Glencoe Science

Chapter Resources

Atoms, Elements, and the Periodic Table

Includes:

Reproducible Student Pages

ASSESSMENT

- ✔ Chapter Tests
- ✔ Chapter Review

HANDS-ON ACTIVITIES

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- ✔ Laboratory Activities
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- ✔ Content Outline for Teaching
- ✔ Spanish Resources
- ✔ Teacher Guide and Answers

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Glencoe Science

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Additional Assessment Resources available with Glencoe Science:

- Exam*View*® Pro Testmaker
- Assessment Transparencies
- Performance Assessment in the Science Classroom
- Standardized Test Practice Booklet
- MindJogger Videoquizzes
- Vocabulary PuzzleMaker at **msscience.com**
- Interactive Chalkboard
- The Glencoe Science Web site at: **msscience.com**
- An interactive version of this textbook along with assessment resources are available online at: **mhln.com**

To the Teacher

This chapter-based booklet contains all of the resource materials to help you teach this chapter more effectively. Within you will find:

Reproducible pages for

- Student Assessment
- Hands-on Activities
- Meeting Individual Needs (Extension and Intervention)
- Transparency Activities

A teacher support and planning section including

- Content Outline of the chapter
- Spanish Resources
- Answers and teacher notes for the worksheets

Hands-On Activities

MiniLAB and Lab Worksheets: Each of these worksheets is an expanded version of each lab and MiniLAB found in the Student Edition. The materials lists, procedures, and questions are repeated so that students do not need their texts open during the lab. Write-on rules are included for any questions. Tables/charts/graphs are often included for students to record their observations. Additional lab preparation information is provided in the *Teacher Guide and Answers* section.

Laboratory Activities: These activities do not require elaborate supplies or extensive pre-lab preparations. These student-oriented labs are designed to explore science through a stimulating yet simple and relaxed approach to each topic. Helpful comments, suggestions, and answers to all questions are provided in the *Teacher Guide and Answers* section.

Foldables: At the beginning of each chapter there is a *Foldables: Reading & Study Skills* activity written by renowned educator, Dinah Zike, that provides students with a tool that they can make themselves to organize some of the information in the chapter. Students may make an organizational study fold, a cause and effect study fold, or a compare and contrast study fold, to name a few. The accompanying *Foldables* worksheet found in this resource booklet provides an additional resource to help students demonstrate their grasp of the concepts. The worksheet may contain titles, subtitles, text, or graphics students need to complete the study fold.

Meeting Individual Needs (Extension and Intervention)

Directed Reading for Content Mastery: These worksheets are designed to provide students with learning difficulties with an aid to learning and understanding the vocabulary and major concepts of each chapter. The *Content Mastery* worksheets contain a variety of formats to engage students as they master the basics of the chapter. Answers are provided in the *Teacher Guide and Answers* section.

Directed Reading for Content Mastery (in Spanish): A Spanish version of the *Directed Reading for Content Mastery* is provided for those Spanish-speaking students who are learning English.

Reinforcement: These worksheets provide an additional resource for reviewing the concepts of the chapter. There is one worksheet for each section, or lesson, of the chapter. The *Reinforcement* worksheets are designed to focus primarily on science content and less on vocabulary, although knowledge of the section vocabulary supports understanding of the content. The worksheets are designed for the full range of students; however, they will be more challenging for your lower-ability students. Answers are provided in the *Teacher Guide and Answers* section.

Enrichment: These worksheets are directed toward above-average students and allow them to explore further the information and concepts introduced in the section. A variety of formats are used for these worksheets: readings to analyze; problems to solve; diagrams to examine and analyze; or a simple activity or lab which students can complete in the classroom or at home. Answers are provided in the *Teacher Guide and Answers* section.

Note-taking Worksheet: The *Note-taking Worksheet* mirrors the content contained in the teacher version—*Content Outline for Teaching*. They can be used to allow students to take notes during class, as an additional review of the material in the chapter, or as study notes for students who have been absent.

Assessment

Chapter Review: These worksheets prepare students for the chapter test. The *Chapter Review* worksheets cover all major vocabulary, concepts, and objectives of the chapter. The first part is a vocabulary review and the second part is a concept review. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Chapter Test: The *Chapter Test* requires students to use process skills and understand content. Although all questions involve memory to some degree, you will find that your students will need to discover relationships among facts and concepts in some questions, and to use higher levels of critical thinking to apply concepts in other questions. Each chapter test normally consists of four parts: Testing Concepts measures recall and recognition of vocabulary and facts in the chapter; Understanding Concepts requires interpreting information and more comprehension than recognition and recall—students will interpret basic information and demonstrate their ability to determine relationships among facts, generalizations, definitions, and skills; Applying Concepts calls for the highest level of comprehension and inference; Writing Skills requires students to define or describe concepts in multiple sentence answers. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Transparency Activities

Section Focus Transparencies: These transparencies are designed to generate interest and focus students' attention on the topics presented in the sections and/or to assess prior knowledge. There is a transparency for each section, or lesson, in the Student Edition. The reproducible student masters are located in the *Transparency Activities* section. The teacher material, located in the *Teacher Guide and Answers* section, includes Transparency Teaching Tips, a Content Background section, and Answers for each transparency.

Teaching Transparencies: These transparencies relate to major concepts that will benefit from an extra visual learning aid. Most of these transparencies contain diagrams/photos from the Student Edition. There is one *Teaching Transparency* for each chapter. The *Teaching Transparency Activity* includes a black-and-white reproducible master of the transparency accompanied by a student worksheet that reviews the concept shown in the transparency. These masters are found in the *Transparency Activities* section. The teacher material includes Transparency Teaching Tips, a Reteaching Suggestion, Extensions, and Answers to Student Worksheet. This teacher material is located in the *Teacher Guide and Answers* section.

Assessment Transparencies: An *Assessment Transparency* extends the chapter content and gives students the opportunity to practice interpreting and analyzing data presented in charts, graphs, and tables. Test-taking tips that help prepare students for success on standardized tests and answers to questions on the transparencies are provided in the *Teacher Guide and Answers* section.

Teacher Support and Planning

Content Outline for Teaching: These pages provide a synopsis of the chapter by section, including suggested discussion questions. Also included are the terms that fill in the blanks in the students' *Note-taking Worksheets.*

Spanish Resources: A Spanish version of the following chapter features are included in this section: objectives, vocabulary words and definitions, a chapter purpose, the chapter Activities, and content overviews for each section of the chapter.

Reproducible Student Pages

Reproducible Student Pages

■ Hands-On Activities

■ Meeting Individual Needs

Extension and Intervention

■ Assessment

■ Transparency Activities

Hands-On Activities

Mini LAB

Investigating the Unseen

Procedure

1. Your teacher will give you a **sealed shoe box** that contains **one or more items.**
2. Try to find out how many and what kinds of items are inside the box. You cannot look inside the box. The only observations you can make are by handling the box. Write observations in the Data and Observations section.

Data and Observations

Analysis

1. How many items do you infer are in the box? Sketch the apparent shapes of the items and identify them if you can.

2. Compare your procedure with how scientists perform experiments and make models to find out more about the atom.

TRY AT HOME Mini LAB

Comparing Compounds

Procedure

1. Collect the following substances— **granular sugar, rubbing alcohol,** and **salad oil.**
2. Observe the color, appearance, and state of each substance. Note the thickness or texture of each substance. Record your observations in the table below.
3. Stir a spoonful of each substance into separate **glasses** of **hot tap water** and observe. Record your observations in the table below.

Data and Observations

Substance	Sugar	Rubbing Alcohol	Salad Oil
1. Color			
2. Appearance			
3. State			
4. Thickness/texture			
5. In water			

Analysis

1. Compare the different properties of the substances.

2. The formulas of the three substances are made of only carbon, hydrogen, and oxygen. Infer how they can have different properties.

Elements and the Periodic Table

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. What safety practice is indicated by the safety symbol with the hand that is included in this lab?

2. List at least two research sources that might be useful in this lab.

The periodic table organizes the elements, but what do they look like? What are they used for? In this lab, you'll examine some elements and share your findings with your classmates.

Real-World Question

What are some of the characteristics and purposes of the chemical elements?

Goals

- **Classify** the chemical elements.
- **Organize** the elements into the groups and periods of the periodic table.

Materials

colored markers
large index cards
Merck Index
encyclopedia
**other reference materials*
large bulletin board
$8^1/_2$-in × 14-in paper
thumbtacks
**pushpins*
**Alternate materials*

Safety Precautions

WARNING: *Use care when handling sharp objects.*

Procedure

1. Select the assigned number of elements from the list provided by your teacher.
2. **Design** an index card for each of your selected elements. On each card, mark the element's atomic number in the upper left-hand corner and write its symbol and name in the upper right-hand corner.
3. **Research** each of the elements and write several sentences on the card about its appearance, its other properties, and its uses.
4. **Classify** each of your elements as a metal, a metalloid, or a nonmetal based upon its properties.
5. **Write** the appropriate classification on each of your cards using the colored marker chosen by your teacher.
6. Work with your classmates to make a large periodic table. Use thumbtacks to attach your cards to a bulletin board in their proper positions on the periodic table.
7. **Draw** your own periodic table. Place the elements' symbols and atomic numbers in the proper locations on your table.

(continued)

Conclude and Apply

1. **Interpret** the class data and classify the elements into the categories metal, metalloid, and nonmetal. Highlight each category in a different color on your periodic table.

2. **Predict** the properties of a yet-undiscovered element located directly under francium on the periodic table.

Mystery Mixture

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Explain why it is important to wear goggles while performing this experiment.

2. What are the three tests that you will apply to each compound?

You will encounter many compounds that look alike. For example, a laboratory stockroom is filled with white powders. It is important to know what each is. In a kitchen, cornstarch, baking powder, and powdered sugar are compounds that look alike. To avoid mistaking one for another, you can learn how to identify them. Different compounds can be identified by using chemical tests. For example, some compounds react with certain liquids to produce gases. Other combinations produce distinctive colors. Some compounds have high melting points. Others have low melting points.

Real-World Question

How can the compounds in an unknown mixture be identified by experimentation?

Goals

- **Test** for the presence of certain compounds.
- **Decide** which of these compounds are present in an unknown mixture.

Materials

test tubes (4)
cornstarch
powdered sugar
baking soda
mystery mixture
small scoops (3)
dropper bottles (2)
iodine solution
white vinegar
hot plate
250-mL beaker
water (125 mL)
test-tube holder
small pie pan

Safety Precautions

WARNING: *Use caution when handling hot objects. Substances could stain or burn clothing. Be sure to point the test tube away from your face and your classmates while heating.*

Procedure

1. Record your results for each of the following steps in the data table on the next page.

2. Place a small scoopful of cornstarch on the pie pan. Do the same for the sugar and baking soda making separate piles. Add a drop of vinegar to each. Wash and dry the pan after you record your observations.

3. Again, place a small scoopful of cornstarch, sugar, and baking soda on the pie pan. Add a drop of iodine solution to each one. Wash and dry the pan after you record your observations.

4. Place a small scoopful of each compound in a separate test tube. Hold the test tube with the test-tube holder and with an oven mitt. Gently heat the test tube in a beaker of boiling water on a hot plate.

5. Follow steps 2 through 4 to test your mystery mixture for each compound.

LAB (continued)

Data and Observations

Identifying Presence of Compounds

Substance to be Tested	Fizzes with Vinegar	Turns Blue with Iodine	Melts When Heated
1. Cornstarch			
2. Sugar			
3. Baking soda			
4. Mystery mix			

Analyze Your Data

1. **Identify** from your data table which compound(s) you have.

Conclude and Apply

1. **Describe** how you decided which substances were in your unknown mixture.

2. **Explain** how you would be able to tell if all three compounds were not in your mystery mixture substance.

3. **Draw a Conclusion** What would you conclude if you tested baking powder from your kitchen and found that it fizzed with vinegar, turned blue with iodine, and did not melt when heated?

Communicating Your Data

Make a different data table to display your results in a new way. **For more help, refer to the Science Skill Handbook.**

LAB 1 Laboratory Activity

Mixtures and Compounds

Matter is anything that has mass and occupies space. Matter exists in different forms. Three classifications of matter are well known to us: elements, mixtures, and compounds. Elements are the basic materials of our world. Elements in a mixture have recognizable boundaries and can be separated by mechanical means. Elements that form a chemical compound can be separated only by a chemical process. The element oxygen(O) combines with the element hydrogen (H) to form water (H_2O), which is a compound. Salt water is a mixture of two compounds, water and salt.

Strategy

You will separate a mixture into its parts.
You will compare the characteristics of a compound and a mixture.

