Glencoe Science

Chapter Resources

Matter

Includes:

Reproducible Student Pages

ASSESSMENT

✔ Chapter Tests

✔ Chapter Review

HANDS-ON ACTIVITIES

✔ Lab Worksheets for each Student Edition Activity

✔ Laboratory Activities

✔ Foldables–Reading and Study Skills activity sheet

MEETING INDIVIDUAL NEEDS

✔ Directed Reading for Content Mastery

✔ Directed Reading for Content Mastery in Spanish

✔ Reinforcement

✔ Enrichment

✔ Note-taking Worksheets

TRANSPARENCY ACTIVITIES

✔ Section Focus Transparency Activities

✔ Teaching Transparency Activity

✔ Assessment Transparency Activity

Teacher Support and Planning

✔ Content Outline for Teaching

✔ Spanish Resources

✔ Teacher Guide and Answers

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Send all inquiries to:
Glencoe/McGraw-Hill
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Table of Contents

ASSESSMENT ADVANTAGE

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

TRY AT HOME Mini LAB

Searching for Elements

Procedure

1. Obtain a copy of the **periodic table of the elements** and familiarize yourself with the elements.
2. Search your house for items made of various elements.
3. Use a **highlighter** to highlight the elements you discover on your copy of the periodic table.

Analysis

1. Were certain types of elements more common?

_____

_____

2. Infer why you did not find many of the elements.

_____

_____

Mini LAB

Classifying Forms of Matter

Procedure

1. Classify each of these items into the proper column on the chart below: **air, sand, hydrogen, muddy water, sugar, ice, sugar water, water, salt, oxygen, copper**.
2. Make a solution using two or more of the items listed above.

Data and Observations

1. Mixtures	2. Compounds	3. Elements

Analysis

1. How does a solution differ from other types of mixtures?

_____

_____

2. How does an element differ from a compound?

_____

_____

Scales of Measurement

Lab Preview

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

1. What physical properties are you measuring in this lab?

_____

_____

2. Why is the sharp object safety symbol shown?

_____

How would you describe some of the objects in your classroom? Perhaps your desktop is about one-half the size of a door. Measuring physical properties in a laboratory experiment will help you make better observations.

Real-World Question

How are physical properties of objects measured?

Materials

triple beam balance
100-mL graduated cylinder
metersticks (2)
non-mercury thermometers (3)
stick or dowel
rock sample
string
globe
water

Goals

- **Measure** various physical properties in SI.
- **Determine** sources of error.

Safety Precautions

WARNING: *Never "shake down" lab thermometers.*

Procedure

1. Go to every station and determine the measurement requested. Record your observations in the data table on the next page and list sources of error.

a. Use a balance to determine the mass, to the nearest 0.1g, of the rock sample.

b. Use a graduated cylinder to measure the water volume to the nearest 0.5 mL.

c. Use three thermometers to determine the average temperature, to the nearest 0.5°C, at a selected location in the room.

d. Use a meterstick to measure the length, to the nearest 0.1 cm, of the stick or dowel.

e. Use a meterstick and string to measure the circumference of the globe. Be accurate to the nearest 0.1 cm.

LAB (continued)

Data and Observations

Measurement and Error		
Sample at Station	**Value of Measurement**	**Causes of Error**
a.	mass = _____ g	
b.	volume = _____ mL	
c. (location)	average temp. = _____ °C	
d.	length = _____ cm	
e.	circumference = _____ cm	

Conclude and Apply

1. **Compare** your results with those provided by your teacher.

_____

_____

2. **Calculate** your percentage of error in each case. Use this formula.

$$\% \text{ error} = \frac{\text{your value} - \text{teacher's value} \times 100}{\text{teacher's value}}$$

3. Being within five to seven percent of the correct value is considered good. If your error exceeds ten percent, what could you do to improve your results and reduce error?

_____

_____

_____

Communicating Your Data

Compare your conclusions with those of other students in your class. **For more help, refer to the Science Skill Handbook.**

Design Your Own

Determining Density

Lab Preview

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

1. Why does this lab include the sharp object safety symbol?

_____

_____

2. What equation is used to determine the density of an object?

_____

Real-World Question

Which has a greater density—a rock or a piece of wood? Is cork more dense than clay? Density is the ratio of an object's mass to its volume.

Form a Hypothesis

State a hypothesis about what process you can use to measure and compare the densities of several materials.

Possible Materials

pan	piece of quartz
triple-beam balance	piece of clay
100-mL beaker	small wooden block
250-mL graduated cylinder	small metal block
water	small cork
chalk	rock
	ruler

Goals

- **List** some ways that the density of an object can be measured.
- **Design** an experiment that compares the densities of several materials.

Safety Precautions

WARNING: *Be wary of sharp edges on some of the materials and take care not to break the beaker or graduated cylinder. Wash hands thoroughly with soap and water when finished.*

Test Your Hypothesis

Make a Plan

1. As a group, agree upon and write the hypothesis statement.
2. As a group, list the steps that you need to take to test your hypothesis. Be specific, describing exactly what you will do at each step. List your materials.
3. Working as a group, use the equation: density = mass/volume. Devise a method of determining the mass and volume of each material to be tested.
4. **Design** a data table on a separate sheet of paper so that it is ready to use as your group collects data.
5. Read over your entire experiment to make sure that all steps are in a logical order.
6. Should you run the process more than once for any of the materials?
7. **Identify** any constants, variables, and controls of the experiment.

Follow Your Plan

1. Make sure your teacher approves your plan before you start.
2. Carry out the experiment as planned.
3. While the experiment is going on, write any observations that you make and complete the data table you made.

LAB (continued)

Analyze Your Data

1. **Observe** Do you observe anything about the way objects with greater density feel compared with objects of lower density?

2. **Predict** Which of those objects you measured directly would float in water? Which would sink?

3. **Predict** how your volume measurements might be affected by using a tool to push a floating object under water. Explain how this error might increase or decrease the density you obtained.

Conclude and Apply

1. **Form Hypotheses** Based on your results, would you hypothesize that a cork is more dense, the same density, or less dense than water?

2. **Draw Conclusions** Without measuring the density of an object that floats, conclude how you know that it has a density of less than 1.0 g/cm^3.

3. **Predict** Would the density of the clay be affected if you were to break it into smaller pieces?

4. **Explain** why ships float, even though they are made mostly of steel that has a density much greater than that of water.

Communicating Your Data

Write an informational pamphlet on different methods for determining the density of objects. Include equations and a step-by-step procedure.

LAB 1 Laboratory Activity

Mixtures and Compounds

Matter is anything that has mass and occupies space. Matter exists in different forms. Three forms 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. Oxygen (O) is an element, which combined with hydrogen forms water, H_2O, 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

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

Procedure

1. Use the magnifying glass to observe the sand and granite. Sketch the shapes of the different minerals found in the granite 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 it 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.
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

Sketch C

Laboratory Activity 1 (continued)

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 saltwater and sand and water similar? How are they different?

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

4. Is granite a compound or mixture? Explain.

5. Name some mechanical processes used to separate mixtures.

Strategy Check

_____ Can you separate components of a mixture?

_____ Can you compare the characteristics of a compound and a mixture?

LAB 2 Laboratory Activity

Density and Buoyancy

Density is the mass per unit of volume. Buoyancy involves mass and volume. The buoyant force is the upward push exerted on an object by a liquid. When the mass of the displaced liquid is equal to the mass of the object, the object floats.

Strategy

You will determine the densities of freshwater, salt water, and an egg.
You will deduce the relationship between density and buoyancy.

Materials

balance
beakers (250-mL and 2000-mL, heat proof)
egg
graduated cylinder (50-mL)
heat source
measuring tray
pan
salt
spoon
stirring rod
water

Procedure

1. Using the balance, measure out 25 grams of salt.
2. Heat 1 liter of water in the pan. Dissolve the salt in the water.
3. Pour the salt water into the 2000-mL beaker and let it cool to room temperature.
4. Determine the mass of 10 mL of the salt water. Record it in the table. Pour the salt water back into the beaker.
5. Determine the mass of 10 mL of freshwater at room temperature. Record it in the table.
6. Determine the mass of the egg. Record it in the table.
7. Determine the volume of the egg. Record it in the table.
8. Carefully pour 250 mL of freshwater on top of the cool salt water. Pour the water down the side of the beaker using the stirring rod. *Do not mix.*
9. Slip the egg into the beaker using the spoon. Observe and record its position.
10. Stir the solution, and observe what happens to the egg.

Data and Observations

	Mass (g)	Volume (cm^3)	Density (g/cm^3)
1. salt water		10	
2. freshwater		10	
3. egg			

Laboratory Activity 2 (continued)

Questions and Conclusions

1. Calculate the density of the freshwater, salt water, and egg. Show your work.

Record the densities in the table under Data and Observations.

2. What happened to the egg when you added it to the separated freshwater and salt water?

3. Compare the density of the egg to that of the freshwater and the salt water.

4. What happened to the egg after you mixed the salt water and freshwater together?

5. State the relationship between density and buoyancy.

6. Explain, in terms of density, why a person is able to float in water.

7. Is it easier for a person to float in seawater or in freshwater? Why?

8. Explain how a balloon inflated with helium floats in the air.

Strategy Check

_____ Can you determine densities experimentally?

_____ Can you state the relationship between density and buoyancy?

Matter

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

matter

atom

element

proton

neutron

electron

atomic number

mass number

isotope

compound

molecule

ion

heterogeneous mixture

mixture

homogeneous mixture

solution

density

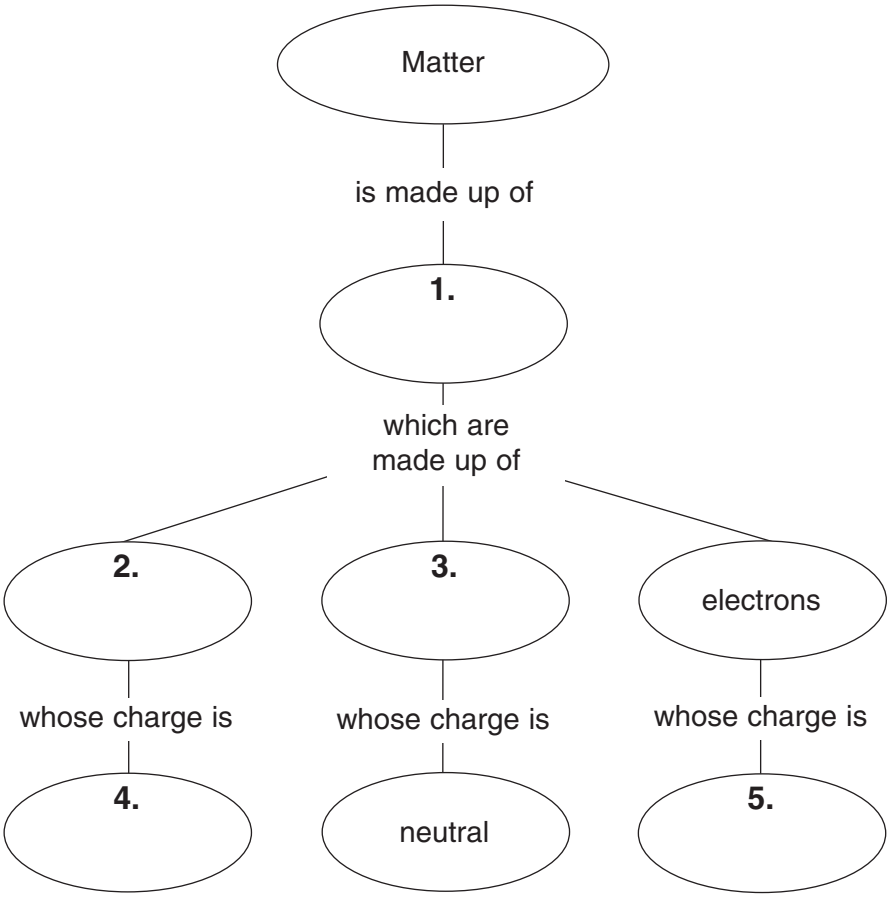
Meeting Individual Needs

Directed Reading for Content Mastery

Overview Matter

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

atoms **positive** **negative**
protons **neutrons**



Directions: *Complete the following sentences using the correct terms.*

6. Atoms combine to form _____.

7. An object that is more dense than water will _____.

8. _____ is the only substance that can be naturally found on Earth as a solid, liquid, and gas.

