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Correlation to Science Standards
For information on alignment to state science standards and NGSS, visit https://sallyridescience.com/learning-products/product-standards

Correlation to Common Core
Sally Ride Science’s *Key Concepts* and *Cool Careers* book series provide students with authentic literacy experiences aligned to Common Core in the areas of Reading (informational text), Writing, Speaking and Listening, and Language as outlined in *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects*. *Solids, Liquids, and Gases: Matter’s Amazing States* and the accompanying activities align to the following standards:

**Reading Standards for Literacy in Science and Technical Subjects 6-12 (RST)**
**Grades 6-8**

**Key Ideas and Details**
1. Cite specific textual evidence to support analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

**Craft and Structure**
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.

**Integration of Knowledge and Ideas**
7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

**Range of Reading and Level of Text Complexity**
10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

**Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12 (WHST)**
**Grades 6-8**

**Text Types and Purposes**
1. Write arguments focused on discipline-specific content. a.-e.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. b., d., f.

**Production and Distribution of Writing**
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

**Research to Build and Present Knowledge**
7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
9. Draw evidence from informational texts to support analysis, reflection, and research.
Range of Writing
10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Speaking and Listening Standards 6-12 (SL)
Grades 6-8

Comprehension and Collaboration
1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6, grade 7, and grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly. a.-d.

Presentation of Knowledge and Ideas
4. Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
   Grade 6
   Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation. Grade 7
   Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. Grade 8

Language Standards 6-12 (L)
Grades 6-8

Vocabulary Acquisition and Use
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 6, grade 7, and grade 8 reading and content, choosing flexibly from a range of strategies. a.-d.
6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

*Book pages pictured in the Teacher Guides are from eBook editions. Some pages in the print books have different images or layouts.

**Cool Careers**

- Cool Careers in Biotechnology
- Cool Careers in Earth Sciences
- Cool Careers in Engineering (Upper Elementary)
- Cool Careers in Engineering (Middle School)
- Cool Careers in Environmental Sciences (Upper Elementary)
- Cool Careers in Environmental Sciences (Middle School)
- Cool Careers in Green Chemistry
- Cool Careers in Information Sciences
- Cool Careers in Math
- Cool Careers in Medical Sciences
- Cool Careers in Physics
- Cool Careers in Space Sciences

**Key Concepts in Science**

- Adaptations
- Biodiversity
- The Biosphere
- Cells
- Earth’s Air
- Earth’s Climate
- Earth’s Energy
- Earth’s Natural Resources
- Earth’s Water
- Elements and Compounds
- Energy Basics
- Energy Transformations
- Flowering Plants
- Food Webs
- Forces
- Genetics
- Geologic Time
- Gravity
- Heat
- Life Cycles
- Light
- Motion
- Organic Molecules
- Photosynthesis and Respiration
- Physical Properties of Matter
- Plant and Animal Systems
- Plate Tectonics
- The Rock Cycle
- Solids, Liquids, and Gases
- Sound
- Space Exploration
- Sun, Earth, and Moon
- Units of Measurement
- Vertebrates
- The Water Cycle
- Weathering and Erosion

Sally Ride Science provides professional development and classroom tools to build students’ passion for STEM fields and careers. Founded by Dr. Sally Ride, America’s first woman in space, the company brings science to life for upper-elementary and middle school students.

Visit us at [SALLYRIDESCIENCE.COM](http://SALLYRIDESCIENCE.COM) for more information.
**Solids, Liquids, and Gases: Matter’s Amazing States**

*In Your World* engages students' interest by asking them to imagine the rise and fall of ocean waves as they ride on a sailboat. This vivid scenario encourages students to think of matter they encounter each day as solids, liquids, and gases, which they will learn about throughout the book.

**Chapter 1** explains that atoms are the building blocks of all matter and relates the motion of atoms to the states of matter. Students learn that particles of a solid are packed closely, particles of a liquid can move past each other, and particles of a gas move freely. The chapter explores characteristics of solids, including the concept of density.

