Material A

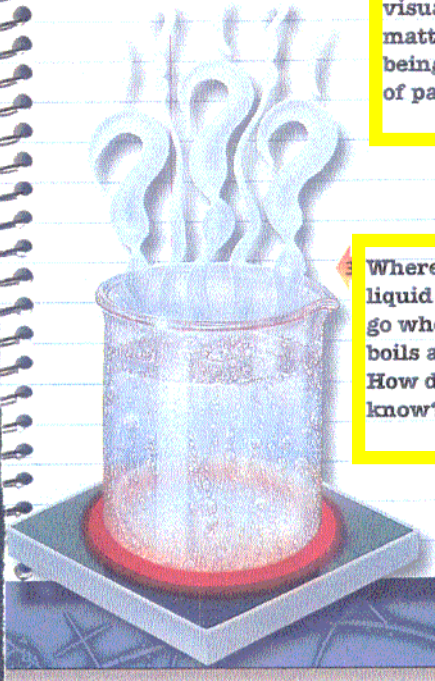
Some help for teachers in identifying their students' ideas is provided by *Science Log* questions, questions or activities in the Prior Knowledge and Misconceptions sections, and questions interspersed in both the student and teacher editions (Level Blue, pp. **87st**, **107st**, **200st**). Nevertheless, the set of questions provided is not sufficient to elicit the variety of student preconceptions about the key ideas that have been identified in research studies. There is a sufficient number of questions that will help elicit students' ideas about the particulate nature of matter, but hardly any of these questions will help bring out students problems understanding the intrinsic motion of particles or their tendency to attribute macroscopic properties to particles. *Science Log* questions sometimes express ideas in ways that are not likely to be meaningful to the students who have not studied the topic before and are not familiar with the scientific vocabulary. For example, in the beginning of a chapter that is meant to introduce the particle model, the *Science Log* includes the question "If you could see individual air particles, what might they look like?" (p. **78s**). Despite identified weaknesses, when it is compared with other middle school textbooks, this program makes the best explicit effort to help teachers identify student ideas related to the structure of matter.

CHAPTER 5

A Case for Particles

1 If matter is made up of particles, what's in between the particles?

2 Why do scientists visualize matter as being made of particles?



3 Where does liquid water go when it boils away? How do you know?

ScienceLog

Think about these questions for a moment, and answer them in your ScienceLog. When you've finished this chapter, you'll have the opportunity to revise your answers based on what you've learned.

Prior Knowledge and Misconceptions

Your students' responses to the ScienceLog questions on this page will reveal the kind of information—and misinformation—they bring to this chapter. Use what you find out about your students' knowledge to choose which chapter concepts and activities to emphasize in your teaching. After students complete the material in this chapter, they will be asked to revise their answers based on what they have learned. Sample revised answers can be found on page 106.

In addition to having students answer the questions on this page, you may wish to have them complete the following activity: Have students describe what would happen if they could break a rock up into gravel, grind the gravel into a powder, and then grind the powder into even smaller pieces. Ask: What would you eventually end up with if you could break the rock up into smaller and smaller pieces?

Assure students that there are no right or wrong answers to this exercise. Collect their answers, but do not grade them. Instead, use the answers to identify possible problem areas and to find out what students know about the particle nature of matter, what misconceptions students may have, and what aspects of this topic are interesting to them.

CHAPTER 5

A Case for Particles

Connecting to Other Chapters

Chapter 4
introduces scientific models and how exponents are used to describe large and small numbers.

Chapter 5
explores the evidence for an atomic theory of matter and discusses the states and structure of matter.

Chapter 6
investigates how temperature changes affect matter and explores the properties of matter.

