1. Ask students to consider the following: the more energy matter has, the more the atoms in the matter are moving. Discuss how this relates to different states of matter.
2. Discuss with students whether they think there is any more water on Earth now than there was one million years ago.
3. Discuss the characteristic differences among solids, liquids and gases and list reasons why knowing about these differences is helpful.

Follow-up Activities

- In a creative writing activity, ask students to brainstorm about a world in which familiar properties of matter are different. For example, what would life be like if water was not found on Earth in liquid form? What if cars were made of liquid? What if objects did not have any weight? Have each student write a paragraph describing a day in this strange world.
- Have students investigate differences in solids, liquids and gases and create a bulletin board illustrating each phase. Be sure to include graphic representations of how tightly the particles are packed, as well as information about the amount of energy the particles of each substance has and the shape and volume of examples from each state of matter.
- In a hands-on lab activity, have students discover the freezing point and melting point of some common nontoxic liquids. Make sure they record their observations and present their findings in a table or a chart. Have students compare data and try to explain any discrepancies.

Internet Resources

Periodically, Internet Resources are updated on our web site at www.LibraryVideo.com

- **www.chemistry.org/portal/a/c/s/1/wondernetdisplay.html?DOC=wondernet\index.html**
  These pages are part of an excellent online science magazine for elementary students created by the American Chemical Society and include lessons on states of matter.
- **www.nyu.edu/pages/mathmol/textbook/slg.html**
  This site is a hypermedia science textbook geared to third and fourth graders that gives descriptions and examples of the different states of matter. ***(Continued)***

- **www.cesu.k12.vt.us/K-4Resources/matter.htm**
  The Chittenden East Supervisory Union in Richmond, Vermont has complied a list of web sites containing information about states of matter that is suitable for students in the younger grades.

Suggested Print Resources

- Curry, Don. *What is Matter?* Children's Press, Danbury, CT; 2004.
- Lilly, Melinda. *Solid, Liquid, and Gas.* Rourke Book Co., Vero Beach, FL; 2003.
- Zoehfeld, Kathleen. *What Is the World Made Of? All About Solids, Liquids, and Gases.* Harper Collins, New York, NY; 1998.

TEACHER'S GUIDE CONSULTANT

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Physical Science for Children™

All About Solids, Liquids & Gases

Grades K–4

This guide is a supplement, designed for educators to use when presenting this program in an instructional setting.

Before Viewing: Research in learning suggests that it is important for the teacher to discover what the students know — or think they know — about a topic, at the start of a new unit, so that their accurate conceptions can be validated and reinforced, and their misconceptions identified and corrected. Therefore, after reviewing the pre-viewing discussion questions provided for your class, create an "Everything We Know About…" list. Preview key vocabulary words and have students raise additional questions they hope will be answered by this program. Most importantly, students should be told that as "science detectives" they must listen closely, so that after viewing the program, they will be able to tell whether or not the facts/beliefs they put on their list were scientifically accurate.

After Viewing: After a brief discussion about the program, challenge your "science detectives" to prove or disprove the accuracy of the facts they put on their "Everything We Know About…" list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.

SCHLESSINGER SCIENCE LIBRARY

Program Summary

Everything in the world is made of tiny particles called atoms, and, believe it or not, every particle is constantly moving! Atoms move in different ways in solids, liquids and gases. In solids, the particles are packed so tightly together that they can barely move. This allows them to keep their shape. The particles in liquids are able to move around and spread out more than the particles in solids. This allows them to change shape easily. In fact, they take the shape of whatever container they're in. Gases have no definite shape at all; they keep spreading out to fill whatever space they're in. In gases, particles are moving very quickly and spread far apart from each other. We all know that solids are hard and liquids are wet. Most gases are invisible to us, like the air we breathe.

Another important thing to understand is that substances can change from one form to another when energy is either added or taken away. When water loses energy, it cools down. When liquid water reaches its freezing point (0 degrees Celsius or 32 degrees Fahrenheit), the particles stop moving, and it turns into a solid — ice. When water is heated, adding energy, the particles move faster and spread out farther. This is called evaporation. Clouds are made when water evaporates. However, when the air gets colder and loses energy, the gas, called water vapor, turns back into the liquid we call rain. This process is called condensation. On Earth, frozen water is always melting, liquid water is constantly evaporating to the sky, and water vapor is falling back down again as rain or snow. This process is called the water cycle. It is important to remember that matter can change form from a solid to a liquid to a gas and still be the same matter!

Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the show.

matter — Any substance that takes up space. Matter is made of small particles called atoms.

atoms — The small particles that make up matter.

solid — Matter with a definite shape and volume. Particles of solids are tightly packed together and are barely moving.

liquid — Matter that has no definite shape but has a definite volume. Particles of liquids are loosely packed together and are moving faster than those in solids.

(Continued)

gas — Matter that has no definite shape or volume. Particles of a gas are not packed together and have a lot of energy to move around rapidly.

energy — The ability to cause movement or changes in things. Heat is energy.

melting point — The temperature at which a solid becomes a liquid. Every solid has a different melting point.

freezing point — The temperature at which a liquid becomes a solid. Water freezes at 0 degrees Celsius or 32 degrees Fahrenheit.

evaporation — The process of a liquid changing to a gas at the liquid's surface when heat energy is added.

boiling point — The temperature at which a liquid bubbles and quickly changes into a gas.

condensation — The point at which a gas cools and changes into a liquid. Water vapor in clouds becomes rain.

water cycle — The process that involves water changing from a solid to a liquid to a gas over and over again on Earth.

Pre-viewing Discussion

Before students generate their list of "Everything We Know About…" this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

1. What are the difference among solids, liquids and gases?
2. How do things change from a solid to a liquid to a gas?
3. What kinds of things change form?

After the class has completed their "Everything We Know About…" list, and before watching the show, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

Focus Questions

You may wish to ask your class the following questions to assess their comprehension of key points presented in the program:

1. What are some examples of solids?
2. What is the difference between a solid and a liquid?
3. How do solids keep their shape?
4. Why don't liquids keep their shape?
5. What is the difference in the movement of atoms in a liquid and a gas?

(Continued)

6. How would you describe the particles of a gas?
7. How is energy involved in changing form among solids, liquids and gases?
8. What is everything in the universe made of?
9. How would you describe the way that atoms are packed together in solids?
10. Do the atoms in solids move? Explain.
11. What are some examples of common liquids?
12. How would you describe the way that atoms are packed together in liquids? Why do liquids flow or pour?
13. What shape are liquids? How is that different from solids?
14. How would you describe the way that atoms are packed together in gases? Why can gases spread out?
15. What happens to the gas in a party balloon when it pops?
16. What happens if heat energy is added to a solid like ice?
17. Why does ice melt?
18. What happens when a solid reaches its melting point?
19. Do all solids have the same melting point? Explain.
20. What happens when a liquid reaches its freezing point?
21. Do all liquids have the same freezing point? Explain.
22. How does liquid water turn into water vapor?
23. What is evaporation, and what does it have to do with the clouds in the sky?
24. What is condensation, and what does it have to do with the clouds in the sky?

Follow-up Discussion

The most important part of this segment is to examine both the facts and beliefs generated by the class in their "Everything We Know About…" list. Research indicates that students will retain their previous misconceptions — in preference to the new information — until they actively recognize and correct their own errors. Because of this, it is important to lead students to the correct ideas while identifying and correcting any misconceptions from the class list. After reviewing the list, encourage students to share the answers they got to the questions raised before viewing the program.

Raising a thought-provoking question is a good way to assess the overall depth of understanding. A couple of suggestions are listed below:

(Continued)