Red Butte Garden
THE UNIVERSITY OF UTAH

Conserving Water in the Desert

Lesson 2: What's the Matter?
Water's Changing States

Enduring Understanding

Water is the only natural substance that is found in three different physical states - liquid, vapor, and solid at Earth's temperatures. Plants are an integral part of the movement of water through the water cycle in its liquid state and its vapor state.

Essential Questions

What processes or energy sources affect the changes in water's three states of matter. What is the importance of photosynthesis in plants to the water cycle?

Background Information

Heat from the sun's energy, and subsequent cooling, changes water into three different states of matter.

Even though we cannot see it, water vapor exists in the air all around us. We can see evidence of this when we observe the process of condensation (i.e., as the vapor turns back into a liquid on the outside of a glass of ice water or on the outside of a toilet tank).

The processes or energy events that stimulate the next step in each of the stages of the water cycle:

- Evaporation: Heat energy from the sun (or other source) breaks the bond in water molecules, and creates movement. The molecules then leave the liquid and evaporate into the air, taking the form of water vapor.
- Condensation: The water vapor must be cooled in order for the water vapor to convert back into a liquid; the water molecules also need solid matter such as dust, smoke or salt particles, called *condensation nuclei*, upon which to condense.
- Precipitation: The mass of water vapor molecules that have condensed into liquid droplets then stick together by the property of *cohesion*. This collection of liquid water molecules is called *coalescence*, which forms clouds. Once there is a substantial collection of water molecules colliding and creating enough movement and weight, precipitation will fall from the atmosphere to the ground.
- Collection: Water will collect on the surface of the Earth or percolate into the ground when it is heated by sun to its liquid state.

Note: For further, more detailed explanations of each of the water cycle stages, see the United States Geological Survey website:

http://water.usgs.gov/edu/waterproperties.html

Lesson Plan

Activity #1: Physical State of Matter / Temperature

Materials

- BB Student Worksheet Water Form #1 (upper or lower grade)
- BB Student Worksheet Water Form #2 (upper or lower grade)
- BB Student Worksheet Water Form #3 (upper or lower grade)
- BB *Bill Nye the Science Guy: Water Cycle* video
- BB *Photosynthesis: Changing Sunlight into Food* book
- BB Ice cube trays
- BB Beakers with measuring lines
- BB Thermometers
- Water
- Ice cubes
- Baggies

Procedure

Warm-up

Review the material in the book, *Photosynthesis: Changing Sunlight into Food* so students understand the role of plants in the water cycle. Or you may have them view the video clip on transpiration at:
https://www.youtube.com/watch?v=U4rzLhz4HHk

If your students completed Lesson One and have already viewed the following video clips, you can review the four stages of the water cycle.

If they have not seen these video clips, have students view the water cycle on the *Bill Nye the Science Guy: Water Cycle* DVD or on the following website:

http://water.usgs.gov/edu/watercycle-kids-beg.html

Students will complete three different experiments to explore water's changing states of matter, and the energy or processes that stimulate those changes. Divide the class into three groups and assign each group one of the experiments.

Experiment One: Water Form One (liquid to vapor)

Have students fill two beakers with water and record the water level on the Student Worksheet Water Form #1. Have them take the temperature of the water in each beaker and record it on the Student Worksheet, and then place one of the beakers in a sunny spot. Have them put the other beaker in a cooler, shady spot. They will write a prediction on their Student Worksheet about what they think will take place with the water in each of the beakers.

They should observe the beakers after 12 hours and record the temperature and the water level. They should then do the same after 24 hours, and after 36 hours, and record the data. Have them complete the Reasoning and Communicating Your Findings sections of the Student Worksheet.

Experiment Two: Water Form #2 (liquid to solid)

Have students fill two ice cube trays with water. They should then take and record the temperature of the water in each tray. Have them put one tray in the freezer and take the temperature inside the freezer.

Have them put the other ice cube tray in a sunny window, and take the temperature of the sunny spot. Have them make predictions and record on the Student Worksheet Water Form #2. Then have them check the water temperature and state of the water in one hour, two hours, 12 hours. They should complete the Reasoning and Communicating Your Findings sections of the Worksheet.

Experiment Three: Water Form #3 (solid to liquid)

Have students place three ice cubes in a zip lock baggie and take the temperature of the ice cubes, and then place the bag in a sunny window. They should also take the temperature of the sunny spot and record this data on their Student Worksheet Water Form #3.

They should place three more ice cubes in a baggie in a shady spot, and take the temperature of the ice cubes and the shady spot and record. They should then make a prediction of what might happen. The students should take the temperature of the cubes again in one hour, two hours, 12 hours and record this on the Worksheet. They should then fill out the Reasoning and Communicating Your Findings sections of the Student Worksheet.

Have a whole class discussion about the findings of each of the groups. Discuss the energy that stimulated the change in the states of matter of the water.

