

### **3.F.2 The Water Cycle: Part 2**

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*Diagramming the water cycle and demonstrating the expansion of frozen water*

<b>Grade Level</b>	3
<b>Sessions</b>	(3): 1 at 30-40 minutes, 2 at 40-50 minutes
<b>Seasonality</b>	None
<b>Instructional Mode(s)</b>	Whole Class
<b>Team Size</b>	N/A
<b>WPS Benchmarks</b>	03.SC.TE.04, 03.SC.PS.06, 03.SC.IS.04
<b>MA Frameworks</b>	3-5.TE.2.2, 3-5.PS.0.3
<b>Key Words</b>	Condensation, Diagram, Evaporation, Water Cycle

### **Summary**

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After seeing a demonstration of the water cycle (see lesson 3.F.1 The Water Cycle: Part 1), students will diagram and label the water cycle on their own. The students will also confirm that water expands when cooled.

### **Learning Objectives**

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*2002 Worcester Public Schools (WPS) Benchmarks for Grade 3*

1. 03.SC.TE.04 Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists.
2. 03.SC.PS.06 Do simple investigations with evaporation, condensation, freezing and melting. Confirm that water expands upon freezing.
3. 03.SC.IS.04 Conduct multiple trials to test a prediction. Compare the results of an investigation or experiment with the prediction.

*2001 Massachusetts Frameworks for Grade 3*

1. 3-5.TE.2.2 Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists.
2. 3-5.PS.3 Describe how water can be changed from one state to another by adding or taking away heat.

### **Additional Learning Objectives**

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1. Students will have a full understanding of the water cycle.
2. Students will be able to describe what happens to water when it is cooled.

## **Required Background Knowledge**

1. Some knowledge of solids, liquids and gases is needed.
2. Students must have seen the water cycle and be familiar with how water changes phase upon addition or subtraction of heat (see lesson [3.F.1 Water Cycle 1](#)).

## **Essential Questions**

1. What is a diagram?
2. What are the four stages of the water cycle?
3. When does condensation occur?
4. When does evaporation occur?
5. What happens when water is cooled?

## **Introduction / Motivation**

The instructor might begin the lesson by reviewing the water cycle and writing the stages on the board. (S)he might demonstrate the water cycle again, emphasizing condensation and evaporation. Another option to begin the lesson is to ask the students if they know how rain and snow happen.

## **Procedure**

The Instructor will:

Part 1: (40-50 minutes)

1. Ask each student to bring two empty, disposable water bottles from home with their initials on them.
2. Provide each student with a sheet of paper.
3. Ask the students to create a labeled diagram of the water cycle; ensure that students include arrows.
4. The diagram should include clouds, the ocean, land, and the sun, as well as the words “evaporation”, “condensation” and “precipitation” (“rain” or “snow”) written in the correct locations.
5. Ask students to label their diagrams with words representing the different phases of water (“gas”, “liquid” and “solid”).
6. If time permits, ask students to color their diagrams.

Part 2: (40-50 minutes)

1. In a visible location, place three, clear, plastic cups: one filled with cold water, one filled with room temperature water, and one filled with hot water (see Materials List).
2. Ask students to use their worksheets (see The Phases of Water) to write a prediction about what will happen when ice is put into each of the three cups.
3. Place one ice cube in each cup.
4. Allow students to observe the cups.
5. Ask students to record their observations on The Phases of Water worksheet.
6. Explain to students why and how the ice cube quickly melted in the cup with the hot water.
7. Ask each student to fill his or her two water bottles *almost* to the top. The bottles should not be completely full or they will explode in the freezer.
8. Ask students to measure the height, in centimeters, of the *water* inside each water bottle; students should record this information on The Phases of Water worksheet.
9. Ask students to predict what will happen when one of the bottles is put into the freezer with the cap on, and the other is left at room temperature with the cap off. They should record their predictions on The Phases of Water worksheet.
10. Leave one of each student's water bottles in a room-temperature location where it will not be disturbed. *Leave the cap off of the bottle so that evaporation can occur.*
11. Collect the other water bottle, place it in the freezer, and leave it overnight.

Part 3: (30-40 minutes)

1. Ask students to collect both of their water bottles.
2. Ask each student to measure and record the height, in centimeters, of water in each water bottle.
3. Discuss what happened to the water.
  - a. Some of the water in the water bottle left at room temperature should have evaporated; therefore, the height of the water decreased.
  - b. The frozen water should have expanded; therefore, the height of the water increased.
4. Have the students complete the rest of The Phases of Water worksheet.