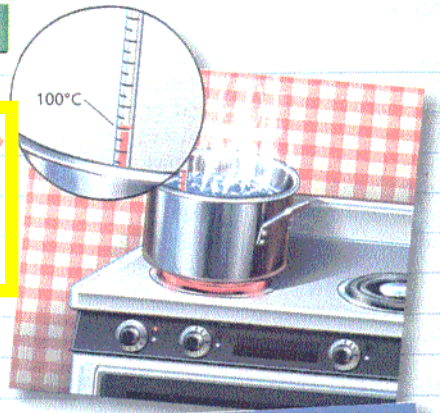
Chapter 7
surveys the historical development of our understanding of the atom and the particles contained in its nucleus.

Homework

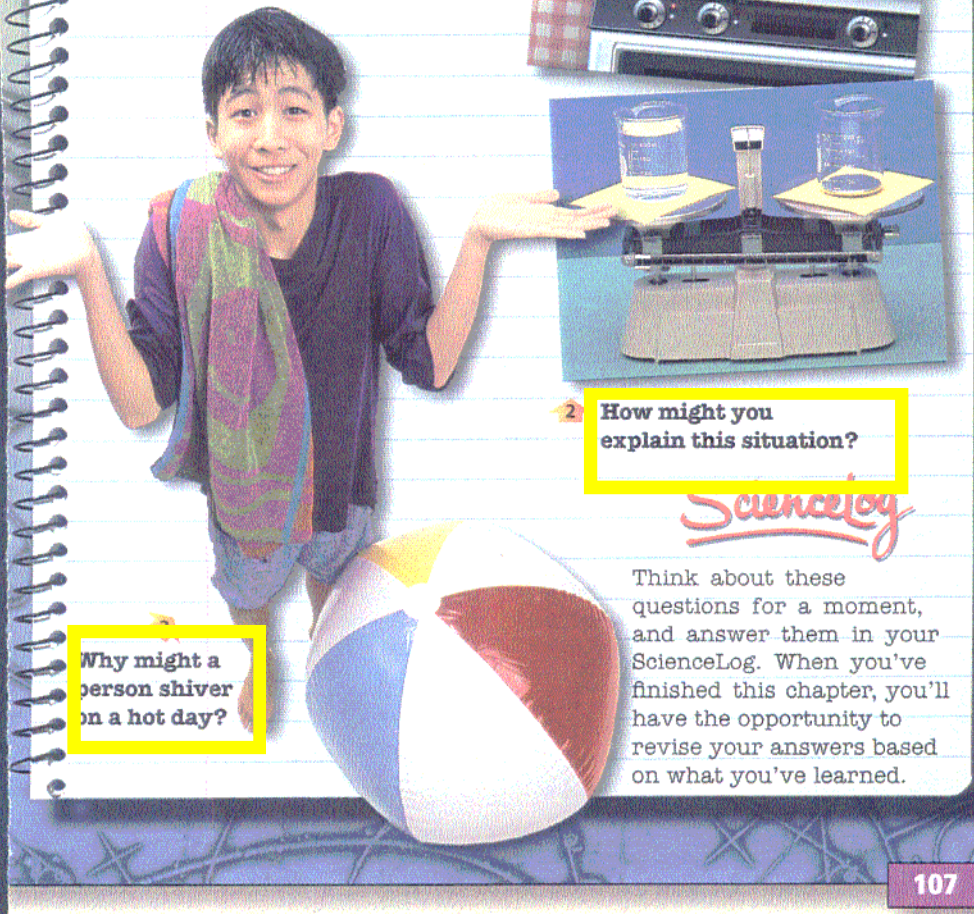
Ask each student to make three observations at home and state what he or she infers from these observations. For example, a student could observe an empty food dish and infer that the dog has eaten its dinner. Or a student might observe the good mood of a sibling and infer that he or she got an A on a test in school that day.

CHAPTER 6

Testing the Particle Model



1 Why does the thermometer read no higher than 100°C even though the stove continues to supply heat to the water?



2 How might you explain this situation?

Why might a person shiver on a hot day?

ScienceLog

Think about these questions for a moment, and answer them in your ScienceLog. When you've finished this chapter, you'll have the opportunity to revise your answers based on what you've learned.