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Name: _____ Date: _____

Student STEM Practices Worksheet

Lesson 2: Water Form #1, 1st – 2nd Grade

Objectives
You will test how the sun's heat energy affects the state of matter of water.

1. Gathering Data:

Questions I have: _____

_____

- Fill two beakers with equal amounts of water.
- Take the temperature of the water.
- Put one in a sunny spot and the other in a cooler, shady spot in your classroom. What do you think will happen? Write your prediction below:
- Check the temperature and level of the water in each beaker after 12 hours, 24 hours and 36 hours. Write this on the chart below.

My Prediction: _____

_____

	Beginning Temperature/ Water level	After 12 hrs Temperature/ Water level	After 24 hrs Temperature/ Water level	After 36 hrs Temperature/ Water level
Beaker #1				
Beaker #2				

2. Reasoning:

Look at your data chart and tell what happened. You may draw a picture.

3. Communicating Your Findings: You may draw a picture.

What happened to the water level in the beakers?

Circle one: More Water Same Water Less Water

Tell why: _____

_____

_____

Circle one: Less Water in Shady Beaker Less Water in Sunny Beaker

Tell why: _____

_____

_____

Could you see the water disappearing?

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Student STEM Practices Worksheet

Lesson 2: Water Form of Matter #1, 3rd-6th Grade

Objectives
You will test the effects of the sun's heat energy on the state of matter of water.

1. Gathering Data:

Questions I have: _____

_____

- Fill two beakers with equal amounts of water.
- Take the temperature of the water.
- Put one in a sunny spot and the other in a cooler, shady spot in your classroom. What do you think will happen? Write your prediction below:
- Check the temperature and level of the water in each beaker after 12 hours, 24 hours and 36 hours. Record below.

My Prediction: _____

_____

	Beginning Temperature/ Amount of water	**After 12 hrs** Temperature/ Amount of water	**After 24 hrs** Temperature/ Amount of water	**After 36 hrs** Temperature/ Amount of water
Beaker #1				
Beaker #2				

2. Reasoning:

Analyze your data and explain what happened. You may draw a picture.

3. Communicating Your Findings: You may draw a picture.

Explain what happened to the water. _____

_____

Was there less water in the beakers? Why? _____

_____

Was there a difference in the water level between the beaker in the sunny spot and the beaker in the shady spot? Why? _____

_____

Could you see the water disappearing? _____

_____

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Student STEM Practices Worksheet

Lesson 2: Water Form #2, 1st-2nd Grade

Objectives
You will test the effects of temperature change on the state of matter of water.

1. Gathering Data:

Questions I have: _____

_____

- Fill two ice cube trays with water. Take the temperature of the water; write it on the chart.
- Put one tray in a freezer and put the other in a cool spot in your classroom. Take the temperature in the classroom and record it on the line below. Take the temperature in the freezer and record it on the line below.
- Take the temperature of each tray of water after 1 hour, 2 hours, 12 hours. Write it on the chart.
- What do you think will happen? Write your prediction here:

My Prediction: _____

_____

Classroom Temperature: _____ **Freezer Temperature:** _____

	Beginning Water Temperature/ Appearance	**After 1 hr** Water Temperature/ Appearance	**After 2 hrs** Water Temperature/ Appearance	**After 12 hrs** Water Temperature/ Appearance
Tray #1				
Tray #2				

2. Reasoning:

Look at your data chart and tell what happened. You may draw a picture.

3. Communicating Your Findings: You may draw a picture.

Tell what happened to the water: _____

_____

What did the water look like after one hour? _____

Tray #1 _____

Tray #2 _____

What did the water look like after two hours? _____

Tray #1 _____

Tray #2 _____

What did the water look like after twelve hours? _____

Tray #1 _____

Tray #2 _____

What caused the changes? _____

_____

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Student STEM Practices Worksheet

Lesson 2: Water Form #2, 3rd-6th Grade

Objectives
You will test the effects of temperature change on the state of matter of water.

1. Gathering Data:

Questions I have: _____

_____

- Fill two ice cube trays with water. Take the temperature of the water; record it below.
- Put one tray in the freezer compartment of the refrigerator and the other in a cool spot in your classroom. Take the temperature in the classroom and record it below. Take the temperature inside the freezer and record it on the line below.
- Take the temperature of each tray of water after 1 hour, 2 hours, 12 hours. Record your data.
- What do you think will happen? Write your prediction here:

My Prediction: _____

_____

Classroom Temperature: _____ **Freezer Temperature:** _____

	Beginning Water Temperature/ Appearance	**After 1 hr** Water Temperature/ Appearance	**After 2 hrs** Water Temperature/ Appearance	**After 12 hrs** Water Temperature/ Appearance
Tray #1				
Tray #2				

2. Reasoning:

Analyze your data and explain what happened. You may draw a picture.

3. Communicating Your Findings:

Explain what happened to the water. What was the appearance of the water each time you took the temperature of Tray #1? Of Tray #2? What can you say about this? You may draw a picture.

