on its own. If it changes into a crystal form under high temperature and pressure, diamonds, a particularly rare formation of carbon crystal, are formed. If it crystallizes in other conditions, other crystal structures, such as graphite, can form.

Directions: *Respond to each question or statement using complete sentences.*

1. You have used graphite many times in the form of pencil lead. **Compare** the properties of carbon in the form of graphite to the properties of carbon in diamond form, and point out the properties that make graphite useful for writing.

_____

_____

_____

_____

2. If silicon-based life is eventually discovered, should silicon-based molecules that help support life be called organic molecules? **Propose** a name for such molecules.

_____

_____

_____

_____

Name _____ Date _____ Class _____

Content Vocabulary

Combining Atoms and Molecules

CHAPTER 5

Directions: *Match each term with its definition by writing the correct letter in the blank.*

_____ **1.** the ability of a substance to be pulled into wires

_____ **2.** an electrical attraction between positively and negatively charged ions in an ionic compound

_____ **3.** a negatively charged particle that is one of three building blocks for atoms

_____ **4.** a pure substance made of only one type of atom

_____ **5.** the smallest unit of an element that retains all the properties of that element

_____ **6.** a pure substance that contains two or more elements

_____ **7.** a force that holds atoms together in a compound

_____ **8.** a covalent compound made up of many small, repeating units linked together in a chain

_____ **9.** a small molecule that forms a link in a polymer chain

_____ **10.** the number of electrons in the outermost energy level of an atom

_____ **11.** a neutral particle that forms as a result of electron sharing

_____ **12.** a method for representing a compound with atomic symbols and subscripts that shows the elements and the number of atoms of each element that combine to form the compound

A. atom

B. chemical bond

C. chemical formula

D. compound

E. ductility

F. electron

G. element

H. ionic bond

I. molecule

J. monomer

K. polymer

L. valence

Name _____ Date _____ Class _____

Content **Vocabulary** CONTINUED

CHAPTER 5

Directions: *Complete each sentence by writing the correct term on each line.*

binary	**carbohydrate**	**covalent**	**crystal**
ion	**Lewis dot diagram**	**malleability**	**metallic bond**
noble gas	**organic polymer**	**proteins**	**unit cell**

13. Anything that consists of two parts can be called _____.

14. A drawing called a(n) _____ represents an atom with its chemical symbol and the electrons in the atom's outer energy level with carefully arranged dots.

15. _____ is the ability of a material to be hammered or rolled into sheets.

16. A regular, repeating arrangement of atoms, ions, or molecules is called a(n) _____.

17. A(n) _____ is a polymer made up of monomers that contain the element carbon.

18. A _____ bond is formed when atoms share electrons.

19. Natural organic polymers whose monomers are amino acids are _____.

20. A(n) _____ is a charged particle.

21. A(n) _____ is an element from the right-hand column of the periodic table that exists in nature in a gaseous state and does not easily form chemical compounds with other elements.

22. A(n)_____ is formed when many metal atoms share their pooled electrons.

23. The smallest repeating pattern that shows how the atoms, ions, or molecules are arranged in a crystal is a(n) _____.

24. A(n) _____ is a natural organic polymer whose monomers are sugar molecules.

Name _____ Date _____ Class _____

Chapter Review — Combining Atoms and Molecules

CHAPTER 5

Part A. Vocabulary Review

Directions: *In the space provided, write the term that fits the definition.*

_____ **1.** a force that holds atoms together in a compound

_____ **2.** a covalent compound made up of many small, repeating units linked together in a chain

_____ **3.** the ability of a material to be hammered or rolled into sheets

_____ **4.** the number of electrons in the outermost energy level of an atom

_____ **5.** a pure substance that contains two or more elements

_____ **6.** the ability of a substance to be pulled into wires

_____ **7.** the smallest repeating pattern that shows how the atoms, ions, or molecules are arranged in a crystal

_____ **8.** a type of chemical bond in which atoms share electrons

_____ **9.** the smallest unit of an element that retains all the properties of that element

Directions: *Identify the correct choice from the two options listed by circling the correct word or phrase.*

10. In a(n) (metallic bond/ionic bond), many metal atoms share their pooled electrons.

11. A (monomer/unit cell) is a small molecule that forms a link in a polymer chain.

12. Positively and negatively charged ions in an ionic compound experience an electrical attraction called a(n) (covalent bond/ionic bond).

13. A (Lewis dot diagram/chemical formula) uses atomic symbols and subscripts to show the elements and the number of atoms of each element that combine to form a compound.

14. Snowflakes are one example of a (crystal/polymer), or a regular, repeating arrangement of atoms, ions, or molecules.

Name _____ Date _____ Class _____

Chapter **Review** CONTINUED

CHAPTER 5

Part B. Concept Review

Directions: *On the line at the left, write* T *if the statement is true and* F *if it is false. For each false statement, write a new version that is true.*

_____ **1.** Metallic crystals tend to be more brittle than ionic crystals.

_____

_____ **2.** Table salt is necessary for human life, even though it is made from a poisonous gas and an explosive solid.

_____

_____ **3.** A noble gas such as helium tends not to form compounds with other elements because its outer energy level is missing two electrons.