Materials

magnifying glass
sand (coarse)
granite rock
granite (crushed)
water
disposable pie pans (2)
rock salt
heat source

Procedure

1. Use the magnifying glass to observe the sand and granite rock. Sketch the granite with the minerals in it, and the shapes of the sand grains under Sketch A.
2. Sort the crushed granite into separate piles according to color.
3. Sketch the general shape of a piece from each pile of the sorted granite, and label each as to color under Sketch B.
4. Mix a spoonful of sand in some water in a pie pan. Sketch what you observed under Sketch C.
5. Examine and sketch the salt crystals under Sketch D. **WARNING:** *Do not ingest rock salt. It might contain harmful impurities.*
6. Mix a spoonful of salt in some water in the second pie pan. Record your observations.
7. Heat both pans until the water is evaporated. Sketch what is left in each pan under Sketch E. **WARNING:** *Be careful not to get clothes or hair close to the heat source.*

Data and Observations

Sketch A

Sketch B

Laboratory Activity 1 (continued)

Sketch C

Sketch D

Sketch E

Questions and Conclusions

1. Are any of the sand grains similar to any of the granite fragments? If so, describe them.

2. How are salt and sand similar? How are they different?

3. Is salt water a compound or a mixture? Explain.

4. Is granite a compound or a mixture? Explain.

5. Name some mechanical processes used to separate mixtures.

Strategy Check

_____ Can you separate components of a mixture?

_____ Can you tell the difference between a compound and a mixture?

LAB 2 Laboratory Activity

Constructing Compounds

All elements are made of atoms. Compounds are formed when two or more elements combine to form a different type of matter. A chemical formula is a shortcut chemists take to describe a specific compound. It tells the numbers and types of atoms that make up a single unit of a compound. You probably already know that the formula for one common compound—water—is H_2O. The formula for water tells us that a molecule of water has two hydrogen atoms and one oxygen atom.

Strategy

You will build models of different compounds.
You will use your models to determine how many atoms of each element are in each molecule.

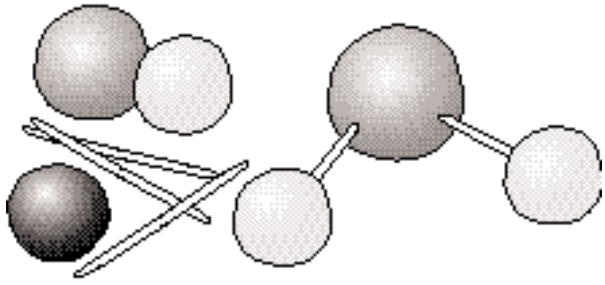
Materials

modeling clay (red, yellow, and blue)
toothpicks

Procedure

1. Obtain enough clay to make four balls of each color. Each clay ball represents one atom of an element. Blue balls represent hydrogen atoms, red balls represent oxygen atoms, and yellow balls represent carbon atoms.
2. Using toothpicks to connect your clay atoms as shown Figure 1, construct a model of each of the following compounds. After you construct each model, fill in the blanks for that compound in the table in the Data and Observations section. After you finish making the molecules for water and carbon dioxide, take them apart. Then make the methane molecule.
   - **a.** H_2O (water): Connect two hydrogen atoms to one oxygen atom.
   - **b.** CO_2 (carbon dioxide): Connect two oxygen atoms to one carbon atom.
   - **c.** CH_4 (methane): Connect four hydrogen atoms to one carbon atom.

Figure 1



Laboratory Activity 2 (continued)

Data and Observations

Chemical formula	Number of atoms in compound			
	Hydrogen	Carbon	Oxygen	Total
1. H_2O (water)				
2. CO_2 (carbon dioxide)				
3. CH_4 (methane)				

Questions and Conclusions

1. What would the answers in the table be for a molecule of fruit sugar, $C_6H_{12}O_6$?

2. From the formulas given, identify each of the following as either an element or a compound: NaCl, Ag, Co, CO, SO_2, AgBr.

3. Each carbon atom can be attached to up to four other atoms. The compound hexane has six carbon atoms joined together in a chain. If only carbon and hydrogen make up the hexane molecule, what is the greatest number of hydrogen atoms that could be in the molecule? Draw a picture of the molecule to help you.

4. Nitrogen in air is in the form of two nitrogen atoms fastened together, N_2. Is nitrogen an element or is it a compound? Explain.

Strategy Check

_____ Can you make a simple model of a compound based on its molecular formula?

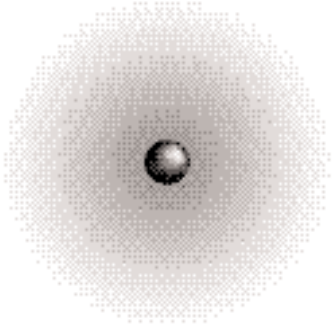
_____ Based on a compound's molecular formula, can you figure out how many atoms of each element are in a compound?

_____ Do you understand the difference between an element and a compound?

Atoms, Elements, and the Periodic Table

Directions: *Use this page to label your Foldable at the beginning of the chapter.*

Atoms



Elements

Compounds

Mixtures

carbon

table salt

nitrogen

air

soft drinks

hydrogen

iron

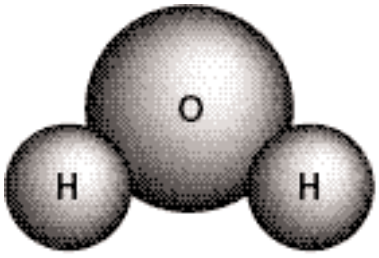
sugar

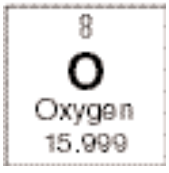
pizza

oxygen

mercury

carbon dioxide





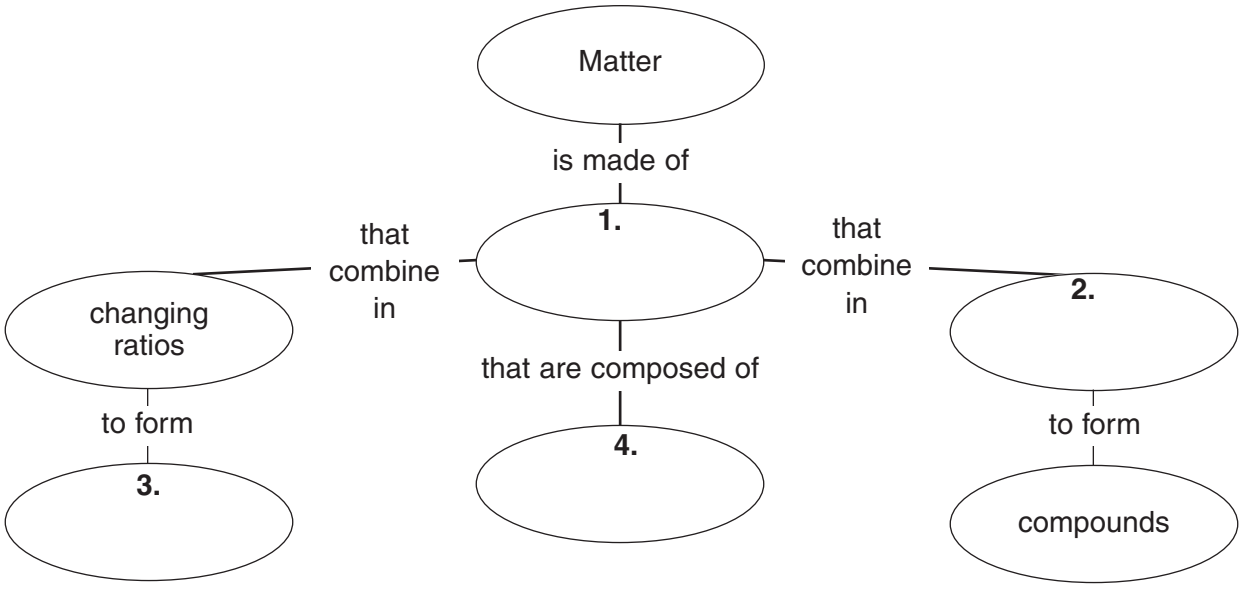
Meeting Individual Needs

Directed Reading for Content Mastery

Overview
Atoms, Elements, and the Periodic Table

Directions: *Complete the concept map using the terms in the list below.*

specific ratios **elements** **mixtures** **atoms**



Directions: *Use the information in the concept map to answer the following questions.*

5. All elements that make up matter are made up of _____.

6. All compounds are formed from _____.

7. Mixtures can be formed from elements in _____.

8. Compounds contain two or more elements combined in _____.

Directions: *Number the following steps in our understanding of the atom in the order in which they occurred.*

_____ **9.** J.J. Thomson discovers the existence of the electron.

_____ **10.** John Dalton comes up with the idea that each type of matter is made of only one kind of atom.

_____ **11.** Ernest Rutherford suggests that electrons are scattered in the mostly empty space around an atom's nucleus.

_____ **12.** Democritus devises the theory that the universe is composed of tiny bits of matter he called atoms.

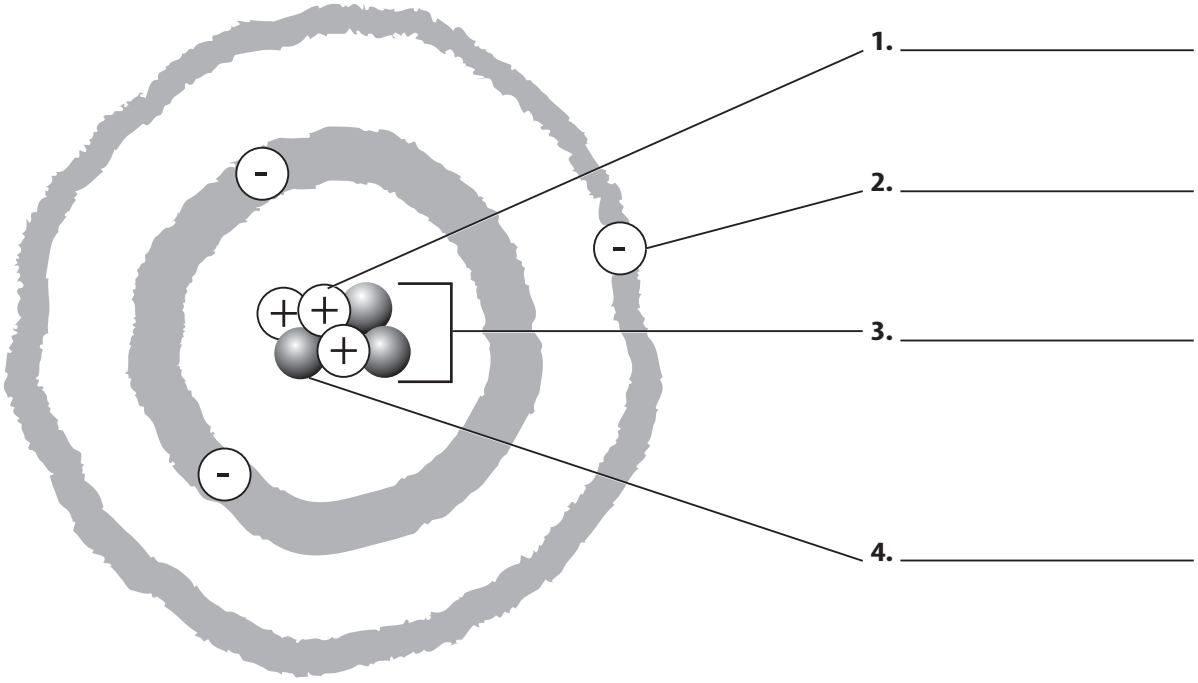
Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ Structure of Matter

Directions: *Study the following diagram. Then label the parts of the atom using the correct terms from the list.*

nucleus **electron** **proton** **neutron**



Directions: *Complete the following sentences using the terms listed below.*

sub-atomic **neutral** **nucleus** **conservation**
matter **atoms** **proton** **neutron** **electron**

5. A(n) _____ is a particle with a positive charge.
6. Most types of matter are made up of small particles called _____.
7. _____ is anything that has mass and takes up space.
8. A(n) _____ is a particle with no charge at all.
9. A(n) _____ is a particle with a negative charge.
10. The law of _____ of matter states that matter is neither created or destroyed—only changed in form.
11. Atoms are made up of _____ particles.
12. Matter that has an equal amount of positive and negative charge is said to be _____.
13. Most of the mass of an atom is concentrated in the _____.

Directed Reading for Content Mastery

Section 2 ▪ The Simplest Matter
Section 3 ▪ Compounds and Mixtures

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

1. copper, iron, salt

_____

2. air, milk, water

_____

3. protons, neutrons, mixtures

_____

4. mixture, isotope, compound

_____

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

5. The number of protons in an atom determines its (atomic number/nucleus).

6. An element's (atomic mass/mass number) is an average mass of the different isotopes of the element.

7. A(n) (compound/element) is matter that is made up of only one kind of atom.

8. (Mixtures/Isotopes) are atoms of the same element with different numbers of neutrons.

9. (Metals/Metalloids) are the best conductors of heat and electricity.