Directed Reading for Content Mastery

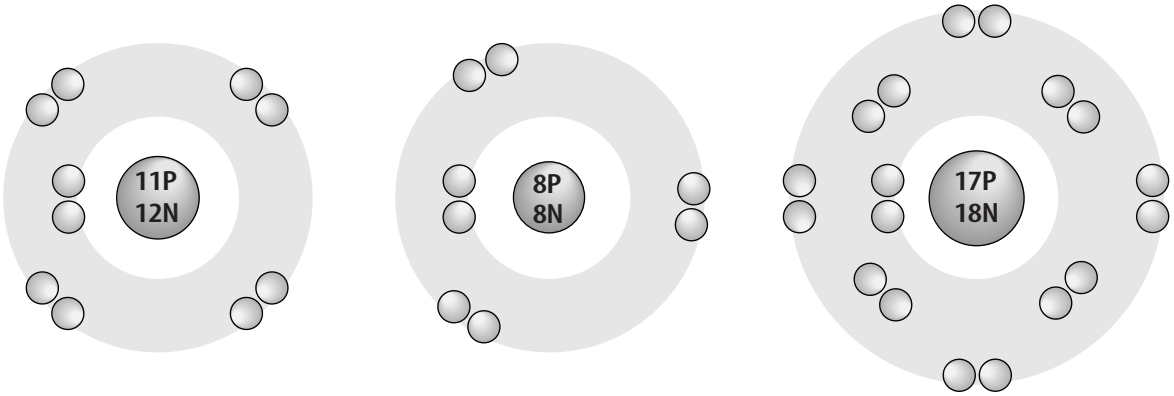
Section 1 ▪ Atoms
Section 2 ▪ Combinations of Atoms

Directions: *Circle the term in parentheses that makes each statement correct.*

1. The building blocks of matter are (atoms, compounds).
2. Isotopes are atoms of the same element that have different numbers of (neutrons, protons).
3. Electrically charged atoms are (electrons, ions).
4. An example of a (compound, mixture) is water.
5. The (chemical, physical) properties of an element determine how the element will change when it reacts with another element.
6. An example of matter is (air, heat).
7. A difference in the (mass, atomic) number of atoms means the atoms are of different elements.
8. Combined atoms form a (molecule, proton).
9. Table salt is an example of a (compound, mixture).
10. Isotopes enable scientists to determine the (size, age) of some rocks and fossils.

Directions: *On the lines beneath each atom, indicate which two are ions and which one is not. Then indicate which ion is negative with a minus sign (–) and which is positive with a plus sign (+).*

11 protons	8 protons	17 protons
12 neutrons	8 neutrons	18 neutrons
10 electrons	8 electrons	18 electrons



11. _____ 12. _____ 13. _____

Directed Reading for Content Mastery

Section 3 ▪ Properties of Matter

Directions: *Change the italicized word in each statement to make the statement correct.*

_____ **1.** Orange juice and milk are both *solids.*

_____ **2.** Matter with atoms in a fixed position in relation to one another is in the *liquid* state.

_____ **3.** The way a substance reacts with another substance is a *physical* property.

_____ **4.** An object's density is equal to its mass divided by its *length.*

_____ **5.** The *size* of an object determines whether it will float in water.

_____ **6.** Density and state of matter are *chemical* properties.

_____ **7.** *Liquids* fill their entire container regardless of the container's size or shape.

_____ **8.** *Hydrogen* is the only substance that occurs naturally on Earth as a gas, a liquid, and a solid.

_____ **9.** The *physical* properties of a liquid do not change when it becomes a gas.

_____ **10.** Molecules in the *gas* state are strongly attracted to each other, but can change positions.

_____ **11.** A lightning bolt is an example of matter in a *gaseous* state.

_____ **12.** When thermal energy is added to ice, the rate of movement of its molecules *decreases.*

_____ **13.** Ice floats in liquid water because it is less *heavy* than water.

_____ **14.** On Earth matter occurs in *five* physical states.

Directed Reading for Content Mastery

Key Terms
Matter

Directions: *Write the correct terms next to their definitions on the lines provided. Then circle the terms in the word search puzzle.*

P	R	O	A	E	L	E	M	E	N	T	O	D	F	O	S	Z
L	U	A	T	H	P	A	O	B	I	R	Z	G	E	Y	O	I
A	B	M	O	J	R	V	L	C	L	E	A	R	L	U	L	D
C	X	N	M	O	L	D	E	N	S	I	T	Y	E	X	U	O
Y	F	L	I	O	N	W	C	O	D	Z	H	P	C	K	T	B
T	H	I	C	J	N	E	U	T	R	O	N	S	T	V	I	F
B	V	N	G	L	Q	U	L	Q	G	C	J	S	R	H	O	A
D	I	S	O	T	O	P	E	S	C	O	M	P	O	U	N	D
O	Z	U	H	O	S	X	A	M	U	L	C	T	N	M	W	C
S	W	A	L	K	T	I	Y	D	P	A	S	N	D	F	E	R

_____ **1.** atomic particles with a negative charge

_____ **2.** substances made up of only one kind of atom

_____ **3.** substance that has different properties from the elements in it

_____ **4.** atoms of the same element that have different numbers of neutrons

_____ **5.** a mixture whose parts are the same throughout

_____ **6.** a physical property of matter

_____ **7.** type of number that equals the amount of protons inside a nucleus and electrons outside a nucleus

_____ **8.** particles that have no electric charge

_____ **9.** an atom that has gained or lost electrons causing an electric charge

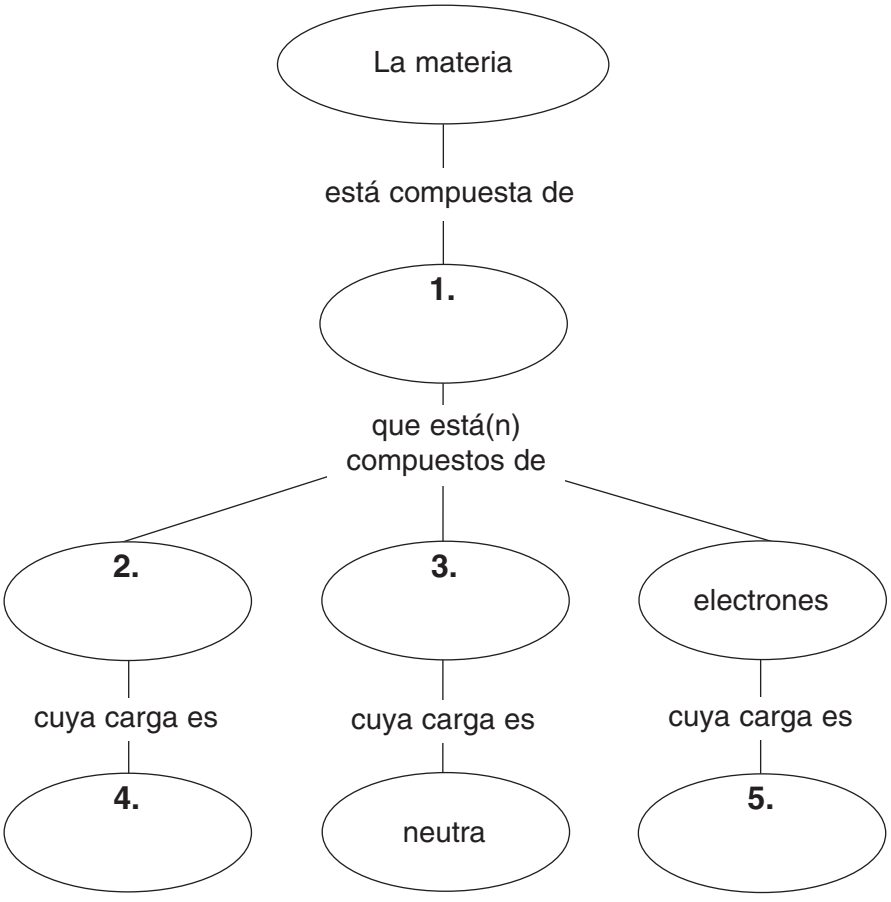
Lectura dirigida para Dominio del contenidio

Sinopsis La materia

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

átomos **positiva** **negativa**

protones **neutrones**



Instrucciones: *Completa las oraciones usando los términos correctos.*

6. Los átomos se combinan para formar _____.

7. Un objeto que es más denso que el agua _____.

8. El(La) _____ es la única sustancia que se puede encontrar naturalmente sobre la Tierra como sólido, líquido y gas.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

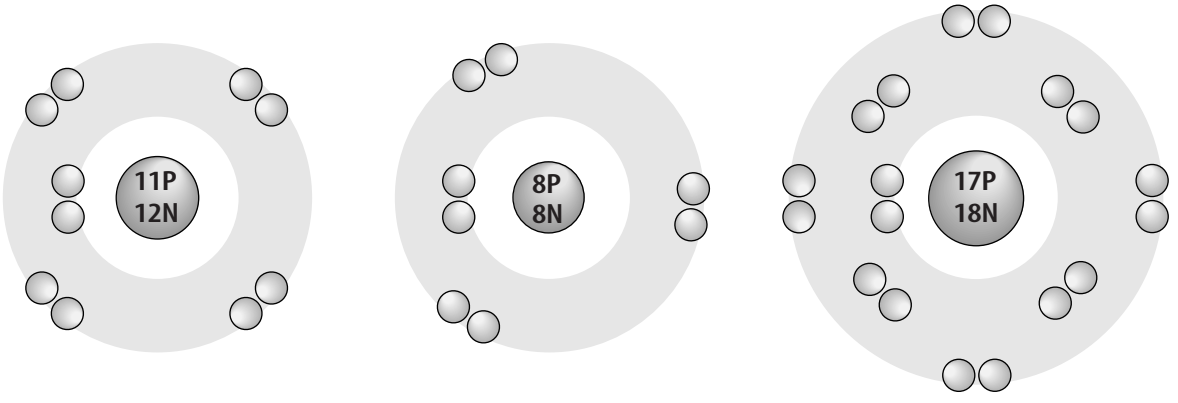
Sección 1 ▪ Los átomos
Sección 2 ▪ Combinaciones de átomos

Instrucciones: *Encierra en un círculo en término en paréntesis que hace la afirmación verdadera.*

1. Los componentes básicos de la materia son (átomos/compuestos).
2. Los isótopos son átomos del mismo elemento que tienen números diferentes de (neutrones/protones).
3. Los átomos con carga eléctrica son (electrones/iones).
4. El agua es un ejemplo de un(a) (compuesto/mezcla).
5. Las propiedades (químicas /físicas) de un elemento determinan la forma en que el elemento cambiará cuando reacciona con otro elemento.
6. El (aire/calor) es un ejemplo de materia.
7. Una diferencia en el número (de masa/atómico) de los átomos indica que los átomos son de elementos diferentes.
8. Los átomos se combinan y forman (moléculas/compuestos).
9. La sal de mesa es un ejemplo de un(a) (compuesto/mezcla).
10. Los isótopos permiten a los científicos determinar el(la) (tamaño/edad) de algunas rocas y fósiles.

Instrucciones: *Indica en las líneas bajo cada átomo cuáles dos son iones y cuál no lo es. Indica luego si el ion es negativo con un* **signo de menos** *o positivo con un* **signo de más**.

11 protones	8 protones	17 protones
12 neutrones	8 neutrones	18 neutrones
10 electrones	8 electrones	18 electrones



11. _____ 12. _____ 13. _____

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

Sección 3 ▪ Propiedades de la materia

Instrucciones: *Cambia la palabra en bastardilla para que cada afirmación sea correcta.*

_____ **1.** El jugo de naranja y la leche son *sólidos*.

_____ **2.** La materia que tiene los átomos en posición fija unos con respecto a otros está en estado *líquido*.

_____ **3.** Las estrellas están compuestas por materia en estado *gaseoso*.

_____ **4.** La densidad de un objeto es igual a su masa dividida por su *longitud*.

_____ **5.** El *tamaño* de un objeto determina si flotará en el agua.

_____ **6.** La densidad y el estado de la materia son propiedades *químicas*.

_____ **7.** Los *líquidos* llenan todo el recipiente sin importar la forma o tamaño del recipiente.

_____ **8.** El *hidrógeno* es la única sustancia que en la Tierra ocurre en forma natural como gas, líquido y sólido.

_____ **9.** Las propiedades *físicas* de un líquido no cambian cuando se convierte en un gas.

_____ **10.** En el estado *gaseoso*, las moléculas tienen atracción fuerte entre sí, pero sí pueden cambiar de posición.