Prior Knowledge and Misconceptions

Your students' responses to the ScienceLog questions on this page will reveal the kind of information—and misinformation—they bring to this chapter. Use what you find out about your students' knowledge to choose which chapter concepts and activities to emphasize in your teaching. After students complete the material in this chapter, they will be asked to revise their answers based on what they have learned. Sample revised answers can be found on page 125.

In addition to having students answer the questions on this page, you may wish to have them complete the following exercise: Students should write a paragraph to explain evaporation and condensation, giving several examples of each and offering an explanation of what is happening on a particle level during these two processes. Collect the papers, but do not grade them. Instead, use them to find out what students already know about evaporation and condensation, what misconceptions they might have, and what about the topic is interesting to them.

CHAPTER 6

Testing the Particle Model

Connecting to Other Chapters

Chapter 4
introduces scientific models and how exponents are used to describe large and small numbers.

Chapter 5
explores the evidence for an atomic theory of matter and discusses the states and structure of matter.

Chapter 6
investigates how temperature changes affect matter and explores the properties of matter.

Chapter 7
surveys the historical development of our understanding of the atom and the particles contained in its nucleus.

CHAPTER 11

Meet Matter

Connecting to Other Chapters

Chapter 11 explores the nature of matter, including its physical, chemical, and biological properties.

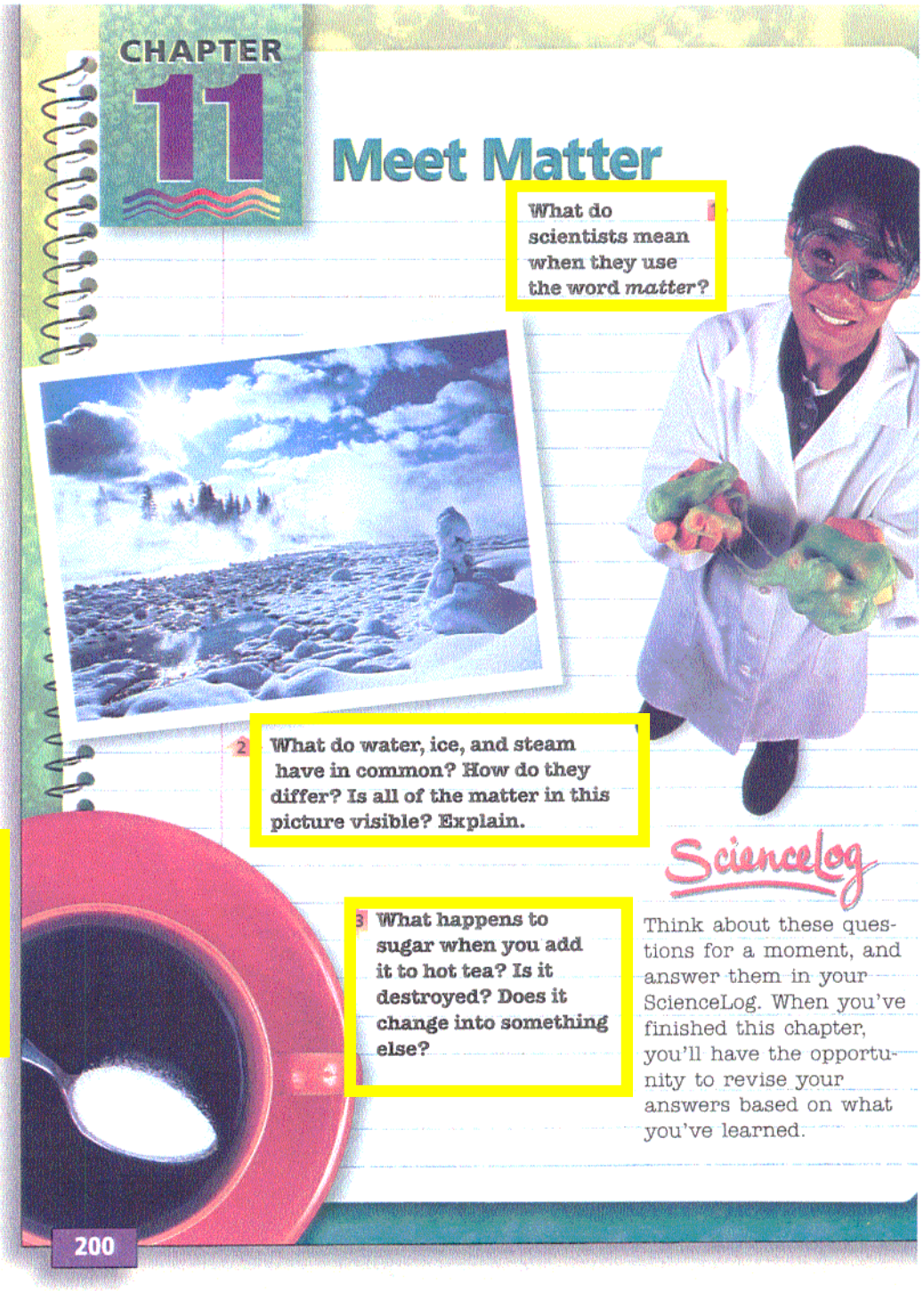
Chapter 12 introduces the metric system and ways to measure volume and mass.