10. All the metals except mercury are (solid/liquid) at room temperature.

11. A(n) (compound/element) is a substance whose smallest unit is made up of more than one element.

12. Matter that has the same composition and properties throughout is called a(n) (substance/isotope).

Name Date Class

Directed Reading for Content Mastery

Key Terms
Atoms, Elements, and the Periodic Table

Directions: *Unscramble the terms in italics to complete the sentences below. Write the terms on the lines provided.*

_____ **1.** The number of protons plus the number of neutrons gives the atomic *sams.*

_____ **2.** An atomic particle **NOT** in the nucleus is a(n) *roltecen.*

_____ **3.** A(n) *meeteln* is a material that contains only one kind of atom.

_____ **4.** An element that has characteristics of both metals and nonmetals is a *tademlilo.*

_____ **5.** A(n) *dunomcop* is a pure substance whose smallest unit is made of atoms of more than one element.

_____ **6.** An atomic particle with no electrical charge is a(n) *ennrout.*

_____ **7.** Two or more substances form a *tumirex* when they come together without forming a new substance.

_____ **8.** The number of protons in the *sculune* of an atom is the atom's atomic number.

_____ **9.** Elements that are *selamt* are usually shiny and conduct electricity well.

_____ **10.** Anything that takes up space and has mass is *tramte.*

_____ **11.** A *tronop* is a positively charged particle in the nucleus.

_____ **12.** Matter that has the same composition and properties throughout is called a *sceuntabs.*

_____ **13.** Atoms of the same element that have different numbers of neutrons are called *psoitoes.*

_____ **14.** An element's *coatim* number tells you the number of protons in its nucleus.

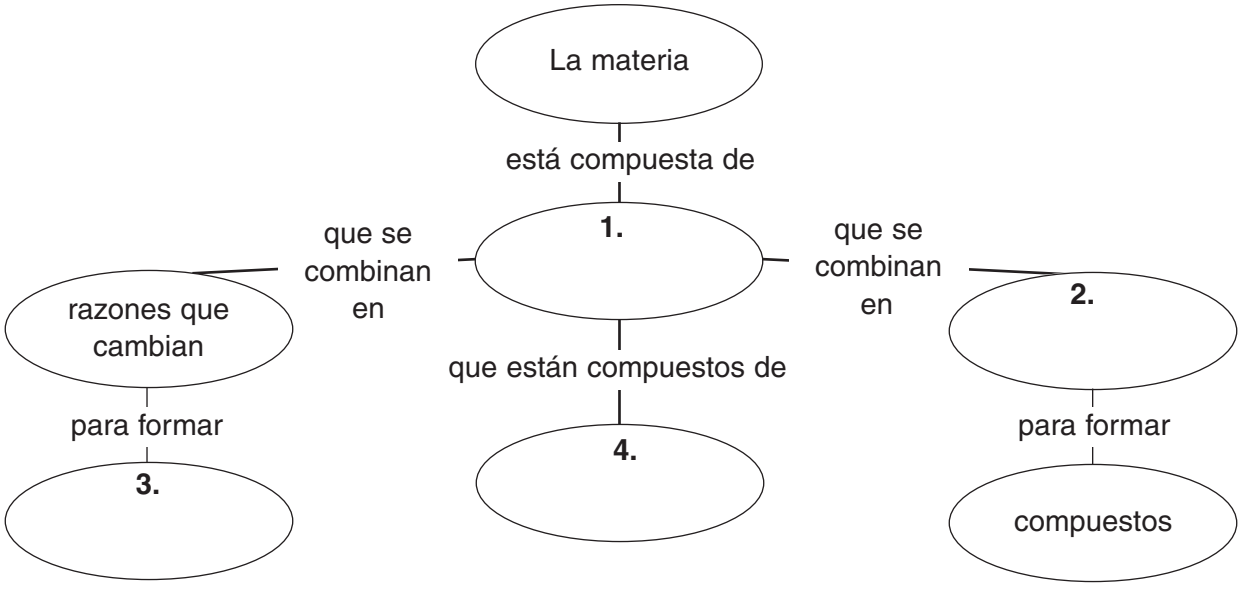
Meeting Individual Needs

Lectura dirigida para Dominio del contenido

Sinopsis
Los átomos, elementos y la Tabla periódica

Instrucciones: *Completa el mapa de conceptos usando los siguientes términos.*

razones específicas **elementos** **mezclas** **átomos**



Instrucciones: *Utiliza la información del mapa conceptual y responde las siguientes preguntas.*

5. Todos los elementos que forma la materia están compuestos de _____.

6. Todos los compuestos están formados de _____.

7. Las mezclas pueden estar formadas de elementos en _____.

8. Los compuestos contienen dos o más elementos combinados en _____.

Instrucciones: *Enumera los siguientes hechos, de acuerdo a nuestro entendimiento del átomo, en el órden en que ocurrieron los hechos.*

_____ **9.** J.J. Thomson descubre la existencia del electrón.

_____ **10.** John Dalton expuso que cada tipo de materia está formada de sólo un tipo de átomo.

_____ **11.** Ernesto Rutherford sugiere que los electrones están esparcidos mayormente en el espacio vacío alrededor del núcleo de un átomo.

_____ **12.** Democrito expone la teoría de que el universo está compuesta de pequeñas partículas de materia llamadas átomos.

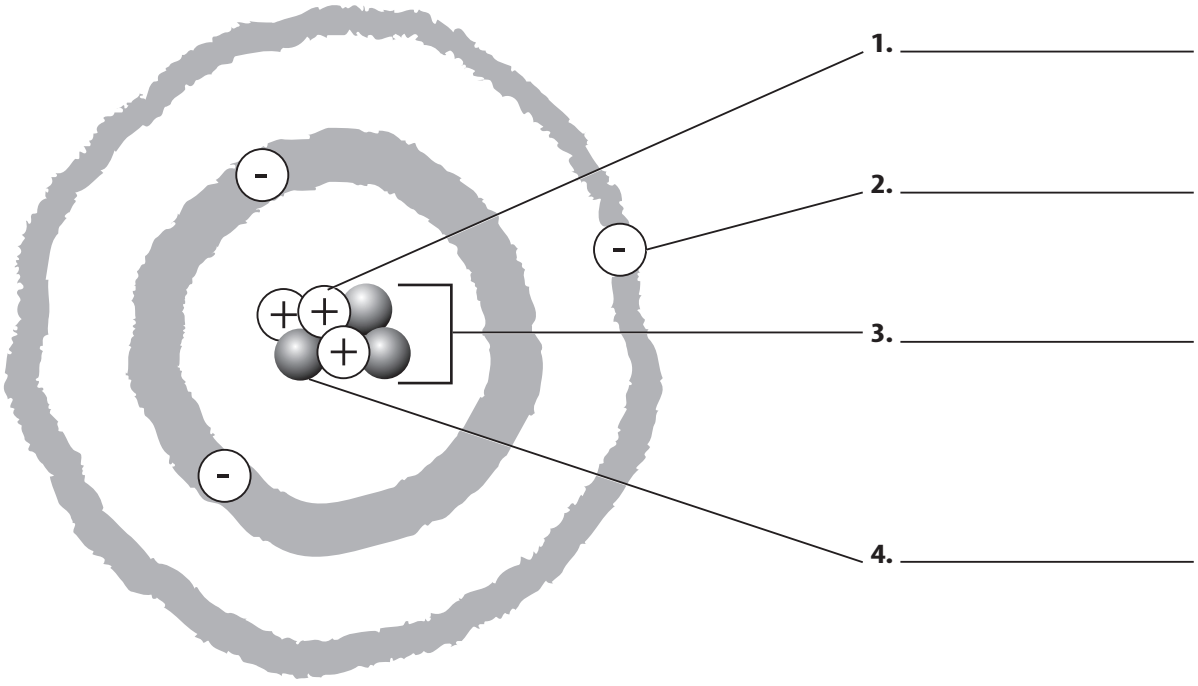
Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 1 ▪ Estructura de la materia

Instrucciones: *Estudia el siguiente diagrama. Rotula luego las partes del·tomo usando el término correcto de la lista.*

núcleo **electrón** **protón** **neutrón**



Instrucciones: *Completa las siguientes oraciones con el término correcto de la lista.*

subatómico **neutro** **núcleo** **conservación**
materia **átomos** **protón** **neutrón** **electrón**

5. Un(a) _____ es una partícula con carga positiva.
6. La mayor parte de la materia está compuesta de partículas pequeñas llamadas _____.
7. _____ es cualquier cosa que tiene masa y ocupa espacio.
8. Un(a) _____ es una partícula que no tiene carga.
9. Un(a) _____ es una partícula que tiene carga negativa.
10. La ley de _____ la materia dice que la materia no se crea ni se destruye, sólo cambia de forma.
11. Los átomos están formados por partículas _____ .
12. La materia que tiene igual número de cargas positivas y negativas se conoce como _____ .
13. La mayor parte de la masa de un átomo se concentra en el(la) _____.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 2 ▪ La materia más elemental
Sección 3 ▪ Compuestos y mezclas

Instrucciones: *Encierra en un círculo los dos términos de cada grupo que estén relacionados. Explica luego por qué están relacionados.*

1. cobre, hierro, sal

_____

2. aire, leche, agua

_____

3. protones, neutrones, mezclas

_____

4. mezcla, isótopo compuesto

_____

Instrucciones: *Encierra en un círculo el término que completa correctamente cada oración.*

5. El número de protones en un átomo determina su (número atómico/núcleo).

6. La(El) (masa atómica/número de masa) de un elemento es la masa promedio de los diferentes isótopos del elemento.

7. Un (compuesto/elemento) es materia formada por un solo tipo de átomo.

8. Las(os) (mezclas/isótopos) son átomos del mismo elemento con diferente número de neutrones.

9. Los (metales/metaloides) son los mejores conductores de calor y electricidad.

10. Todos los metales excepto el mercurio son (sólidos/líquidos) a temperatura ambiente.

11. Un (compuesto/elemento) es una sustancia cuya unidad más pequeña está fo mada por más de un tipo de átomo.

12. La materia que tiene la misma composición y propiedades en toda ella se llama una (sustancia/isótopo).

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Términos claves
Los átomos, elementos y la Tabla periódica

Instrucciones: *Descrifra los términos en letras itálicas para completar cada oración. Escribe cada término en la línea en blanco.*

_____ **1.** El número de protones más el número de neutrones da el(la) *sama* del átomo.

_____ **2.** Una partícula atómica que **NO** está en el núcleo es el(la) *róltecen.*

_____ **3.** Un(a) *meoeteln* es un material que contiene un solo tipo de átomo.

_____ **4.** Un elemento que tiene características tanto de metales como de no metales es un *tadeemlio.*

_____ **5.** Un(a) *seocmoput* es una sustancia pura cuya unidad más pequeña está formada por átomos de más de un elemento.

_____ **6.** La partícula atómica que no tienen carga es un *ennróut.*

_____ **7.** Dos o más sustancias forman un(a) *mzacel* cuando se unen sin formar una sustancia nueva.

_____ **8.** El número de protones en el (la) *olecún* de un átomo es su número atómico.

_____ **9.** Los elementos que son *selaemt* son generalmente brillantes y conducen bien la electricidad.

_____ **10.** Cualquier cosa que ocupa espacio y tiene masa es *reamtai.*

_____ **11.** Un(a) *tnóopr* es una partícula con carga positiva en el núcleo.

_____ **12.** La materia que tiene la misma composición y propiedades en toda ella se llama un(a) *scuntasai.*

_____ **13.** Los átomos del mismo elemento que tienen diferente número de neutrones se llaman *posiósto.*

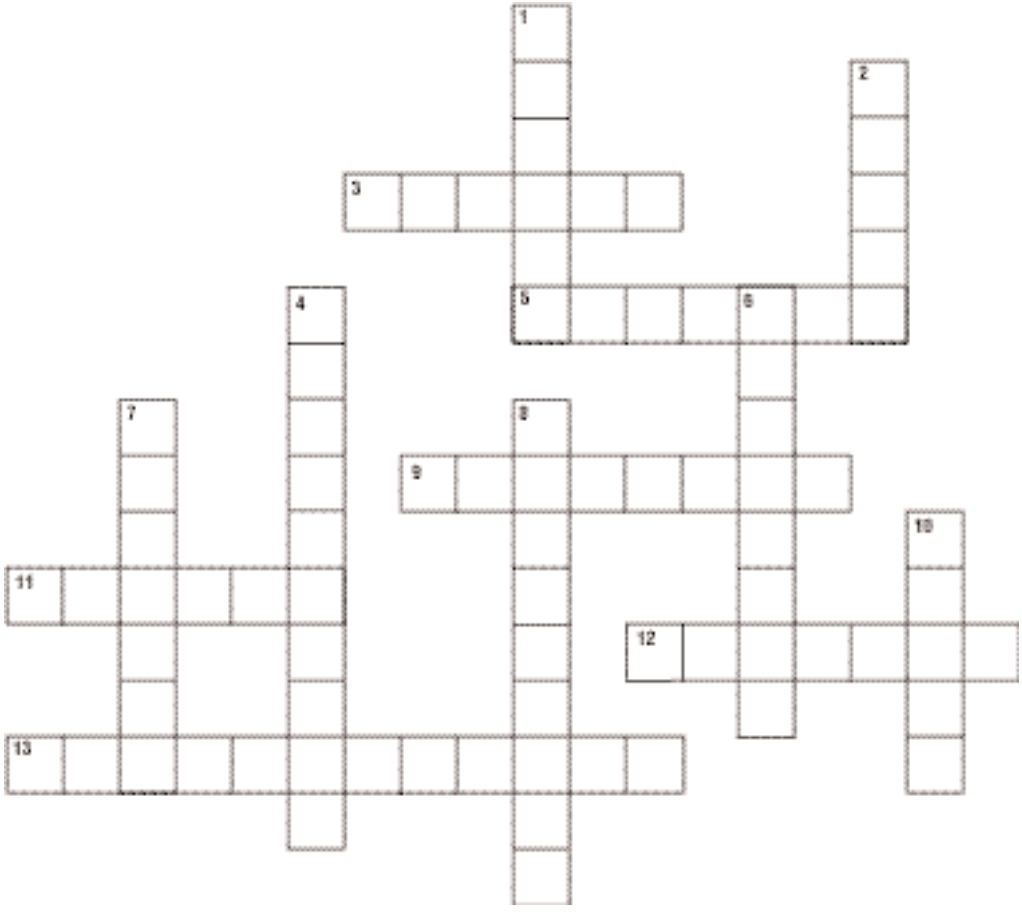
_____ **14.** El número *maticóo* de un elemento da el número de protones en el núcleo.

