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How Much Salt is in the GSL Water? (Introduction)

Abstract: During this introductory lesson the students will learn about the water cycle and the different processes that are involved, like precipitation, evaporation, etc. Most of their learning will be done via an experiment in which they will observe the water cycle in action. This lesson is also focused on having the students write a hypothesis, observations and conclusions. They will also be drawing a picture that shows how the water cycle works.

Grade Level: 4th Grade

Utah Elementary Core Curriculum Standards:

Topic: Water Cycle

Standard 1: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation and condensation of water on Earth.

- Compare the processes of evaporation and condensation of water.

Objective 2: Describe the water cycle.

- Locate examples of evaporation and condensation in the water cycle.
- Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.
- Construct a model or diagram to show how water continuously moves through the water cycle over time.

In Class Instructional Time: 60 Minutes

Terminology:

Evaporation- The process by which water on earth is heated by the sun and changes from liquid into vapor. The vapor then rises into the air.

Condensation- The process by which water vapor in the air is cooled and changes back into liquid forming clouds.

Water Cycle- The process by which water is naturally recycled on earth through evaporation and condensation.

Intended Learning Outcomes:

- The students will understand the water cycle and will be able to demonstrate this understanding through a pictorial representation.

- The students will learn about the basic processes found in the water cycle (mainly evaporation and condensation).
- The students will learn how the water cycle helps them through class discussions.

Background:

The earth has a limited amount of water. That water keeps going around and around and around in what we call the Water Cycle. It is important for students to learn about this cycle because it provides all of the water we use to survive. On top of it being a vital cycle to our lives it is part of the Fourth Grade Utah State Science Core which also makes this information important, especially for fourth graders.

This cycle is made up of a few main parts:

- evaporation (and transpiration)
- condensation
- precipitation
- collection

The following definitions were taken from The Water Cycle (<http://www.kidzone.ws/water/>).

Evaporation:

Evaporation is when the sun heats up water in rivers or lakes or the ocean and turns it into vapor or steam. The water vapor or steam leaves the river, lake or ocean and goes into the air.

Condensation:

Water vapor in the air gets cold and changes back into liquid, forming clouds.

Precipitation:

Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the earth in the form of rain, hail, sleet or snow.

Collection:

When water falls back to earth as precipitation, it may fall back in the oceans, lakes or rivers or it may end up on land. When it ends up on land, it will either soak into the earth and become part of the “ground water” that plants and animals use to drink or it may run over the soil and collect in the oceans, lakes or rivers where the cycle starts all over again.

The following information is important to know for the second part of this experiment. These definitions were taken from <http://www.dictionary.reference.com>.

Solute:

A substance dissolved in another substance, usually the component of a solution present in the lesser amount. (Ex. Salt in Great Salt Lake)

Solvent:

A substance, usually a liquid, capable of dissolving another substance. (Ex. H₂O)

Solution:

A homogeneous mixture of two or more substances, which may be solids, liquids, gases, or a combination of these. (Ex. The Great Salt Lake is a solution containing mostly H₂O and salt.)

Materials:

- Paper
- Colored pencils / Regular pencils
- 5 plastic containers
- Saran Wrap
- Marbles
- Rubber bands
- 5 small shallow plastic cups
- Plastic cups
- Dirt
- Water
- 5 heat lamps (can be done with fewer)
- Science notebooks (each child should have one)

Assessment of Prior Knowledge:

A K-W-L should be used to assess their knowledge of the water cycle. This form of assessment shows you what the students already **Know**, **Want** to know and what they have **Learned** through the lesson. This will help you know where to go with the lesson, maybe the students need more information than you had thought or maybe they need less because they already know a lot. For example, if the K-W parts or this assessment show that the students are confused about condensation, there will be a class discussion on this topic.

Instructional Procedures:

1. After you conduct the K-W parts of the K-W-L split the class up into five groups (there should be no more than 5 students in each group).
2. Explain to the class that they will be conducting an experiment in groups to better understand the water cycle.
3. Make sure all the students have their lab notebooks and a pencil.

4. Give each group a clear plastic container, a rubber band, a few marbles, a piece of saran wrap, a cup of dirt, a cup of water, a shallow plastic cup and a heat lamp.
5. Before you release them to set up their experiment walk through with them, step by step, what they will be doing with the materials.
 - a. Make really wet mud (using the water and dirt) in the base of the plastic container.
 - b. Put the shallow plastic cup in the middle of the container.
 - c. Place Saran Wrap over the top of the container and secure it with a rubber band.
 - d. Place marbles on top of the saran wrap and make sure the saran wrap slopes down directly above the shallow cup.
 - e. Plug in the heat lamp and arrange it directly over the container.
6. Now allow them to work in groups to set up their experiment.
7. After the experiment is set up have them work in their groups to create a hypothesis. The students should already have a basic understanding of what a hypothesis is and how to write one. (I think _____ because _____.)
8. Instruct the students to spend a few minutes writing in their notebooks about the set up of their experiment and their hypothesis.
9. Inform the students that they will be observing the experiments over the next few hours and will be writing down their observations.
10. After at least 2 hours have passed have them conclude what happened and see if their conclusions support their hypothesis.
11. As a class go over the terms evaporation, condensation and water cycle and relate these terms to the experiments the students just concluded.
12. To conclude the lesson, have the students use colored pencils and paper to draw a representation of the water cycle.

