# States of 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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**Additional Assessment Resources available with Glencoe Science:**

- ExamView® 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 Activity Masters

**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

- **Hands-On Activities**
  - MiniLAB: Observing Vaporization
  - MiniLAB: Try at Home Predicting a Waterfall
  - Lab: The Water Cycle
  - Lab: Design Your Own Design Your Own Ship
  - Laboratory Activity 1: States of Matter
  - Laboratory Activity 2: Crystal Formation
  - Foldables: Reading and Study Skills

- **Meeting Individual Needs**
  - Extension and Intervention
    - Directed Reading for Content Mastery
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    - Reinforcement
    - Enrichment
    - Note-taking Worksheet

- **Assessment**
  - Chapter Review
  - Chapter Test

- **Transparency Activities**
  - Section Focus Transparency Activities
  - Teaching Transparency Activity
  - Assessment Transparency Activity
Hands-On Activities
Mini LAB

Observing Vaporization

Procedure
1. Use a dropper to place one drop of rubbing alcohol on the back of your hand.
2. Describe in the Data and Observations section how your hand feels during the next 2 min.
3. Wash your hands.

Data and Observations

Analysis
1. What changes in the appearance of the rubbing alcohol did you notice?

2. What sensation did you feel during the 2 min? How can you explain this sensation?
Predicting a Waterfall

Procedure
1. Fill a plastic cup to the brim with water.
2. Cover the top of the cup with an index card.
3. Predict what will happen if you turn the cup upside down.
4. While holding the index card in place, turn the cup upside down over a sink. Then let go of the card.

Analysis
1. What happened to the water when you turned the cup?

2. How can you explain your observation in terms of the concept of fluid pressure?
Lab Preview

Directions: Answer these questions before you begin the Lab.

1. Why do you need the stirring rod in this lab?

2. By increasing the temperature of water, how are you changing the energy of the water molecules?

Water is all around us and you’ve used water in all three of its common states. This lab will give you the opportunity to observe the three states of matter and to discover for yourself if ice really melts at 0°C and if water boils at 100°C.

Real-World Question

How does the temperature of water change as it is heated from a solid to a gas?

Materials

- hot plate
- ice cubes (100 mL)
- Celsius thermometer
- electronic temperature probe
- wall clock
- watch with a second hand
- stirring rod
- 250-mL beaker
- Alternate materials

Goals

- Measure the temperature of water as it heats.
- Observe what happens as the water changes from one state to another.
- Graph the temperature and time data.

Safety Precautions

Procedure

1. Put 150 mL of water and 100 mL of ice into the beaker and place the beaker on the hot plate. Do not touch the hot plate.
2. Put the thermometer into the ice/water mixture. Do not stir with the thermometer or allow it to rest on the bottom of the beaker. After 30 s, read the temperature and record it in Table 1.
3. Plug in the hot plate and turn the temperature knob to the medium setting.
4. Every 30 s, read and record the temperature and physical state of the water until it begins to boil. Use the stirring rod to stir the contents of the beaker before making each temperature measurement. Stop recording. Allow the water to cool.
Analyze Your Data
Use your data to make a graph plotting time on the x-axis and temperature on the y-axis. Draw a smooth curve through the data points.

Data and Observations

Table 1

<table>
<thead>
<tr>
<th>Characteristics of Water Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
</tr>
<tr>
<td>0.0</td>
</tr>
<tr>
<td>0.5</td>
</tr>
<tr>
<td>1.0</td>
</tr>
<tr>
<td>1.5</td>
</tr>
<tr>
<td>2.0</td>
</tr>
<tr>
<td>2.5</td>
</tr>
</tbody>
</table>

Conclude and Apply

1. Describe how the temperature of the ice/water mixture changed as you heated the beaker.

2. Describe the shape of the graph during any changes of state.

Communicating Your Data

Add captions to your graph. Use the detailed graph to explain to your class how water changes state. For more help, refer to the Science Skill Handbook.
Lab Preview

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

1. What does each of the safety symbols for this experiment mean?

2. What should be the topic of your hypothesis?

*It is amazing to watch ships that are taller than buildings float easily on water. Passengers and cargo are carried on these ships in addition to the tremendous weight of the ship itself.*

**Real-World Question**

How can you determine the size of a ship needed to keep a certain mass of cargo afloat?

**Form a Hypothesis**

Think about Archimedes’ principle and how it relates to buoyant force. Form a hypothesis about how the volume of water displaced by a ship relates to the mass of cargo the ship can carry.

**Possible Materials**

- balance
- small plastic cups (2)
- graduated cylinder
- metric ruler
- scissors
- marbles (cupful)
- sink
- *basin, pan, or bucket
- *Alternate materials

**Goal**

- **Design** an experiment that uses Archimedes’ principle to determine the size of ship needed to carry a given amount of cargo in such a way that the top of the ship is even with the surface of the water.

**Test Your Hypothesis**

**Make a Plan**

1. Obtain a set of marbles or other items from your teacher. This is the cargo that your ship must carry. Think about the type of ship you will design. Consider the types of materials you will use. Decide how your group is going to test your hypothesis.

2. **List** the steps you need to follow to test your hypothesis. Include in your plan how you will measure the mass of your ship and cargo, calculate the volume of water your ship must displace in order to float with its cargo, and measure the volume and mass of the displaced water. Also, explain how you will design your ship so that it will float with the top of the ship even with the surface of the water. Make the ship.

3. **Prepare** a data table on a separate sheet of paper so that it is ready to use as your group collects data. Think about what data you need to collect.
Follow Your Plan
1. Make sure your teacher approves your plan before you start.
2. Perform your experiment as planned. Be sure to follow all proper safety procedures. In particular, clean up any spilled water immediately.
3. Record your observations carefully and complete your data table.

Analyze Your Data
1. Write your calculations showing how you determined the volume of displaced water needed to make your ship and cargo float.

2. Did your ship float at the water’s surface, sink, or float above the water’s surface? Draw a diagram of your ship in the water.

3. Explain how your experimental results agreed or failed to agree with your hypothesis.

Conclude and Apply
1. If your ship sank, how would you change your experiment or calculations to correct the problem? What changes would you make if your ship floated too high in the water?

2. What does the density of a ship’s cargo have to do with the volume of cargo the ship can carry? What about the density of the water?

Communicating Your Data
Compare your results with other students’ data. Prepare a combined data table or summary showing how the calculations affect the success of the ship. For more help, refer to the Science Skill Handbook.
Three common states of matter are solid, liquid, and gas. A fourth state of matter, the plasma state, exists only at extremely high temperatures. Differences among the physical states depend on the attractions between the atoms or molecules and on the rate of movement of the atoms or molecules. Pressure and temperature control these two factors.

**Strategy**
You will observe the characteristics of a solid.
You will change a gas to a liquid.
You will compare the characteristics of a solid, a liquid, and a gas.

**Materials**
- marker
- beaker (1,000-mL)
- plastic drinking glass (cold or add an ice cube)
- ice cubes (frozen from 500 mL of water)
- water

**Procedure**
1. Mark the level of the top of the ice cubes while they are still in the tray. Remove the ice cubes and place them in the beaker. Record the characteristics of ice in Table 1.
2. Let the ice cubes melt. Record the characteristics of the resulting water in Table 1.
3. Pour the water back into the tray. Mark the level of the top of the water on the tray. Under “Other characteristics” in Table 1, record whether this level is higher or lower than that of the ice.
4. Place the cold glass in a warm area. After a few minutes, record your observations of the surface of the glass in Table 1.
5. Place an ice cube in the beaker of water. Observe whether or not it floats. Record your observations in Table 1.

**Data and Observations**

<table>
<thead>
<tr>
<th>Material</th>
<th>State of matter</th>
<th>Takes shape of container (yes or no)</th>
<th>Other characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice cubes</td>
<td>Solid</td>
<td></td>
<td>float: yes or no</td>
</tr>
<tr>
<td>Water</td>
<td>Liquid</td>
<td></td>
<td>higher or lower in tray than ice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass</td>
<td></td>
</tr>
<tr>
<td>Beaker with ice</td>
<td></td>
</tr>
</tbody>
</table>
Laboratory Activity 1 (continued)

Questions and Conclusions

1. What is solid water called?
   
   Liquid water?
   
   Water as a gas?

2. Did the ice cube sink or float in the water? Explain.

3. Which occupies more volume, an equal amount of water or ice? Explain.

4. Where did the water on the glass come from?
   
   What are the characteristics of water as a gas?