**Thinking Like a Scientist** describes the properties of three different types of glass and provides measurements taken to compare their thermal expansion. Students learn that scientists have developed special kinds of glass for applications such as windows in the space shuttle. Students create a table to organize data and analyze the measurements to answer questions about the thermal expansion and uses of different types of glass.

**Chapter 2** reinforces the concept that molecules are not packed as closely in liquids as they are in solids. Students learn that water is unusual because, unlike most substances, it is most dense in its liquid form. The chapter explains that heating a liquid to its boiling point changes it to a gas.

**Chapter 3** explores properties of gases. Students read about the relationship between the pressure and density of a gas. They learn about the contents of Earth’s atmosphere and how gravity keeps the air around Earth from escaping into space. And they find out how temperature affects the density and pressure of air.

**How Do We Know?** introduces students to Waleed Abdalati, a glaciologist who studies the rate at which ice sheets in Greenland are melting. Students learn how he developed a way to use satellite data to improve monitoring of the melting of ice sheets. In *Math Connection*, students perform fraction calculations of the mass and volume of icebergs that form when chunks of ice break off from melting ice sheets.

**Hey, I Know That!** allows students to assess their own learning through a variety of assessment tasks relating to the key concepts covered in *Solids, Liquids, and Gases.*
Preview the book

Guide students in browsing through Solids, Liquids, and Gases: Matter’s Amazing States. Have them look at the table of contents, headings, photographs, and diagrams. For each chapter, ask students to tell what the focus of the chapter is. Explain that identifying the main idea of what you are about to read improves your comprehension of the topic.

Read In Your World (pages 4 and 5) and discuss key concepts

Tell students to read In Your World. Ask if anyone has ever been sailing. If so, ask them to describe things they saw and felt. If students have not had this experience, ask what they think they might see and feel, based on other experiences, such as standing by a lake shore or feeling the wind. Have the class examine the picture on page 4. Ask questions that encourage students to consider the properties of the states of matter shown in the picture.

What does the billowing sail show about the air? [Air is a gas, and its molecules push against the sail.]

What happens to the liquid water as the boat slices through it? [The water flows away from the sides of the boat.]

Encourage deeper thinking about the states of matter in the photo with questions such as these:

Why do you think gases are usually not visible in photos but liquids and solids are? [The molecules of a gas are spread so far apart that you can’t see the gas.]

How would a liquid’s shape change if it were poured from a small cup into a bigger cup? [A liquid takes the shape of the container you put it in.]
Read Chapter 1: Everything Is Atoms

Before reading: Model making a personal science dictionary

Before students read Chapter 1 of Solids, Liquids, and Gases, model how to learn science vocabulary by making a personal dictionary. Use the text on page 5 as an example. Ask,

What are some of the important words on this page?

Listen to students’ responses and then write solid, liquid, gas, and states of matter on the board. Invite students to give definitions, and write these on the board. Ask students to look up each word in the book’s glossary and to suggest modified definitions. Add these revisions to the definitions on the board. Have students copy the words and definitions in their science notebooks.

Tell students that they should add other science words to their dictionaries as they read. They can add diagrams or illustrations and sentences using each word to help them make sure they understand the meaning.

Tell students that the goal of learning science vocabulary is to help clarify concepts. Keeping a personal dictionary is a way to keep track of the words, as well as to review those terms and their meanings.

Read Chapter 1: Everything Is Atoms (pages 6–13)

Ask students to read Chapter 1: Everything Is Atoms. Provide them with a copy of the Chapter 1 handout. Tell students they can use it for taking notes as they read. Point out that the handout has a space for them to draw diagrams illustrating some of the vocabulary words in the chapter.

After reading: Discuss key concepts

Write the following questions on the board:

What does “state of matter” mean? [The state of matter of a substance indicates whether it is a solid, liquid, or gas.]

