

Phases of Water: Solid, Liquid, and Gas

Strand	Matter
Topic	Investigating phases of water
Primary SOL	K.5 The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include a) water occurs in different phases.
Related SOL	K.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which a) basic characteristics or properties of objects are identified by direct observation; g) a question is developed and predictions are made from one or more observations; h) observations are recorded; j) unusual or unexpected results in an activity are recognized. K.5 The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include b) water flows downhill.

Background Information

There are three phases of water that are studied in elementary school: solid, liquid, and gas. Water can be found in all three phases on Earth. Water changes phases by adding or subtracting energy (heat). Liquid water becomes ice as heat is removed. As heat is added, the ice will change back to a liquid. As more heat is added, the liquid water will become a gas (water vapor), which is invisible. Steam is merely water vapor at a temperature equal to or greater than the boiling point of water. You can have water vapor at any moderate temperature, but steam only occurs when the water contains enough heat to boil.

Materials

- Ice cubes
- Small plastic bags
- KWL Chart (attached)
- Electric skillet
- Pitcher of water
- Various sizes of bowls and jars
- Small, clear cups
- Clean water
- Microwave oven

Vocabulary

phases of water, solid, liquid, gas, water, ice, water vapor, matter

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Start a KWL chart about water. Have students come together and share what they know about water. Record ideas in the K (What I **K**now) section. Guide students by asking focus questions about water, such as:
 - Where do you see it?
 - What does it do?
 - How does it act?
 - Can it change?
 - Can it look or feel different ways?
2. Move to the W (What I **W**ant to Know) section of the chart. Have students brainstorm then record their questions about water.

Procedure

1. Give each student a small plastic bag with an ice cube in it. Have them feel the coldness of the ice cube and discuss the other characteristics of the ice. Ask what the ice is made of. Discuss the phase water is in when it is frozen (solid). Make observations about what happens as students hold the ice and/or as it sits out at room temperature. Observe as a class how the ice is changing into a liquid.
2. Put one ice cube in a cup. Put another ice cube on top of an electric skillet. Discuss basic safety rules when using appliances with heat. Make a boundary area that students may not cross. Before turning the skillet on, have students predict which ice cube will melt more quickly. Turn the skillet on, and count with students how many seconds it takes the ice cube to melt. Point out and show that the one in the cup has not melted as quickly. Remind students that more heat makes objects melt quickly (There is heat in the air; just not as much as in the pan.).
3. Make a chart labeled in three sections: “SOLID,” “LIQUID,” and “GAS.” As a class activity, list ice cubes as a solid form. Explain that *solid* means a substance that keeps its form no matter what shape container it is put in. Review the concept of solids with students by having students find examples in the classroom of other solid forms of matter. Place each of the solid items one at a time in a bowl or bucket, and point out that each keeps its shape, no matter what container it is put in. Write and discuss a word list of other forms of solid water such as glaciers, frozen pond, or snow.
4. Hold up a clear plastic cup of water. Ask students what is in the plastic cup. Discuss forms of liquid matter. Explain to students that matter that is liquid changes shape to match the container that it is being held in and that it flows when it is poured. Pour the same amount of water into several plastic cups. Then pour each cup of water into each of the following: a tall glass, a short cup, and a bowl. Allow the class to discuss how each cup of water now looks different in the different containers; however, each container is holding the exact same amount of water. Notice the natural flow of water when it is poured.
5. Discuss what happened to the ice cube that we put in the cup in the last experiment. Lead students to understand that it turned into liquid water.

6. Give each student a small cup of liquid water, and discuss the phase water is in at room temperature. Have students touch the water, drink it, smell it, and listen to it. Emphasize the characteristics of liquid water. Ask the following questions: “Can we feel liquid? Can we see liquid? Can we touch liquid? Can we stand on liquid that is not frozen? Can we pour liquid into another container?” List, and discuss forms of liquid matter. Concentrate on places where we could find liquid water. List class responses such as a cup of water, a puddle, a fish bowl, an ocean, a river, a stream, a swimming pool, and a bathtub. List them on the SOLID, LIQUID, GAS chart.
7. Point to the part of the chart labeled Gas. Point out that when the ice cube melted on the electric skillet it seemed to have disappeared. It turned into a gas, which is invisible. Ask students for examples of gases.

Observations and Conclusions

1. Review the three phases of water. Talk about ice as a solid form of matter, and when heat is applied to the ice, it melts and turns into a liquid. When the heat becomes high enough, the liquid turns into a gas.
2. Write “Solid,” “Liquid,” and “Gas” on the board. Tell students that a form of matter will be called out and they can raise their hands to guess if the object is a solid, liquid, or gas. The volunteers will go to the board and place a tally mark under the correct column. Demonstrate the process for students. Remind students that tally marks are a way to keep track of information or data.
3. Finish the KWL chart by listing things students learned about water in the L (What I Learned) part of the chart.

Assessment

- **Questions**
 - What are the three phases of water?
 - How would you describe each phase?
- **Journal/Writing Prompts**
 - Draw a picture of water in each phase: solid, liquid, and gas.
- **Other**
 - Observe student responses during the review game and when completing the last portion of the KWL chart.

Extensions and Connections (for all students)

- Make root beer floats, and discuss the three states of matter in the float: solid (ice cream), liquid (soda), and gas (bubbles from carbon dioxide in the soda), and ask students to observe what happens when you add the soda to the ice cream. Let students enjoy the treat. *Check for food allergies prior to doing this.*
- Make an ice pop experiment to show students how a liquid can become a solid and can turn back into a liquid. Fill an ice cube tray with fruit juice. Put a clean craft stick into each section of the tray. Freeze the ice pops, and serve them to students. Make note of how the liquid froze into a solid. As students eat the ice pop, make note that the solid is turning back into a liquid form. *Check for food allergies prior to doing this.*

- Take students outside on a cold and snowy day. Have them observe an icicle. Check the icicle throughout the day to see how it changes. Have students illustrate and write about the changes they observe.

Strategies for Differentiation

- Share a video about the phases of water.
- Create a slide presentation on the phases of water.
- Use a communication device with an auditory output to allow students to name the phases of water.
- Have an adult touch the ice to students' hands.
- Display a large colorful poster with visual picture symbols of basic science safety rules.
- Provide pictures of water in different phases for students to sort in the assessment.
- Put bright colored tape or another barrier on the floor to establish the boundaries/mark of the "danger zone" (3 feet surrounding the heat source).
- Practice a test of the marked boundary zone (i.e., walk on the outside of the boundary line).
- Use a magnifying glass to observe the changes in the phases of water.
- Create an interactive chart using hook and loop tape for students to sort and display symbols representing the phases of water. Students needing extra challenge can create the interactive chart for other students to use.
- Create a book of items representing different phases of water. Organize the pictures according to those phases.
- Use symbol-making software to match pictures to words.

KWL Chart

Name _____ Date _____

What I <u>K</u> now	What I <u>W</u> ant to Know	What I <u>L</u> earned