5. What change caused the water vapor to change to a liquid?

6. If you changed liquid water to water vapor in a pressure cooker, what volume would the water vapor occupy?

7. Compare the characteristics of water as a solid, a liquid, and a gas.

Strategy Check

_____ Can you observe the characteristics of a solid?

_____ Can you observe a gas change to a liquid?

_____ Can you compare the characteristics of a solid, a liquid, and a gas?
Early in Earth’s history, the crust was produced by the cooling of magma. When this molten rock flows into cracks, its temperature is about 1200°C. As the atoms of the different elements that make up the magma cool and slow down, they group themselves into a regular order to form a solid or crystal. This grouping is referred to as a mineral. When the magma cools to about 500°C, most of the minerals have crystallized out. The remaining minerals are dissolved in water. As the hot solution cools still more and finds its way to the surface where there is less pressure, the minerals crystallize out. If the cooling is slow, large crystals result. If the cooling is fast, small crystals result. If the cooling is very fast, and the atoms do not have time to arrange themselves into regular order, an amorphous substance results.

**Strategy**
You will observe crystal growth from a melt.
You will see mineral crystals in a sample of granite.
You will discover the effect that cooling rate has on crystal size.
You will discover processes that result in crystal growth.

**Materials**
- magnifying glass
- microscope slides (2)
- salol
- granite samples
- microscope (optional)
- clear small medicine bottle with cap
- fine copper wire
- dropper bottle
- hot plate
- steel wool
- dilute silver nitrate solution
- beaker tongs

**Procedure**

**Part A**
1. Using the magnifying glass, look at a sample of granite. The granite was once molten. The minerals that make up the granite can be recognized by their different colors. Fill in Table 1 according to your observations.

**Table 1**

<table>
<thead>
<tr>
<th>Mineral (color)</th>
<th>Having a definite shape</th>
<th>Shapeless</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) White or pink</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Black and shiny</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Black and dull</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Clear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Laboratory Activity 2 (continued)

Questions and Conclusions

Part A
1. The clear material in granite is called quartz. It is nearly the last to crystallize out from a melt (500°C). Why do you suppose quartz is shapeless?

2. Were the mineral crystals in granite easy to see with the unaided eye?

3. What can you say about the cooling rate of granite?

Procedure

Part B
1. Place a clean fine copper wire (you may have to clean it with steel wool) about 1 cm long on a clean microscope slide.
2. Put the slide on the stage of a microscope or on a piece of white paper if you are using a hand lens.
3. From the dropper bottle marked silver nitrate solution, put 1 drop of the dilute silver nitrate on the copper wire and immediately watch what happens.
   WARNING: Do not spill the silver nitrate or get any of it on your clothes or hands; it will permanently stain.
4. Draw a representative sample of the growth and the copper wire in the box to the right.

Questions and Conclusions

Part B
1. The pattern you have drawn, which represents the pattern silver crystals make, is called a dendritic pattern. Is there a regular pattern to the growth?

2. Is the pattern repeated?

3. Are there plane surfaces that might suggest an orderly arrangement of atoms?

4. Look up the word crystal in your textbook. If this activity were to occur in nature, could the silver dendrite be called a crystal? Explain.

States of Matter
5. On a very cold day, the water vapor in the air of a warm room contacts the cold windowpane and freezes. The result is a feathery, almost dendritic pattern of ice. Would the dendritic pattern be the result of fast or slow crystallization? What is your evidence?

**Laboratory Activity 2 (continued)**

**Procedure**

**Part C**

1. Place a few crystals of salol into a small glass bottle and screw on the lid.
2. Heat the bottle in a water bath. The salol melts at 43°C, which is a little above body temperature.
3. When the salol has melted, lift the bottle out of the water bath using beaker tongs. Use the dropper bottle to put a drop of the liquid salol onto a clean microscope slide.
4. Watch the crystal growth using a magnifying glass or microscope.

**Questions and Conclusions**

**Part C**

1. The salol melts at 43°C, but when placed in the closed bottle, it melts at a higher temperature. Why?
2. Where did the crystals begin to form in the “puddle” of salol?
3. Where would you expect to find the irregular shaped crystals?

**Strategy Check**

_____ Can you recognize different crystals in a granite sample?
_____ Can you list some natural processes that result in crystal formation?
_____ Can you associate crystal size with the rate of cooling?
States of Matter

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

Liquid
Water

Water as a Vapor

Water as a Solid (Ice)

Define States

+Heat

–Heat

has definite shape and volume

has definite volume but no definite shape

does not have shape or volume
Meeting Individual Needs
Overview
States of Matter

Directions: Use the following terms to complete the concept map below.

boiling point
increases

liquid
solid
decreases
condensation

Three states of matter are

1. which gains kinetic energy as its temperature
   becoming a liquid at its melting point

2. becoming a liquid at its melting point

3. which gains kinetic energy as its temperature
   increasing,

4. which loses kinetic energy as its temperature
   becoming a gas at its boiling point

5. becoming a gas at its boiling point

6. becoming a liquid during

Directions: For the following equations, define the letters P and D.

P = Force/Area

7. P = ____________________________

D = Mass/Volume

8. D = ____________________________
1. List the three states of water shown here.

   

2. What makes water change from one state to another?

   

3. List three ways that you can use water in each of its states.

   

4. How does the way water changes from one state to another compare to the way other substances change?

   

Directions: Describe the process that is happening in each illustration on the lines provided.

1. 

2. 

3. 

Meeting Individual Needs
**Key Terms**

**States of Matter**

**Directions:** Write the letter of the term that correctly completes each sentence in the space at the left.

1. When a liquid is ______ it is turning into a solid.
   - a. pressure
   - b. buoyant force
   - c. liquid
   - d. freezing
   - e. Archimedes’ principle
   - f. condensation
   - g. density
   - h. gas
   - i. heat
   - j. matter
   - k. melting
   - l. Pascal’s principle
   - m. solid
   - n. temperature
   - o. vaporization

2. You experience ______ when you float in a swimming pool.

3. The amount of force applied to an area is called ______.

4. The measure of the average kinetic energy of the particles of a substance is the ______.

5. ______ explains why a balloon bulges on one end when you pinch the other end.

6. ______ objects have definite shape and volume.

7. To determine an object’s buoyant force, use ______.

8. ______ relates an object’s mass and volume and determines whether an object will sink or float.

9. Matter that has definite volume but takes the shape of its container is ______.

10. Thermal energy that flows from higher temperature to lower temperature is ______.

11. ______ quickly forms on a cold glass on a hot day.

12. A ______ has no definite shape or volume.

13. If it takes up space and has mass, it is ______.

14. Boiling and evaporation are both forms of ______.

15. A solid object is ______ when it is transforming into a liquid.
**Sinopsis**
Los estados de la materia

**Instrucciones:** Usa los siguientes términos para completar el mapa de conceptos.

- **punto de ebullición:** disminuye
- **líquido:** aumenta
- **sólido:** condensación

Los tres estados de la materia son:

1. que gana energía cinética a medida que su temperatura aumenta
2. convirtiéndose en líquido en su punto de fusión
3. que gana energía cinética a medida que su temperatura aumenta
4. convirtiéndose en gas en su estado gaseoso
5. que pierde energía cinética a medida que su temperatura disminuye
6. convirtiéndose en líquido durante su estado líquido

**Instrucciones:** Para las siguientes ecuaciones, define las letras P y D.

7. \( P = \frac{Fuerza}{Área} \)

8. \( D = \frac{Masa}{Volumen} \)
Sección 1 - La materia

Instrucciones: Usa los diagramas para contestar las siguientes preguntas.

1. Nombra los tres estados de la materia que se muestran.

2. ¿Qué hace que el agua cambie de un estado a otro?

3. Enumera tres formas en que puedes usar el agua en cada uno de sus estados.

4. Compara la manera en que el agua cambia de un estado a otro con la manera en que otras sustancias pasan por esos cambios.
Instrucciones: Describe el proceso que está sucediendo en cada ilustración. Usa los espacios dados.

1. ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

2. ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

3. ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
### Instrucciones: Escribe en los espacios a la izquierda la letra del término que complete correctamente cada oración.