Satisface las necesidades individuales

SECTION 1 Reinforcement

Structure of Matter

Directions: *Use the clues below to complete the crossword puzzle.*



Across

3. Positively charged particle in the nucleus of an atom

5. The central part of an atom that contains the protons and neutrons

9. Scientist who discovered neutrons

11. Has mass and takes up space

12. Scientist who discovered electrons

13. The law of _____ of matter states that matter can neither be created nor destroyed.

Down

1. Scientist who developed a model called the atomic theory of matter

2. Most matter on Earth is made up of these small particles.

4. Scientist who discovered protons

6. Negatively charged particle in an atom

7. Uncharged particle in the nucleus of an atom

8. Scientist who showed that wood and oxygen combine during burning

10. Electrons move in what is called an atom's electron _____.

Name Date Class

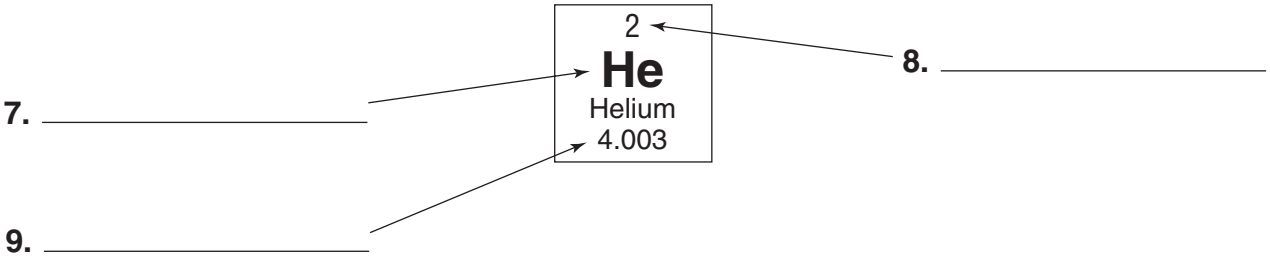
SECTION 2 Reinforcement

The Simplest Matter

Directions: *Complete the table by writing in the appropriate characteristics for metals, metalloids, and nonmetals.*

Characteristics	Metals	Metalloids	Nonmetals
1. State of matter at room temperature			
2. Shininess			
3. Conductor of heat or electricity			
4. Malleability			
5. Ductility			
6. Location on periodic table			

Directions: *The square below represents one element from the periodic table. Identify and describe the numbered items. Then answer the questions below.*



10. What is the atom's mass number?

_____

11. What are isotopes?

_____

_____

Meeting Individual Needs

Name Date Class

SECTION 3 Reinforcement

Compounds and Mixtures

Directions: *Select the term below that best describes each food listed.*

homogeneous mixture **compound** **heterogeneous mixture**

1. milk _____
2. salt _____
3. sugar _____
4. soda pop _____
5. ice cream _____
6. popsicle _____
7. chili _____
8. taco _____
9. pizza _____
10. water _____

Directions: *Answer the following questions on the lines provided.*

11. Describe what a compound's formula tells us about the compound.

_____

_____

_____

12. Both compounds and mixtures contain more than one kind of atom. Explain how a compound is different from a mixture.

_____

_____

_____

Directions: *Draw a line from the term on the right to its definition or description on the left.*

13. a sample of matter that has the same composition and properties throughout

14. a pure substance whose smallest unit is made up of atoms of more than one element

15. two or more substances that are together but do not combine to form a new, pure substance

16. a mixture that is the same throughout

17. a mixture with visible components

heterogeneous mixture

homogeneous mixture

compound

substance

mixture

Meeting Individual Needs

SECTION 1 Enrichment

Flow, Flow, Old Phlogiston!

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

- **Phlogiston Theory** Wood is made up of ash and a substance called phlogiston. When wood burns, it gives off phlogiston into the air, leaving the ash. Iron is made up of metallic ash (now called iron oxide) and phlogiston. When iron rusts, it gives off 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 with equals the total mass of the resulting substances.

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 percent oxygen, and 21 percent other gases.) The wood did not burn in nitrogen, but it burned vigorously in oxygen. Which theory do these results support? Explain.

2. When iron rusts, the resulting substance has a greater mass than the original iron. With which theory does this result seem to agree? Explain.

Name Date Class

SECTION 2 Enrichment

The Periodic Table

Directions: *Refer to a periodic table to complete the first four columns of the table below. Then use a dictionary, encyclopedia, or other resources to complete the last column. When you have completed the table, answer the question that follows.*

Element	Symbol	Number of protons	Atomic number	Metal, nonmetal, or metalloid	Characteristics and uses
1. Hydrogen					
2. Carbon					
3. Oxygen					
4. Silicon					
5. Iron					
6. Krypton					
7. Chlorine					
8. Plutonium					
9. Lead					
10. Silver					

11. Name three things that you can predict about an element from its position on the periodic table.

_____

_____

_____

Meeting Individual Needs

Name Date Class

SECTION 3 Enrichment

Compounding Compounds

You probably already know that the formula for water is H_2O. However, do you realize that hydrogen and oxygen, the two elements in water, are found in thousands of compounds?

Directions: *Research using books such as encyclopedias or dictionaries or other resources to complete the columns for the compounds listed in the table below. Then add at least two compounds that contain hydrogen and oxygen, and complete the column for these compounds.*

Common name	Chemical name	Formula	How many atoms of hydrogen? Oxygen?	What other elements are in the compound?	Description/uses
1. Wood alcohol					
2. Ammonia cleaning solution					
3. Baking soda					
4. Sugar					
5. Vinegar					
6.					
7.					

Meeting Individual Needs

Name Date Class

Note-taking Worksheet

Atoms, Elements, and the Periodic Table

Section 1 Structure of Matter

A. Matter—anything that has _____ and takes up space.

1. The **atom**—a small particle that makes up most types of _____
2. Lavoisier introduced the **law of conservation of matter**—matter is neither _____ nor _____, but only changes form.
3. Before Lavoisier, people used to think _____ could appear and disappear.
4. Dalton introduced an early atomic _____.
   - **a.** _____ are too small to be seen by human eye.
   - **b.** Each type of matter is made of _____ of atom.
5. Thomson discovered that atoms are made of even smaller _____.
   - **a.** _____—tiny, negatively charged particles with mass
   - **b.** Proposed that an atom was a ball of _____ with electrons embedded in it
6. _____ suggested a new model of the atom.
   - **a.** _____—the positively charged central part of the atom
   - **b. Protons**—the _____ charged particles in the nucleus
   - **c.** Electrons are scattered in the mostly empty space around the _____.
7. Chadwick introduced _____—particles that come from the nucleus and have no charge
8. _____ Model—Electrons are so small and fast that they move in a cloud.

Section 2 The Simplest Matter

A. Elements—matter made up of _____ kind of atom

1. There are _____ known elements.
2. 90 _____ occurring elements, plus _____ elements—made by scientists

Meeting Individual Needs

Note-taking Worksheet (continued)

B. Periodic Table—Chart that organizes and displays information about the _____

1. **Atomic** _____—the top number in the element's periodic table block
   - **a.** Tells the number of _____ in the nucleus of each atom of that element
   - **b.** The number of _____ remains constant in every atom of an element.
2. _____—atoms of the same element that have different numbers of _____
3. **Mass number**—number of _____ plus number of _____
4. **Atomic** _____—the number found below the element symbol
   - **a.** The weighted average _____ of an atom of an element
   - **b.** The unit used for atomic mass is the _____, which is given the symbol u.

C. Elements fall into three general groups characterized by similar _____

1. _____—majority of elements
   - **a.** _____ luster
   - **b.** Good conductors of _____ and _____
   - **c.** Most are _____ at room temperature.
   - **d.** _____, or can be shaped
   - **e.** _____, or can be drawn into wires without breaking
2. _____—found on the right side of the periodic table
   - **a.** _____ in appearance
   - **b.** _____ conductors of heat and electricity
   - **c.** Many are _____ at room temperature.
   - **d.** _____, cannot change shape without breaking
   - **e.** 97 percent of the _____ is made up of nonmetals.
3. _____—found between the metals and nonmetals on the periodic table
   - **a.** Have characteristics of both _____ and _____
   - **b.** Do not _____ heat and electricity as well as metals
   - **c.** All are _____ at room temperature.

Note-taking Worksheet (continued)

Section 3 Compounds and Mixtures

A. Substance—Matter that has the same _____ and properties throughout

B. Compound—Substance whose smallest unit is made up of _____ element

1. _____—tells which elements make up a compound as well as how many atoms of each element are present
   - **a.** The subscript number tells _____ of the preceding element are in the compound.
   - **b.** No subscript is used when _____ of the element is present.
2. A given compound is always made of the same elements in the same_____.

C. Mixture—Two or more substances mixed together which don't make a _____ substance

1. Unlike in compounds, the _____ of the substances in a mixture can be changed without changing the identity of the mixture.
2. Examples: air, _____
3. Can _____ mixtures easily
4. _____ mixtures—the same throughout
5. _____ mixtures—you can see the different parts

Assessment

Name Date Class

Chapter Review

Atoms, Elements, and the Periodic Table

Part A. Vocabulary Review

Directions: *Match the terms in Column II with the definitions in Column I. Write the letter of the correct term in the blank at the left.*

Column I

_____ **1.** weighted average mass of an element

_____ **2.** a sample of matter that has the same composition and properties throughout

_____ **3.** states that matter is neither created nor destroyed, only changed in form

_____ **4.** negatively charged subatomic particle

_____ **5.** positively charged central part of the atom

_____ **6.** positively charged particle in the nucleus of the atom

_____ **7.** uncharged particle in the nucleus of the atom

_____ **8.** elements that generally have a shiny or metallic luster

_____ **9.** matter made up of only one kind of atom

_____ **10.** tells you the number of protons in the nucleus of each atom of an element

_____ **11.** anything that has mass and takes up space

_____ **12.** atoms of the same element that have different numbers of neutrons

_____ **13.** the sum of an atom's protons and neutrons

_____ **14.** a small particle that makes up most types of matter on Earth

_____ **15.** a pure substance whose smallest unit is made up of atoms of more than one element

_____ **16.** formed when two or more substances come together but don't combine to form a new substance

_____ **17.** elements that are usually dull in appearance and poor conductors of heat and electricity

_____ **18.** elements that have characteristics of both metals and nonmetals

Column II

a. atom

b. atomic mass

c. atomic number

d. compound

e. electron

f. element

g. isotopes

h. law of conservation of matter

i. mass number

j. matter

k. metals

l. metalloids

m. mixtures

n. neutron

o. nonmetals

p. nucleus

q. proton

r. substance

Chapter Review (continued)

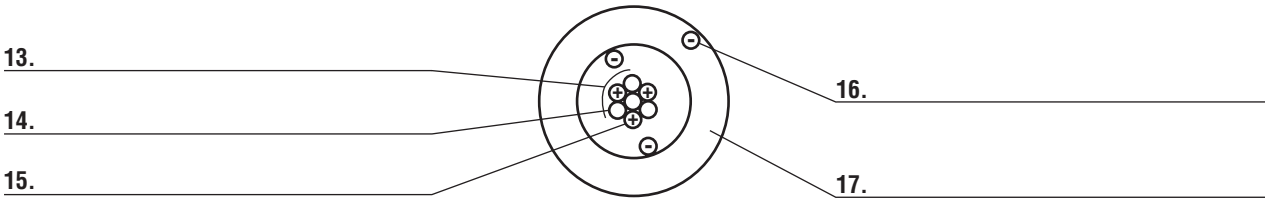
Part B. Concept Review

Directions: *Correctly complete each sentence by underlining the best of the three choices in parentheses.*

1. An element is made up of only one kind of (isotope, atom, plastic).
2. The periodic table lists (common molecules, compounds, elements).
3. Isotopes can have the same (mass number, atomic number, number of subatomic particles).
4. Most elements are (metals, nonmetals, metalloids).
5. On the periodic table, metalloids are found (on the left side, on the right side, between the metals and nonmetals).
6. A (metal, metalloid, nonmetal) has no luster and is a poor conductor.
7. Many (metals, metalloids, nonmetals) can conduct heat and electricity, but they are not the best conductors.
8. The (metals, metalloids, nonmetals) all are malleable, have luster, and are good conductors.
9. The elements in a (mixture, solution, compound) are always combined in the same proportion by mass.
10. The compound ammonia contains three atoms of hydrogen for every atom of nitrogen, so the chemical formula for ammonia is (NH_3, N_3H_3, N_3H).
11. An example of a homogenous mixture is (vegetable soup, air, granite rock).
12. A mixture is heterogenous if (it is made of two compounds, one of its parts is water, you can see its individual parts).