How is the motion of atoms different in solids, liquids, and gases? [Atoms in a solid vibrate; atoms in a liquid move past each other; atoms in a gas zip quickly past each other in every direction.]

How do you think the temperature of a substance affects its state of matter? [The higher the temperature of a substance, the more likely the substance will become first a liquid and then a gas.]

Divide the class into small groups, and have each group discuss possible answers to these questions. Afterward, have groups share their answers with the class and discuss any differences.
Read *Thinking Like a Scientist* (pages 14-15)

Ask students to read *Thinking Like a Scientist*. Give them the *Thinking Like a Scientist* handout. It instructs them to use the information in the lab notebook, shown here, to make a data table and then use the information in the table to answer the questions. Have students work in small groups to complete the handout. Then ask each group of students to go through one question and show how they arrived at their answer.

Interpreting Data

A chemistry student in a college lab tested samples of soda-lime, borosilicate, and fused silica glass. She heated each sample, measured its thermal expansion, and recorded her observations. Read the chemistry student’s lab notes. Create a table that organizes the results of each kind of glass tested. Then use the information in the table to answer the questions.

**ANSWER KEY**

1. Which type of glass expands the most when heated? Which expands the least?  
   *Soda-lime glass expands the most when heated. According to the lab notes, soda-lime glass had a thermal expansion measurement of 9, borosilicate glass had a thermal expansion of 3.5, and fused silica glass had a thermal expansion of 0.6.*

2. Which type of glass has roughly one-third the thermal expansion of soda-lime glass?  
   *Borosilicate glass has a thermal expansion measurement of 3.5. That’s roughly one-third the thermal expansion of 9 measured for soda-lime glass.*

3. What type of glass would be a better choice for a glass coffee pot—soda-lime glass or borosilicate glass? Explain why.  
   *Borosilicate glass would be a better choice for a glass coffee pot. It can withstand higher temperatures than soda-lime glass can. When soda-lime glass is heated, it expands quickly and so is likely to shatter. Borosilicate glass does not expand as quickly or as much when it is heated, and so it is not as likely to crack.*

4. If you need a piece of glass to fit into something perfectly—no matter what the temperature—what kind of glass would you want to use? Explain your answer.  
   *For a piece of glass that must fit perfectly no matter what the temperature, fused silica glass would be the best choice. It expands much less than the other two types of glass. This kind of glass is used for the windows in the International Space Station because it is able to withstand extreme heat so well.*
Read Chapter 2: *From Solid to Liquid*

**Before reading: Model summarizing with an outline**

Before students read Chapter 2 of *Solids, Liquids, and Gases*, model how to summarize the chapter by making an outline. Give students the Chapter 2 handout and point out that it has a space for them to make an outline of the chapter.

Ask students to turn to page 16. Tell students that they can use the chapter title as the title of their outline. Write *From Solid to Liquid* on the board to begin your outline. Tell students to copy the outline on their handouts as you develop it.

Next, tell students that the section titles can be used for the sections of their outline, and that they should be set off with Roman numerals. On the board, write,

I. Go with the Flow
II. Elbow Room

Say,

*I am leaving some space between the sections so I can add more details.*

Call on a student to read aloud the text on page 16. Then say,

*What is the most important information to add to the first section of our outline, Go With the Flow?*

Students might suggest,

A. Forces in a liquid keep the particles together
B. A liquid doesn’t have a definite shape.

Write the concepts under Go with the Flow in the outline.

Then tell students that they can add more detail about each lettered section by adding another level to the outline set off by numbers. Tell students they should add to the outline as they read Chapter 2.

**Read Chapter 2: *From Solid to Liquid*** (pages 16–21)

Ask students to read Chapter 2, taking notes on their handouts as they read and continuing to build an outline of the chapter.

**After reading: Elaborate on key concepts**

Place an ice cube in a glass of water. Have students work in pairs and use what they have learned in this chapter to explain why the ice floats. Ask,

*Why is the ice cube floating instead of sinking?* [The density of the ice is lower than the density of the liquid water. Substances with lower density float in fluids with higher density, so ice floats in water.]