1. Cuando un líquido se _____ se está convirtiendo en un sólido.
2. Experimentas el(la) _____ cuando flotas en una piscina.
3. La cantidad de fuerza que se aplica a un área es el(la) _____.
4. La medida de la energía cinética promedio de las partículas de una sustancia es su _____.
5. El(La) _____ explica por qué un globo se abomba en un lado cuando presionas el otro lado.
7. Para determinar la fuerza de flotabilidad de un cuerpo usas _____.
8. El(La) _____ relaciona la masa con el volumen de un objeto y determina si el objeto flotará o se hundirá.
9. Materia que tiene un volumen definido pero toma la forma del recipiente es _____.
10. La energía térmica que fluye desde una temperatura alta hacia una temperatura baja se llama _____.
11. Durante un día cálido, el(la) _____ se forma rápidamente en la superficie de un vaso frío.
12. Un(a) _____ no tiene forma o volumen definidos.
13. Si ocupa espacio y tiene masa, entonces es _____.
14. La ebullición y la evaporación son ambas formas de _____.
15. Un objeto sólido se _____ cuando está formando un líquido.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>presión</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>fuerza de flotabilidad</td>
<td></td>
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<td>c.</td>
<td>líquido</td>
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<td>d.</td>
<td>congelándose</td>
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<td>e.</td>
<td>principio de Arquimedes</td>
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<tr>
<td>f.</td>
<td>condensación</td>
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<td>g.</td>
<td>densidad</td>
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<td>h.</td>
<td>gas</td>
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<td>i.</td>
<td>calor</td>
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<tr>
<td>j.</td>
<td>materia</td>
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<td>k.</td>
<td>derritiendo</td>
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<td>l.</td>
<td>principio de Pascal</td>
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<td>m.</td>
<td>sólido</td>
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<td>n.</td>
<td>temperatura</td>
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<tr>
<td>o.</td>
<td>vaporización</td>
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</tbody>
</table>
Directions: Match the terms in Column II with the descriptions in Column I by writing the letter of the correct term in the blank at the left.

Column I

1. Tar is hard to pour because it doesn’t flow easily.
2. Energy from hot cocoa melts a marshmallow placed in it.
3. Like diamond, soot is made of carbon, but its atoms are arranged in a random manner.
4. Table salt changes to a liquid at 808°C.
5. Aluminum atoms are arranged in a repeating cubic pattern.
6. This sheet of paper is an arrangement of shaking particles.
7. A thermometer indirectly measures the average kinetic energy of particles.
8. Water changes to ice at 0°C.
9. The three physical states are liquid, solid, and gas.
10. A pin can float on the water in a cup.

Column II

a. amorphous solid
b. crystalline solid
c. freezing point
d. heat
e. matter
f. temperature
g. melting point
h. viscosity
i. solid
j. surface tension

Directions: Answer the following questions on the lines provided.

11. Why does water fill the bottom of a glass, rather than cling to the sides?

12. Why do beads of water often form on a slippery surface, such as a freshly waxed car?

13. What causes surface tension in water?

14. Explain why certain bugs can walk on water.

15. When does water begin entering the gaseous state?
Changes of State

Directions: Write the word that best describes each process illustrated below.

1. ____________________
2. ____________________
3. ____________________
4. ____________________

Directions: Use the graphs below to answer the questions that follow.

5. Which graph shows the melting of a crystalline solid? Explain your reasoning.

6. What type of solid does the other graph show? Explain.
Behavior of Fluids

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

Across
2. The amount of force applied per unit of area
3. It is nearly impossible to ______ solids and liquids.
5. Pascal’s principal says that pressure applied to a confined ______ transmits unchanged throughout the ______.
7. One of the factors affecting density
8. An increase in _____ results in an increase in pressure.

Down
1. As _____ pressure decreases, boiling points of liquids becomes lower.
2. The pressure produced by a force of one Newton per square meter of surface area is one ______.
4. The ______ force determines whether or not an object will float.
6. Mass divided by volume
Designing Scientific Models

As you learned in this section, each crystalline solid has a melting point and a freezing point. These are the same, whether measured in the Fahrenheit or Celsius system. For water, the freezing point is 32°F, or 0°C. When water reaches a temperature above 0°C, it exists either in the liquid or gaseous state, depending on how high the temperature goes. When the temperature of water falls below 0°C, it exists in a solid state. The molecules that make up ice are farther apart than the molecules that make up water.

This property makes water unique: as a solid it is less dense than as a liquid. This explains why ice cubes float in a glass of water.

Scientists use models to help them represent matter in its various states. The models can be created using a computer graphic program, by drawing them on paper, or by creating them out of three-dimensional objects. Using your knowledge that water in its solid state is less dense than water in its liquid state, create a model that would help explain to someone why ice cubes float in a glass of water.

1. What type of model did you choose to create?

2. Describe how your model represents water as a solid and as a liquid.

3. A copper penny will sink in molten copper. What can you infer about the differences in distance between the molecules in a copper penny and in molten copper?
Water Desalinization

Water is an essential component of all living things. The human body is composed primarily of water and would cease to live without it. In fact, your body can go longer without food than without water. So, it should come as no surprise that people have spent, and continue to spend, a considerable amount of time figuring out where the water we need will come from.

Water exists in its liquid state in the oceans, lakes, rivers, and wetlands of the world. Water exists in its solid state as ice, found in the world’s polar regions. In its gaseous state, water exists as vapor in the air.

Unfortunately, certain regions of the world have arid climates and most of the water in their lakes and oceans is too salty to drink. Scientists and engineers have worked diligently to find ways to make the salty water usable for human consumption and crop irrigation. Currently, these regions depend on desalinization plants. Desalination plants are buildings that house equipment used to separate the salt from the water. Most desalination plants use a system of heating the water until it evaporates and then cooling it so it condenses. In this procedure the salt is left behind when the water evaporates.

Design Your Own Desalinization Plant

Materials
- ice
- glass bowl
- pot
- hot plate
- water
- salt
- glass or cup

Directions: Using these materials and what you know about the properties of water, design your own desalinization plant. Describe how you set up your desalinization plant. Include what worked and what didn’t work.

Meeting Individual Needs

Enrichment

Meeting Individual Needs
Have you ever floated on a raft in a swimming pool? It’s certainly fun to do, but did you ever wonder why you don’t sink? The reason is buoyancy. Buoyancy depends on the density of the object; in this case, you and the raft. Density is the mass of an object, divided by its volume. As long as you and the raft have a lower density than the water in the swimming pool, you’ll float. But try floating a brick in a bathtub. You can’t, because the opposite is true—the brick has a higher density than the water, so it sinks.

Archimedes’ Discovery

Buoyant force results when pressure pushes up on the bottom of an object and pressure pushes down on the same object. The buoyant force, according to Archimedes’ principle, is equal to the weight of the fluid displaced by the object. Archimedes was an ancient Greek scientist who discovered this almost by accident. Archimedes was asked to determine if a king’s statue was 100 percent gold. While pondering how to measure that, Archimedes began to lower himself into a hot bath. When he realized his own body displaced the water in the tub, Archimedes’ principle was created. Then he put it to the test by measuring both the statue and the amount of water displaced when it was lowered into a container full of water.

Archimedes compared the density of the statue with the known density of pure gold and found that the statue was more dense. Thus, it probably contained lead or some other metal and was not pure gold.

Changing Submarine Density

Knowing this should tell us how a submarine is able to both float and sink. As long as the density of the submarine is less than that of the water surrounding it, it surfaces. But when the density of the submarine is greater than the water surrounding it, it submerges. Submarine density is easily controlled by ballast tanks, which can be filled with air or water. When compressed air is pumped into the tanks and ballast water is forced out, the submarine becomes less dense than the water, so the submarine surfaces. When the ballast tanks are emptied of air and filled with water, the submarine becomes more dense than the water, so the boat submerges.

Even though metal-hull ships have buoyancy, they can’t control it like submarines can. Modern-day submarines even have a switch that can generate an emergency ballast blow. With this technique, water is blown out of the tanks with tremendous force while large amounts of compressed air are blasted into the tanks. The result is that the submarine becomes less dense very quickly and pops to the surface.

1. Even though a brick weighs less than a metal-hull ship, a brick in a bathtub sinks, but a metal-hull ship in the ocean floats. Why?

2. What do you think neutral buoyancy in a submarine is? Explain how you think it works and when it might be used.

3. Compare the directions of the buoyant force and the force of gravity on an object.
States of Matter

Section 1   Matter

A. __________________—anything that takes up space and has mass; matter is composed of tiny particles.
   1. Three usual __________________________ are solid, liquid, and gas.
   2. ____________________________, a fourth state, occurs only at very high temperatures and is not common on Earth.

B. __________________________—have definite shape and volume because particles are packed closely together and merely vibrate in place.
   1. Solids in which particles are arranged in a repeating, three-dimensional pattern are called __________________________ or crystalline solids.
   2. ____________________________ solids have a random arrangement of particles.

C. Matter with a definite volume but no definite shape is a ________________; a liquid’s particles move more freely than those of a solid.
   1. __________________________ is a liquid’s resistance to flow and increases when particles are more strongly attracted to each other.
   2. ____________________________—uneven forces acting on the particles of a liquid’s surface.

