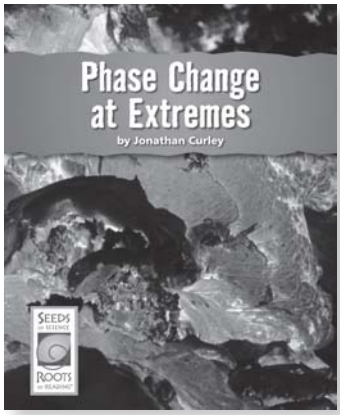
Interpreting Visual Representations

with *Phase Change at Extremes* from *Seeds of Science/Roots of Reading®*



Introduction

This strategy guide introduces an approach for teaching students about interpreting visual representations. Teaching students how to interpret visual information can enhance reading comprehension and is particularly important for understanding science texts. This guide includes an introductory section about interpreting visual representations, a general overview of how to teach this strategy with many science texts, and a plan for teaching students to interpret visual representations with the *Seeds of Science/Roots of Reading®* book *Phase Change at Extremes*.

Book Summary

Phase Change at Extremes expands readers' conceptions of phase change beyond water and other familiar substances that change phase at common temperatures. The first part of the book provides basic information about the three phases of matter (solid, liquid, and gas), how atoms and molecules move, and how energy is related to phase change. The sections that follow describe phase change of four materials that change phase at very high temperatures or very low temperatures. Learning about how gold, diamond, alcohol, and carbon dioxide can change phase highlights that even as materials change phase, they fundamentally remain the same substance.

About This Book

Reading Level

Guided Reading Level*: S

Key Vocabulary

atom, molecule, phase change, property, substance, temperature

Text Features

bold print, captions, diagrams, glossary, graphs, headings, illustrations, labels, photographs, table of contents, text boxes

*Guided Reading Levels based on the text characteristics from Fountas and Pinnell, *Matching Books to Readers.*

Science Background

Everything in the physical world is made of matter. Matter can be found on Earth in three phases: solid, liquid, and gas. A solid holds its shape and does not make puddles. A penny is an object in a solid state. It holds its shape wherever it is. Liquid, on the other hand, assumes the shape of its container. It does not hold its shape on its own, so when it is not in a container, it flows and forms puddles. The water in a pool is a liquid. Gas also does not hold its shape, but, unlike a liquid, gas expands and spreads out in all directions to fill its container. Gas is usually invisible. Helium is an example of a gas. Substances can exist in more than one phase, but no matter what phase a substance is in, it is still the same substance. For example, solid water (ice), liquid water, and water vapor are all different forms of the same substance—water (H_2O). When energy is added or taken away from matter, the matter can change phase. Adding energy causes the atoms and molecules of a substance to move faster, and the substance changes from solid to liquid or from liquid to gas. Taking energy away from a substance causes the atoms and molecules to move slower, and the substance changes from gas to liquid or from liquid to solid. Different substances change phase at particular temperatures, which is a characteristic property of each substance.

About Interpreting Visual Representations

Information in science texts is often conveyed visually as well as with words. Different forms of visual representations found in science texts may include flow charts, labeled diagrams, cutaway drawings, and illustrations. While the text in a book may *tell* about ideas, visual representations *show* information, complex relationships, and processes in graphic form. These features aid in visualization and afford students another modality from which to derive meaning and solidify understanding of science concepts. Asking students to think carefully about visual representations and what they communicate can help them better understand what they are reading.

Teaching Ways to Interpret Visual Representations

The following guidelines can be used to teach the strategy of interpreting visual representations with any science text.

- Select a text with content related to your curriculum that includes two or more different types of visual representations. (Though not an exhaustive list, the box at the top of the next column contains four different types that are common in science texts.) These should be central to understanding the main ideas in the text.
- Tell students that science texts incorporate different kinds of visual representations, or ways of showing information in pictures. These can include models, photographs, diagrams, and graphs. Authors include these visual representations to help readers visualize and better understand ideas.
- Show examples of visual representations from a range of science texts and have students share what they notice about each.
- Draw students' attention to the text you selected before class. Point out one or two visual representations that are most prominent and central to understanding the content you selected. By thinking aloud, model how to use one of the visual representations to enhance understanding of the text. Explain that the words and the images usually work together to convey ideas.
- Direct students to read the text and pay close attention to the visual representations in addition to the words. For instance, if the text contains diagrams, ask students to think carefully about what the diagrams show about a particular concept.
- As students read, encourage them to take the time to examine the visual representations closely. You may wish to use the Visual Representations copymaster, included in this guide, to record ideas about what the visual representations explain. Alternatively, students can discuss the visual representations with a partner as they read.
- After reading, encourage students to reflect on why they think the author might have included the visual representations and how the visual representations helped them understand the ideas presented in the text. Lead a class discussion reflecting on each of the visual representations in the text.
- Continue guiding students as they interpret visual information in other content-rich texts. Remind them to examine visual representations during reading and think about what the visual representations convey.
- As students become more comfortable with interpreting visual representations, ask students to include them in their own informational writing.

Visual Representations in Science Texts

- **Models** represent something in a simple way that makes it easier to see or understand (e.g., a model of a DNA molecule).
- **Photographs** depict scientific ideas in a realistic way (e.g., photographs of a snail's habitat).
- **Diagrams** are illustrations with labels and/or symbols that explain something (e.g., a diagram showing the water cycle or the parts of a crayfish).
- **Graphs** display data about the relationship between two variables (e.g., a graph showing the average temperature for different months of the year).