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Student STEM Practices Worksheet

Lesson 2: Water Form #3, 1st – 2nd Grade

Objectives
You will test the effects of heat energy on the state of matter of water.

1. Gathering Data:

Questions I have: _____

_____

- Put three ice cubes in a zip lock baggie. Zip it tightly. Put the bag in a sunny spot.
- Put three more ice cubes in another baggie. Zip it tightly. Put this bag in a shady spot.
- Take the temperature of both baggies of ice cubes. Write this on the chart below.
- Take the temperature of the shady spot and record it on the line below. Take the temperature of the sunny spot and record it on the line below.
- Take the temperature of the cubes/water after one hour, two hours and 12 hours. Write this on the chart below.
- What do you think will happen? Write your prediction here:

My Prediction: _____

_____

Temperature in sunny spot: _____ ***Temperature in shady spot:*** _____

	Beginning Cubes & Water Temperature/ Appearance	**After 1 hr** Cubes & Water Temperature/ Appearance	**After 2 hrs** Cubes & Water Temperature/ Appearance	**After 12 hrs** Cubes & Water Temperature/ Appearance
Baggie #1				
Baggie #2				

2. Reasoning:

Look at your data chart and tell what happened. You may draw a picture.

Tell what happened to the frozen water (ice cubes):
Beginning ice cubes

Baggie #1: _____

Baggie #2: _____

Cubes after one hour

Baggie #1: _____

Baggie #2: _____

Cubes after two hours

Baggie #1: _____

Baggie #2: _____

Cubes after 12 hours

Baggie #1: _____

Baggie #2: _____

3. Communicating Your Findings:

Tell why there was a difference between the two baggies, you may draw a picture:

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Student STEM Practices Worksheet

Lesson 2: Water Form #3, 3rd-6th Grade

Objectives
You will test the effects of heat energy on the state of matter of water.

1. Gathering Data:

Questions I have: _____

_____

- Place three ice cubes in a zip lock baggie and secure tightly. Place the bag in a sunny window.
- Place three more ice cubes in another baggie and secure tightly. Place this bag in a shady spot.
- Take the temperature of both baggies of ice cubes and record the data on the chart below.
- Take the temperature of the shady and sunny area in the room where you place your baggies and record on the lines below.
- Take the temperature of the cubes/water after one hour, two hours and 12 hours and record the data on the chart below.
- What do you think will happen? Write your prediction on the lines below:

My Prediction: _____

_____

Temperature in sunny spot: _____ **Temperature in shady spot: _____**

	Beginning Cubes & Water Temperature/ Appearance	**After 1 hr** Cubes & Water Temperature/ Appearance	**After 2 hrs** Cubes & Water Temperature/ Appearance	**After 12 hrs** Cubes & Water Temperature/ Appearance
Baggie #1				
Baggie #2				

2. Reasoning:

Analyze your data and explain what happened. You may draw a picture.

3. Communicating Your Findings:

Explain what happened to the frozen water (ice cubes). What did each baggie of ice cubes look like each time you took the temperature? What can you say about this? You may draw a picture.

Activity #2: Weight of Ice/Water (conservation of matter)

Materials

- BB Student Worksheet Weight of Ice/Water
- BB Small digital scale
- 3 Ice cubes
- Baggie

Have students put three ice cubes in a baggie, and seal it tightly so that no water can evaporate.

- Have them weigh and record the data.
- They should make a prediction about what the water will weigh if the ice cubes melt and record this on the Student Worksheet Weight of Ice/Water.
- Have the students put the cubes in a sunny place until they have melted completely, and then weigh again and record.
- They should then fill out the Reasoning and Conclusion sections of the Student Worksheet.

Have a whole class discussion about the findings.

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Name: _____ Date: _____

Student STEM Practices Worksheet

Lesson 2: Weight of Ice/Water, 1st-2nd Grade

Objectives
You will explore whether matter is created or destroyed when water changes its state of matter (solid to liquid).

1. Gathering Data:

Questions I have: _____

_____

- Place three ice cubes in a zip lock baggie. Zip tightly. Weigh it and write the weight on the chart below.
- Put the baggie in a sunny window and weigh it after one hour. Write the weight on the chart below.
- Weight it again after two hours. Write the weight on the chart below.
- What do you think will happen? Write your prediction here:

My Prediction: _____

_____

	Beginning Weight / Appearance	**One Hour** Weight / Appearance	**Two Hours** Weight / Appearance
Baggie of ice cubes			

2. Reasoning:

Look at your data chart and tell what happened. You may draw a picture.

3. Communicating Your Findings: You may draw a picture.

Tell what happened to the frozen ice cubes: _____

_____

_____

Was there a difference in the weight of the cubes from the beginning of the experiment to the end when they were melted into liquid water? Why or why not? _____

_____

_____

What can you say about this? _____

_____

Project Wet Curriculum and Activity Guide:

Molecules in Motion, page 33