_____ **11.** Un relámpago es un ejemplo de materia en estado *gaseoso*.

_____ **12.** Cuando se agrega al hielo energía térmica, la tasa de movimiento de sus moléculas *disminuye*.

_____ **13.** El hielo flota sobre el agua líquida porque es *menos pesado* que el agua.

_____ **14.** En la Tierra, la materia ocurre en *cinco* estados físicos.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

Términos claves
La materia

Instrucciones: *Escribe los términos correctos al lado de sus definiciones. Luego encierra en un círculo cada término en la sopa de letras.*

U	E	L	E	M	E	N	T	O	T	W	S	I	S	I
E	L	N	I	M	A	D	M	I	N	I	O	M	V	E
D	E	N	S	I	D	A	D	I	N	A	L	I	M	Q
U	C	I	S	O	N	O	S	S	T	N	U	R	U	D
E	T	X	E	N	R	C	M	O	L	E	C	U	L	A
I	R	T	A	T	O	N	I	T	L	U	I	L	A	M
C	O	M	P	U	E	S	T	O	C	T	O	R	P	E
R	N	S	C	U	S	I	B	P	O	R	N	T	I	S
N	I	A	T	O	M	I	C	O	S	O	L	U	T	A
L	Q	I	P	E	X	E	A	C	O	N	M	M	D	O

_____ **1.** Partícula atómica con carga negativa

_____ **2.** Sustancias que están formadas por solamente un tipo de átomo

_____ **3.** Sustancia cuyas propiedades son diferentes de las de los elementos que la forman

_____ **4.** Átomos del mismo elemento que tienen un número diferente de neutrones

_____ **5.** Mezcla cuyas partes están igualmente distribuidas

_____ **6.** Propiedad física de la materia

_____ **7.** Tipo de número que es igual a la cantidad de protones en el núcleo y la cantidad de electrones fuera del núcleo

_____ **8.** Partícula que no tienen carga eléctrica

_____ **9.** Átomo que ha ganado o perdido electrones, por lo que tiene carga eléctrica

Satisface las necesidades individuales

SECTION 1 Reinforcement

Atoms

Each element is made of just one kind of atom. The number of protons in the atoms of an element is unique to that element. The number of protons in an atom is called the **atomic number.** The mass of an atom depends on the number of its protons and neutrons. The **mass number** is the sum of the protons and neutrons in the nucleus. The mass of an electron is so small that it is usually omitted in mass determinations.

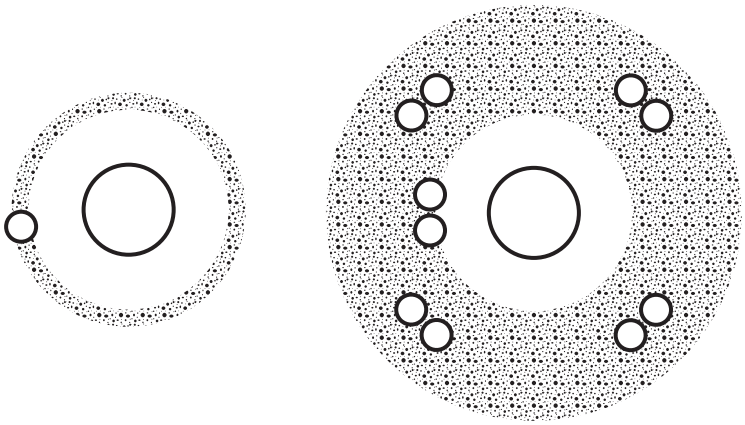
Directions: *Use the definitions of atomic number and mass number to help you fill in the blanks in the table below.*

Element	Symbol	Number of protons	Number of neutrons	Number of electrons	Atomic number	Mass number
1. Oxygen	O	8		8		16
2. Silicon	Si	14	14			28
3. Aluminum	Al		14	13	13	
4. Iron	Fe				26	56
5. Calcium	Ca	20		20		
6. Sodium	Na				11	23
7. Copper	Cu	29	35	29		
8. Magnesium	Mg				12	24
9. Gold	Au	79				197
10. Silver	Ag		61	47		

Directions: *Add electrons to complete the atomic models of helium and sodium.*

11. Helium
Atomic number 2
Mass number 4

12. **Sodium**
Atomic number 11
Mass number 23



Meeting Individual Needs

SECTION 2 Reinforcement

Combinations of Atoms

Directions: *Define the following terms.*

1. compound _____

_____

2. mixture _____

_____

Directions: *Identify each of the following as a* **mixture** *or a* **compound**.

3. NaCl _____
4. solution _____
5. water _____
6. NaCl + H_2O _____
7. salt _____
8. H_2O _____
9. air _____
10. salt water _____
11. vinegar and oil _____

Directions: *Complete the following sentences using the correct terms.*

12. Sweetened tea is a type of mixture called a(n) _____.
13. A water molecule is made up of two atoms of _____ and one atom of _____
14. The substances in a(n) _____ can be physically separated from one another.
15. Table salt is made up of one ion of _____ and one ion of _____.
16. A(n) _____ cannot be separated into its individual elements by physical means.

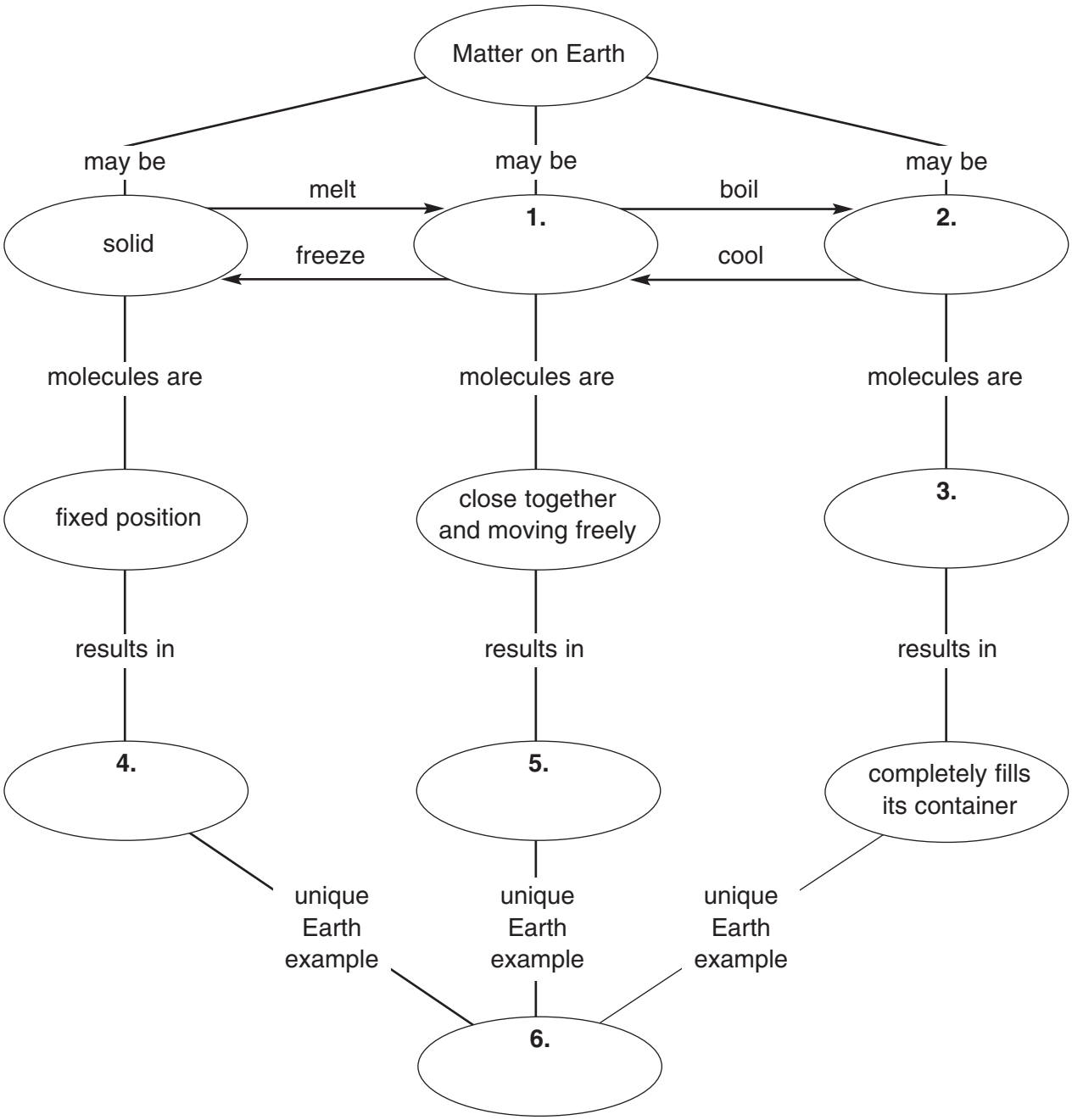
SECTION 3 Reinforcement

Properties of Matter

Directions: *Complete the concept map using the terms in the list below. Pay particular attention to the linking words or statements between boxes. The completed diagram will help you organize the relationships between physical states of matter on Earth.*

liquid **definite size and shape** **gas**

freely moving and independent **takes the shape of its container** **water**



Meeting Individual Needs

SECTION 1 Enrichment

Carbon-14 Dating

How can archeologists determine the age of fossils? One way is through dating radioactive isotopes. One of the isotopes archeologists use to determine the age of artifacts is carbon-14. The most common isotope of carbon on Earth is carbon-12, which has six protons and six neutrons. Carbon-14, which has six protons and eight neutrons, is much rarer. It makes up only about 1 percent of the carbon in Earth's atmosphere.

Radioactive Decay

Carbon-14 is radioactive. A radioactive isotope is unstable. Over time, it breaks down into a more stable isotope by releasing energy or particles. The energy and particles released by a radioactive isotope are called radiation. Radioactive carbon-14 breaks down into nitrogen-14, a stable isotope of nitrogen.

All organisms take in carbon-14 throughout their lives. Plants use carbon dioxide gas from the air as they make food from sunlight. Some of this carbon dioxide contains carbon-14. This carbon becomes stored in the plant's tissues. Animals take in carbon-14 when they eat plants. Once an organism dies, it stops taking in carbon. The carbon-14 left in the organism's tissues slowly breaks down into nitrogen-14. The longer an organism has been dead, the less carbon-14 its remains contain.

By measuring the amount of carbon-14 in an organism's remains, archeologists can determine how long ago the organism lived. Carbon-14 breaks down at a regular rate. Scientists have found that it takes 5,730 years for one-half of the carbon-14 in an organism to decay. This period of time is called the half-life of carbon-14. After each half-life, the amount of carbon-14 remaining will decrease by one-half. Carbon-14 can only be used to date objects less than 50,000 years old. Other techniques are used to date older finds.

Change in Amount of Carbon-14 over Time

Time since organism died (years)	Number of half-lives	Fraction of carbon-14 that remains
0	0	1
5,730	1	1/2
11,460	2	1/4
	3	

1. Complete the last row of the table above by filling in the blanks.
2. An archeologist finds that about 30% of the carbon-14 remains in a bone from a wooly mammoth. Approximately how old is the bone?

_____

3. Archeologists have found that carbon-14 dating cannot be used for remains more than 50,000 years old. Why do you think this is true?

_____

_____

4. Which one of the following artifacts could *not* be dated by using carbon-14: a wooden bowl, a stone arrowhead, or a mummy? Explain.

_____

_____

SECTION 2 Enrichment

Paper Chromatography

One method scientists use to separate substances in a mixture is called paper chromatography. This method involves filter paper and a liquid such as water. Some of the substances in the mixture will "stick" to the paper more strongly than to the liquid. This property allows scientists to separate the substances.

Materials

paper cup	coffee filter	waxed paper	toothpicks
water	scissors	food coloring (blue and yellow)	

Procedure

1. Cover the bottom of the paper cup with 1 to 2 mm of water.
2. Cut a strip from the coffee filter, measuring about 3 cm by 10 cm.
3. On the waxed paper, make a mixture of one drop of blue food coloring and one drop of yellow.
4. Use a toothpick to place a dot of the mixture on the strip. Place the dot about 2 cm from the edge of one of the short sides.
5. Place the strip in the cup. The water will slowly creep up the strip of filter paper. Remove it from the cup when the water gets near the top. Place it on the waxed paper to dry.

Data and Observations

Use colored pencils or crayons to make a sketch of your strip in the space below.