D. _______________—matter that does not have a definite shape or volume; gas particles spread out evenly as far apart as possible.

Section 2   Changes of State

A. Particles are in constant motion; amount of movement depends on their ____________________________.
   1. ____________________________—total energy of all the particles in a sample of matter
   2. The average kinetic energy of particles in a substance is its ____________________________.
   3. ____________________________—movement of thermal energy from a substance with a higher temperature to one with a lower temperature
States of Matter

B. __________________—amount of heat needed to raise the temperature of 1 g of a substance 1° C

C. Matter can _______________ states as energy is absorbed or released.
   1. A change from the solid to the liquid state is called ________________.
   2. A change from the liquid to the solid state is called ________________.

D. Changes between ________________________ states
   1. A change from liquid to gas is called ____________________.
      a. ___________________ is vaporization that occurs below the liquid’s surface at its boiling point.
      b. ___________________ is vaporization that occurs at the surface of a liquid; molecules must be at or near the surface and at the right speed to evaporate.
   2. ______________________________—a change from gas to liquid

E. Changes between solid and gas states—during ________________ the surface particles of a solid gain enough energy to become a gas.

Section 3 Behavior of Fluids

A. __________________ equals the force exerted on a surface divided by the total area over which the force is exerted, or \( P = \frac{F}{A} \).
   1. If force __________________ over an area, the pressure increases; if force over an area ________________, the pressure decreases.
   2. ______________________________—air presses down on Earth with force.
   3. Pressure can be ________________ as the pressure pushing down equals the pressure pushing up.
   4. As ________________ increases, air pressure decreases.

B. Gas pressure in a closed container ________________ with volume and temperature changes.
   1. Decreasing volume ________________ pressure; increasing volume ________________ pressure.
   2. Increasing temperature ________________ pressure; decreasing temperature ________________ pressure.
Note-taking Worksheet (continued)

C. ________________—an upward force on an object immersed in a fluid
   1. ________________—buoyant force on an object is equal to the weight of the fluid displaced by the object.
   2. ________________ is mass divided by volume.
      a. An object will ________________ in a fluid that is denser than the object.
      b. An object with the same density as the fluid will stay at the ________________ level in the fluid.
      c. An object will ________________ in a fluid that is less dense than the object.

D. ________________—when a force is applied to a confined fluid, an increase in pressure is transmitted equally to all parts of the fluid.
   1. ________________—allow people to lift heavy objects with relatively little force
   2. When squeezed, liquids will be pushed out of a ________________, a closed container with a hole in it.
Assessment
### States of Matter

#### Part A. Vocabulary Review

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

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. tells you whether a material is a solid, liquid or gas</td>
<td>a. freezing point</td>
</tr>
<tr>
<td>2. anything that takes up space and has mass</td>
<td>b. evaporation</td>
</tr>
<tr>
<td>3. thermal energy that flows from higher temperature to lower temperature</td>
<td>c. pressure</td>
</tr>
<tr>
<td>4. the temperature at which a substance changes from a solid to a liquid</td>
<td>d. buoyant force</td>
</tr>
<tr>
<td>5. the kinetic and potential energy of the particles of a substance</td>
<td>e. state of matter</td>
</tr>
<tr>
<td>6. the temperature at which attractive forces begin to trap particles here and there, and crystals begin to form</td>
<td>f. vaporization</td>
</tr>
<tr>
<td>7. temperature where some of a liquid begins to enter the gaseous state</td>
<td>g. condensation</td>
</tr>
<tr>
<td>8. the process by which individual particles of liquid escape from the surface and form a gas</td>
<td>h. melting point</td>
</tr>
<tr>
<td>9. the process by which particles move slowly enough for their attraction to bring them together to form a droplet of liquid</td>
<td>i. density</td>
</tr>
<tr>
<td>10. when a liquid changes to a gas</td>
<td>j. matter</td>
</tr>
<tr>
<td>11. the amount of force applied per unit of area</td>
<td>k. Pascal’s principle</td>
</tr>
<tr>
<td>12. the ability to do work or cause change</td>
<td>l. energy</td>
</tr>
<tr>
<td>13. the term referring to the pressure applied at any point to a confined fluid being transmitted unchanged throughout the fluid</td>
<td>m. heat</td>
</tr>
<tr>
<td>14. the term referring to mass divided by volume</td>
<td>n. Archimedes’ principle</td>
</tr>
<tr>
<td>15. When an object is placed in a fluid, the object weighs less by an amount equal to the weight of the displaced fluid.</td>
<td>o. thermal energy</td>
</tr>
<tr>
<td>16. the upward force of displaced fluid causing flotation</td>
<td>p. boiling point</td>
</tr>
</tbody>
</table>
Chapter Review (continued)

Part B. Concept Review

Directions: Fill in the blanks with the correct terms.

1. Water has a high ____________________ which causes it to heat very slowly.
2. Solids that are made up of particles arranged in repeating geometric patterns are called ____________________.
3. When the crystal structure of matter begins to collapse into a swarm of freely flowing molecules, the matter is moving from the ____________________ state to the ____________________ state.
4. If the attractive forces between particles are strong enough to keep them together as a group, but not hold them in a fixed position, the particles make up a(n) ____________________.
5. Boiling is one form of the state change called ____________________.
6. Puddles drying up in the Sun are examples of ____________________.
7. Steam changing to liquid water is an example of ____________________.
8. As a gas condenses to a liquid, it ____________________ the heat that was required to vaporize the liquid.
9. If an object’s density is greater than the density of a fluid, it ____________________ in the fluid.

Directions: Answer the following questions using complete sentences.

10. Describe the time vs. temperature graph for water going from room temperature to past the boiling point.

11. Explain why a gas completely fills any container you put it in.

12. Describe how our bodies use evaporation to cool themselves.

13. Explain why water comes squirting out of a full water bottle when you squeeze it.
I. Testing Concepts

Directions: In the blank at the left, write the letter of the term that best completes the statement or answers the question.

1. Particles that make up matter are in a state of ______.
   a. constant motion  c. ionization
   b. flux  d. constant combination

2. When a warm object is brought near a cool object, the cool object will ______.
   a. cool off  c. evaporate
   b. remain unchanged  d. warm up

3. Which of the following is not a change from liquid to gas states?
   a. vaporization  b. boiling  c. condensation  d. evaporation

4. A gas ______ fills its container.
   a. partially  c. sometimes
   b. most of the time  d. completely

5. The physical state of a type of matter depends mostly upon how its ______ are arranged and how they move.
   a. pressures and densities  c. nucleus and protons
   b. nucleus and neutrons  d. atoms and molecules

6. Different objects don’t heat at the same rate because they have different ______.
   a. specific heats  c. boiling points
   b. energy  d. temperatures

7. The net upward force caused by displaced fluid is ______.
   a. buoyant force  c. density force
   b. Pascal’s principle  d. pressure force

8. Solids made up of particles of matter arranged in repeating geometric patterns are ______.
   a. geometric solids  c. triangular matter
   b. tile solids  d. crystalline solids

9. The energy of moving particles is called ______.
   a. kinetic energy  c. atomic energy
   b. latent energy  d. potential energy

10. If an object’s density is less than that of the fluid it is in, it will ______.
    a. sink  b. float  c. melt  d. boil

11. When the attractive forces holding particles together are strong enough to hold them together as a group, but not in a fixed position, they form a ______.
    a. solid  b. gas  c. liquid  d. crystal

12. The ______ remains constant when a liquid reaches its boiling point.
    a. temperature  c. odor
    b. sound  d. color
Chapter Test (continued)

13. The higher the temperature of matter, the ______ the particles are moving.
   a. slower  
   b. farther  
   c. faster  
   d. closer

14. The formula for pressure is ______.
   a. \( P + F = A \)  
   b. \( P = \frac{F}{A} \)  
   c. \( P = F/A \)  
   d. \( P = F - A \)

15. Because the particles that make up a liquid are so ______, it is hard to compress a liquid.
   a. large  
   b. spread apart  
   c. active  
   d. close together

16. The formula for density is ______.
   a. \( D = \frac{m}{V} \)  
   b. \( D - m = V \)  
   c. \( D = \frac{V}{m} \)  
   d. \( D - V = m \)

II. Understanding Concepts

Skill: Identifying Cause and Effect

Directions: Complete the sentences by writing the correct term in the blank.

1. If the attractions between particles are strong enough to hold the particles in almost fixed positions, the matter involved is in a _________________________ state.