*What happens when you take a bottle of olive oil out of the refrigerator and part of the oil is solid and part is liquid?* [The liquid olive oil will rise to the top of the bottle, and the solid olive oil will stay at the bottom.]

*Why does the ice in liquid water behave differently from solid and liquid olive oil?* [In the olive oil and in most other substances, the solid form is denser than the liquid form, so the solid form sinks. Water is one of the only common substances in which the liquid form is denser than the solid form, so the solid form floats.]

Discuss and evaluate students’ explanations as a class and come to a conclusion.
**SOLIDS, LIQUIDS, AND GASES: CHAPTER 3**

**From Liquid to Gas**

Read Chapter 3: *From Liquid to Gas*

Before reading: Model how to summarize with a Venn diagram

Before students read Chapter 3 of *Solids, Liquids, and Gases*, model how to compare and contrast information by making a Venn diagram. Draw two overlapping circles on the board. Write *Solids* in the left circle and *Liquids* in the right circle. In the overlapping area, write *Both*. Ask,

**What do solids and liquids have in common?**

Listen to students’ ideas. Then in the overlapping area of the diagram, write one of their responses, such as, *Both are made of molecules*. Then ask,

**What properties do solids have that are not shared by liquids?**

Again, listen to students’ ideas and write a response in the *Solids* circle, such as, *Solids have a definite shape*. Finally, ask,

**What properties do liquids have that are not shared by solids?**

In the *Liquids* circle, write one of the responses, such as *Molecules in a liquid slip and slide past each other*.

After making the Venn diagram for solids and liquids, explain that using Venn diagrams helps compare and contrast information. Tell students they’ll make their own Venn diagram as they read Chapter 3.

Read Chapter 3: *From Liquid to Gas* (pages 22-25)

Ask students to read Chapter 3: *From Liquid to Gas*. Give them the Chapter 3 handout. As they read, they should take notes on the handout. Note that the handout has a place for them to make a Venn diagram contrasting liquids and gases. [Venn diagram sample labels: Properties shared by liquids and gases (to be written in the overlapping area) include: made of molecules, shape can change, molecules vibrate, and molecules change location. A property of liquids that they do not share with gases (to be written in the Liquids circle) is definite volume. A property of gases that they do not share with liquids (to be written in the Gases circle) is spreads out to fill a container.]

After reading: Discuss key concepts

Ask students to look at the photo of the balloon on page 23. Ask,

**Why is the balloon round?** [The air molecules exert equal pressure in all directions as they move around, pushing out the sides of the balloon equally, causing a round shape.]

**Why do puddles on a sidewalk evaporate faster on a hot day?** [On a hot day, the water molecules absorb more heat energy from the air and sidewalk. That energy makes the water molecules move faster until they have enough energy to break the bonds holding them in the liquid state and escape from the surface of the liquid. The more energy given to the water molecules, the faster they move and the more easily they escape into the air as a gas.]

Call on several students to share their ideas. As students discuss their ideas, help them to correct any misconceptions.

**ADDRESS MISCONCEPTIONS**

Students may think that steam is a gas. Whether they are correct depends on their definition of steam. If defined as the water vapor that forms when water boils, then steam is a gas. However, most students think of steam as the mist rising from a pot of boiling water, a whistling teakettle, or occasionally, from a lake or river. This mist is not a gas but rather tiny droplets of water formed when water vapor (gas) condenses into liquid. In a pot of boiling water, for example, the boiling water evaporates into vapor but then condenses almost immediately as it meets the cooler air above the water. The resulting mist is made of countless droplets of liquid water. These droplets are not visible water molecules, as some students might think. Instead, each droplet is made of billions and billions of water molecules.
Describe how matter changes state

Give students the Science Writing handout. It instructs students to choose two examples from nature in which matter changes from one state to another. Each example should be of a different change, such as solid to liquid, liquid to gas, or liquid to solid. For each example, students will write a paragraph describing the change. They should be sure to answer these questions for each example:

> How do the energy and motion of the particles of the matter change?
> How does the temperature of the matter change?
> How does the change affect the shape and volume of the matter?