Questions and Conclusions

1. Which part of the mixture was attracted more strongly to the filter paper? How do you know?

_____

_____

2. The ink in black markers usually contains a mix of dyes of different colors. What do you think would happen if you repeated your experiment using the ink in a compound? Explain.

_____

_____

3. Could paper chromatography be used to separate elements in a compound? Explain.

_____

_____

SECTION 3 Enrichment

Freezing Points

Different substances have different freezing points. At its freezing point, a substance becomes a solid. At temperatures above its freezing point, the substance melts into a liquid. Ice forms from water when the temperature reaches 0°C. At temperatures above 0°C, the ice melts and the water becomes a liquid. Paraffin wax is a substance that is solid at room temperature. At what temperature does this wax melt? At what temperature will the melted wax become a solid again?

Directions: *Devise an experiment to help you answer the questions about the temperatures at which paraffin wax will melt and solidify.*

1. Identify the materials you will need and tell why you will need them.

2. Describe the procedures you will follow in your experiment.

Directions: *If possible, perform your experiment. Then answer questions 3 and 4. If you are unable to perform the experiment, use reasoning and information from the chapter to help you answer the questions.*

3. Why is a heat source needed for the experiment?

4. Is the freezing point of the wax higher or lower than the freezing point of water? Explain.

Note-taking Worksheet

Matter

Section 1 Atoms

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

1. Matter is made up of tiny particles called _____.
2. Substances that contain only one type of atom are _____.

B. Three basic particles make up an atom: _____, _____, and _____.

1. Protons and neutrons make up the _____ of an atom.
   - **a. Protons**—particles that have _____ electric charge
   - **b. Neutrons**—particles that have _____ electrical charge
   - **c.** The nucleus has a _____ charge.
2. **Electrons**—_____ charged particles that move around the nucleus
3. **Atomic number**—the number of _____ in an atom's nucleus
   - **a.** All atoms of a specific element have the same _____.
   - **b.** This number also equals the number of _____ in the atom's electron cloud.
4. **Mass number**—the number of _____ and _____ making up an atom's nucleus

C. Isotopes—atoms of the same element that have different numbers of _____

Section 2 Combinations of Atoms

A. When atoms of more than one element combine, they form a _____.

B. _____—describes a change that occurs when one substance reacts with another substance

C. _____—the force that holds atoms in compounds together

1. _____ bonds form by sharing electrons.
2. Atoms that combine if they become positively or negatively charged have _____bonds.
   - **a.** Electrically charged atoms are called _____.
   - **b.** Ions are attracted to each other when they have _____ charges.

Meeting Individual Needs

Note-taking Worksheet (continued)

3. _____ bonds—electrons are free to move from one ion to the other.
   a. Found in _____ such as copper, gold, aluminum, and silver
   b. Give metals the ability to conduct _____
4. _____ bonds—form when the positive end of one molecule is attracted to the negative end of another molecule
   a. Form without the interaction of _____
   b. Responsible for the property of _____—allows water to form raindrops
   c. Hydrogen bonds are easily _____.

D. _____—two or more substances that are not chemically combined

1. _____ mixture—components not mixed evenly; each component retains its own properties.
2. _____ mixture—compounds evenly mixed; can't see each component; also called _____
3. The components of a mixture can be separated by _____ means.
4. The components of a compound must be separated by _____ means.

Section 3 Properties of Matter

A. _____—properties you can observe without changing a substance into a new substance

1. One physical property is **density**, which is an object's mass divided by its _____.
2. The measurement of density is usually given in _____ per cubic centimeter (g/cm^3).
3. An object less dense than water will _____ in water.

B. Four physical states of matter: solid, liquid, gas, and _____

1. Solids—the matter's atoms are in a _____ position relative to each other.
2. _____—atoms are attracted to each other, but can change positions with each other
3. Gases—atoms have almost no _____ force on each other, so atoms move freely and will fill the entire container they are placed in

Note-taking Worksheet (continued)

4. _____—electrons can escape and move outside of the ion's electron cloud.
   a. The _____ common state of matter in the universe
   b. Stars and _____ are composed of matter in the plasma state.

C. _____ can change from one state to another.

1. Changes in state can occur because of increases or decreases in _____ and _____.
   a. Matter is changed from a liquid to a solid at its _____ point.
   b. Matter is changed from a liquid to a gas at its _____ point.
2. When matter changes state, its _____ properties do not change, but _____ properties may change.

Assessment

Chapter Review

Matter

Part A. Vocabulary Review

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

Column I

_____ **1.** matter

_____ **2.** element

_____ **3.** atom

_____ **4.** protons

_____ **5.** neutrons

_____ **6.** electrons

_____ **7.** isotopes

_____ **8.** solution

_____ **9.** compound

_____ **10.** mixture

_____ **11.** chemical properties

_____ **12.** mass number

_____ **13.** ion

_____ **14.** density

_____ **15.** physical properties

_____ **16.** solid

_____ **17.** plasma

_____ **18.** gas

_____ **19.** liquid

_____ **20.** atomic number

Column II

a. atoms of an element with different atomic names but the same atomic number

b. form of matter containing only one type of atom

c. causes of iron changing to rust when it reacts with water

d. the number of protons and neutrons in an atom's nucleus

e. anything that has mass and takes up space

f. particles in an atom's nucleus that do not have an electrical charge

g. a building block of matter

h. other name for homogenous mixture

i. mass divided by volume

j. an electrically charged atom

k. density and state of matter

l. water

m. positively charged particles inside the nucleus of an atom

n. negatively charged particles outside the nucleus of an atom

o. sweetened tea

p. state in which a substance completely fills its container

q. state in which atoms are strongly attracted and do not change position

r. the number of protons in an atom's nucleus

s. the most common state of matter in the universe

t. state in which matter flows as it takes the shape of a container

Chapter Review (continued)

Part B. Concept Review

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

1. How do you measure the density of an object?

_____

_____

_____

2. What are two ways atoms can combine to form compounds?

_____

_____

_____

3. Compare and contrast compounds and mixtures.

_____

_____

_____

_____

4. Carbon-12 has a mass number of 12 and an atomic number of 6. Tell which of the following atoms is an isotope of carbon-12. Explain your answer.

Atom A: 12 protons, 12 neutrons, 12 electrons
Atom B: 6 protons, 8 neutrons, 6 electrons

_____

_____

_____

Directions: *Identify each of the properties as either a chemical property or a physical property. Write* **C** *by chemical properties and* **P** *by physical properties.*

_____ **5.** the sharing of electrons by elements to form compounds

_____ **6.** the density of a substance

_____ **7.** the solid state of water

_____ **8.** the effect of water on iron

_____ **9.** the size of a salt crystal

_____ **10.** the attraction of two ions

Chapter Test

Matter

I. Testing Concepts

Directions: *In the blank at the left, write the letter of the term that best completes the sentence.*

_____ **1.** A(n) _____ is the basic unit of matter.
a. electron **b.** molecule **c.** atom **d.** space

_____ **2.** Properties of matter that do not change a substance into a new substance are _____ properties.
a. chemical **b.** atomic **c.** physical **d.** solid

_____ **3.** _____ are particles without electric charge in the atom's nucleus.
a. Neutrons **b.** Electrons **c.** Ions **d.** Protons

_____ **4.** Electrically charged atoms are called _____.
a. electrons **b.** isotopes **c.** molecules **d.** ions

_____ **5.** Hydrogen-1 and hydrogen-2 are _____ of one another.
a. ions **b.** conductors **c.** isotopes **d.** compounds

_____ **6.** The density of a substance is a _____ of the substance.
a. state of matter **c.** solution
b. physical property **d.** chemical property

_____ **7.** Anything that takes up space and has mass is _____.
a. a compound **b.** an element **c.** matter **d.** plasma

_____ **8.** Tea with sugar is an example of a(n) _____.
a. mixture **b.** gas **c.** compound **d.** element

_____ **9.** A positively charged _____ has more protons than electrons.
a. ion **b.** isotope **c.** neutron **d.** molecule

_____ **10.** Isotopes of carbon have different _____.
a. numbers of electrons **c.** atomic numbers
b. mass numbers **d.** numbers of protons

_____ **11.** _____ are particles located in an atom's nucleus.
a. Electrons and neutrons **c.** Protons and electrons
b. Only electrons **d.** Protons and neutrons

_____ **12.** On Earth, water is naturally found in all of these states except _____.
a. gas **b.** liquid **c.** solid **d.** plasma

_____ **13.** At its boiling point, a liquid becomes a _____.
a. gas **b.** liquid **c.** solid **d.** plasma

_____ **14.** State of matter can be changed by _____ or temperature.
a. weight **b.** density **c.** pressure **d.** observation

_____ **15.** H_2O is a compound formed by sharing _____.
a. neutrons **b.** electrons **c.** ions **d.** protons

Chapter Test (continued)

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

_____ **16.** A substance with greater density than water will sink in water.

_____

_____ **17.** A compound is a group of substances in which each substance retains its own properties.

_____

_____

_____ **18.** One chemical property of a substance is its density.

_____

_____ **19.** A substance that expands to completely fill a container is a liquid.

_____

_____ **20.** A proton is a positively charged particle in an atom's nucleus.

_____

Directions: *If the statement or term identifies a compound, list its number under "Compound." If it identifies a mixture, list its number under "Mixture."*

Compound	Mixture
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

21. H_2O or NaCl

22. It has properties that differ from those of its separate elements.

23. a solution

24. Its components can be separated by physical means.

25. It can be formed by atoms sharing electrons or by negative and positive ions joining.

26. air or salt water

27. It is made up of two or more compounds.

28. Its components keep their own properties.

29. It requires a chemical change to be separated.

30. carbon dioxide

Chapter Test (continued)

II. Understanding Concepts

Skill: Making and Using a Table

Directions: *Complete the table. Then use the table to answer the questions.*

Atom	Number of protons	Number of neutrons	Number of electrons	Atomic number	Mass number
1. a	6		6		12
2. b		0	1	1	
3. c	11		10		23
4. d		8	6	6	
5. e	17		18		35
6. f	12	12	12		
7. g		10	10	9	

8. Which two substances are isotopes of one another? Explain why they are isotopes.

_____

_____

9. Identify the particles that are ions and tell how you know they are ions.

_____

_____

_____

10. Identify the positively charged ion and explain why its charge is positive.

_____

_____

11. Which atom could combine with atom e to form a compound? Explain why they could combine.

_____

_____

12. Can atoms e and g combine to form a compound? Explain.

_____

_____

Skill: Outlining

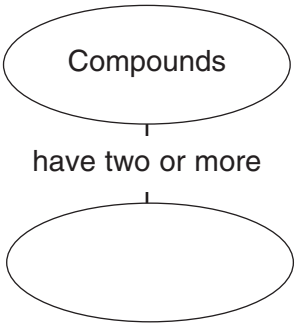
13. In an outline, the subtopics are neutron, proton, and electron. What would the main topic be?

_____

Chapter Test (continued)

Skill: Concept Mapping

14. In a network-tree concept map, what word would complete the diagram?



III. Applying Concepts

1. If you place 100 mL of water in a beaker and boil the water, will you have more or less liquid after the water has boiled for five minutes? Explain your answer.

_____

_____

_____

2. Identify the state of matter of each of the following substances. Explain the relationship of the different atoms or molecules in the substances and tell how each substance would fit into a container.

a. egg whites

_____

_____

_____

b. frozen juice bars

_____

_____

_____

IV. Writing Skills

3. Use your knowledge of the state of matter and the other physical properties of matter to write an explanation for what may have caused the following situation.

Situation: Although it hasn't rained in a week, every morning the grass and car windows are wet.