Directions: *Study the following diagram. Then label the atom using the correct terms from the list.*

electron **electron cloud** **neutron** **nucleus** **proton**



Directions: *Classify the following by writing* **matter** *or* **not matter** *in the blank before each item.*

_____ **18.** hydrogen

_____ **19.** a wish

_____ **20.** the sun

_____ **21.** any atom

_____ **22.** heat

_____ **23.** light

Name Date Class

Chapter Test

Atoms, Elements, and the Periodic Table

I. Testing Concepts

Directions: *For each of the following, write the letter of the term or phrase that best completes the sentence.*

_____ **1.** A(n) _____ is a particle in an atom with a positive charge.
a. electron **b.** isotope **c.** neutron **d.** proton

_____ **2.** Each of these is an example of matter **EXCEPT** _____.
a. a cloud **c.** a dust particle
b. a beam of light **d.** air

_____ **3.** An atom of the element with atomic number 6 always has _____.
a. six electron clouds **c.** six protons in its nucleus
b. more than six neutrons **d.** an atomic mass of six

_____ **4.** The atomic number of an element tells the number of _____ in the nucleus of an atom of that element.
a. neutrons **b.** electrons **c.** protons **d.** isotopes

_____ **5.** Rutherford's experiment showed that most of an atom is made up of _____.
a. an electron cloud **c.** alpha particles
b. a nucleus **d.** empty space

_____ **6.** Isotopes of an element contain different numbers of _____.
a. electrons **b.** neutrons **c.** protons **d.** energy levels

_____ **7.** Water is an example of a(n) _____.
a. compound **c.** homogeneous mixture
b. heterogeneous mixture **d.** element

_____ **8.** Most elements found on the left side of the periodic table are _____.
a. metals **b.** metalloids **c.** brittle **d.** nonmetals

_____ **9.** Air is an example of a _____.
a. heterogeneous mixture **c.** substance
b. compound **d.** homogeneous mixture

_____ **10.** _____ developed a model called the atomic theory of matter.
a. John Dalton **c.** Democritus
b. Ernest Rutherford **d.** J. J. Thompson

_____ **11.** During Chadwick's experiments, streams of _____ were unaffected by an electric field.
a. alpha particles **c.** electrons
b. neutrons **d.** protons

_____ **12.** _____ small particles that make up most types of matter on Earth.
a. Compounds **c.** Mixtures
b. Elements **d.** Atoms

Chapter Test (continued)

_____ **13.** Matter that is **NOT** considered to be a single substance is a(n) _____.
- **a.** compound
- **b.** element
- **c.** mixture
- **d.** isotope

_____ **14.** A property **NOT** associated with metals is _____.
- **a.** electric conductivity
- **b.** ductility
- **c.** shininess
- **d.** brittleness

Directions: *Identify each statement as* **true** *or* **false.** *Rewrite false statements to make them correct.*

_____ **15.** Matter is anything that you can see and that takes up space.

_____

_____ **16.** Metalloids are elements that have characteristics of both metals and nonmetals.

_____

_____ **17.** J. J. Thompson's experiments with cathode rays led to the discovery of the neutron.

_____

_____ **18.** A compound with the formula $C_6H_{12}O_6$ is made up of three atoms.

_____

_____ **19.** Fruit salad is an example of a heterogeneous mixture.

_____

II. Understanding Concepts

Skill: Making and Using a Table

Directions: *Fill in the missing numbers in the table.*

Element	Number of protons	Number of neutrons	Number of electrons	Atomic number	Mass number
1. A	3	4	3		7
2. B	2		2	2	4
3. C	11	12		11	
4. D		6	6		12
5. E		18			35

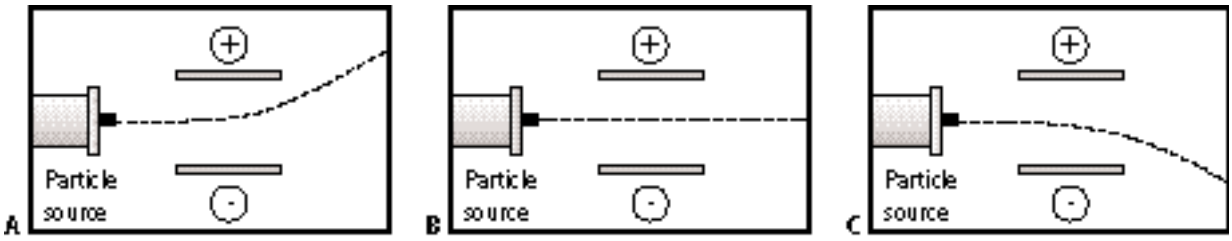
Assessment

Chapter Test (continued)

Skill: Interpreting Scientific Illustrations

Directions: *Study diagrams A, B, and C below. Then, identify the particles that make up each stream and explain your reasoning.*

Each diagram shows the path followed by a stream of particles moving between two electrically charged plates. The particles may be electrons, which carry a negative charge, alpha particles, which carry a positive charge; or neutrons, which carry no net charge.



6. Diagram A: _____

_____

7. Diagram B: _____

_____

8. Diagram C: _____

_____

Skill: Comparing and Contrasting

Directions: *Answer the following questions on the lines provided.*

9. Compare and contrast the properties of a homogeneous mixture such as salt water and a heterogeneous mixture such as muddy water.

_____

_____

_____

10. Compare and contrast the composition of a compound having the formula CO with one having the formula CO_2.

_____

_____

_____

Chapter Test (continued)

III. Applying Concepts

Directions: *Answer the following questions using complete sentences.*

1. Thomson's model of the atom pictured electrons embedded in a ball of positive charge. Why did Rutherford's gold-foil experiment lead to a change in this model?

2. Why is it impossible for the atomic number of an element to be greater than its mass number?

IV. Writing Skills

Directions: *Answer the following questions using complete sentences.*

1. Suppose a new element with atomic number 120 is discovered. If some isotopes of this element have 122 neutrons and some have 124 neutrons, what can you infer about the atomic mass of the element? Explain your answer.

2. Why can you write a formula for a compound but not for a mixture?

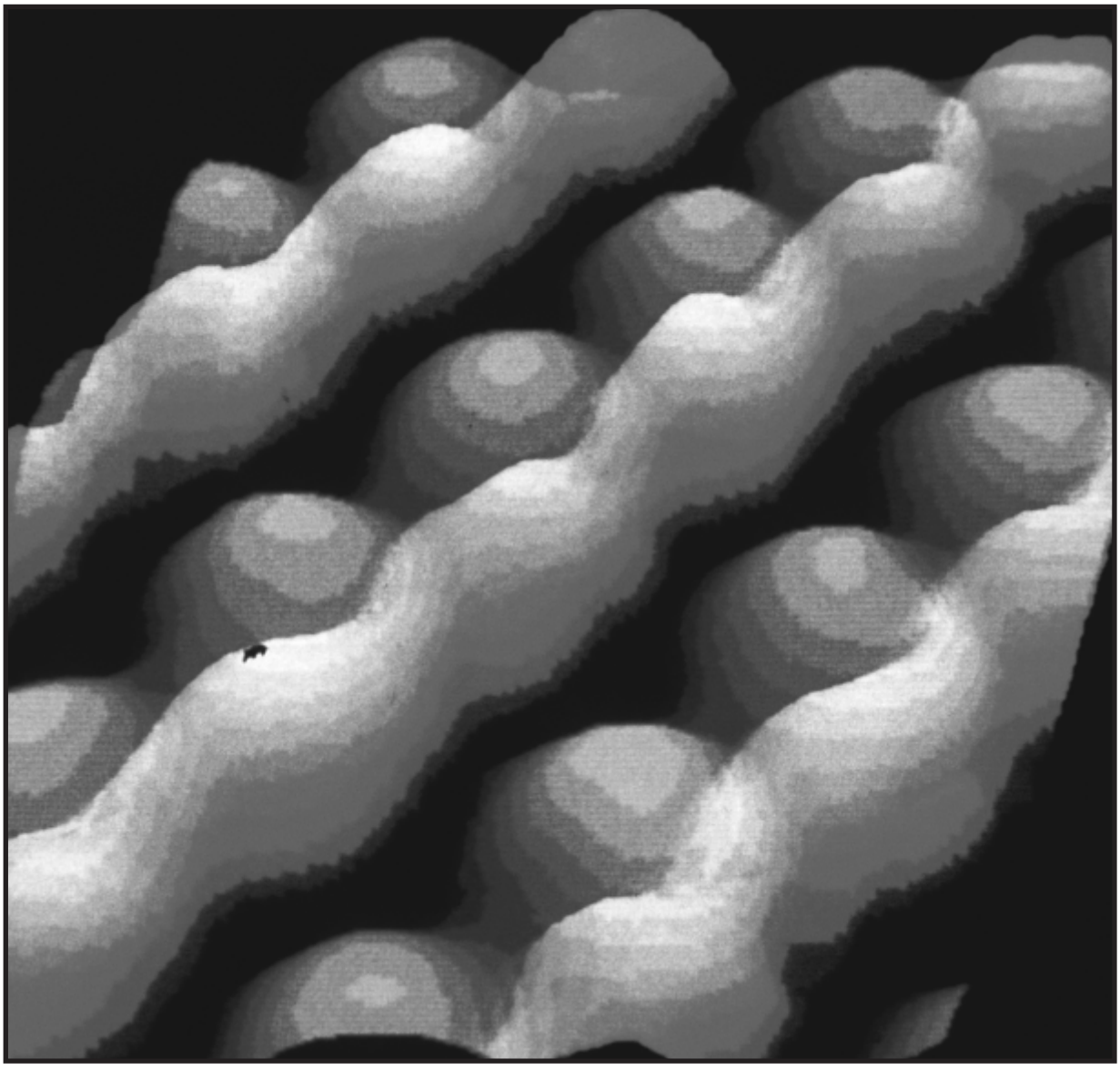
Transparency Activities

Name Date Class

SECTION 1 Section Focus Transparency Activity

What's the matter in this picture?

This unusual image is made with a scanning tunneling microscope (STM). This microscope actually images individual atoms.

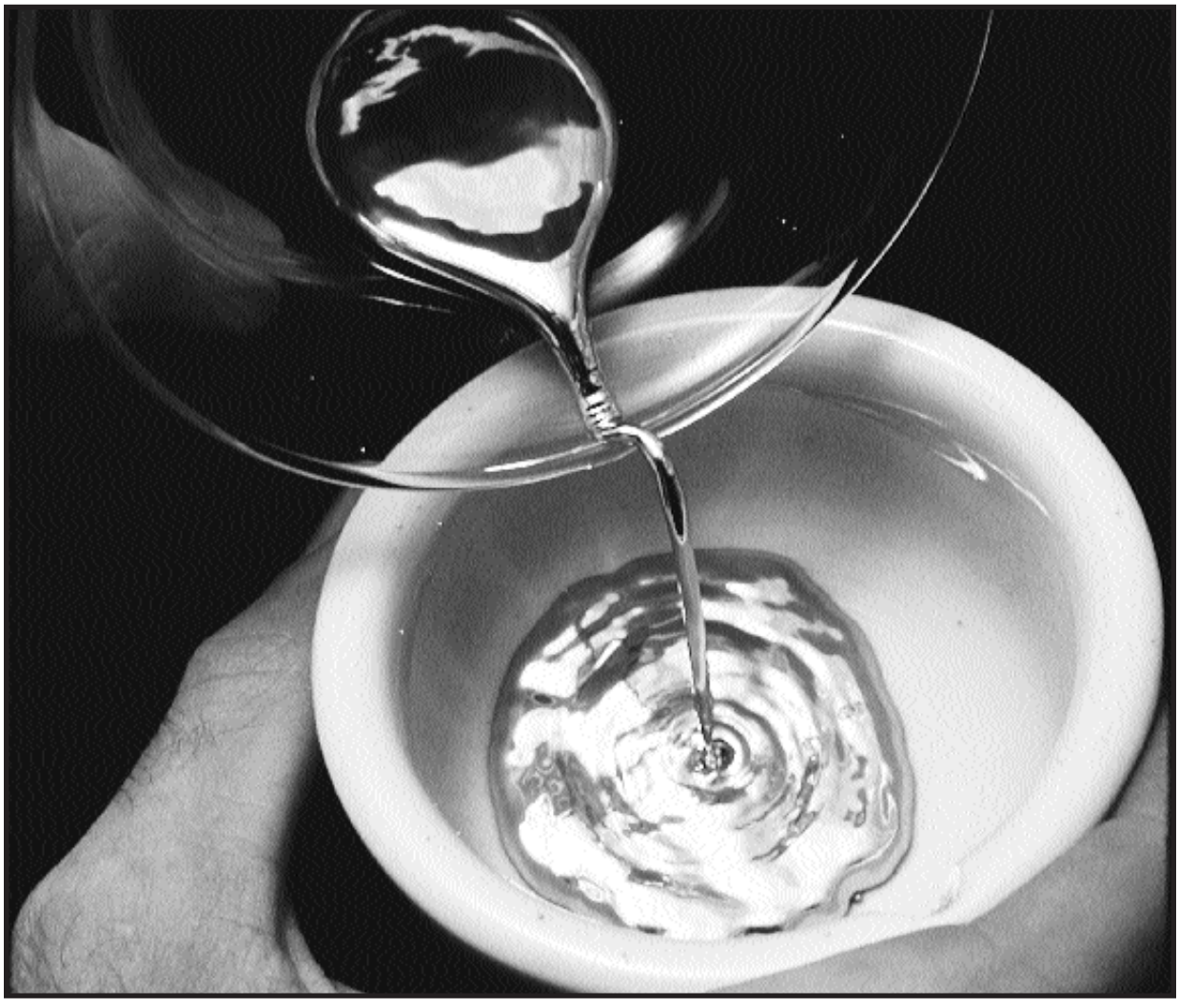


1. **Why could this image not be from a traditional microscope?**
2. **How many different types of atoms are shown?**

SECTION 2 Section Focus Transparency Activity

Some Call it Quicksilver

This element is a liquid at room temperature. It is probably best known as the liquid in traditional thermometers; however, it is so toxic that people often choose digital thermometers that do not contain this element.