Interpreting Visual Representations with *Phase Change at Extremes*

Getting Ready

Make a copy of the Visual Representations copymaster for each student.

Before Reading

1. Tell students that *Phase Change at Extremes* is about what happens to atoms and molecules at extreme temperatures. Ask students to preview the book and discuss what they notice about *how* information is presented.
2. Draw attention to the model on page 6, the diagrams on page 7, and the graph on pages 22–23. Explain that models, diagrams, graphs, and other images found in science books are called visual representations. Authors of science texts use visual representations to help readers understand important ideas.
3. Turn to page 7 and read the text aloud. Model examining the diagrams, thinking aloud about how they help you understand more about how atoms and molecules move in gases, liquids, and solids. Point out the symbols used to show motion and explain that these are diagrams—illustrations with labels or symbols that explain something.
4. Tell students that today they will read *Phase Change at Extremes* and discuss the visual representations in the book.

During Reading

Read the book in a way that is consistent with your classroom routines, giving students as much independence as possible. Ask students to try to use the visual representations as they read, in order to better understand the text.

After Reading

1. Distribute the Visual Representations student sheets. Have students turn to page 9, reread the text, and examine the diagram. Direct students to record "diagram" in the first column on their student sheets and the page number in the second column.
2. Point out the question in the heading of the third column: "What does the visual representation explain?" Have students share ideas about what the diagram on page 9 explains and what they think readers can learn from it. Guide students toward recording a response, such as "how phases of matter change when energy is added or taken away."
3. Ask students to reflect on why the author might have included a diagram here and how the diagram shows information in a way that the words do not. Discuss their ideas. [The diagram is a simple way to show a few ideas at once. When you look at the diagram as you read, it is easier to understand the text.]
4. Have students reread pages 12–13, closely examining the diagram. On their student sheets, have students record the name of this visual representation (diagram), the page numbers, and what they think it explains. Ask several students to share their ideas and discuss the purpose of the diagram. Ask, "What does the diagram show that is hard to explain in words?" Point out the caption on the bottom of page 13 to guide students in this discussion.
5. Have students reread pages 20–21, paying particular attention to the photograph of dry ice on page 21. On their student sheets, have them record what they think the photograph explains. Guide students to see that the dry ice photograph is helpful because it shows a scientific process described in the text (carbon dioxide changing from a solid to a gas).
6. Have students select another visual representation from the book and record their ideas about its purpose on their student sheets. Have students share ideas about the visual representations they selected with the class.

Independent Extension

Have students compare and contrast two visual representations found in *Phase Change at Extremes*. Direct students to discuss how well each visual representation enhances understanding of the text. Good choices for comparisons include pages 4 and 5 or pages 12–13 and 22–23.

Name _____ **Date** _____

Visual Representations

Title of Book: _____

Type of visual representation	Page number(s)	What does the visual representation explain?

About Strategy Guides

A six-page strategy guide is available for each *Seeds of Science/Roots of Reading*® student book. These strategies support students in becoming better readers and writers. They help students read science texts with greater understanding, learn and use new vocabulary, and discuss important ideas about the natural world and the nature of science. Many of these strategies can be used with multiple titles in the *Seeds/Roots* series. For more information, as well as for additional instructional resources, visit the *Seeds/Roots* Web site (**www.seedsofscience.org/strategyguides.html**).

Available Student Books for Grades 4–5

Nine engaging student books are now available from *Models of Matter* and *Chemical Changes*, each with a corresponding strategy guide. The books are part of the *Seeds of Science/Roots of Reading*® curriculum program described on page 6. Eighteen student books from the remaining grade 4–5 units (*Planets and Moons* and *Aquatic Ecosystems*) are currently in development and will be available in spring and summer 2010.

Chemical Changes	
Strategy	**Student Book**
Teaching Scientific Explanation Writing	*Chemical Reactions Everywhere*
Posing Investigation Questions	*Handbook of Chemical Investigations*
Teaching Text Structure	*What Happens to the Atoms?*
Teaching Procedural Writing	*Bursting Bubbles: The Story of an Improved Investigation*
Promoting Word Consciousness	*Communicating Chemistry*
Models of Matter	
Strategy	**Student Book**
Teaching Summary Writing	*Made of Matter*
Using Roundtable Discussions	*Break It Down: How Scientists Separate Mixtures*
Interpreting Visual Representations	*Phase Change at Extremes*
Teaching About How Scientists Make Inferences	*Science You Can't See*

Extend Learning with *Seeds of Science/Roots of Reading*®

The strategy featured in this guide is drawn from the *Seeds of Science / Roots of Reading*® curriculum program. *Seeds / Roots* is an innovative, fully integrated science and literacy program.

The program employs a multimodal instructional model called "Do-it, Talk-it, Read-it, Write-it." This approach provides rich and varied opportunities for students to learn science as they ***investigate*** through firsthand inquiry, ***talk*** with others about their investigations, ***read*** content-rich books, and ***write*** to record and reflect on their learning.

Take advantage of the natural synergies between science and literacy instruction.

- Improve students' abilities to read and write in the context of science.
- Excite students with active hands-on investigation.
- Optimize instructional time by addressing goals in two subject areas at the same time.

To learn more about *Seeds of Science / Roots of Reading*® products, pricing, and purchasing information, visit **www.seedsofscience.org**

***Models of Matter* Science and Literacy Kit**

Developed at Lawrence Hall of Science and the Graduate School of Education at the University of California at Berkeley.

Seeds of Science/Roots of Reading® is a collaboration of a science team led by Jacqueline Barber and a literacy team led by P. David Pearson and Gina Cervetti.

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