_____

_____

_____

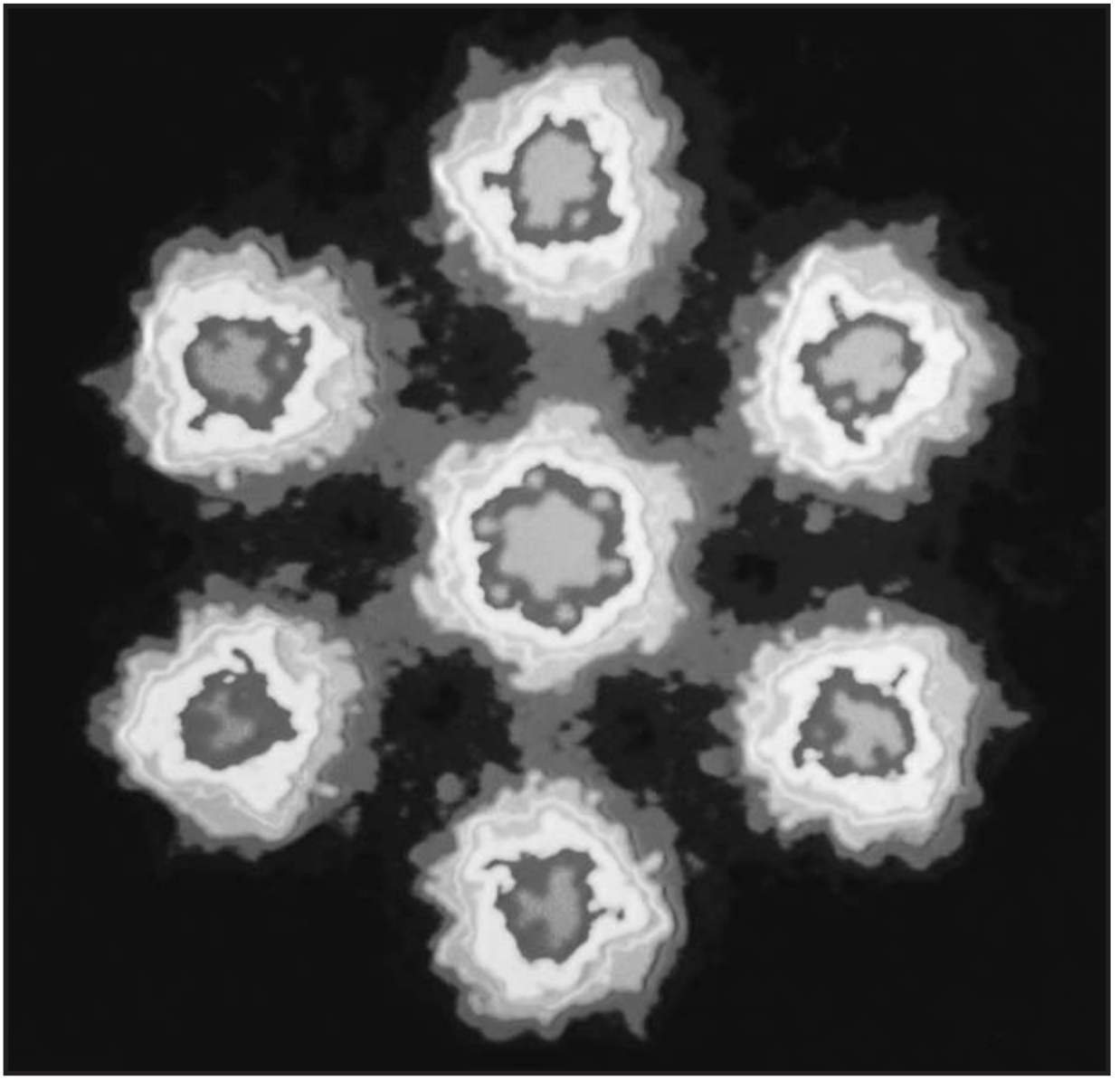
Assessment

Transparency Activities

SECTION 1 Section Focus Transparency Activity

A Closer Look

Do you know what this is? Long before anyone had actually seen these objects, people reasoned that they existed. The development of the electron microscope eventually led to the image you see below.



1. **Describe what you see in this image. What do you think is pictured here?**
2. **Why is the image so difficult to identify?**
3. **Why couldn't a traditional (optical) microscope make this image?**

SECTION 2 Section Focus Transparency Activity

Oxygen-Oxygen

All matter, including everything in this scene, is composed of atoms in different combinations. Oxygen is an atom that is very important to living things. As you look at this scene, try to figure out what oxygen has to do with it all.

1. **Why is oxygen important to everything in the picture?**
2. **How do plants and animals exchange oxygen?**

SECTION 3 Section Focus Transparency Activity

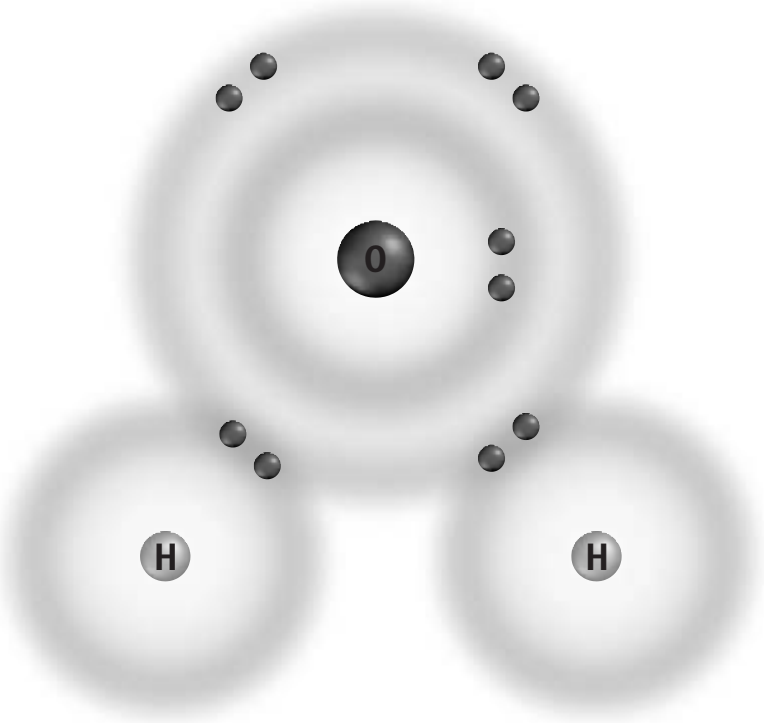
Water Doesn't Look Tense

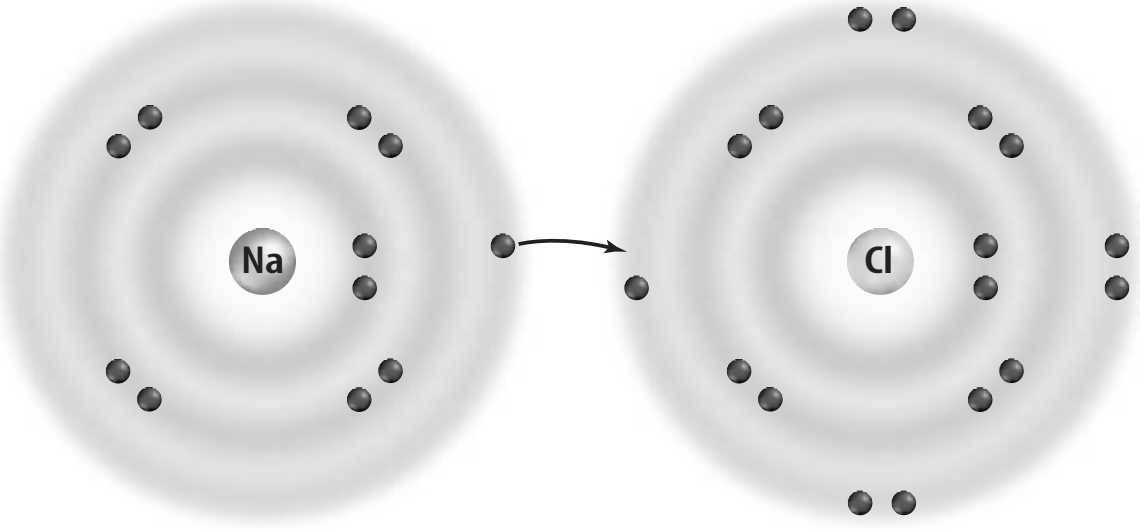
You've probably drunk, bathed, and swum in water without thinking about its very interesting properties. Surface tension, for example, is a property of liquids that describes their tendency to form a thin, film-like barrier at the surface.

1. How is the insect able to walk on the water's surface?
2. How is this different from floating?
3. What other properties of water can you name?

SECTION 2 Teaching Transparency Activity

Covalent and Ionic Bonds





Sodium Chlorine

Teaching Transparency Activity (continued)

1. How many electrons does oxygen have in its innermost electron level?

2. In water, how many electrons does oxygen share with each hydrogen atom? What kind of bond does this form?

3. How many electrons does sodium have in its outer level? How many electrons does chlorine have in its outer level?

4. Describe what happens when sodium bonds with chlorine. What kind of bond is this called?

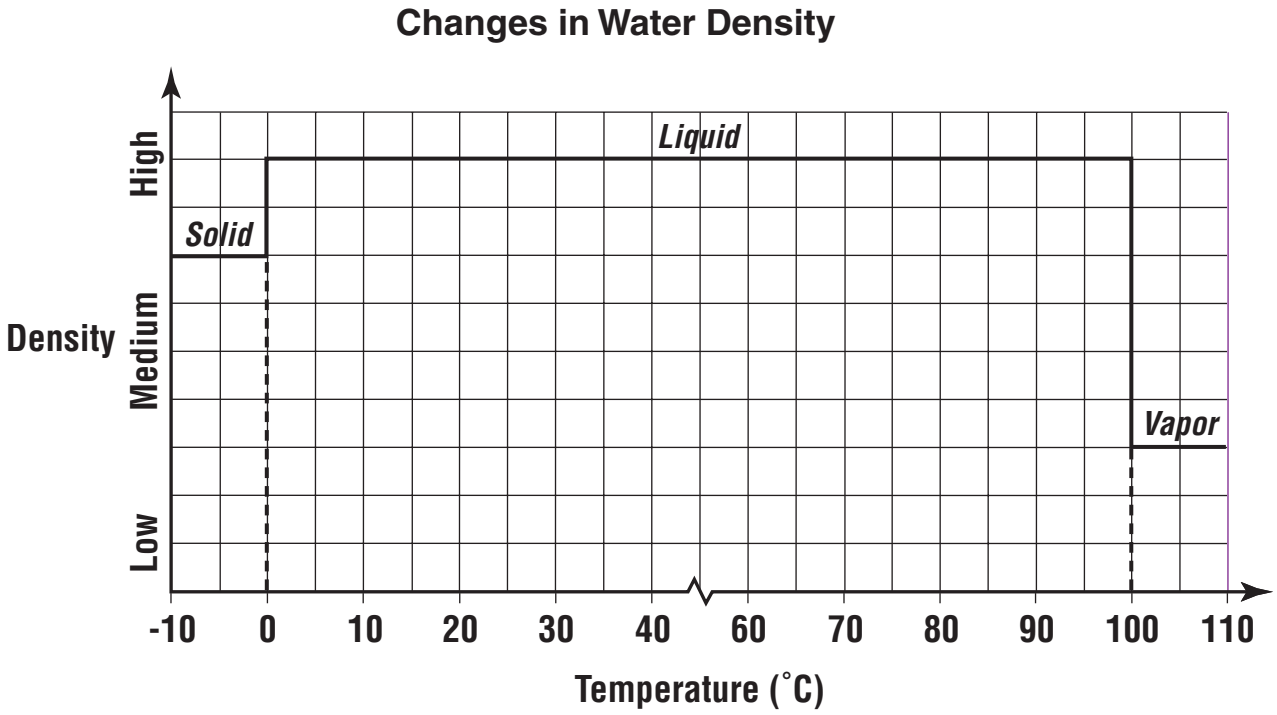
5. After the bond between sodium and chlorine forms, how many electrons does sodium have in the resulting outer layer?

6. What is the charge on a teaspoonful of salt (NaCl) crystals? Explain.

Assessment Transparency Activity

Matter

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



1. According to the graph which statement best describes what happens to the density of water as it is heated from minus 10 degrees C to 110 degrees C?

A Density decreases and then increases.
B Density increases and then decreases.
C Density increases and then remains the same.
D Density decreases and then remains the same.

2. If the temperature is 110 degrees C and is decreased by 75 degrees, the water will change to a ___.

F liquid **G** solid **H** vapor **J** mix of all three

3. According to this information, in which state will the water molecules be the farthest apart?

A Solid **C** Vapor
B Liquid **D** Always the same distance

Teacher Support and Planning

Teacher Support and Planning

Content Outline for Teaching

Matter

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

Section 1 Atoms

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

1. Matter is made up of tiny particles called **atoms**.
2. Substances that contain only one type of atom are **elements**.