1. **Describe what you see in the picture. What characteristics does this element have?**
2. **Which element do you think this is? Do you know of any other uses for it?**

Name Date Class

SECTION 3 Section Focus Transparency Activity

Here Today, Rust Tomorrow

This was seaworthy metal once, but now it's mostly rust. Before it rusted, it was a sturdy ship for work and transportation. As rust, it is falling apart. What happened?

1. **What properties of metals are useful for making ships?**
2. **Is rust the same material as the original metal? Why or why not?**

SECTION 1 Teaching Transparency Activity

Fire and Ash

Teaching Transparency Activity (continued)

1. What is burning in the picture?

2. Where does the oxygen needed for burning come from?

3. What is produced when wood burns?

4. What does the law of conservation of matter state?

5. How does the mass of substances remaining after burning compare to the mass of the substances before burning?

6. How does the burning of wood illustrate the law of conservation of matter?

7. When iron and oxygen combine to form rust, how do the masses compare?

Assessment Transparency Activity

Atoms, Elements, and the Periodic Table

Directions: *Carefully review the table and answer the following questions.*

Characteristics of Some Elements

Element	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
Boron	5	11	5	5	6
Carbon	6	12	6	6	6
Nitrogen	7	14	7	7	7
Oxygen	8	16	8	8	8
Fluorine	9	19	9	9	10

1. According to the table, which element has an atomic number of 7?

A Boron
B Carbon
C Nitrogen
D Oxygen

2. According to the table, which element has a mass number less than 12?

F Boron
G Carbon
H Oxygen
J Fluorine

3. According to the table, an atom with 9 protons in its nucleus is most likely to be ___.

A carbon
B nitrogen
C oxygen
D fluorine

Teacher Support and Planning

Teacher Support and Planning

Content Outline for Teaching

Atoms, Elements, and the Periodic Table

Section 1 Structure of Matter

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

A. Matter—anything that has mass and takes up space

1. The **atom**—a small particle that makes up most types of matter
2. Lavoisier introduced the **law of conservation of matter**—matter is neither created nor destroyed, but only changes form.
3. Before Lavoisier, people used to think matter could appear and disappear.
4. Dalton introduced an early atomic theory of matter.
   a. Atoms are too small to be seen by human eye.
   b. Each type of matter is made of only one kind of atom.
5. Thomson discovered that atoms are made of even smaller subatomic particles.
   a. **Electrons**—tiny, negatively charged particles with mass
   b. Proposed that an atom was a ball of positive charge with electrons embedded in it
6. Rutherford suggested a new model of the atom.
   a. **Nucleus**—the positively charged central part of the atom
   b. **Protons**—the positively charged particles in the nucleus
   c. Electrons are scattered in the mostly empty space around the nucleus
7. Chadwick introduced **neutrons**—particles that come from the nucleus and have no charge.
8. Electron Cloud Model — Electrons are so small and fast that they move in a cloud.

DISCUSSION QUESTION:
According to the law of conservation of matter, what happens to wood when it "burns up"? *Matter is neither created nor destroyed, but only changes form. Wood and the oxygen from the air that it combines with during burning have the same mass as the ash, water, and carbon dioxide produced.*

Section 2 The Simplest Matter

A. Elements—matter made up of only one kind of atom

1. There are 115 known elements.
2. 90 naturally occurring elements, plus synthetic elements—made by scientists

B. Periodic Table—Chart that organizes and displays information about the elements

1. **Atomic number**—the top number in the element's periodic table block
   - **a.** Tells the number of protons in the nucleus of each atom of that element
   - **b.** The number of protons remains constant in every atom of an element.
2. **Isotopes**—atoms of the same element that have different numbers of neutrons
3. **Mass number**—number of protons plus number of neutrons
4. **Atomic mass**—the number found below the element symbol
   - **a.** The weighted average mass of an atom of an element
   - **b.** The unit used for atomic mass is the atomic mass unit, which is given the symbol u.

C. Elements fall into three general groups characterized by similar properties

1. **Metals—**most of the elements
   - **a.** Shiny luster
   - **b.** Good conductors of heat and electricity
   - **c.** Most are solids at room temperature.
   - **d.** Malleable, or can be shaped
   - **e.** Ductile, or can be drawn into wires without breaking
2. **Nonmetals**—found on the right side of the periodic table
   - **a.** Dull in appearance
   - **b.** Poor conductors of heat and electricity
   - **c.** Many are gases at room temperature.
   - **d.** Brittle, cannot change shape without breaking
   - **e.** 97 percent of the human body is made up of nonmetals.

Content Outline for Teaching (continued)

3. **Metalloids**—found between the metals and nonmetals on the periodic table
   - **a.** Have characteristics of both metals and nonmetals
   - **b.** Do not conduct heat and electricity as well as metals
   - **c.** All are solids at room temperature.

DISCUSSION QUESTION:
What do you know about chlorine, based only on the fact that it is a nonmetal? *It is probably a gas at room temperature. It probably does not conduct heat and electricity very well. It is probably dull in appearance. It cannot change shape without breaking.*

Section 3 Compounds and Mixtures

A. Substance—Matter that has the same composition and properties throughout

B. Compound—Substance whose smallest unit is made up of atoms of more than one element

1. Chemical formula—tells which elements make up a compound as well as how many atoms of each element are present
   - **a.** The subscript number tells how many atoms of the preceding element are in the compound.
   - **b.** No subscript is used when only one atom of the element is present.
2. A given compound is always made of the same elements in the same proportion.

C. Mixture—two or more substances mixed together which don't make a new substance

1. Unlike in compounds, the proportions of the substances in a mixture can be changed without changing the identity of the mixture.
2. Examples: air, blood
3. Can separate mixtures easily
4. Homogeneous mixtures—the same throughout
5. Heterogeneous mixtures—you can see the different parts

DISCUSSION QUESTION:
What is the difference between compounds and mixtures? *Compounds are single substances; mixtures are two or more substances mixed together. Compounds always contain the same elements in the same proportion; the proportions of the substances in a mixture can be changed. Mixtures can be easily separated; compounds cannot.*

Spanish Resources

Los átomos, elementos y la Tabla periódica

Sección 1 Estructura de la materia

Lo que aprenderás

- A describir las características de la materia.
- A identificar los constituyentes de la materia.
- A identificar las partes de un átomo.
- A comparar los modelos del átomo en uso.

Vocabulario

matter/materia: cualquier cosa que tiene masa y ocupa espacio y que está compuesta de diferentes tipos de átomos; incluye todas las cosas que pueden verse, saborearse, olerse o tocarse, pero no incluye el calor, el sonido o la luz.

atom/átomo: partícula diminuta que forma la mayoría de la materia y que está a su vez formada por partículas más pequeñas llamadas protones, neutrones y electrones.

law of conservation of matter/ley de la conservación de la materia: enuncia que la materia no se puede crear ni destruir, sino que sólo cambia de forma.

electron/electrón: partícula invisible y de carga negativa localizada en una región en forma de nube que rodea el núcleo de un átomo.

nucleus/núcleo: parte central de un átomo; tiene carga positiva.

proton/protón: partícula con carga positiva ubicada en el núcleo de un átomo y la cual se cuenta para identificar el número atómico.

neutron/neutrón: partícula sin carga ubicada en el núcleo de un átomo.

Por qué es importante

La materia constituye casi todo lo que vemos y mucho de lo que no vemos.

Sección 2 La materia más elemental

Lo que aprenderás

- A describir la relación entre los elementos y la tabla periódica.
- A explicar el significado de la masa y número atómicos.
- A identificar qué es lo que constituye un isótopo.
- A contrastar metales, metaloides y no metales.

Vocabulario

element/elemento: materia de un sólo tipo de átomo.

atomic number/número atómico: número de protones en el núcleo de cada átomo de un elemento determinado; es el número en la parte superior de cada casilla en la tabla periódica.

isotopes/isótopos: dos o más átomos del mismo elemento que tienen números diferentes de neutrones en su núcleo.

mass number/número de masa: suma del número de protones y neutrones en el núcleo de un átomo.

atomic mass/masa atómica: masa promedio del átomo de un elemento; su unidad de medida es la unidad de masa atómica (u), que equivale a 1/12 de la masa de un átomo de carbono 12.

metal/metal: elemento maleable, dúctil, buen conductor de electricidad y que generalmente tiene lustre metálico o brillante.

nonmetals/no metales: elementos que por lo general son gases o sólidos quebradizos y malos conductores de electricidad y calor; son las bases de las sustancias químicas de la vida.

metalloid/metaloide: elemento que tiene tanto características de metales como de no metales y que es sólido a temperatura ambiente.

Por qué es importante

Todo en la Tierra está constituido por los elementos que se enumeran en la tabla periódica.

LABORATORIO Elementos y la tabla periódica

La tabla periódica organiza los elementos, pero, ¿a qué se parecen éstos? ¿En qué se usan? En esta actividad examinarás algunos elementos y compartirás tus resultados con tus compañeros de clase.

Preguntas del mundo real

¿Cuáles son algunas de las propiedades y propósitos de los elementos químicos?

Spanish Resources (continued)

Metas

- **Clasificar** los elementos químicos.
- **Organizar** los elementos de acuerdo a los grupos y periodos de la tabla periódico.

Materiales

marcadores de color
fichas grandes
un Índice Merck
una enciclopedia
**otros materiales de consulta*
un tablero de anuncios grande
papel de $8\frac{1}{2} \times 14$ pulgadas
tachuelas
**alfileres de cabeza grande*
**Materiales alternativos*

Medidas de seguridad

PRECAUCIÓN: *Maneja con cuidado los objetos puntiagudos.*

Procedimiento

1. Escoge el número asignado de elementos de la lista proporcionada por tu maestro(a).
2. Diseña una ficha para cada uno de los elementos elegidos. En cada ficha, escribe el número atómico del elemento en el extremo superior izquierdo y su símbolo y nombre en el extremo superior derecho.
3. Busca información sobre cada uno de los elementos y escribe varias frases en la ficha sobre su aspecto, sus otras propiedades y sus usos.
4. Clasifica, basándote en sus propiedades, cada uno de los elementos como metal, metaloide o no metal.
5. Escribe la clasificación adecuada en cada una de las fichas usando los marcadores de color escogidos por tu maestro(a).
6. Trabaja con tus compañeros en la confección de una gran tabla periódica. Usa tachuelas para fijar tus fichas al diario mural en sus posiciones correctas en la tabla periódica.
7. Dibuja tu propia tabla periódica. En tu tabla, coloca los símbolos de los elementos y sus números atómicos en la ubicación correcta.

Concluye y aplica

1. Interpreta los datos de la clase y clasifica los elementos en las categorías metal, metaloide y no metal. En tu tabla periódica, realza cada categoría con un color distinto.
2. Predice las propiedades de un elemento aún no descubierto situado directamente debajo del francio en la tabla periódica.

SECCIÓN 3 Compuestos y mezclas

Lo que aprenderás

- A identificar las características de un compuesto.
- A comparar y contrastar tipos distintos de mezclas.

Vocabulario

substance/sustancia: materia que tiene la misma composición y propiedades a lo largo de toda su extensión.

compound/compuesto: sustancia formada por la combinación de elementos y cuyas propiedades son diferentes a las de los elementos que la forman.

mixture/mezcla: una combinación de compuestos y elementos que no ha formado una nueva sustancia y cuyas proporciones pueden variarse al cambiar la identidad de la mezcla.

Por qué es importante

El alimento que comes, los materiales que usas y toda la materia puede clasificarse en estos términos.

LABORATORIO Mezcla misteriosa

Vas a encontrar muchos compuestos que tienen el mismo aspecto. Por ejemplo, el depósito de un laboratorio está lleno de polvos blancos. Es importante saber qué es qué. En una cocina, la maicena, el bicarbonato de soda y la azúcar flor son compuestos que se parecen. Para evitar confusiones, puedes aprender a identificarlos. Compuestos distintos pueden identificarse por medio de pruebas químicas. Por ejemplo, algunos compuestos reaccionan con ciertos

líquidos, produciendo gases. Otras combinaciones producen colores característicos. Algunos compuestos tienen un elevado punto de fusión; otros tienen un bajo punto de fusión.

Preguntas del mundo real

¿Cómo se pueden identificar experimentalmente los compuestos de una mezcla desconocida?

Metas

- Realizar pruebas para determinar la presencia de ciertos compuestos.
- Decidir cuáles de estos compuestos están presentes en una mezcla desconocida.