2. Solids are called _________________________ if their particles are arranged in repeated three-dimensional patterns.

3. Because particles in a liquid move more freely than those in a solid, liquids have no definite _________________________.

4. When a substance is _________________________, it gains thermal energy.

5. A lower _________________________ will cause a sidewalk to be warmer than the grass next to it, although both are in the sunlight.

6. It is possible to increase the amount of pressure by _________________________ the area where force is applied.

7. When the volume of a confined gas remains the same, the pressure will increase if the _________________________ increases.

8. An iceberg floats in water because the _________________________ of the ice is less than the _________________________ of water.
III. Applying Concepts

Directions: Do the following calculations. Show your work in the spaces provided.

1. Calculate the pressure exerted on a surface with an area of 8 m² by a force of 34 N.

2. Calculate the density of an object that has a mass of 12.6 kg and a volume of 3 dm³.

3. State Pascal’s principle. Give an example of how it can be used.

4. Describe the process of condensation. Use what you know about condensation to explain how dew is formed on grass.

5. The temperature of a material is an indirect measure of the average kinetic energy of the particles that make up the material. Using this indirect measure, describe the relationship between the speed at which the particles move and the temperature of the material.

6. Describe what happens when matter at a higher temperature touches matter at a lower temperature. Give at least one example.
IV. Writing Skills

Directions: Answer the following questions using complete sentences.

1. Using the information you have learned from this chapter, hypothesize why the following scenario takes place.
   
   **Scenario:** On a hot summer day you decide to have a glass of cold water, so you add ice to it. After you add the ice, the ice cubes become smaller and the drink becomes cooler. You also notice that the outside of the glass becomes wet.

2. Use Archimedes’ principle to explain why water aerobics is less stressful on the body’s joints than regular aerobics.

3. How will increasing the size of an object affect its thermal energy? How will increasing size affect temperature? Assume that all factors other than size are constant.
Transparency Activities
If you found a rock like one of these, what would you think? A lot of people would think they had found gold. Unfortunately, this rock is really a mineral called pyrite, or fool’s gold.

1. What can you determine about pyrite from this picture?
2. How is pyrite similar to gold? How might pyrite and gold differ?
Be sure not to forget about any water you put in the freezer to cool quickly. You might come back to a big ice cube.

1. What state of matter was the water in before it was put into the freezer? What happened in the freezer?
2. Compared to liquid water, how much space does solid water take up?
3. What are some examples of the effects of water expanding as it freezes?
Submarines have the ability to float on top of the ocean as well as dive beneath its surface. They accomplish this by taking water into holding tanks to dive and releasing it to surface.

1. The shape of a submarine is similar to an airplane’s body. Why is this so?
2. Name some metal objects that float. Name some metal objects that sink. Why might metal sometimes float and sometimes sink?
3. How are submarines and hot air balloons similar in the way they ascend and descend?
Solid, Liquid, Gas

- Sodium
- Chlorine

Liquid

Gas

Teaching Transparency Activity
1. What are the three familiar states of matter?

2. What is viscosity?

3. Which state of matter has no definite shape or volume?

4. Which state of matter has a constant shape and volume?

5. Describe the motion of the particles in the three states of matter on the transparency.

6. What state of matter is found in stars but is not common on Earth?
Directions: Carefully review the diagram and answer the following questions.

Archimedes' Principle

1. According to the diagram, how much fluid was displaced by the ball?
   A 35 mL       C 10 mL
   B 30 mL       D 5 mL

2. Justine wanted to determine the amount of fluid other objects displaced in the beaker. Which observation would mean she could NOT measure this amount of fluid?
   F More than one object was in the beaker.
   G She removed some water to make more room for objects.
   H The water rose above the measurement markings.
   J She used a different size of beaker for each new object.

3. According to Archimedes’ principle, the buoyant force on the ball equals the weight of ____.
   A 10 mL of fluid       C 35 mL of fluid
   B 30 mL of fluid       D 5 mL of fluid
Teacher Support and Planning

Teacher Support and Planning
Content Outline for Teaching .............................. T2
Spanish Resources ............................................ T5
Teacher Guide and Answers ............................... T9
Section 1  Matter

A. **Matter**—anything that takes up space and has mass; matter is composed of tiny particles.
   1. Three usual **states of matter** are solid, liquid, and gas.
   2. **Plasma**, a fourth state, occurs only at very high temperatures and is not common on Earth.

B. **Solids**—have definite shape and volume because particles are packed closely together and merely vibrate in place.
   1. Solids in which particles are arranged in a repeating, three-dimensional pattern are called **crystals** or crystalline solids.
   2. **Amorphous** solids have a random arrangement of particles.

C. Matter with a definite volume but no definite shape is a **liquid**; a liquid’s particles move more freely than those of a solid.
   1. **Viscosity** is a liquid’s resistance to flow and increases when particles are more strongly attracted to each other.
   2. **Surface tension**—uneven forces acting on the particles of a liquid’s surface.

D. **Gas**—matter that does not have a definite shape or volume; gas particles spread out evenly as far apart as possible.

**DISCUSSION QUESTION:**
Why do some liquids have greater viscosity than others do? *Liquids with greater viscosity have particles more strongly attracted to each other than do liquids with less viscosity.*

Section 2  Changes of State

A. Particles are in constant motion; amount of movement depends on their **kinetic energy**.
   1. **Thermal energy**—total energy of all the particles in a sample of matter
   2. The average kinetic energy of particles in a substance is its **temperature**.
   3. **Heat**—movement of thermal energy from a substance with a higher temperature to one with a lower temperature

B. **Specific heat**—amount of heat needed to raise the temperature of 1 g of a substance 1°C
C. Matter can change states as energy is absorbed or released.
   1. A change from the solid to the liquid state is called melting.
   2. A change from the liquid to the solid state is called freezing.

D. Changes between liquid and gas states
   1. A change from liquid to gas is called vaporization.
      a. Boiling is vaporization which occurs below the liquid’s surface at its boiling point.
      b. Evaporation is vaporization which occurs at the surface of a liquid; molecules must be at
         or near the surface at the right speed to evaporate.
   2. Condensation—a change from gas to liquid

E. Changes between solid and gas states—During sublimation the surface particles of a solid gain
   enough energy to become a gas.

DISCUSSION QUESTION:
How do heat and specific heat differ? Heat is a movement of thermal energy; specific heat is the
amount of heat needed to increase the temperature of 1 g of a substance by 1°C.

Section 3  Behavior of Fluids

A. Pressure equals the force exerted on a surface divided by the total area over which the force is
   exerted or, \( P = \frac{F}{A} \).
   1. If force increases over an area, the pressure increases; if force over an area decreases, the
      pressure decreases.
   2. Atmospheric pressure—air presses down on Earth with force.
   3. Pressure can be balanced as the pressure pushing down equals the pressure pushing up.
   4. As altitude increases, air pressure decreases.

B. Gas pressure in a closed container changes with volume and temperature changes.
   1. Decreasing volume increases pressure; increasing volume decreases pressure.
   2. Increasing temperature increases pressure; decreasing temperature decreases pressure.
C. Buoyant force—an upward force on an object immersed in a fluid

1. Archimedes’ principle—Buoyant force on an object is equal to the weight of the fluid displaced by the object.

2. Density is mass divided by volume.
   a. An object will float in a fluid that is denser than the object.
   b. An object with the same density as the fluid will stay at the same level in the fluid.
   c. An object will sink in a fluid that is less dense than the object.

D. Pascal’s principle—When a force is applied to a confined fluid, an increase in pressure is transmitted equally to all parts of the fluid.

1. Hydraulic systems allow people to lift heavy objects with relatively little force.
2. When squeezed, liquids will be pushed out of a force pump, a closed container with a hole in it.

DISCUSSION QUESTION:
Why does air pressure decrease with altitude? At higher altitudes air particles can spread out farther from each other, reducing pressure.
Los estados de la materia

La materia
Lo que aprenderás
■ A reconocer que la materia está formada de partículas en constante movimiento.
■ A relacionar los tres estados de la materia con la disposición de las partículas en ellos.

Vocabulario
matter / materia: todo lo que ocupa espacio y posee masa.
solid / sólido: materia con forma y volumen definidos; tiene partículas muy apretadas que se mueven principalmente por vibración.
liquid / líquido: materia que posee un volumen definido pero no una forma definida y que puede fluir de un lugar a otro.
viscosity / viscosidad: la resistencia de un líquido al agua.
surface tension / tensión de la superficie: fuerzas desequilibradas que actúan sobre la superficie de un líquido.

gas / gas: materia que no posee una forma o un volumen definido; posee partículas que se mueven a gran velocidad en todas direcciones.