Chapter 13 examines the three principal states of matter—solid, liquid, and gas.

Prior Knowledge and Misconceptions

Your students' responses to the ScienceLog questions on this page will reveal the kind of information—and misinformation—they bring to this chapter. Use what you find out about your students' knowledge to choose which chapter concepts and activities to emphasize in your teaching.

In addition to having students answer the questions on this page, you may wish to assign a "free write" to assess prior knowledge. To do this, instruct students to write for 3 to 5 minutes on the subject of matter. (If students are unfamiliar with the scientific use of this word, it may be helpful to have them describe other ways that they have heard the word used.) Tell them to keep their pens moving at all times, writing in a stream-of-consciousness fashion. Emphasize that there are no right or wrong answers in this exercise. It may be best to ask students not to put their names on their papers. Collect the papers, but do not grade them. Instead, read them to find out what students know about matter, what misconceptions they may have, and what about matter is interesting to them.



CHAPTER 4

More Than Observing

Connecting to Other Chapters

Chapter 4
introduces scientific models and how exponents are used to describe large and small numbers.

Chapter 5
explores the evidence for an atomic theory of matter and discusses the states and structure of matter.

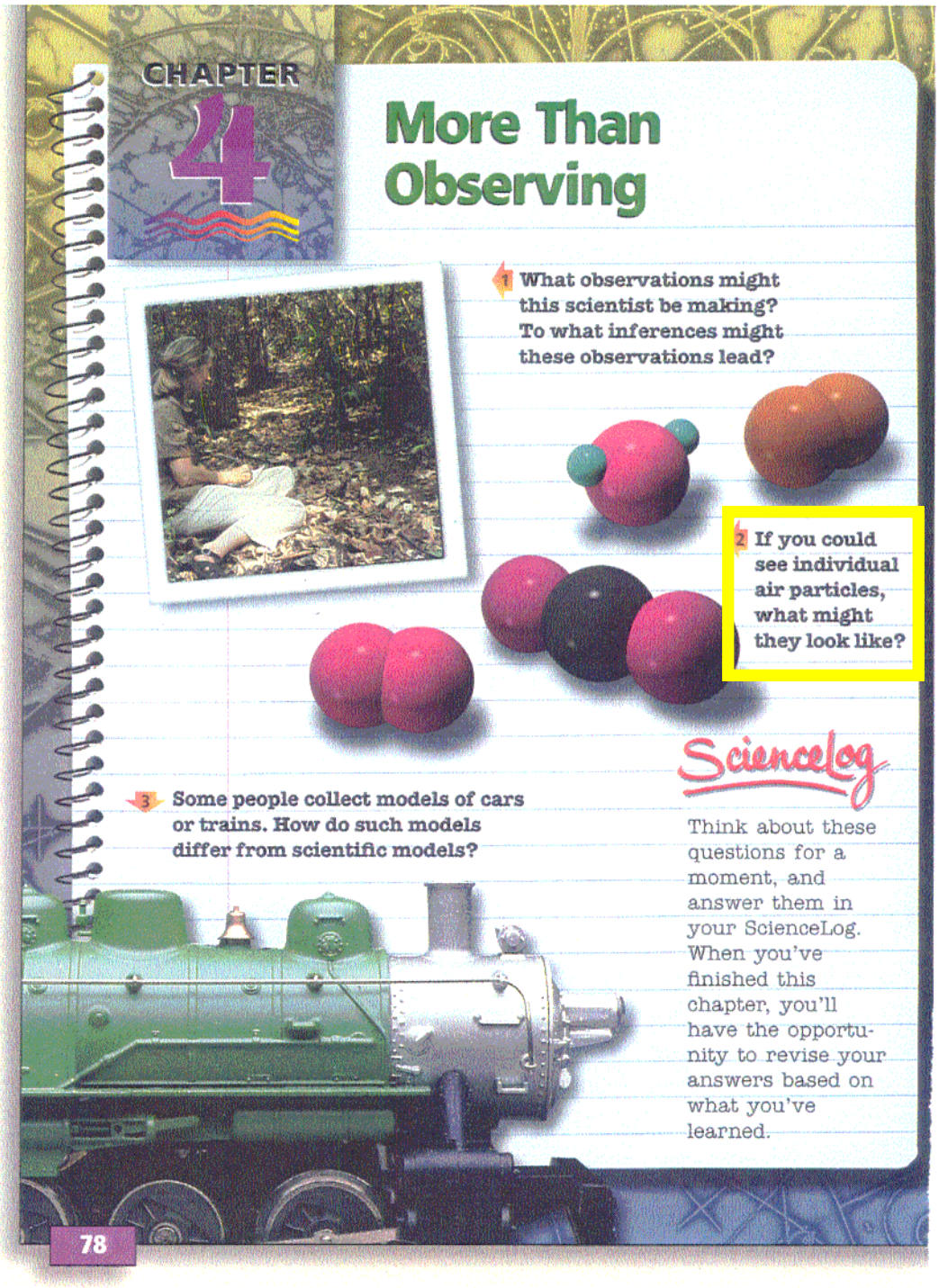
Chapter 6
investigates how temperature changes affect matter and explores the properties of matter.

Chapter 7
surveys the historical development of our understanding of the atom and the particles contained in its nucleus.

Prior Knowledge and Misconceptions