**ANSWER KEY**

**Example 1**—State change: from a liquid to a gas [Sample paragraph: An example of a change from a liquid to a gas is the evaporation of a puddle of rainwater from a sidewalk. The Sun’s energy increases the energy of the water molecules that make up the puddle of water. This increases the motion of the water molecules. As they gain more energy, the temperature of the water increases. As the temperature rises, the water molecules vibrate faster. Some of the water molecules on the surface are able to break free of the forces that hold them to other water molecules. They float into the air as a gas, or water vapor. As a liquid, water does not have a definite shape, but it has a definite volume. Once it changes to a gas, neither its shape nor its volume is definite.]

**Example 2**—State change: from a liquid to a solid [Sample paragraph: An example of a change from a liquid to a solid is the freezing of rainwater to form an icy surface on a road on a cold night. As rain falls, the liquid raindrops splash on a road. They lose energy to the surrounding cold air and cold pavement. This decreases the energy of the water molecules and slows down their motion. The temperature of the water begins to decrease. As the water molecules continue to lose energy, they vibrate more and more slowly. Water molecules come together and form ice crystals as the liquid water changes to solid ice. As a liquid, water has a particular volume, but its shape can change. But as a solid, water has a particular shape and volume.]
Read *How Do We Know?* (pages 26-29)

Give students the *How Do We Know?* handout for *Solids, Liquids, and Gases*. Ask students to look over the questions for the first section of *How Do We Know?, The Issue* (page 26) and then read that section and answer the questions. Have them complete the rest of the sections (*The Expert*, page 27; *In the Field*, page 28; *Technology*, page 29) in the same way.

Go over each question as a class. Call on students to share their answers to each question.

**ANSWER KEY**

1. How does the writer make the topic interesting?  
   *Sample answer: The writer describes the formation of the Greenland ice sheet and then asks the reader to consider what would happen if the ice sheet melted.]*

2. Why do you think the writer chose the picture on page 26 (shown here) to explain the topic?  
   *Sample answer: The picture shows both land and ice, and it also shows melting ice.]*

3. How did Waleed Abdalati’s early life prepare him to be a glaciologist?  
   *Waleed grew up around snow and ice, and he was good at science and math.*

4. How did Waleed prove that using satellites to measure the melting of ice sheets was reliable?  
   *Waleed went into the field to gather measurements by hand, and then he compared those to measurements taken by satellites.*

5. How does the melting of ice sheets and glaciers affect the world’s oceans?  
   *Water that is locked up in ice sheets and glaciers becomes part of the ocean as the ice melts, resulting in a rise in the sea level.*
Answer the *Math Connection* questions

Give students the *Math Connection* handout. Have them read *Math Connection* on page 29 of *Solids, Liquids, and Gases* and answer the questions, showing their work, on their handouts.

**Tip of the Iceberg**

Large chunks of ice can break off ice sheets to form icebergs. Icebergs float because ice is only about 9/10 as dense as salt water. That means about 9/10 of an iceberg’s mass and volume is under water. So 1/10 of an iceberg—its tip—sticks out of the water.

**Answer Key**

1. If an iceberg has a total mass of 100,000 metric tons, what is the mass of its tip? *The mass of the tip would be 10,000 metric tons. (100,000 metric tons x 1/10 = 10,000 metric tons)*

2. Imagine that the tip of an iceberg holds 10 cubic meters of ice. How much ice does the full iceberg contain? *The total mass of the iceberg would be 100 cubic meters. (10 cubic meters x 10 = 100 cubic meters)*
What would you ask a scientist?

Give students the Interview Questions handout. Tell them to imagine that they are journalists for a kids’ science magazine. They are assigned to write an article about glaciologist Waleed Abdalati and his work. Students’ job: prepare a list of 10 questions to ask Waleed during an interview.