Materiales

tubos de ensayo (4)
maicena
azúcar
bicarbonato de soda
mezcla misteriosa
cucharitas (3)
goteros (2)
solución de yodo
vinagre blanco
hornilla
vaso de 250 ml
agua (125 ml)
pinzas para sostener tubos de ensayo
un molde pequeño para pasteles
cerillas

Medidas de seguridad

PRECAUCIÓN: *Maneja cuidadosamente los objetos calientes. Las sustancias pueden manchar o quemar la ropa. Al calentarlo, asegúrate de no apuntar el tubo hacia tu cara o hacia tus compañeros.*

Usa métodos científicos

Procedimiento

1. Copia la tabla de datos en tu diario de ciencias. Anota los resultados para cada uno de los pasos siguientes.
2. Deposita una cucharadita de maicena en el molde para pasteles. Haz lo mismo con el azúcar y el bicarbonato de soda haciendo pilas separadas. Añade una gota de vinagre a cada uno. Lava y seca el molde una vez que hayas anotado tus observaciones.
3. Nuevamente, deposita una cucharadita de maicena, azúcar y bicarbonato de soda en el molde para pasteles. Añade una gota de solución de yodo a cada uno. Lava y seca el molde luego de registrar tus observaciones.
4. Deposita una cucharadita de cada compuesto en tubos de ensayo separados. Sostén el tubo de ensayos con un guante para horno y con las pinzas. Calienta suavemente el tubo de ensayo en el vaso con agua hirviendo sobre la hornilla.
5. Repite los pasos del 2 al 4 para determinar la presencia de cada compuesto en la mezcla misteriosa.

Identifica la presencia de compuestos

Sustancia a probar	Burbujea con el vinagre	Se torna azul con el yodo	Se derrite al calentarse
maicena			
azúcar			
bicarbonato de soda			
mezcla misteriosa			

Analiza tus datos

Identifica con tu tabla de datos que compuesto(s) tienes.

Concluye y aplica

1. **Describe** cómo decidiste qué sustancias había en tu mezcla.
2. **Explica** cómo podrías determinar si la sustancia de mezcla misteriosa no contiene ninguno de los tres compuestos.
3. **Saca una conclusión** ¿A qué conclusión llegarías si realizases una prueba con el bicarbonato de soda de la cocina y descubrieras que burbujea con el vinagre, se torna azul con el yodo y no se derrite cuando se calienta?

Guía de estudio

Repasa las ideas principales

Refiérete a las figuras en tu libro de texto.

Sección 1 Estructura de la materia

1. La materia es cualquier cosa que tiene masa y ocupa espacio.
2. La materia de átomos está hecha.
3. Se han construido muchos modelos del átomo a medida que los científicos tratan de descubrir y definir la estructura interna del átomo. El modelo actual posee un núcleo central con protones y neutrones, así como una nube electrónica que lo rodea y que contiene los electrones.

Sección 2 La materia más elemental

1. Los elementos son los bloques constitutivos de la materia.
2. El número atómico de un elemento te indica cuántos protones contienen sus átomos, mientras que su masa atómica te indica la masa de sus átomos.
3. Los isótopos son dos o más átomos del mismo elemento que tienen un número distinto de neutrones.

Sección 3 Compuestos y mezclas

1. Los compuestos son sustancias que se forman por la combinación de elementos. Los compuestos contienen proporciones específicas de los elementos que los integran.
2. Las mezclas son combinaciones de compuestos y elementos que no forman sustancias nuevas. Sus proporciones pueden cambiar.

Hands-On Activities

MiniLAB (page 3)

1. Answers will vary depending on items in the box.
2. Scientists perform experiments on matter to make models of the atom, but they cannot actually see inside an atom to verify that their models are correct.

MiniLAB: Try at Home (page 4)

Data and Observations

1. white, colorless, golden
2. white grains, looks like water, thick liquid
3. solid, liquid, liquid
4. gritty, thin, thick
5. dissolves, dissolves, floats

Analysis

1. rubbing alcohol—colorless liquid, strong chemical smell, dissolves in water; salad oil—golden liquid, more viscous than rubbing alcohol, little or no odor, floats on water; sugar—white granular solid, little or no odor, dissolves easily in water.
2. The number of atoms of each type of element and their arrangement account for the different properties.

Lab (page5)

Lab Preview

1. Be careful using sharp objects that could puncture skin. Remember that sharp objects, even small ones, can be dangerous.
2. Merck, Index, encyclopedia, Internet

Conclude and Apply

1. The table students make will look like the periodic table, but only certain elements will be present.
2. This element should be shiny in the solid state, have such metallic characteristics as high electrical and thermal conductivities, and be reactive with nonmetals to form compounds.

Lab (page 7)

Lab Preview

1. Eyes should be protected from fumes and spattering that might occur when heating objects and adding substances.
2. Add a drop of vinegar to each. Add a drop of iodine to each. Heat each sample in a test tube.

Data and Observations

1. no; yes; no
2. no; no; yes
3. yes; no; no
4. Answers will vary with the unknown that is analyzed.

Analyze Your Data

1. Answers will vary.

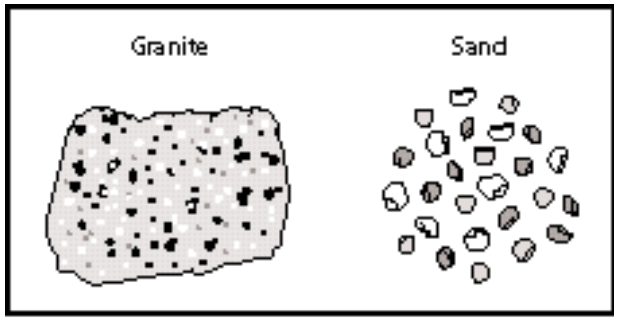
Conclude and Apply

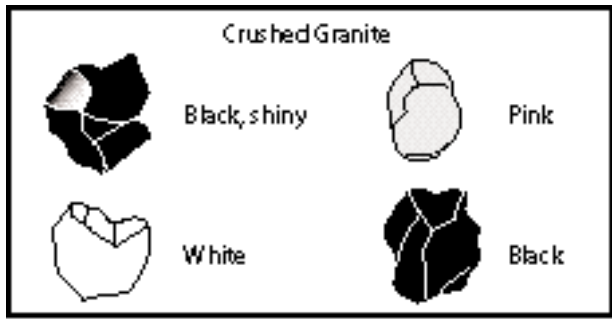
1. Answers will vary depending on the two compounds used for the mystery mixture. In describing their conclusions, students should include the data they gathered.
2. If all three compounds were absent from the mystery mixture, the mixture would not turn blue in the presence of iodine, it would not melt when heated, and it would not fizz with vinegar.
3. It contained baking soda and cornstarch.

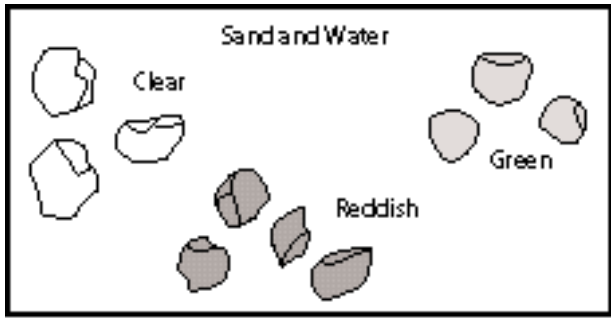
Laboratory Activity 1 (page 9)

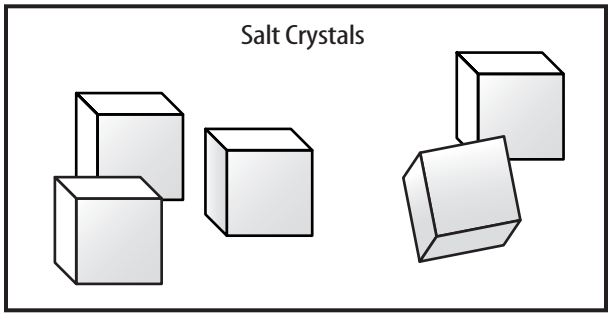
Lab Note: Colors in minerals depend largely on impurities. Organic matter gives a black color, iron shows up as red or yellow, and manganese gives a purple color. A good reference book for minerals might be useful.

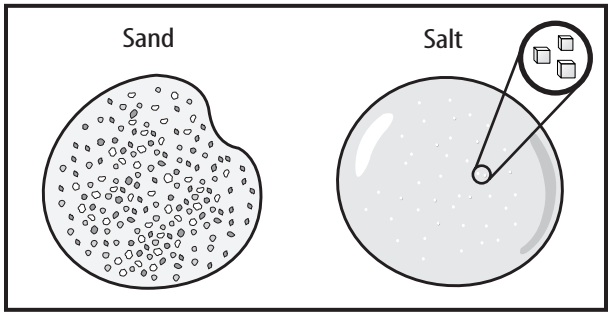
Data and Observations











Questions and Conclusions

1. Yes; Most sands contain fragments of quartz, which are present in granite.
2. Both salt and sand contain crystals. Salt will dissolve in water; sand will not.
3. Mixture; Salt can be removed by evaporating the water. Salt and water are both compounds, but salt water is not composed of elements in a definite ratio.
4. Mixture; Granite is composed of particles that can be recognized. The granite can be separated into simpler substances by mechanical means.
5. Evaporation or cooling of solutions; magnetism; sorting by size using sieves; filtering of solutions; settling of solutions.

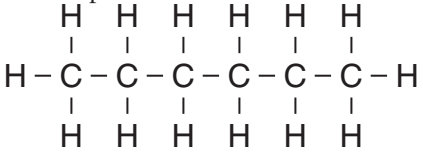
Lab Note: You may want to introduce students to distillation as a means of separating mixtures.

Laboratory Activity 2 (page 11)

Data and Observations

1. 2 hydrogen, 0 carbon, 1 oxygen, 3 total
2. 0 hydrogen, 1 carbon, 2 oxygen, 3 total
3. 4 hydrogen, 1 carbon, 0 oxygen, 5 total

Questions and Conclusions

1. 12 hydrogen, 6 carbon, 6 oxygen, 24 total
2. Ag and Co are elements; the other formulas include more than one type of element, so they are compounds.
3. 

14—two on each of the four carbon atoms that are not on the ends of the chain and three on each of the end carbon atoms.

4. Even though there are two atoms present, only one type of atom is present, so nitrogen is an element.

Meeting Individual Needs

Directed Reading for Content Mastery (page 15)

Overview (page 15)

1. elements
2. specific ratios
3. mixtures
4. atoms
5. one of a kind atom
6. elements
7. changing ratios
8. specific ratios
9. 3
10. 2
11. 4
12. 1

Section 1 (page 16)

1. proton
2. electron
3. nucleus
4. neutron
5. proton
6. atoms
7. Matter
8. neutron
9. electron
10. conservation
11. sub-atomic
12. neutral
13. nucleus

Sections 2 and 3 (page 17)

1. copper, iron; They are both elements.
2. air, milk; They are both mixtures.
3. protons, neutrons; They are both particles inside a nucleus.
4. mixture, compound; They are both made up of two or more elements.
5. atomic number
6. atomic mass
7. element
8. isotopes
9. metals
10. solid
11. compound
12. substance

Key Terms (page 18)

1. mass
2. electron
3. element
4. metalloid
5. compound
6. neutron
7. mixture
8. nucleus
9. metals
10. matter
11. proton
12. substance
13. isotopes
14. atomic

Lectura dirigida para Dominio del contenido (pág. 19)

Sinopsis (pág. 19)

1. elementos
2. razones específicas
3. mezclas
4. átomos
5. átomos
6. elementos
7. razones que cambian
8. razones específicas
9. 3
10. 2
11. 4
12. 1

Sección 1 (pág. 20)

1. protón
2. electrón
3. núcleo
4. neutrón
5. protón
6. átomos
7. materia
8. electrón
9. neutrón
10. conservación
11. atómico
12. neutro
13. núcleo

Secciones 2 y 3 (pág. 21)

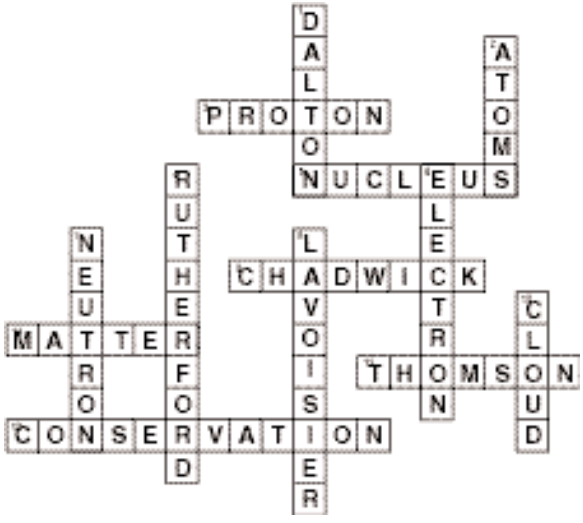
1. cobre, hierro; ambos son elementos.
2. aire, leche; ambas son mezclas.
3. protones, neutrones; ambas son partículas dentro del núcleo.
4. mezcla, compuesto; ambas están compuestas de dos o más elementos.
5. número atómico
6. masa atómica
7. elemento
8. isótopos
9. metales
10. sólidos
11. compuesto
12. sustancia

Términos claves (pág. 22)

1. masa
2. electrón
3. elemento
4. metaloide
5. compuesto
6. neutrón
7. mezcla
8. núcleo
9. metales
10. materia
11. protón
12. sustancia
13. isótopos
14. atómico

Reinforcement (page 23)

Section 1 (page 23)



Section 2 (page 24)

1. solids (except mercury); solids; Many are gases.
2. shiny; some are shiny; dull
3. good conductors; moderate conductors; poor conductors
4. yes; some; no
5. yes; some; no
6. left; middle; right
7. The element's symbol identifies the element.
8. The atomic number tells the number of protons in the nucleus.
9. The atomic mass shows the weighted average mass of an atom of the element.
10. 4.00, which is the sum of the number of protons and neutrons in the atom's nucleus
11. Isotopes are atoms of the same element that contain a different number of neutrons.