_____

Directions: *Answer each question or respond to each statement in complete sentences.*

4. Differentiate How are covalent bonds different from ionic bonds?

_____

_____

_____

_____

5. Compare and **Contrast** Both crystals and polymers can be made of repeating patterns of molecules. How are these materials similar and different?

_____

_____

_____

_____

6. Recommend at least three uses for which metals are suited because they are ductile and malleable.

_____

_____

_____

_____

Name _____ Date _____ Class _____

Chapter Outline

Combining Atoms and Molecules

CHAPTER 5

Lesson 1: How Atoms Form Compounds

A. What is a compound?

1. A _____ is a pure substance that contains two or more elements.

2. A(n) _____ is an ingredient list for a compound that uses atomic symbols and subscripts.

3. A neutral particle that forms as a result of electron sharing is

a(n) _____.

4. Compounds have properties that are different from the _____ that compose them.

a. Table salt is formed when the elements _____ and

_____ combine.

b. An **ionic bond** is an electrical attraction between _____ and

_____ charged ions in an ionic compound.

B. Ionic Bonds and Ionic Compounds

1. An atom that is not neutral because it has gained or lost electrons is

a(n) _____.

2. The force that holds atoms together in a compound is called

a(n) _____.

3. A(n) _____ is an electrical attraction between positively and negatively charged ions in an ionic compound.

4. A(n) _____ compound is one in which two or more elements or compounds gain or lose electrons and form ionic bonds.

a. In an ionic compound, the _____ ion is usually a metal. The negative

ion is a(n) _____.

b. If an ionic compound has only two different ions, it is called

a(n) _____.

Chapter **Outline** CONTINUED

c. Metals like magnesium and calcium from Group 2 of the periodic table can form binary ionic compounds with elements from either Group _____ or Group _____.

d. Many ionic compounds dissolve in water. Water with dissolved ionic compounds is a(n) _____ of electricity.

5. _____ are one method for using atomic symbols and dots representing electrons to help predict how compounds will form.

6. The number of electrons in an atom's outermost energy level is its _____.

7. The noble gases, elements from _____ of the periodic table, have eight valence electrons.

8. Some atoms become ions by gaining or losing electrons until they have the same filled _____ energy levels as noble gases.

C. Covalent Bonds—Sharing Electrons

1. A(n) _____ is a chemical bond formed when atoms share electrons.

2. All _____ are covalent compounds based on carbon atoms.

3. _____ compounds can be solids, liquids, or gases at room temperature.

4. Atoms that have _____ electrons can form compounds if they share electrons.

5. Carbon has _____ unpaired electrons, and can form four covalent bonds.

6. A(n) _____ consists of two pairs of electrons shared between the same two atoms. Double bonds are stronger than single bonds.

7. _____ are stronger than single or double bonds and share three pairs of electrons.

Lesson 2: Forming Solids

A. Metals

1. _____ make up about two-thirds of the elements and have many useful properties.

Chapter **Outline** CONTINUED

a. Metals are good _____ of heat and electricity because their electrons are free to move.

b. Metals have a _____ melting point and a _____ boiling point.

c. _____ is the ability of a material, such as metal, to be hammered or rolled into sheets.

d. _____is the ability of a substance to be pulled into wires.

2. _____ of metal in solids pack together as closely as possible in a regular, three-dimensional pattern.

3. A(n) _____ is a bond formed when many metal atoms share their pooled electrons.

4. Metal atoms combine in regular patterns in which some _____ are free to move from atom to atom.

5. In a metal, individual atoms lose electrons to become positive _____.

B. Crystals

1. Crystals are regular, repeating arrangements of _____,

_____, or _____.

2. Crystals can be held together by metallic, _____, or

_____ bonds.

3. A(n) _____ is the smallest repeating pattern that shows how the atoms, ions, or molecules are arranged in a crystal.

4. One common crystal is table salt, also known as _____.

a. Sodium chloride (NaCl) is a(n) _____ crystal.

b. Ionic crystals are _____, unlike solid metals.

C. What is a polymer?

1. _____ are covalent compounds made up of many small, repeating units linked together in a chain.

2. A(n) _____ is a small molecule that forms a link in a polymer chain.

3. _____ is a synthetic polymer used for grocery bags and food wrap.

Chapter **Outline** CONTINUED

4. Organic polymers are polymers that contain the element _____ and are involved with life.

a. The monomer of a protein is a(n) _____, which includes carbon, nitrogen, and oxygen atoms.

b. _____ are organic polymers whose monomer is a sugar molecule called a monosaccharide.