Have students work in pairs. Tell them to reread the How Do We Know? feature on pages 26-29 of Solids, Liquids, and Gases and to look back through the rest of the book to get ideas for questions.

Tell students that their questions should cover a variety of topics, including Waleed’s experiences as a glaciologist, his personal characteristics, and what it’s like to work in remote, cold areas. Tell them that good journalists use the 5W’s and H—what, who, why, where, when, and how—to gather information.

After 10 minutes, have pairs gather in groups of four to six students. Each group should choose the five best questions from among the pairs in the group. Then have each group read their questions aloud as you (or one or two student helpers) record all original questions on the board. Then, as a class, choose the five best questions.
Complete the *Hey, I Know That!* study guide (page 30)

Have students use the *Hey, I Know That!* handout to answer the questions on page 30 of *Solids, Liquids, and Gases*. Have pairs of students discuss their answers and note any misunderstandings they may have. Whip around the room, asking one student to read aloud a question and one or two students to share their answers to each question.

**ANSWER KEY**

1. What are the building blocks of all matter? What are groups of these building blocks called if they have bonded together? (page 6) *The building blocks of all matter are atoms. Atoms are too tiny for us to see, but they make up all matter in the Universe. When atoms bond together in groups, they are called molecules. The simplest molecule has just two atoms. A large, complex molecule might have hundreds of atoms.]*

2. Create three drawings that show how far apart the molecules of an imaginary substance are in its solid, liquid, and gas states. (page 8) *Drawings should show a substance in which the molecules of the solid are close together, the molecules of the liquid are farther apart, and the molecules of the gas are farthest apart, as in the illustration on page 8, shown here.*

3. Name two things that affect the density of a solid, and explain them. (page 11) *The density of a solid depends on how much its individual atoms weigh and how tightly they are packed together. An example of a solid with a high density is lead. In a solid piece of this metal, the atoms are comparatively large and heavy, with an atomic number of 82. And these large, heavy atoms are packed tightly together. So solid lead is extremely dense. That’s why lead is used for such things as weights to keep scuba divers submerged.*

4. What is the difference between melting point and boiling point? Use an example of a particular substance to explain. (pages 13 and 21) *The melting point of a substance is the temperature at which it changes from a solid to a liquid. Ice is the solid form of water. As the temperature of ice rises, its molecules gain more and more energy and vibrate faster. Eventually they vibrate so much that they break out of their orderly pattern and start moving over, under, and around each other. The solid ice has turned into liquid water. The boiling point of a substance, on the other hand, is the temperature at which it changes from a liquid to a gas. As the temperature of liquid water rises, its molecules move faster and faster. When the water gets hot enough, some molecules become energetic enough to break away from the liquid and float off into the air as a water vapor. As water below the surface begins turning rapidly to water vapor, it bubbles up vigorously and escapes into the air. That is why boiling water bubbles.*

5. Remember that liquids expand as they get warmer. What do you think happens to warm water when it gets colder, but not cold enough to freeze? (page 18) *As warm water gets cooler, it takes up less space. The molecules of warm water have a lot of energy, so they vibrate and move farther apart. But when a liquid cools, the molecules have less energy and do not vibrate or move around as much. They move closer together, and the water takes up less space. But as long as the cold water is above the freezing point, it remains liquid.*
6. Which would evaporate faster—a puddle on a sidewalk in the shade or a puddle on a sidewalk in sunlight? Explain your answer. (page 20) [A puddle of water would evaporate faster in the sunlight than in the shade. The more heat you add to a liquid, the more its molecules move around. More of them get enough energy to escape from the liquid and float off into the air as a gas. A puddle in the sunlight would take in more heat energy from the Sun’s rays, and more of the puddle’s molecules would become energetic enough to float away as water vapor.]