B. Three basic particles make up an atom: protons, neutrons, and electrons.

1. Protons and neutrons make up the nucleus of an atom.
   - **a. Protons**—particles that have a positive electric charge
   - **b. Neutrons**—particles that have no electrical charge
   - **c.** The nucleus has a positive charge.
2. **Electrons**—negatively charged particles that move around the nucleus
3. **Atomic number**—the number of protons in an atom's nucleus
   - **a.** All atoms of a specific element have the same atomic number.
   - **b.** This number also equals the number of electrons in the atom's electron cloud.
4. **Mass number**—the number of protons and neutrons making up an atom's nucleus

C. Isotopes—atoms of the same element that have different numbers of neutrons

DISCUSSION QUESTION:
It was once thought that the atom was the smallest particle possible. Why is that no longer believed? *We now know that atoms are made up of even smaller particles: protons, neutrons, and electrons.*

Section 2 Combinations of Atoms

A. When atoms of more than one element combine, they form a **compound**.

B. Chemical property—describes a change that occurs when one substance reacts with another substance

C. Bond—the force that holds atoms in compounds together

1. Covalent bonds form by sharing electrons.
2. Atoms that combine if they become positively or negatively charged have ionic bonds.
   - **a.** Electrically charged atoms are called **ions**.
   - **b.** Ions are attracted to each other when they have opposite charges.

3. Metallic bonds—electrons are free to move from one ion to the other.
   a. Found in metals such as copper, gold, aluminum, and silver
   b. Give metals the ability to conduct electricity
4. Hydrogen bonds—form when the positive end of one molecule is attracted to the negative end of another molecule
   a. Form without the interaction of electrons
   b. Responsible for the property of cohesion—allows water to form raindrops
   c. Hydrogen bonds are easily broken.

D. **Mixture**—two or more substances that are not chemically combined
1. **Heterogeneous** mixture—components not mixed evenly; each component retains its own properties.
2. **Homogenous** mixture—compounds evenly mixed; can't see each component; also called **solutions**
3. The components of a mixture can be separated by physical means.
4. The components of a compound must be separated by chemical means.

DISCUSSION QUESTION:
Why are materials with metallic bonds malleable, or easily shaped? *Their electrons are free to move from one ion to the other.*

Section 3 Properties of Matter

A. Physical properties—properties you can observe without changing a substance into a new substance
1. One physical property is **density**, which is an object's mass divided by its volume.
2. The measurement of density is usually given in grams per cubic centimeter (g/cm^3).
3. An object less dense than water will float in water.

B. Four physical states of matter: solid, liquid, gas, and plasma
1. Solids—the matter's atoms are in a fixed position relative to each other
2. Liquids—atoms are attracted to each other, but can change positions with each other
3. Gases—atoms have almost no attractive force on each other, so atoms move freely and will fill the entire container they are placed in

Content Outline for Teaching (continued)

4. Plasma—electrons can escape and move outside of the ion's electron cloud.
   a. The most common state of matter in the universe
   b. Stars and lightning bolts are composed of matter in the plasma state.

C. Matter can change from one state to another.

1. Changes in state can occur because of increases or decreases in temperature and pressure.
   a. Matter is changed from a liquid to a solid at its freezing point.
   b. Matter is changed from a liquid to a gas at its boiling point.
2. When matter changes state, its chemical properties do not change, but physical properties may change.

DISCUSSION QUESTION:
What happens to its molecules when matter changes from a liquid to a gas? *Atoms spread out and move further away from one another.*

Spanish Resources

La materia

SECCIÓN 1 Los átomos

Lo que aprenderás

- A identificar los estados de la materia.
- A describir la estructura interna de un átomo.
- A comparar los isótopos de un elemento.

Vocabulario

matter / materia: cualquier cosa que tiene masa y ocupa espacio; las propiedades de la materia están determinadas según la estructura y enlace de sus átomos.

atoms / átomos: partículas diminutas de materia compuestas de protones, neutrones y electrones.

element / elemento: sustancia que sólo contiene un tipo de átomo; por ejemplo, el oxígeno, el aluminio y el hierro.

proton / protón: partícula cargada positivamente, compuesta de quarks, que se halla en el interior de un átomo.

neutron / neutrón: partícula sin carga eléctrica ubicada en el núcleo del átomo.

electrons / electrones: partículas con carga negativa que se mueven alrededor del núcleo de un átomo y forman la nube de electrones.

atomic number / número atómico: número de protones en el núcleo de un átomo.

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

isotopes / isótopos: átomos de un mismo elemento que poseen diferentes números de neutrones.

Por qué es importante

Casi todo a tu alrededor – el aire, el agua, el alimento y la ropa – está hecho de átomos.

SECCIÓN 2 Combinaciones de átomos

Lo que aprenderás

- A describir varias formas en las que se combinan los átomos para formar compuestos.
- A enumerar las diferencias entre los compuestos y las mezclas.

Vocabulario

compound / compuesto: materia que está hecha de dos o más elementos y que tiene propiedades físicas y químicas diferentes a las de los elementos que la formaron.

ion / ion: átomo con carga eléctrica cuya carga resulta cuando un átomo pierde o gana electrones.

mixture / mezcla: describe dos o más sustancias que retienen sus propiedades a pesar de estar combinadas y la cual se puede separar mediante medios físicos.

heterogeneous mixture / mezcla heterogénea: mezcla, como el concreto o una mezcla de sopa seca, en la cual diferentes materiales se hallan distribuidos desigualmente y se pueden identificar con facilidad.

homogeneous mixture / mezcla homogénea: sólido, líquido o gas que contiene dos o más sustancias combinadas uniformemente.

solution / solución: tipo de mezcla en que una sustancia se mezcla completa y uniformemente en otra y que es idéntica en toda su extensión.

Por qué es importante

En la Tierra, la mayoría de materia existe como compuestos o mezclas.

LABORATORIO Escalas de medición

¿Cómo describirías algunos de los objetos de tu salón? Tal vez tu escritorio es aproximadamente la mitad del tamaño de una puerta. Medir las propiedades físicas en un experimento de laboratorio te ayudará a hacer mejores observaciones.

Preguntas del mundo real

¿Cómo se miden las propiedades físicas de los objetos?

Metas

- **Medir** varias propiedades físicas en SI
- **Determinar** las fuentes de error.

Materiales

balanza de triple viga
probeta de 100 mL
varas de medir (2)
termómetros sin mercurio (3)
vara o perno
piedra muestra
cordón
globo
agua

Medidas de seguridad

CUIDADO: *No "sacudas" los termómetros de laboratorio.*

Procedimiento

1. Ve a cada estación y determina la medida solicitada. Registra tus observaciones en la tabla de datos y enumera las fuentes de error.
   a. Usa una balanza para determinar la masa de la piedra muestra al 0.1g más cercano.
   b. Usa una probeta para medir el volumen de agua al 0.5mL más cercano.
   c. Usa tres termómetros para determinar la temperatura promedio al 0.5° C más cercano en una posición seleccionada de la habitación.
   d. Usa la vara de medir para medir la longitud de la vara o el perno al 0.1cm más cercano.
   e. Usa la vara de medir y el cordón para medir la circunferencia de un globo. Se preciso hasta el 0.1cm más próximo.

Medición y error		
Muestra en la estación	**Valor de la medición**	**Causas de error**
a.	masa = ___ g	
b.	volumen = ___ mL	
c. (posición)	temperatura promedio = ___ °C	
d.	longitud = ___ cm	
e.	circunferencia = ___ cm	

Concluye y aplica

1. **Compara** tus resultados con los provistos por tu maestro.
2. **Calcula** tu porcentaje de error en cada caso. Usa esta formula.

$$\frac{\text{tu valor} - \text{valor del maestro} \times 100}{\text{valor del maestro}} = \%\ \text{de error}$$

3. Generalmente, estar dentro del cinco al siete por ciento de un valor correcto es considerado bueno. Si tus valores exceden diez por ciento de error, ¿qué podrías hacer para mejorar tus resultados y reducir el error?

Comunicar tu información

Compara tus conclusiones con las de otros estudiantes de tu clase. Para más ayuda, ve al *Science Skill handbook*.

SECCIÓN 3 Propiedades de la materia

Lo que aprenderás

- A describir las propiedades físicas de la materia.
- A identificar qué causa los cambios de estado en la materia.
- A enumerar los cuatro estados de la materia.

Vocabulario

density / densidad: cambio físico de la materia que puede calcularse dividiendo la masa de un cuerpo entre su volumen.

Por qué es importante

Puedes reconocer muchas sustancias por sus propiedades físicas.

LABORATORIO *Diseña tu propio* Determina la densidad

Preguntas del mundo real

¿Cuál tiene más densidad – una piedra o una esponja? ¿Es el corcho más denso que la arcilla? La densidad es la razón de la masa de un objeto a su volumen.

Formula una hipótesis

Enuncia una hipótesis acerca del proceso que puedes usar para medir y comparar las densidades de varios materiales.

Metas

- **Enumerar** algunas de las maneras en las que se puede medir la densidad de un objeto.
- **Diseñar** un experimento que compare las densidades de varios materiales

Materiales posibles

sartén
balanza de triple viga
vaso de precipitados de 100 mL
probeta de 250 mL
agua
tiza
pedazo de cuarzo
pedazo de arcilla
bloque de madera pequeño
bloque de metal pequeño
corcho pequeño
piedra
regla

Medidas de seguridad

CUIDADO: *Pon atención a las orillas afiladas de algunos materiales y ten cuidado de no romper el vaso de precipitados o la probeta. Lávate muy bien las manos con agua y jabón al terminar.*

Prueba tu hipótesis

Diseña un plan

1. Como grupo, pónganse de acuerdo y escriban el enunciado de la hipótesis.
2. Como grupo, enumeren los pasos que necesitan para probar su hipótesis. Sean específicos, describe exactamente lo que harás en cada paso. Enumera tus materiales.
3. Trabajando como grupo, usen esta ecuación: densidad = masa / volumen. Desarrolla un método para determinar la masa y el volumen de cada material que va a ser ensayado.
4. **Diseña** una tabla de datos en tu Diario de ciencias para que esté lista para usarse mientras recolectas los datos.
5. Lee por completo tu experimento y asegúrate que todos los pasos están en un orden lógico.
6. ¿Deberías de usar el procedimiento más de una vez para cualquier material?
7. **Identifica** cualquier constante, variable y control del experimento.

Sigue tu plan

1. Asegúrate que tu maestro apruebe tu plan antes de comenzar.
2. Lleva a cabo el experimento como se planeo.
3. Mientras el experimento esta sucediendo, escribe cualquier observación que hagas y completa la tabla de datos de tu Diario de ciencias.

Analiza tus datos

1. **Observa** ¿Observaron algo acerca de cómo se sienten los objetos de mayor densidad comparados con los objetos de menor densidad?
2. **Predice** ¿Cuál de los objetos que ensayaron flotará en el agua? ¿Cuál se hundirá?
3. **Predice** ¿Cómo se ven afectadas tus mediciones al usar una herramienta para hundir un objeto que flota en el agua. Explica cómo este error puede aumentar o disminuir la densidad que obtuviste.

Saca conclusiones

1. **Formula hipótesis** Con base en tus resultados, ¿formularías la hipótesis de que el corcho es más denso, igual de denso o menos denso que el agua?
2. **Saca conclusiones** Sin medir la densidad de un objeto que flota, concluye cómo es que sabes que tiene una densidad de menos de 1.0 g/cm^3.
3. **Predice** ¿Se afectaría la densidad de la arcilla si la rompieras en pedazos más pequeños?
4. **Explica** por qué los barcos flotan a un cuando están hechos de acero, cuya densidad es mucho mayor que la del agua.

Comunica tu información

Escribe un panfleto informativo sobre los diferentes métodos para determinar la densidad de los objetos. Incluye ecuaciones y procedimientos paso a paso.

Guía de estudio

Repasa las ideas principales

Sección 1 Los átomos

1. La materia es algo que tiene masa y ocupa un espacio. *¿En qué se parece la materia a los bloques de ensamble que se muestran a continuación?*
2. Los protones y neutrones forman el núcleo de un átomo. Los protones tienen carga positiva y los neutrones no tienen carga. Los electrones tienen carga negativa y rodean al núcleo formando una nueve de electrones.
3. Los isótopos son átomos del mismo elemento que tienen diferentes números de neutrones.