Por qué es importante
Todo lo que puedes ver, saborear y tocar es materia. Sin la materia, pues, ¡nada importaría!

Los cambios de estado
Lo que aprenderás
■ A definir y comparar energía térmica y temperatura.
■ A relacionar cambios en energía térmica con cambios en la materia.
■ A explicar cómo los átomos tienen mayor energía de movimiento cuando la temperatura aumenta.

Vocabulario

temperature / temperatura: medida de la energía cinética promedio de las partículas individuales de una sustancia.

heat / calor: movimiento de la energía térmica de una sustancia con mayor temperatura a una sustancia con menor temperatura.
melting / fusión: cambio de la materia del estado sólido al líquido.
freezing / congelación: cambio de la materia del estado líquido al sólido.
vaporization / vaporización: cambio de la materia del estado líquido al gaseoso.
condensation / condensación: cambio de la materia del estado gaseoso al estado líquido, por ejemplo, cuando el agua se convierte en líquido.

Por qué es importante
La materia cambia de estado a medida que se calienta o que se enfria.

Laboratorio El ciclo del agua
El agua está por todas partes y la usas en sus tres estados. Este Lab te dará la oportunidad de observar los tres estados de la materia y de descubrir por ti mismo si el hielo se derrite realmente a 0°C y si el agua hiere a 100°C.

Preguntas del mundo real
¿Cómo cambia la temperatura del agua a medida que se calienta de un sólido a un gas?

Materiales
hornilla eléctrica
cubos de hielo (100 mL)
termómetro en grados centígrados
*sonda de temperatura electrónica
reloj de pared
*reloj con segundero
agitador de vidrio
vaso de precipitados de 250 mL
*Materiales alternativos

Metas
■ Medir la temperatura del agua a medida que se calienta.
■ Observar qué pasa a medida que el agua cambia de un estado a otro.
■ Graficar los datos de temperatura y tiempo.
Procedimiento
1. Anota tus datos en la tabla de datos de esta página.
2. Vierte 150 mL de agua y 100 mL de hielo en un vaso de precipitados y colócalo en la hornilla. No toques la hornilla.
3. Coloca el termómetro dentro de la mezcla de hielo con agua. No la revuelvas con el termómetro ni permitas que toque el fondo del vaso de precipitados. Después de 30 s, lee la temperatura y anótala en tu tabla de datos.
4. Enchufa la hornilla eléctrica y ponla a temperatura media.
5. Cada 30 segundos, lee y registra la temperatura en la tabla de datos. También observa y registra el estado físico del hielo o agua en el vaso de precipitados. Usa la varilla para batir el contenido del vaso de precipitados antes de tomar las temperaturas. Deja de anotar. Deja que el agua se enfríe.
6. Usa tus datos para hacer una gráfica colocando el tiempo en el eje x y la temperatura en el eje y. Traza una curva suave a través de los puntos.

Concluye y aplica
1. Describe cómo cambia la temperatura de la mezcla hielo y agua a medida que calientas el vaso.
2. Describe la forma de la gráfica durante cualquier cambio de estado.

Vocabulario
- pressure / presión: fuerza ejercida sobre una superficie dividida entre el área total sobre la cual se ejerce la fuerza.
- buoyant force / fuerza de flotabilidad: fuerza ascendente que se ejerce sobre un cuerpo sumergido en un líquido.
- Archimedes’ principle / principio de Arquímedes: establece que la fuerza de flotación de un cuerpo equivale al peso del líquido que ese cuerpo desplaza.
- density / densidad: la masa de un objeto dividida entre su volumen.
- Pascal’s principle / principio de Pascal: establece que cuando se le aplica una fuerza a un líquido confinado, un aumento en la presión se transmite de manera uniforme a todas las partes del líquido.

Por qué es importante
La presión te permite apretar el tubo de pasta dental y la fuerza de flotabilidad te permite que flotes en el agua.

Diseña tu propio barco
Es asombroso observar cómo barcos más altos que algunos edificios flotan fácilmente sobre el agua. Estos barcos transportan pasajeros y carga, además del enorme peso del barco mismo. ¿Cómo puedes determinar el tamaño de barco que se necesita para mantener cierta carga a flote?
Formula una hipótesis
Piensa acerca del principio de Arquímedes y cómo se relaciona con la fuerza de flotabilidad. Formula una hipótesis acerca de cómo el volumen de agua desplazado por el barco se relaciona con la masa de la carga que la nave puede sostener.

Posibles materiales
balanza
vasos plásticos pequeños (2)
cilindro graduado
regla métrica
tijeras
canicas (un vaso lleno)
recipientes
*vasija, cacerola o cubo
*Materiales alternativos

Medidas de seguridad

Metas
■ Diseñar un experimento que use el principio de Arquímedes para determinar el tamaño del barco necesario para sostener una cantidad dada de carga, de tal manera que la parte superior del barco esté al nivel de la superficie del agua.

Prueba tu hipótesis
Diseña un plan
1. Obtén un juego de canicas u otros artículos de tu maestro(a). Esta es la carga que tu barco debe sostener. Piensa sobre el tipo de nave que diseñarás. Considera los tipos de materiales que usarás. Decide cómo vas a probar tu hipótesis junto con tu grupo.
2. Haz una lista de los pasos que debes seguir para probar tu hipótesis. Incluye en tu plan cómo medirás la masa de tu barco y carga, calcula la cantidad de agua que debe desplazar tu nave, para flotar con la carga y mide el volumen y la masa del agua desplazada. Explica también cómo diseñarás tu barco para que flote con su carga.
3. Prepara una tabla de datos en tu Diario de ciencias y mantenla a mano para usarla mientras tu grupo recoge datos.

Sigue tu plan
1. Asegúrate que tu maestro(a) apruebe tu plan antes de empezar.
2. Lleva a cabo tu experimento según lo planificado. Asegúrate de observar todas las medidas de seguridad. En particular, limpia inmediatamente el agua derramada.
3. Registra tus observaciones cuidadosamente y completa la tabla de datos en tu Diario de ciencias.

Analiza tus datos
1. Escribe tus cálculos mostrando cómo determinaste el volumen de agua desplazada, necesaria para hacer que tu barco y carga flotaran.
2. ¿Flotó tu barco al nivel del agua, se hundió o flotó sobre la superficie del agua? Dibuja un diagrama de tu barco en el agua.
3. Explica cómo tus resultados coincidieron o no con tu hipótesis.

Concluye y aplica
1. Si tu barco se hundió, ¿cómo podrías cambiar tu experimento o cálculos para corregir el problema? ¿Qué cambios harías si tu barco flotó muy alto sobre el agua?
2. ¿Qué tiene que ver la densidad de la carga de un barco con el volumen de carga que el barco puede sostener? ¿Y qué puedes decir de la densidad del agua?
Sección 1 La materia

1. Toda la materia, que incluye todo lo que ocupa espacio y tiene masa, se compone de partículas pequeñas que están en movimiento constante.

2. En estado sólido, las fuerzas de atracción entre partículas las sostienen en su sitio para vibrar. Los sólidos tienen formas y volúmenes definidos.

3. Las partículas en estado líquido tienen volúmenes definidos y tienen libertad para moverse dentro del líquido. ¿Qué propiedad de los líquidos se muestra en la foto?

Sección 2 Los cambios de estado

1. La energía térmica es la energía total de las partículas en una muestra de materia. La energía cinética promedio de las partículas es la temperatura. ¿Cuál de estas muestras tienen una mayor cantidad de energía térmica?

2. Un cuerpo gana energía térmica durante la fusión cuando pasa de sólido a líquido o durante la vaporización cuando pasa de líquido a gas.

3. Un cuerpo pierde energía térmica durante la condensación cuando pasa de gas a líquido o durante la congelación cuando pasa de líquido a sólido.

Sección 3 El comportamiento de los fluidos

1. La presión es la fuerza dividida entre el área.

2. Los fluidos ejercen una fuerza de flotabilidad en dirección ascendente sobre los objetos inmersos en ellos. El principio de Arquímedes establece que la fuerza de flotabilidad sobre un cuerpo es igual al peso del fluido desplazado por el cuerpo.

3. Un cuerpo flotará en un fluido que se más denso que el cuerpo. La densidad es igual a la masa dividida entre el volumen.

4. La presión aplicada a un líquido se transmite uniformemente a través del líquido.

Esto se conoce como el principio de Pascal. ¿Cómo se relaciona el principio de Pascal con este tubo de pasta dental?
Hands-On Activities

MiniLAB (page 3)
1. The alcohol evaporated.
2. The hand felt cool where the alcohol was located. The alcohol removed heat from the skin as it evaporated, and then the hand warmed up again.
3. Sweating alone will not cool the body. The sweat has to evaporate for the body to feel cooler.