7. What is gas pressure? Name one way gas pressure can be increased. (page 23) [Gas pressure is the force exerted by the molecules of a gas zooming around and colliding with surfaces. The force exerted by one air molecule is incredibly small. But when zillions of air molecules are all colliding with the things around them, the pushes add up to create gas pressure. You can increase gas pressure by forcing more gas into the same amount of space so that there are even more gas molecule to collide with the surfaces around them. When you blow up a balloon or inflate a bicycle tire, you are increasing the gas pressure by increasing the number of air molecules inside a confined space.]
Everything Is Atoms: Notes for Chapter 1

As you read Chapter 1, write down the most important information you come across. Resist the urge to write down everything that you read. Instead, focus on the big ideas, or gist, of what you are reading.

MINUSCULE BUT MIGHTY

ON THE MOVE

HOW MUCH MOTION?

MATTER CAN CHANGE

THE STORY ON SOLIDS

FROM PACKING TO PROPERTIES

HEATING THINGS UP

MELTDOWN!
PICTURE THIS
Review your notes for Chapter 1. Summarize your notes by making drawings with labels representing at least four of the vocabulary words in the chapter.

PUT IT ALL TOGETHER
Use your notes and drawings to help you identify and list the most important ideas—the key concepts—in Chapter 1.

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Thinking Like a Scientist: Thermal Expansion of Glass

Read Thinking Like a Scientist on pages 14 and 15 of Solids, Liquids, and Gases.

Interpreting Data

A chemistry student in a college lab tested samples of soda-lime, borosilicate, and fused silica glass. She heated each sample, measured its thermal expansion, and recorded her observations. Read the chemistry student’s lab notes below. Create a table that organizes the results of each kind of glass tested. Then use the information in the table to answer the questions.

<table>
<thead>
<tr>
<th>Type of glass</th>
<th>Thermal expansion</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
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1. Which type of glass expands the most when heated? Which expands the least?

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2. Which type of glass has roughly one-third the thermal expansion of soda-lime glass?

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3. What type of glass would be a better choice for a glass coffee pot—soda-lime glass or borosilicate glass? Explain why.

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4. If you need a piece of glass to fit into something perfectly—no matter what the temperature—what kind of glass would you want to use? Explain your answer.

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From Solid to Liquid: Notes for Chapter 2

As you read Chapter 2, write down the most important information you come across. Resist the urge to write down everything that you read. Instead, focus on the big ideas, or gist, of what you are reading.

GO WITH THE FLOW

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__________________________________________________________________________________________
__________________________________________________________________________________________

ELBOW ROOM

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WEIRD, WONDERFUL WATER

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THE GREAT ESCAPE

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WHEN LIQUIDS GET WARM

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__________________________________________________________________________________________
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IT’S A GAS!

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PICTURE THIS
Review your notes for Chapter 2. Summarize your notes by developing an outline that includes the main ideas and supporting details. Your outline should always begin with a main topic after a Roman numeral I. Main ideas should be listed as A, B, etc. Details can be listed under each letter as 1, 2, etc. You can include further details and examples under each number as a, b, etc.

PUT IT ALL TOGETHER
Use your notes and outline to help you identify and list the most important ideas—the key concepts—in Chapter 2.

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__________________________________________________________________________________________
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From Liquid to Gas: Notes for Chapter 3

As you read Chapter 3, write down the most important information you come across. Resist the urge to write down everything that you read. Instead, focus on the big ideas, or gist, of what you are reading.

INTO THE INVISIBLE

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FEELING THE PRESSURE?

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AIR AND THE ATMOSPHERE

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ABOVE AND ALL AROUND

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PICTURE THIS
Summarize Chapter 3 by making a Venn diagram comparing and contrasting liquids and gases. Draw two overlapping circles. Label one circle \textit{Liquids} and the other \textit{Gases}. Label the overlapping area \textit{Both}. Write characteristics that only liquids have in the \textit{Liquids} circle, characteristics that only gases have in the \textit{Gases} circle, and characteristics shared by liquids and gases in the overlapping area.