Section 3 (page 25)

1. homogenous mixture
2. compound
3. compound
4. homogenous mixture
5. homogenous mixture or heterogeneous mixture
6. homogenous mixture
7. heterogeneous mixture
8. heterogeneous mixture
9. heterogeneous mixture
10. compound
11. A compound's formula tells us which atoms make up the compound and how many atoms of each element are present.
12. A compound is a substance that has more than one type of substance in fixed, specific ratios. A mixture contains more than one substance, which can be either elements or compounds, in no fixed ratio.
13. substance
14. compound
15. mixture
16. homogenous mixture
17. heterogeneous mixture

Enrichment (page 26)

Section 1 (page 26)

1. The results support the oxygen theory. According to the phlogiston theory, the wood would burn (give off phlogiston) in both containers. The fact that the wood does not burn in nitrogen implies that oxygen is needed for burning.
2. The result agrees with the oxygen theory. According to the phlogiston theory, iron rusts by giving off phlogiston, so the resulting substance should have less mass. According to the oxygen theory, iron rusts by combining with oxygen, so the resulting substance should have greater mass.

Section 2 (page 27)

Note: Answers listed in *Characteristics and uses* will vary. Sample answers are given.

1. H; 1; 1.008; nonmetal; colorless gas that bonds with oxygen to form water
2. C; 6; 12.011; nonmetal; found in all living tissue and in diamonds, charcoal, and graphite
3. O; 8; 15.999; nonmetal; colorless, tasteless, odorless gas that is the most abundant element in Earth's crust

4. Si; 14; 28.086; metalloid; second most abundant element in Earth's crust and is used for transistors and computer chips.
5. Fe; 26; 55.847; metal; malleable and ductile and is most-used metal
6. Kr; 36; 83.80; nonmetal; rare gas found in air and reacts only with fluorine
7. Cl; 17; 35.453; nonmetal; yellow, poisonous gas that is used as a bleach and in water purification
8. Pu; 94; 242; metal; radioactive and isotope 239 is used in nuclear weapons and as reactor fuel
9. Pb; 82; 207.19; metal; soft, high density, and a bluish-gray solid
10. Ag; 47; 107.870; metal; extremely ductile and malleable and the best conductor of heat and electricity
11. Responses may include number of protons; probable atomic mass of an atom; whether an element is a metal, nonmetal, or metalloid; whether it is malleable or ductile; whether it conducts heat and electricity.

Section 3 (page 28)

Note: Answers for *Description/uses* are sample data.

1. methyl alcohol or methanol; CH_3OH; 4 hydrogen, 1 oxygen; carbon; colorless, poisonous/fuel, solvent
2. ammonium hydroxide; NH_4OH; 5 hydrogen, 1 oxygen; nitrogen; solution made from ammonia (colorless gas) and water/used for household cleaning.
3. sodium bicarbonate; $NaHCO_3$; 1 hydrogen, 3 oxygen; sodium, carbon; white powder/antacid, makes cakes rise
4. sucrose; $C_{12}H_{22}O_{11}$; 22 hydrogen, 11 oxygen; carbon; white crystals, sweet taste/food flavoring
5. acetic acid; CH_3COOH; 4 hydrogen, 2 oxygen; carbon; sour taste/food preservation and flavoring
6. Answers will vary. Make sure that the formulas for these additional compounds contain both hydrogen and oxygen.
7. Answers will vary. Make sure that the formulas for these additional compounds contain both hydrogen and oxygen.

Note-Taking Worksheet (page 29)

Refer to Teacher Outline, student answers are underlined.

Assessment

Chapter Review (page 33)

Part A. Vocabulary Review

1. b (6/2)
2. r (9/3)
3. h (1/1)
4. e (3/1)
5. p (3/1)
6. q (3/1)
7. n (3/1)
8. k (8/2)
9. f (5/2)
10. c (6/2)
11. j (1/1)
12. g (7/2)
13. i (6/2)
14. a (2/1)
15. d (9/3)
16. m (10/3)
17. o (8/2)
18. l (8/2)

Part B. Concept Review

1. atom (5/2)
2. elements (5/2)
3. atomic number (6,7/2)
4. metals (8/2)
5. between the metals and the nonmetals (5, 8/2)
6. nonmetal (8/2)
7. metalloids (8/2)
8. metals (5/2)
9. compound (9/3)
10. NH_3 (9/3)
11. air (10/3)
12. you can see its individual parts (10/3)
13. nucleus (3/1)
14. neutron (3/1)
15. proton (3/1)
16. electron (3/1)
17. electron cloud (3/1)
18. matter (1, 2/1)
19. not matter (1, 2/1)
20. matter (1, 2/1)
21. matter (1, 2/1)
22. not matter (1, 2/1)
23. not matter (1, 2/1)

Chapter Test (page 35)

I. Testing Concepts

1. d (3/1)
2. b (1/1)
3. c (6/2)
4. c (6/2)
5. d (4/1)
6. b (7/2)
7. a (9/3)
8. a (5/2)
9. d (10/3)
10. a (4/1)
11. b (4/1)
12. d (1, 2/1)
13. c (10/3)
14. d (8/2)
15. false; Matter is anything that has mass and takes up space. (1/1)
16. true (8/2)
17. false; J. J. Thompson's experiments with cathode rays led to the discovery of the electron. (4/1)
18. false; A compound with the formula $C_6H_{12}O_6$ is made up of 24 atoms. (9/3)
19. true (10/3)

II. Understanding Concepts

1. 3 (5, 6/2)
2. 2 (5, 6/2)
3. 11, 23 (5, 6/2)
4. 6, 6 (5, 6/2)
5. 17, 17, 17 (5, 6/2)
6. Students should identify the particles as electrons; reasoning should indicate that negatively charged particles would be attracted toward the positive (+) plate and away from the negative (-) plate. (4/1)
7. Students should identify the particles as neutrons; reasoning should indicate that uncharged particles would not be affected by the charges on the plates. (4/1)
8. Students should identify the particles as alpha particles; reasoning should indicate that positive (+) particles would be attracted toward the negative (-) plate and away from the positive (+) plate. (4/1)
9. Both mixtures will be made up of more than one substance. In a homogenous mixture, the substances will be evenly distributed throughout. In a heterogeneous mixture, the distribution of substances will be uneven. (10/3)
10. Both compounds will be made up of the same elements–carbon and oxygen. One will be made up of two atoms, one carbon and one oxygen. The other will be made up of three atoms, one carbon and two oxygen. (9/3)

III. Applying Concepts

1. Rutherford's experiment showed that much of the atom is empty space, with most of the mass concentrated in a dense central nucleus. (4/1)
2. Atomic number is the number of protons; mass number is the sum of protons and neutrons. Therefore, atomic number is always less than mass number if there is even one neutron in the nucleus. (6/2)

IV. Writing Skills

1. The atomic mass will be greater than 240, since all of the isotopes will have 120 protons and 120 or more neutrons. (6, 7/2)
2. Any given compound is always made of the same elements in the same proportion by mass. So you can write a formula to represent those elements. The proportions of a mixture vary from one mixture to another or from one part of a mixture to another. (9/3)

Transparency Activities

Section Focus Transparency 1 (page 40)

What's the matter in this picture?

Transparency Teaching Tips

- This is an introduction to the structure of matter. Ask the students to infer what the image is. Explain that the picture is of the surface atoms of the compound gallium arsenide (GaAs). The blue spheres are individual gallium atoms, while the red are arsenic atoms.
- Ask the students to define matter. It's anything that has mass and takes up space.

Content Background

- A scanning tunneling microscope positions a tungsten needle barely above the surface of the chosen object. A tiny voltage is applied to the gap. This causes electrons to tunnel just beneath the surface of the object. As the needle is moved over the surface, it registers variations in the current. These changes can be processed, creating a topographical map of the object's surface.
- Binnig and Rohrer created the first STM in 1981. They won the 1986 Nobel prize for creating it.
- The model of the atom has changed appreciably since its inception. The notion of the atom originated in ancient Greece, and modern contributions to the model of the atom came from scientists like John Dalton, Ernest Rutherford, Neils Bohr, and Erwin Schrödinger. Schrödinger's work led to the creation of a new area of physics—quantum mechanics. It was also discovered that protons and neutrons had subparticles. These were named quarks by the physicist Murray Gell-Mann in 1964.
- The study of the nucleus of an atom is called nuclear physics.

Answers to Student Worksheet

1. A traditional microscope is incapable of resolving an image at the atomic level. Regular light and lenses aren't powerful enough.
2. There are two different atoms shown.

Section Focus Transparency 2 (page 41)

Some Call it Quicksilver

Transparency Teaching Tips

- This is an introduction to elements and their identifying characteristics. Ask the students to define the prime characteristic of an element. (It can't be broken down into simple components by ordinary means.)
- Ask the students to list some apparent characteristics of the element shown. Have students identify the element shown. As a hint, indicate the elements that are liquids under standard conditions.
- Explain that quicksilver is also known as mercury. Ask the students why the name quicksilver is appropriate. Explain that mercury is a metal.
- Have the students locate mercury on the periodic table (it's two elements below zinc). Discuss what characteristics the elements in that column might have in common. Explain the organization of the table.

Teacher Guide & Answers (continued)

Content Background

- Mercury can be found in individual droplets or larger fluid masses, usually within the ore cinnabar.
- All the elements in mercury's vertical group on the periodic table are silvery-white metals with low melting and boiling points.
- Mercury is toxic and is the only metal that is a liquid at room temperature.
- Mercury can be used in processing and refining precious metals, and it was shipped by Europeans to the New World for this purpose. Mercury has been recovered from shipwrecks and terrestrial archaeological digs at various sites. The mercury pictured on the transparency was recovered from La Isabella in the Dominican Republic, and it dates to the time of Columbus, roughly 500 years ago.

Answers to Student Worksheet

1. Answers will vary. Possibilities include it is a silvery liquid.
2. The element is mercury. It is used in thermometers and electric switches. Mercury amalgams are also used in batteries and by dentists to fill cavities.

Section Focus Transparency 3 (page 42)

Here Today, Rust Tomorrow

Transparency Teaching Tips

- The concept introduced here is compounds. Point out that a compound is a combination of two or more elements.
- Hold up a glass of water and ask the students why it would be defined as a compound. (It is the combination of hydrogen and oxygen.)
- Looking at the transparency, ask the students to describe the compound-creating process which resulted in rust. (Rust is made of compounds of iron and oxygen.)

Content Background

- When iron is exposed to water and oxygen, corrosion occurs. The iron (Fe) forms a new compound with oxygen. This new compound (Fe_2O_3) continues combining with oxygen and hydrogen to form hydrated iron oxide ($Fe(OH)_3$).
- Iron and steel corrode quicker when salt is added to the equation. The salt increases the rate of electrochemical interaction between the water and the metal. This is why metals exposed to highway salt corrode more quickly.
- The pictured boat is in Australia, exposed to wind, water, and salt.

Answers to Student Worksheet

1. Metal are light weight and strong.
2. Rust is a combination of metal, oxygen, and hydrogen. It is not the same material; it is a new compound.

Teaching Transparency (page 43)

Fire and Ash

Section 1

Transparency Teaching Tips

- Explain that matter does not appear or disappear during changes such as burning or rusting: it only changes form.
- Tell students that the law of conservation of matter applies to physical changes, such as melting and freezing, as well as to chemical changes, such as burning or rusting.

Reteaching Suggestion

- Place a small amount of baking soda in the bottom of a large, self-sealing plastic bag. Carefully set a small plastic pill bottle containing a small amount of vinegar in the bag. Being careful not to spill the vinegar, squeeze the excess air out of the bag and seal it. Weigh the bag and its contents. Allow the vinegar to spill into the baking soda and have students observe the reaction. When the reaction is done, weigh the bag and its contents again. Point out that the total mass has not changed.

Extensions

Activity Have students determine the mass of an ice cube and the paper cup which holds it. After the ice melts, have them again determine the mass. Note that even though the water changed from a solid form to liquid form, the mass stayed the same.

Challenge Ask students to describe how they could show that dissolving sugar in water illustrates the law of conservation of matter.

Answers to Student Worksheet

1. Wood is burning.
2. The oxygen came from the air.
3. Water vapor, carbon dioxide, and ashes
4. The law of conservation of matter states that matter is neither created nor destroyed, it only changes form.
5. The masses are equal.
6. The total mass of the wood and the oxygen it combines with equals the total mass of the water of vapor, carbon dioxide, and ashes.
7. The mass of the iron and oxygen is equal to the mass of the rust they form.

Assessment Transparency (page 45)

Atoms, Elements, and the Periodic Table

Section 3

Answers

1. **C.** This question asks students to retrieve from the table information from the atomic number column. Only *Nitrogen* has an atomic number of 7. Choice C is the answer.

2. **F.** This question requires students to read the table carefully and determine which element has a *mass number* less than 12. Students may confuse mass number with atomic number. the only element with a *mass number* less than 12 is choice F, *Boron.*
3. **D.** Students must match the description given in the question with the correct element in the chart. *Fluorine* has 9 protons.

Test-Taking Tip

Remind students to read charts containing numbers very carefully. When a question asks about a particular column or row in the table, students can highlight that column or row to avoid wandering to the wrong part of the chart accidentally.