MiniLAB: Try at Home (page 4)
1. The water remained in the cup.
2. The pressure of the molecules in the air pushing up on the card was greater than the pressure of the molecules pushing down on the card.

Lab (page 5)
Lab Preview
1. To stir the contents of the beaker before taking each temperature.
2. The thermal energy increases, so the particles move faster and the temperature rises.

Conclude and Apply
1. The temperature increased, stayed the same for a period of time, then increased again.
2. During changes of state, the graph leveled off.

Lab: Design Your Own (page 7)
Lab Preview
1. sharp object; eye safety; clothing protection
2. The hypothesis should relate the volume of water displaced to the mass of the cargo of the ship.

Analyze Your Data
1. Typical calculations will involve relating the mass of the cargo and boat to the volume of the water displaced.
2. Results will vary.
3. Answers will depend on results of experiment. Data should be provided to justify answer.

Conclude and Apply
1. Answers will vary. Either way, students should check their measurements and calculations.
2. A ship can carry only a certain mass of cargo safely. Therefore, the ship can carry less high-density cargo than low-density cargo. If the water density is greater than 1 g/mL, then the volume that the ship can carry will be less. If the water density is less, then the ship can carry more volume.

Laboratory Activity 2 (page 11)
Data and Observations
a. Having a definite shape
b. Having a definite shape
c. Having a definite shape
d. Shapeless

Questions and Conclusions
Part A
1. Quartz was last to form so it filled all the spaces that were left, restricting crystal shape.
2. yes
3. It cooled slowly since it has large crystals.

Part B
1. Yes, faces are repeated.
2. yes
3. yes
4. Yes, it has all the characteristics of a crystal. Note that the act of making the crystal dendrite in lab disqualifies it as a mineral crystal.
5. It would be fast crystallization. This is like the dendrites that formed with the copper wire. The process is rapid.

Part C
1. This is similar to the conditions that occur when a non-boiling liquid under high pressure reaches the surface from deep in the earth. A release of pressure and then a sudden expansion occurs, which results in the boiling of the fluid.
2. on the outside near the edges of the “puddle” of salol
3. in the middle of the “puddle”

Laboratory Activity 1 (page 9)
Data and Observations
Table 1
| Ice cubes | Solid; No; Yes |
| Water     | Liquid; yes; Lower |
| Glass     | beads of water appear on it. |
| Beaker with ice | Floats |

Questions and Conclusions
1. ice; water; water vapor
2. float; The ice cube is less dense then the water.
3. ice; When water freezes, it expands.
4. the air; Water vapor cannot be seen in the air. Water vapor takes the shape of its container. Water vapor fills all available space in its container.
5. The temperature of the air was lowered by the contact with the cold glass.
6. the volume of the pressure cooker
7. Water as a solid resists changes in both shape and volume. Water as a liquid resists changes in volume but not in shape. Water as a gas offers little resistance to changes in shape or volume.
Meeting Individual Needs

Directed Reading for Content Mastery (page 17)
Overview (page 17)
1. solid
2. increases
3. liquid
4. boiling point
5. decreases
6. condensation
7. pressure
8. density

Section 1 (page 18)
1. solid—ice; liquid—water; gas—water vapor
2. Water changes state as its molecules move faster or slower or as temperature increases or decreases.
3. Accept all reasonable answers. Possible answers include: ice—drinks, skating, preserving food; water—drinking, bathing, swimming; gas—cooking foods, ironing, generating electricity
4. The process is the same.

Sections 2 and 3 (page 19)
1. This is an example of vaporization. As the liquid boils, it changes into a gas.
2. This illustrates Pascal’s principle. Pressure applied at any point to a confined liquid is transmitted unchanged throughout the liquid. So applying pressure anywhere on the bottle makes liquid squirt out of any hole in the bottle.
3. This is an example of buoyancy. The liquid water exerts a buoyant force that holds up the floating ice cubes.

Key Terms (page 20)
1. d
2. b
3. a
4. n
5. l
6. m
7. e
8. g
9. c
10. i
11. f
12. h
13. j
14. o
15. k

Reinforcement (page 25)
Section 1 (page 25)
1. h
2. d
3. a
4. g
5. b
6. i
7. f
8. c
9. e
10. j
11. Gravity holds the water molecules at the bottom of the glass, and attractive forces hold the water molecules together as a liquid.
12. The attractive (cohesive) forces between water molecules pull them together to form the beads.
13. Cohesive forces between water molecules cause surface tension. Within a volume of water, molecules are pulled in all directions, but the molecules are only pulled inward at the surface.
14. The force of gravity on a bug can be less than the water’s surface tension. The surface tension will support the bug and it won’t sink.
15. Water begins entering the gaseous state when molecules gain enough energy to overcome attractive forces. At 100°C boiling begins and molecules below the surface enter the gas phase.

Lectura dirigida para Dominio del contenido (pág. 21)
Sinopsis (pág. 21)
1. sólido
2. aumenta
3. líquido
4. punto de ebullición
5. disminuye
6. condensación
7. presión
8. densidad

Sección 1 (pág. 22)
1. sólido—hielo; líquido—agua; gaseoso—vapor de agua
2. El agua cambia de estado a medida que sus moléculas se mueven más rápida o más lentamente o a medida que su temperatura aumenta o disminuye
3. Aceptar todas las respuestas razonables. Algunas posibles respuestas son: hielo—bebidas, patinaje sobre hielo, conservación de alimentos; agua—para beber, bañarse, nadar; gaseoso—cocinar alimentos, planchar, generar electricidad

4. Il proceso è identico.

Secciones 2 y 3 (pág. 23)
1. Este è un ejemplo de vaporización. A medida que hierva, el líquido se convierte en un gas.
2. Esto ilustra el principio de Pascal. La presión aplicada en cualquier punto de un líquido confinado se transmite sin cambio a través de todo el líquido. De modo que al aplicar presión en cualquier parte de la botella hace que el líquido salga disparado de cualquier orificio en la botella.
3. Esta è un ejemplo de flotabilidad. El agua líquida ejerce una fuerza de flotabilidad que permite que los cubos de hielo floten.

Términos claves (pág. 24)
1. d
2. b
3. a
4. n
5. l
6. m
7. e
8. g
9. c
10. i
11. f
12. h
13. j
14. o
15. k
Teacher Guide & Answers (continued)

3. melting
4. evaporating
5. Graph B; as heat is added, the temperature first rises, then remains constant as the solid melts, then rises again. This indicates that some of the energy is being used to break the attractive forces between the particles in the solid. So the solid must be crystalline.
6. Graph A represents the melting of an amorphous solid. It shows a continuous increase in temperature which would occur as an amorphous solid got softer. Since there are no crystalline structures to break in an amorphous solid, the heating process is continuous.

Section 3 (page 27)

Enrichment (page 28)

Section 1 (page 28)
1. Answers will vary.
2. Students should offer an explanation that indicates they understand the molecules in the ice are farther apart than the molecules that make up the water.
3. Students should indicate that the particles that make up the copper penny are closer together than the particles in the molten copper.

Section 2 (page 29)
Students should do this with adult supervision. An example would be to put the ice in the glass bowl, pour the water and salt into the pan and set the pan on the hot plate. While the salt water is heating up in the pot, the bowl of ice should be suspended above the pot. The heat will evaporate the water, leaving the slat behind. As the water vapor rises, it will cool and condense on the bottom of the glass bowl. If the bowl is held at an angle the water will run into the cup.