PUT IT ALL TOGETHER
Use your notes and Venn diagram to help you identify and list the most important ideas—the key concepts—in Chapter 3.

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Science Writing: Describe How Matter Changes State

Choose two examples from nature in which matter changes from one state to another. Each example should be of a different change, such as solid to liquid, liquid to gas, or liquid to solid.

For each example, write a paragraph describing the change.

Be sure to answer these questions for each example:

> How do the energy and motion of the particles of the matter change?
> How does the temperature of the matter change?
> How does the change affect the shape and volume of the matter?

**Example 1**

State change: ______________________________________________

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
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**Example 2**

State change: ______________________________________________

___________________________________________________________________
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How Do We Know? A Melting Blanket of Ice

Review the questions below for each section of How Do We Know? Then read each section in the book and answer the questions.

THE ISSUE
1. How does the writer make the topic interesting?

_______________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________

2. Why do you think the writer chose the picture on page 26 to explain the topic?

_______________________________________________________________________________________
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_______________________________________________________________________________________

THE EXPERT
3. How did Waleed Abdalati’s early life prepare him to be a glaciologist?

_______________________________________________________________________________________
_______________________________________________________________________________________
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IN THE FIELD
4. How did Waleed prove that using satellites to measure the melting of ice sheets was reliable?

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TECHNOLOGY
5. How does the melting of ice sheets and glaciers affect the world’s oceans?

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_______________________________________________________________________________________
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Math Connection: Tip of the Iceberg

Large chunks of ice can break off ice sheets to form icebergs. Icebergs float because ice is only about 9/10 as dense as salt water. That means about 9/10 of an iceberg’s mass and volume is under water. So 1/10 of an iceberg—it's tip—sticks out of the water.

Show your work as you answer the questions.

1. If an iceberg has a total mass of 100,000 metric tons, what is the mass of its tip?

   _______________________________________________________________________________________
   _______________________________________________________________________________________
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2. Imagine that the tip of an iceberg holds 10 cubic meters of ice. How much ice does the full iceberg contain?

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   _______________________________________________________________________________________
Imagine you are a journalist for a kids’ science magazine. You are assigned to write an article about glaciologist Waleed Abdalati and his work.

Your job: Prepare 10 questions to ask Waleed in an interview.

Your questions should cover a variety of topics, such as:

> Waleed’s experiences as a glaciologist.
> Waleed’s personal characteristics.
> What it’s like work in remote, cold areas.

Remember, good journalists use the 5W’s and H—what, who, why, where, when, and how—to gather information.

Interview questions

1. _______________________________________________________________________________________
   _______________________________________________________________________________________
2. _______________________________________________________________________________________
   _______________________________________________________________________________________
3. _______________________________________________________________________________________
   _______________________________________________________________________________________
4. _______________________________________________________________________________________
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8. _______________________________________________________________________________________
9. _______________________________________________________________________________________
10. _____________________________________________________________________________________
Hey, I Know That! Study Guide

Use this sheet to answer the Hey, I Know That! questions on page 30 of Solids, Liquids, and Gases.

1. What are the building blocks of all matter? What are groups of these building blocks called if they have bonded together? (page 6)

_______________________________________________________________________________________

_______________________________________________________________________________________

_______________________________________________________________________________________

2. Create three drawings that show how far apart the molecules of an imaginary substance are in its solid, liquid, and gas states. (page 8)

_______________________________________________________________________________________

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3. Name two things that affect the density of a solid, and explain them. (page 11)

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4. What is the difference between melting point and boiling point? Use an example of a particular substance to explain. (pages 13 and 21)

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5. Remember that liquids expand as they get warmer. What do you think happens to warm water when it gets colder, but not cold enough to freeze? (page 18)

6. Which would evaporate faster—a puddle on a sidewalk in the shade or a puddle on a sidewalk in sunlight? Explain your answer. (page 20)

7. What is gas pressure? Name one way gas pressure can be increased. (page 23)