Sección 2 Combinaciones de átomos

1. Los átomos se unen para formar compuestos y moléculas. Un compuesto es una sustancia hecha de dos o más elementos. Las propiedades de un compuesto son diferentes a las propiedades físicas o químicas de los elementos que lo componen.
2. Una mezcla es una sustancia en la que cada uno de los componentes no está combinado químicamente. *¿Por qué el contenido de la bolsa de libros que se muestra a la derecha se considera una mezcla y no un compuesto?*

Sección 3 Propiedades de la materia

1. Las propiedades físicas se pueden observar sin causar un cambio químico en una sustancia. Las propiedades químicas se pueden observar sólo cuando una sustancia reacciona con otra sustancia.
2. Los átomos o moléculas en el estado sólido están en posiciones fijas relativas entre ellos. En un líquido, los átomos o moléculas están muy juntos pero son libres para cambiar posiciones. Los átomos o moléculas en un gas casi no tienen una fuerza de atracción entre ellos. *¿De qué está hecho el plasma, como el relámpago de la derecha?*
3. El agua es la única sustancia de la Tierra que aparece naturalmente como sólido, líquido y gas porque sus puntos de fusión y ebullición están dentro del rango de temperaturas que se encuentran en la tierra.
4. Una propiedad física que se usa para describir la materia es la densidad. La densidad es la razón de la masa de un objeto con respecto a su volumen. Un material que es menos denso flotará en un material que es más denso. *El hielo flota en agua líquida, de modo que ¿qué estado del agua es el más denso?*

Hands-On Activities

MiniLAB: Try at Home (page 3)

1. Possible answer: Metallic elements, such as iron, copper, and gold, were more common.
2. Most elements are found in compounds with other elements. For example, salt is a compound of sodium and chlorine.

MiniLAB (page 4)

Data and Observations

1. Mixtures: air; muddy water; sugar water; sand
2. Compounds: water; ice; sugar; salt
3. Elements: oxygen; hydrogen; copper

Analysis

1. One substance is thoroughly and evenly mixed in another substance.
2. Compounds are chemical combinations of two or more elements that cannot be separated physically.

Lab 1 (page 5)

Lab Preview

1. Students will be measuring mass, volume, average temperature, length, and circumference.
2. Students may be measuring objects that have a pointed end or sharp edges.

Conclude and Apply

1. Answers will vary depending on the samples used and students' results.
2. Answers will vary depending on the samples used and students' results.
3. Taking several measurements of the same property should decrease error. A common source of error is improper measuring methods.

Lab 2: Design Your Own (page 7)

Lab Preview

1. Students may be measuring objects that have a pointed end or sharp edges.
2. The equation: density = mass/volume.

Analyze Your Data

1. Denser objects feel heavier than less dense objects of the same size. Objects like these are said to have greater heft.
2. Cork and wooden block float in water. Other objects sink.
3. Volume measurement might be increased by the volume occupied by the tool. Increaseing the volume would decrease the density found.

Conclude and Apply

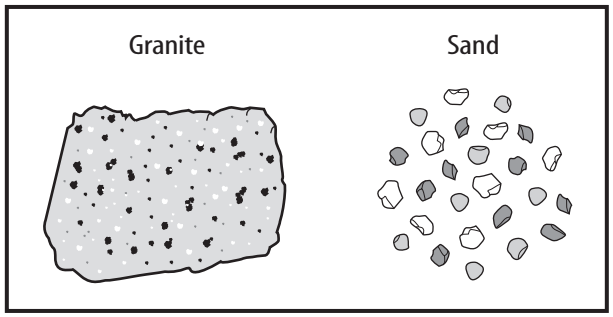
1. The cork is less dense than water.
2. Water has a density of 1 g/cm^3.
3. As long as the same sample is used, the density of the clay is not affected by the size of the piece(s).
4. In the case of ships, density and buoyancy are involved. If a clay boat were shaped so it displaced a large enough volume of water, it would float.

Laboratory Activity 1 (page 9)

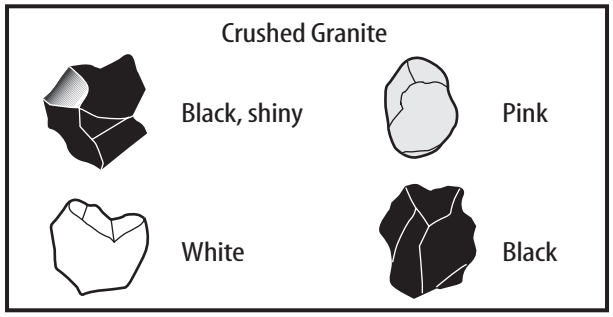
Lab Note: Colors in minerals depend largely on impurities. Organic matter gives a black color; iron, red or yellow; manganese, purple. A good reference book for minerals might be useful.

Data and Observations

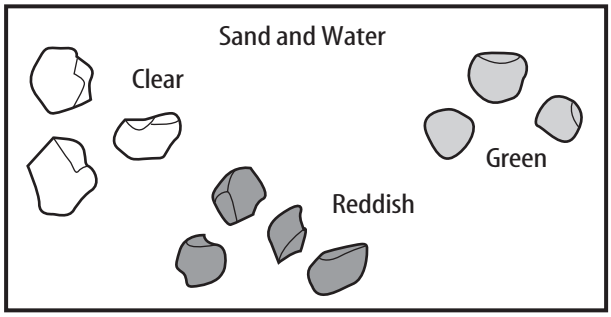
Sketch A



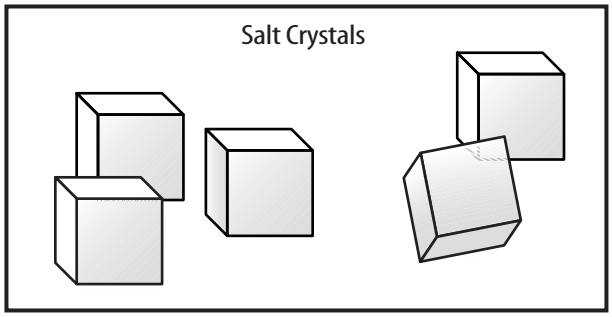
Sketch B



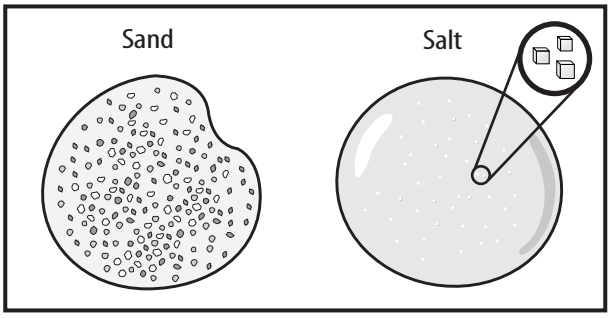
Sketch C



Sketch D



Sketch E



Questions and Conclusions

1. yes; Most sands contain fragments of quartz, which are present in granite.
2. They are both mixtures; both salt and sand contain crystals. Saltwater is homogeneous—salt dissolves in water; sand and water is heterogeneous—sand does not dissolve in water.
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 sizes using sieves, filtering of solutions; settling of solutions

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

Laboratory Activity 2 (page 11)

Data and Observations

Students' answers will vary, but densities should be close to the values given here. Variations can be due to temperature differences.

1. 1.034 g/cm^3 at 4°C
2. 1.0 g/cm^3 at 4°C
3. greater than 1.0 g/cm^3; less than 1.034 g/cm^3

Questions and Conclusions

1. Students' tables for densities; density = mass/volume d= m/v
2. The egg sank through the freshwater but floated on the salt water.
3. The density of the egg is greater than that of the freshwater but less than that of the salt water.
4. The egg probably sank as the density of the salt water was reduced by the addition of freshwater.
5. Buoyancy increases as the density of the liquid increases.
6. A person floats in water because the person is less dense than the water.
7. Because seawater is more dense than freshwater, seawater exerts a greater buoyant force. Therefore, it is easier for a person to float in seawater.
8. The density of the helium is less than the density of the air; thus, the balloon floats.

Meeting Individual Needs

Directed Reading for Content Mastery (page 15)

Overview (page 15)

1. atoms
2. protons
3. neutrons
4. positive
5. negative
6. molecules
7. sink
8. Water

Sections 1 and 2 (page 16)

1. atoms
2. neutrons
3. ions
4. compound
5. chemical
6. air
7. atomic
8. molecule
9. compound
10. age
11. ion+
12. not an ion
13. ion–

Section 3 (page 17)

1. liquids
2. solid
3. chemical
4. volume
5. density
6. physical
7. gases
8. Water
9. chemical
10. liquid
11. plasma
12. increases
13. dense
14. four

Key Terms (page 18)

P	R	O	A	E	L	E	M	E	N	T	O	D	F	O	S	Z
L	U	A	T	H	P	A	O	B	I	R	Z	G	E	Y	O	I
A	B	M	O	J	R	V	L	C	L	E	A	R	L	U	L	D
C	X	N	M	O	L	D	E	N	S	I	T	Y	E	X	U	O
Y	F	L	I	O	N	W	C	O	D	Z	H	P	C	K	T	B
T	H	I	C	J	N	E	U	T	R	O	N	S	T	V	I	F
B	V	N	G	L	Q	U	L	Q	G	C	J	S	R	H	O	A
D	I	S	O	T	O	P	E	S	C	O	M	P	O	U	N	D
O	Z	U	H	O	S	X	A	M	U	L	C	T	N	M	W	C
S	W	A	L	K	T	I	Y	D	P	A	S	N	D	F	E	R

1. electron
2. element
3. compound
4. isotopes
5. solution
6. density
7. atomic
8. neutrons
9. ion

Lectura dirigida para Dominio del contenido (pág. 15)

Sinopsis (pág. 19)

1. átomos
2. protones
3. neutrones
4. positiva
5. negativa
6. moléculas
7. se hunde
8. agua

Secciones 1 y 2 (pág. 20)

1. átomos
2. neutrones
3. iones
4. mezcla
5. química
6. aire
7. atómica
8. molécula
9. compuesto
10. edad
11. ion+
12. no es un ion
13. ion–

Sección 3 (pág. 21)

1.	líquidos	**8.**	agua
2.	sólido	**9.**	química
3.	plasma	**10.**	líquida
4.	volumen	**11.**	plasma
5.	densidad	**12.**	aumenta
6.	física	**13.**	densa
7.	gases	**14.**	cuatro

Términos claves (pág. 22)

U	E	L	E	M	E	N	T	O	T	W	S	I	S	I
E	L	N	I	M	A	D	M	I	N	I	O	M	V	E
D	E	N	S	I	D	A	D	I	N	A	L	I	M	Q
U	C	I	S	O	N	O	S	S	T	N	U	R	U	D
E	T	X	E	N	R	C	M	O	L	E	C	U	L	A
I	R	T	A	T	O	N	I	T	L	U	I	L	A	M
C	O	M	P	U	E	S	T	O	C	T	O	R	P	E
R	N	S	C	U	S	I	B	P	O	R	N	T	I	S
N	I	A	T	O	M	I	C	O	S	O	L	U	T	A
L	Q	I	P	E	X	E	A	C	O	N	M	M	D	O

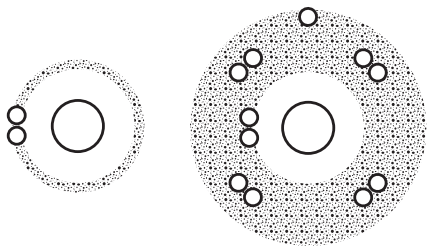
1. electrón
2. elemento
3. compuesto
4. isótopos
5. solución
6. densidad
7. atómico
8. neutrones
9. ion

Reinforcement (page 23)

Section 1 (page 23)

1. 8; 8
2. 14; 14
3. 13; 27
4. 26; 30; 26
5. 20; 20; 40
6. 11; 12; 11
7. 29; 64
8. 12; 12; 12
9. 118; 79; 79
10. 47; 47; 108

11–12.



Section 2 (page 24)

1. a substance made up of two or more combined elements that have different chemical properties from each of the elements in it
2. a substance made up of components that retain their chemical properties
3. compound
4. mixture
5. compound
6. mixture
7. compound
8. compound
9. mixture
10. mixture
11. mixture
12. solution
13. hydrogen; oxygen
14. mixture
15. sodium; chlorine
16. compound

Section 3 (page 25)

1. liquid
2. gas
3. freely moving and independent
4. definite size and shape
5. takes the shape of its container
6. water

Enrichment (page 26)

Section 1 (page 26)

1. 17,190; 1/8
2. About 10,000 years old; accept any answer between 5,730 and 11,460 years old.
3. After about 50,000 years, the amount of carbon-14 remaining is usually too small to be measured. Accept any other reasonable explanation.
4. A stone arrowhead; carbon-14 dating can only be used to determine the age of the remains of organisms. A wooden bowl was once part of a tree, and a mummy was once a person. A stone arrowhead, however, was never alive.