## **Materials List**

<b>Materials per Class</b>	<b>Amount</b>	<b>Location</b>
Clear Plastic Cups	Three	Home
Cold Water	Varies	Classroom
Room Temperature Water	Varies	Classroom
Hot Water	Varies	Classroom
Ice Cubes	Three	Home, school

<b>Materials per Student</b>	<b>Amount</b>	<b>Location</b>
<u>The Phases of Water</u> Worksheet	One	End of lesson plan – print or photocopy
Paper	One Sheet	Classroom
Disposable Plastic Water Bottles	Two	Students' homes
Metric Ruler	One	Classroom

## **Vocabulary with Definitions**

1. *Condensation* – the process by which a gas changes into a liquid, usually by cooling.
2. *Cycle* – a regularly repeated sequence of events.
3. *Diagram* – a symbolic representation of information that shows and explains relationships.
4. *Evaporation* – the process by which a solid (ex. ice) or liquid (ex. water) changes into a gaseous phase (ex. water vapor), usually by taking in heat.
5. *Water Cycle* – the cycle of evaporation and condensation that controls the distribution of the Earth's water as it evaporates from bodies of water, condenses, precipitates, and returns to those bodies of water.

## **Assessment / Evaluation of Students**

The instructor may assess the students in any/all of the following manners:

1. Collect student worksheets to determine whether students understand (a) how to make a diagram and (b) the water cycle.

## **Lesson Extensions**

None

## **Attachments**

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1. The Phases of Water

## **Troubleshooting Tips**

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1. The students may need assistance when measuring the height of the water.

## **Safety Issues**

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1. Use caution with hot water.

## **Additional Resources**

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None

# The Phases of Water

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Directions:** On a separate sheet of paper, use the following words to make a diagram of the water cycle. Label your diagram and include arrows that show the direction of the water cycle.

Ocean	Sun	Clouds	Land
Condensation	Evaporation	Rain	Water Vapor

What do you predict will happen when the ice is put into the cold water?

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What do you predict will happen when the ice is put into the room temperature water?

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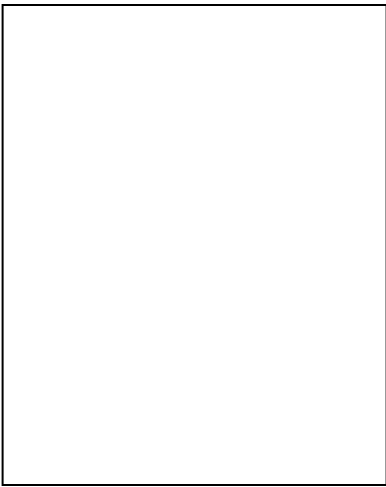
What do you predict will happen when the ice is put into the hot water?

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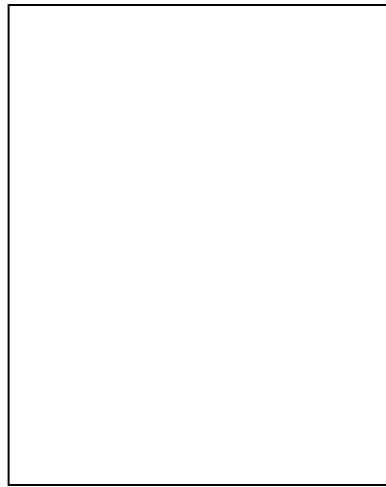
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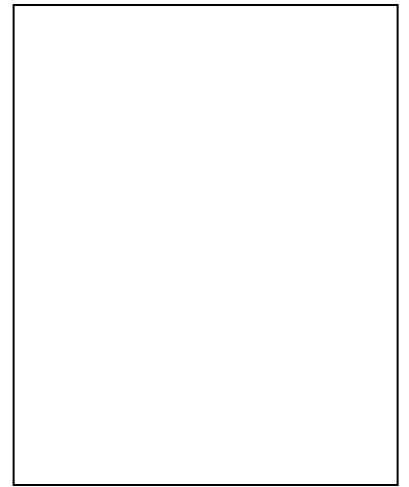
Draw the ice as you saw it in each of the cups:



Cold water



Room Temperature Water



Hot Water

## The Water Bottle Experiment

**Day 1:** Before the water bottle is put into the freezer

1. Height of the water in the room temperature water bottle: \_\_\_\_\_ cm

2. Height of the water in the freezer water bottle: \_\_\_\_\_ cm

What do you predict will happen to the water that is kept at room temperature?

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What do you predict will happen to the water that is frozen?

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**Day 2:** After the water bottle was put into the freezer:

1. Height of the water in the room temperature water bottle: \_\_\_\_\_ cm

2. Height of the water in the freezer water bottle: \_\_\_\_\_ cm

3. What happened to the water that was kept at room temperature?

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4. What happened to the water that was frozen?

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