Your students' responses to the ScienceLog questions on this page will reveal the kind of information—and misinformation—they bring to this chapter. Use what you find out about your students' knowledge to choose which chapter concepts and activities to emphasize in your teaching. After students complete the material in this chapter, they will be asked to revise their answers based on what they have learned. Sample revised answers can be found on page 86.

In addition to having students answer the questions on the page, you may wish to have them complete the following activity: Ask students to write these measurements in exponential form: 100 cm, 1000 m, 10,000 m², 0.1 m. Then ask students to name items that could have these measurements. Collect their answers, but do not grade them. Instead, use the answers to identify possible problem areas and to find out what students know about exponents and the size of units, what misconceptions students may have, and what aspects of this topic are interesting to them.



Integrating the Sciences

Earth and Physical Sciences

Point out to students that a diamond and the graphite in a pencil are made of the same material. Ask: What is this material? *(Carbon)* Why do you think the hardnesses of diamond and graphite are so different? *(The carbon atoms are arranged differently in the two materials.)*

Cross-Disciplinary Focus

Industrial Arts

In this chapter, students will explore the usefulness of creating physical models. Under the supervision of an industrial-arts teacher, you may wish to have students build a working example of a model that they will learn about or have learned about, such as a model of how the ear works (on page 83) or a model of a cell or cell membrane (in Unit 1). Have an industrial-arts teacher supervise their work, and make sure they have their plans approved by you for safety before they begin construction.