Section 2 (page 27)

Data and Observations

Students' sketches should show that the mixture of food coloring has separated into two "blobs," one blue and one yellow. The color closer to the top of the strip may vary depending of the type of food coloring used, but will most likely be blue.

Questions and Conclusions

1. Students should conclude that the coloring that remained closer to the bottom of the strip was more strongly attracted to the filter paper. This coloring moved a shorter distance, so it was less soluble in the water than was the other coloring.
2. Some of the dyes in the ink would move along the filter paper faster than others, depending on how strongly they were attracted to the filter paper and the water. As a result, the ink would separate into different colors as it moved up the filter paper.
3. Accept any reasonable explanation. Sample: No; the only way to separate elements in a compound is with a chemical change, during which one substance is changed into one or more new substances with different chemical properties. Paper chromatography does not cause new substances to form. Instead, it simply separates the components of a mixture.

Section 3 (page 28)
WARNING: *The paraffin wax should be removed from the heat source as soon as it melts. Paraffin wax has a flash point and can catch fire.*

1. a metal pan or container in which to melt the wax, a pot holder for touching the heated container, a thermometer for measuring the temperatures, a source of heat to melt the wax, paraffin wax, paper and pencil to record the measurements
2. Step 1: Gather the needed materials. Step 2: Put the paraffin wax in the container. Step 3: Put the container over the heat source and turn the heat source on. Step 4: Hold the thermometer in the wax and measure the temperature at which the wax melts. Step 5: Record the temperature. Step 6: Remove the container from the heat source. Step 7: Measure the temperature at which the wax becomes a solid. Step 8: Record the temperature at which the wax solidifies. Step 9: Clean up.
3. A heat source is needed because the wax remains a solid at room temperature.
4. The freezing point of the wax is higher than water because the wax remains a solid at temperatures that would cause ice to melt.

Note-taking Worksheet (page 29)

Refer to Teacher Outline, student answers are underlined.

Assessment

Chapter Review (page 33)

Part A. Vocabulary Review

1.	e (1/1)	**11.**	c (6/3)
2.	b (1/1)	**12.**	d (2/1)
3.	g (2/1)	**13.**	j (4/2)
4.	m (2/1)	**14.**	i (6/3)
5.	f (2/1)	**15.**	k (6/3)
6.	n (2/1)	**16.**	q (7/3)
7.	a (3/1)	**17.**	s (7/3)
8.	h (5/2)	**18.**	p (7/3)
9.	l (4/2)	**19.**	t (7/3)
10.	o (5/2)	**20.**	r (2/1)

Part B. Concept Review

1. Measure its mass and its volume. Then divide the mass by the volume. (6/3)
2. Atoms can combine to form compounds by sharing electrons or by attracting negatively charged ions to positively charged ions. (4/2)
3. A compound is made up of two or more elements and has different properties than each element in it. A mixture is made up of components that retain their properties. The properties or elements are changed in a compound; they are not changed in a mixture. (5/2)
4. Atom B is an isotope of carbon. Isotopes have the same atomic number but different mass numbers. Atomic number is equal to the number of protons in an atom, and mass number is equal to the number of protons and neutrons in an atom. (3/1)
5. c (6/3)
6. p (6/3)
7. p (6/3)
8. c (6/3)
9. p (6/3)
10. c (6/3)

Chapter Test (page 35)

I. Testing Concepts

1. c (1/1)
2. c (6/3)
3. a (2/1)
4. d (2/1)
5. c (3/1)
6. b (6/3)
7. c (1/1)
8. a (5/2)
9. a (4/2)
10. b (3/1)
11. d (2/1)
12. d (7/3)
13. a (7/3)
14. c (7/3)
15. b (4/2)
16. true (6/3)
17. false; A compound is a group of substances in which each substance loses its own properties.(4/2)
18. false; One physical property of a substance is its density. (6/3)
19. false; A substance that expands to completely fill a container is a gas. (8/3)
20. true (2/1)
21. compound (5/2)
22. compound (5/2)
23. mixture (5/2)
24. mixture (5/2)
25. compound (5/2)
26. mixture (5/2)
27. mixture (5/2)
28. mixture (5/2)
29. compound (5/2)
30. compound (5/2)

II. Understanding Concepts

1. 6; 6 (2/1)
2. 1; 1 (2/1)
3. 12; 11 (2/1)
4. 6; 14 (2/1)
5. 18; 17 (2/1)
6. 12; 24 (2/1)
7. 9; 19 (2/1)
8. Atoms a and d are isotopes because they have the same atomic number but different mass numbers. (3/1)

9. Atoms c, e, and g are ions because they have gained or lost an electron and have electric charges. (4/2)
10. Atom c is the positively charged ion because it has more protons than electrons. (4/2)
11. Atom c can combine with atom e because it has a positive charge that is attracted to the negative charge of atom e. or Atom c can combine with atom g. (4/2)
12. Atoms e and g cannot form a compound because they are both negatively charged ions that do not attract one another. (4/2)
13. Answers will vary slightly. Topics should indicate that neutrons, protons, and electrons are particles within atoms. (2/1)
14. elements (5/2)

III. Applying Concepts

1. After boiling water for five minutes, there would be less liquid because some of the water molecules would escape into the air as a gas.(7/3)
2. **a.** Egg whites are liquid at room temperature. The molecules are close to one another but are free to change position with one another. The egg whites take the shape of their container.(7/3)
   b. Frozen juice bars are solid. Their molecules are very close to one another and in a fixed relationship. The bars retain their shape in the container.

IV. Writing Skills

3. The wetness is caused by dew. When it is cooler at night than it is during the day, the water molecules in the air cool down to the point where they turn into liquid water. The liquid water molecules are the dew found on the grass and windows.(7/3)

Transparency Activities

Section Focus Transparency 1 (page 40)

A Closer Look

Transparency Teaching Tip

- The purpose here is to introduce the students to the world of atoms, particles so small they can't be seen with standard microscopes. Ask students what scientists hope to learn from studying such particles.

Content Background

- The transparency picture was taken with an electron microscope, which uses beams of electrons rather than light to magnify an image. Because the wavelengths of electrons are shorter than the wavelengths of visible light, the electron microscope can show much more detail than a regular microscope. The transparency shot is an electron micrograph of an uranyl microcrystal, with each splotch representing a single uranium atom. Each atom is more than a million times smaller than the thickness of a hair. Although incredibly small, the atoms contain even smaller particles, such as protons, neutrons, and electrons. The protons and neutrons are 100,000 times smaller than atoms, but they also contain smaller particles called quarks.
- The model of the atom has changed appreciably since Ernest Rutherford proposed a model with a nucleus in the early 1900s. Current understanding of the atom is based on the Schrödinger model in which the regular orbits of electrons are replaced with probability distributions that predict the general region where each electron is most likely to be found. Schrödinger's work led to the creation of a new area of physics—quantum mechanics. It was also discovered that protons and neutrons have 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, while studying the atom's component parts is named atomic physics.
- The smallest particle seen by an ordinary microscope contains ten billion atoms.

Answers to Student Worksheet

1. Answer will vary. Students may suggest that it is the magnified image of any number of things.
2. The parts are so small that it is impossible to identify the image as being of any recognizable object. Additionally, the image was made in an unusual fashion.
3. An optical microscope, using only light to magnify an image, can't resolve images at the atomic level.

Section Focus Transparency 2 (page 41)

Oxygen-Oxygen

Transparency Teaching Tips

- The purpose of the transparency is to introduce the students to oxygen. The title refers to the fact that oxygen gas is a diatomic molecule (one oxygen atom bonded to another oxygen atom, written O_2). Photosynthesis and respiration exchange oxygen, in the forms of O_2 and CO_2, between plants and animals. Additionally, oxygen is contained in water, which is crucial for the survival of plants and animals.
- Discuss with the students how one element can be a part of so many different substances. Atoms of two or more elements can combine in chemical reactions to form new substances that are very different from their component parts.

Content Background

- Oxygen is one of the most common elements on Earth and is one of the cornerstones of every ecosystem. Without it, very few living things would survive. Land-dwelling creatures use lungs to breathe in oxygen, which is carried by the circulatory system to all the cells of the body. Fish and other water-dwellers take oxygen dissolved in water in through their gills and into their bloodstreams.

All of these oxygen-breathing creatures exhale carbon dioxide (CO_2). Using sunlight in a process called photosynthesis, plants take in this carbon dioxide, along with water and chemical compounds, to make their own nutrients. The byproduct of photosynthesis is oxygen.

Answers to Student Worksheet

1. Answers will vary. Students may suggest that oxygen, in the form of O_2, H_2O, or CO_2, is needed by all the living things in the picture. Students may also mention the oxygen-carbon dioxide exchange between animals and plants.
2. A byproduct of photosynthesis is oxygen (needed by animals), and a byproduct of animal respiration is carbon dioxide (needed by plants).

Section Focus Transparency 3 (page 42)

Water Doesn't Look Tense

Transparency Teaching Tips

- This is an introduction to physical properties and states of matter. Explain that a physical property is one that can be observed without a chemical change occurring. Such properties might include size, color, and shape. Hold up a ball of some kind and ask the students to describe its physical properties.
- Explain that the physical property of an object includes its state of matter—solid, liquid, gas, or plasma. Ask the students to reflect on what determines the physical state of an object (the attraction of the atoms within and their rate of movement). Explain that molecular movement can be increased through temperature and pressure.
- Hold up a glass of water and ask the students to describe its properties. Point out that one property of a liquid is surface tension. Pressure is exerted by the water's molecules, creating enough force at the surface to support the insect on the transparency (the insect's weight not being enough to break the molecular bonds on the surface).

Content Background

- Molecular motion is different in each state of matter. As the movement rate increases and the attraction between molecules decreases, a change in physical state eventually results.
- Surface tension in liquids is caused by the attractive force between molecules. Molecules inside the liquid are pulled equally in all directions. However, molecules at the surface of the liquid are pulled inward. As a result, the liquid behaves as if it has a very thin film at the surface. Rainwater beading on a car is another illustration of surface tension.
- Floating is different than surface tension in that an object will float when it is less dense than the liquid it is in. Floating objects are immersed in a fluid; the water strider is standing on a fluid.
- The water strider's feet are covered with fine, water resistant hairs that help displace the weight of the insect over the surface of the water, thus preventing the downward force from exceeding that exerted across the water's surface.

Answers to Student Worksheet

1. Its weight exerts less downward force than that exerted by the water across its surface.
2. To be floating, an object has to be immersed in a fluid; floating relates to density. The water strider is on top of the water, not immersed in the water.
3. Answers will vary. Students might name melting point, boiling point, density, chemical composition (H_2O), etc.

Teaching Transparency (page 43)

Covalent and Ionic Bonds

Section 2

Transparency Teaching Tips

- Review with students the differences between covalent and ionic bonds, which join atoms together to form new substances, and hydrogen bonds, which are associations between charged regions of certain molecules. On the transparency, indicate the charged regions of the water molecule.
- Use the transparency to review the terms *atom, proton, neutron, electron,* and *ion.*

Reteaching Suggestion

- Have students reread the section on bonding and review the vocabulary with them.

Extensions

Activity: Have students use modeling clay and straws to construct a 3-dimensional model of a molecule of water.

Challenge: Have students research the effects of hydrogen bonds. Encourage them to speculate about the consequences if water did not form hydrogen bonds. Students may write a report or a short story to illustrate the results of their research.

Answers to Student Worksheet

1. two
2. Oxygen shares one pair of electrons with each hydrogen atom. This forms a covalent bond.
3. one; seven
4. Sodium donates one electron to chlorine. This forms an ionic bond.
5. eight
6. A teaspoonful of salt crystals is neutral in charge. Though the sodium and chlorine atoms form ions when they bond, the positive and negative charges balance each other.

Assessment Transparency (page 45)

Matter

Section 3

Answers

1. **B.** For this question, students need to interpret the graph and identify the correct sequence of events.
2. **F.** Based on the information given in the graph, the students must predict that the water would cool and change to a *liquid*, choice F.
3. **C.** Using the information from the graph, students must draw an inference based on their knowledge of the interaction of matter and energy. Specifically, they must know that the lower the density of a substance, the farther apart are the substances' molecules.

Test-Taking Tip

Encourage students to remember what they have learned from experiments that were conducted in class as they work through the questions.