Section 3 (page 30)
1. Because of Archimedes’ principle; a brick has a higher density than the bathtub water, so it sinks, while the metal-hull ship has a lower density than the ocean water surrounding it, so it floats.
Teacher Guide & Answers (continued)

3. c (4/2)  
4. d (2/1)  
5. d (2/1)  
6. a (3/2)  
7. a (6/3)  
8. d (2/1)  
9. a (3/2)  
10. b (6/3)  
11. c (2/1)  
12. a (4/2)  
13. c (4/2)  
14. c (7/3)  
15. d (2/1)  
16. a (7/3)

II. Understanding Concepts (page 38)  
1. solid (2/1)  
2. crystalline (2/1)  
3. shape (2/1)  
4. heated (3/2)  
5. specific heat (3/2)  
6. decreasing (7/3)  
7. temperature (7/3)  
8. density; density (6/3)

III. Applying Concepts (page 39)  
1. \[ P = \frac{34 \text{ N}}{8 \text{ m}^2} = 4.25 \text{ Pa} \] (7/3)  
2. \[ D = 12.6 \text{ kg} / 3 \text{ dm}^3 = 4.2 \text{ kg/dm}^3 \] (6/3)  
3. Pascal’s principle states that the pressure applied at any point to a confined fluid is transmitted unchanged throughout the fluid. Example: squeezing a tube of toothpaste. (7/3)  
4. As a gas cools, its particles slow down. When an enormous number of particles have slowed to the point that their attractions bring them together, a droplet of liquid forms. The water vapor in the air cools and its particles slow down. When its particles have slowed enough to form a liquid, it collects on the blades of grass. (4/2)  
5. The higher the temperature of the material, the faster the particles that make it up will move. The lower the temperature of the material, the slower the particles that make it up will move (4/2)  
6. The faster moving particles that make up the higher temperature material transfer some of their energy to the slower moving particles that make up the lower temperature material. Examples will vary, but all should include heat transfer, i.e. ice cubes in a beverage, sweat on your skin, warm skin and cold air, etc. (4/2)

IV. Writing Skills (page 40)  
1. Answers will vary. Answers should include that the reason the glass is wet on the outside is that water vapor has cooled and caused condensation to take place. The ice is water in its solid state, the water is in its liquid state, and the water vapor that condenses is water in its gaseous state. Students should also include that the reason the ice cubes cool the water is that heat transfer occurs, which lowers the temperature of the water and raises the temperature of the ice cubes, casing them to melt and change form the solid to the liquid state. (4/2)  
2. Archimedes’ principle states that when an object is placed in a fluid, the object weighs less by an amount equal to the weight of the displaced fluid. Thus, a person will exert less pressure on their joints in a ratio equal to the reduction in their weight during water aerobics. During regular aerobics the body has to support is full weight. (6/3)  
3. Since thermal energy is the total energy of all the particles in a substance, increasing an object’s size will increase its thermal energy. Temperature, however, is a measure of the average kinetic energy of the particles in a substance. Since all other factors are constant, the average kinetic energy of the particles won’t change.

Transparency Activities

Section Focus Transparency 1 (page 42)

Bummer

Transparency Teaching Tips

- This transparency introduces states of matter. Explain that matter is anything with mass and that takes up space. Ask the students to list the states of matter (solid, liquid, or gas) of the objects on the transparency.
- Ask the students to describe the characteristics of the objects on the transparency (solid, crystalline, shades of blue-gray intermingled with metallic, near-golden sheen, probably a combination of substances).
- Ask the students why pyrite might be mistaken for gold. Discuss which characteristics are the same and which are different.
- Explain that the sections of each sample that are gun-metal in color consist of iron.

Content Background

- Pyrite, also referred to as iron pyrite, is a compound of iron and sulfur (FeS₂).
- Although somewhat similar in appearance to gold, pyrite reacts differently when heated—it will smoke and give off a sulfur odor. Conversely, gold does not react when heated. In addition, pyrite will produce sparks when struck by a hammer, while gold does not.
- Pyrite is smelted commercially to extract its sulfur content. There are better sources of iron, so pyrite is not usually used for its iron content.

Answers to Student Worksheet

1. It’s a crystalline solid that is almost gold in color. It seems to vary a little bit in appearance.
2. Pyrite and gold are somewhat similar in color. Some of the pyrite appears to have the same shape as gold nuggets. On the other hand, the pyrite’s crystalline structure and two-toned coloration are
Teacher Guide & Answers (continued)

not like gold. Gold is a precious metal, while pyrite is a mineral that isn’t worth much in small volumes.

Section Focus Transparency 2 (page 43)

Looking forward to some ice water, are you?

Transparency Teaching Tips
- This is an introduction to changes of state.
- Explain that the energy of motion is called kinetic energy and that there is a connection between kinetic energy and temperature. Temperature is a measure of the average kinetic energy of the molecules in a sample of material.
- Ask the students to explain how this connection applies to the transparency.
- Explain that as water cools, its molecules lose energy and move more slowly. At a certain temperature (0°C or 32°F), the molecules begin to form crystalline bonds. This crystalline structure occupies a greater volume, which explains why ice expands upon freezing. Freezing water can exert enough force to burst jars or soda pop cans.

Content Background
- When freezing, each oxygen atom in water orients toward hydrogen atoms on neighboring molecules, creating a lattice arrangement. Because this structure is more open, it has a lower density. Water is one of the few substances whose density decreases when it goes from liquid to solid state.
- Antifreeze lowers the freezing point of water by adding solute molecules to the water. These particles interfere with the formation of the crystalline structures, thus preventing the water from freezing. At some point, however, low temperature will overcome those barriers, the lattice structure will form, and the water will become a solid.

Answers to Student Worksheet
1. It was a liquid. In the freezer, the liquid turned to a solid.
2. For water, the solid form takes up more space. On the transparency, the bulging container with the popped top illustrates this fact.
3. Answers will vary. Possibilities include ice cubes and icebergs float, plumbing can crack, pool lines need to have antifreeze in the winter (or they might crack), etc.

Section Focus Transparency 3 (page 44)

Up or Down?

Transparency Teaching Tips
- You may use this transparency to introduce the behavior of fluids. Point out that the atmosphere is exerting pressure on everyone in the classroom.
- An object immersed in a fluid experiences pressure on all sides. The upward force a fluid exerts on an object is called the buoyant force. If the buoyant force is greater than the object’s weight, the object will float.
- Explain that an object’s density indicates whether it will sink or float. Density is determined by dividing mass by volume. If an object is less dense than the fluid in which it is immersed, it will float. Otherwise, it will sink.
- Ask the students to explain how taking water into a submarine’s ballast tanks (or pumping it out) affects the submarine’s ability to submerge or surface. (Water increases the submarine’s mass. Since volume stays the same, its density also increases, eventually causing the sub to sink; by blowing water out and replacing it with air, a submarine’s mass and density are decreased, allowing it to rise.)

Content Background
- Modern submarines are as long as 181 m (560 feet) and displace as much as 19,000 metric tons.
- Submarines are now constructed with double-hulls to protect the crew and inner workings from the effects of external water pressure. Some of the space between hulls is used for ballast.
- Cornelius van Drubbel, a Dutch scientist, created the first workable sub in 1620. It was a covered and waterproofed rowboat. In the Civil War, the Confederate submarine Hunley became the first submarine to sink another ship, ramming the Union ship Housatonic in 1864. The explosive device, attached to a long pole on the Hunley’s bow, sunk both the Housatonic and the Hunley.

Answers to Student Worksheet
1. The submarine, like the airplane, is designed to reduce drag as it moves through a fluid.
2. Metal boats and submarines can float. Most metal objects, like planes, cars, pennies, watches, nails, etc., sink. The difference is mostly in the shape of the objects. Boats are shaped in such a way that, as a whole, they are less dense than water. Additionally, the objects must be watertight in order to float.
3. Submarines and hot air balloons both ascend and descend by adjusting density. Subs do this by taking on or discharging water, and hot air balloons do this by controlling the heat source.

Teaching Transparency (page 45)

Solid, Liquid, Gas

Section 1

Transparency Teaching Tips
- Have students give examples of the different states of matter.
- Have students explain the differences among the states of matter.
- Discuss with students the terms vapor, steam, crystals, and compounds.
Reteaching Suggestion
- Explain that there are three familiar physical states of matter. The arrangement and attraction of particles within matter determines whether the matter is a solid, liquid, or gas.

Extensions
Demonstration: Divide the class into groups and assign each group a state of matter. Have the students in each group devise a demonstration that will show the properties of their state of matter.
Research: Have students research plasma and present their findings to the class.

Answers To Student Worksheet
1. solid, liquid, and gas
2. Viscosity is a liquid’s resistance to flow.
3. gas
4. solid
5. The particles in the solid are held in place, but they vibrate; the particles in the liquid are close together, but they are able to flow past one another; the particles in the gas move at high speeds and fill the entire container.
6. plasma

Assessment Transparency (page 47)
States of Matter
Section 3
Answers
1. D. For this question, students need to subtract the new volume of fluid from the original volume of fluid.
   Choice A: No, this amount is the new volume.
   Choice B: No, this amount is the original volume.
   Choice C: No, this amount is not represented in either diagram.
   Choice D: Yes, 35 mL minus 30 mL is 5 mL.
2. H. Students need to understand that scientific data must be accurately collected. Beyond the measurement markings, the volume of fluid can not be reliably assessed.
3. D. To answer this question, students must recall that Archimedes’ principle equates buoyant force with the weight of the fluid displaced.

Test-Taking Tip
When given a diagram, instruct students to make a list of the information they can extract from the diagram.