Discussion Questions:

1. As human beings how do we rely on the water cycle?
2. Do you think we have any affect on the water cycle? If so, how do we affect it?
3. What is condensation and why is it a major part of the water cycle?
4. What is evaporation and how does it relate to the water cycle?
5. When have you seen the water cycle in action?
6. What would happen if there was no water cycle?
7. Do you think the water cycle is active at the Great Salt Lake?

Assessment Strategies:

At the end of the lesson each student will draw the water cycle using colored pencils. Their drawings will help assess what they actually learned and if there are misconceptions or holes in their conceptions.

Assessment will also be done through observation. As the students discuss and work on the activities in class the following criteria will be used to evaluate:

- Students will participate in discussions.

- Students will cooperate with their groups.
- Students will complete the experiment.
- Students will write what is required of them in their science notebooks.
- Students will complete their drawings of the water cycle.

It is also important to do a formal assessment of the hypothesis they write on the class experiment, along with their written observations and conclusion.

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How Much Salt is in 1 cup of Great Salt Lake (GSL) Water?

Abstract: Students will predict what happens to salt water during the evaporation process. They will observe what occurs when a solution of water and salt is placed under a heat lamp and will measure the amount of salt that remains after all the water is evaporated.

Grade Level: 4th grade

Utah Elementary Core Curriculum Standards--

Topic: Water cycle

Standard 1: Students will understand that water changes state as it moves through the water cycle.

Objective 2: Describe the water cycle

- Locate examples of evaporation and condensation in the water cycle.
- Describe the process of evaporation, condensation, and precipitation as they relate to the water cycle.

In Class Instructional Time: 45-60 minutes

Terminology:

-Evaporation: The process by which water on earth is heated by the sun and changes from liquid into vapor. The vapor then rises into the air.

-Water cycle: The process by which water is naturally recycled on earth through evaporation and condensation.

-Solvent: A substance, usually a liquid, capable of dissolving another substance.

-Solute: A substance dissolved in another substance, usually the component of a solution present in the lesser amount.

-Solution: A homogeneous mixture of two or more substances, which may be solids, liquids, gases, or a combination of these.

Intended Learning Outcomes:

- Students will hypothesize about what will happen to the salt water solution when/if it evaporates.
- Students will make observations about the water cycle as they see first hand the changes that occur as salt water evaporates.

- The students will measure the actual amount of salt that exists in 1 cup of the Great Salt Lake water.

Background: Much of the salt now contained in the Great Salt Lake was originally in the water of Lake Bonneville. Even though Lake Bonneville was fairly fresh, it contained salt that concentrated as its water evaporated. Even now a small amount of dissolved salts, leached from the soil and rocks, is deposited in Great Salt Lake every year by rivers that flow into the lake. About two million tons of dissolved salts enter the lake each year by this means. (www.usgs.gov) Although salt can be dissolved in water, as water evaporates, the salt solidifies and remains behind in its changed form.

Materials:

- 1 gallon Great Salt Lake water (or water that measures at 22% salinity)
- 4 aluminum cookie sheets (with 1” lip)
- 4 Heat Lamps
- 1 Mini-scale to weigh salt
- 1-spatula
- Measuring cup (able to measure cups and mL)
- Coffee filters

Assessment of Prior Knowledge: Students created diagrams of the water cycle in the introductory lesson. Discuss the diagrams to assess how much the students remember about the water cycle. Discuss solutes and solvents. Ask the students to give examples, and assess their understanding of these terms.

Instructional Procedures:

- The class will be divided into groups and each one receives 1qt of GSL (22% salinity) water, 1 aluminum cookie sheet, 1 heat lamp, and 1 coffee filter.
- Before setting up the experiment, have each group member record their hypothesis about what will happen to salt water when it’s set out uncovered. Have them think about things based on what they have learned about the water cycle and solvents and solutes. Will everything evaporate, leaving nothing behind? Will the water not evaporate because of the high concentration levels of salt? How long will it take to evaporate? What’s going to happen to their salt water?
- Set up the experiment...Each group will measure 1 qt of the GSL (22% salinity) water and pour it onto their cookie sheet. Because of the other particles that may be in the GSL water, sift bugs, etc. by pouring it through the coffee filter and onto the cookie sheet. Place cookie sheet on a table, labeled with a group number, and place the heat lamp directly over the water.
- The experiments will then be observed each day, with the students taking notes on what they observe taking place.
- Once all the water has eventually evaporated, (may take days), the students will then scrape the dry salt off the cookie sheet and measure/weigh it on the scale. They can also compare their amount of salt to that of the other groups.

- Have them follow up by drawing conclusions based on their observations. Can they support their hypothesis? This can be written or students can create a diagram of what happened.

Discussion Questions:

1. What effect did the solute (salt) have on the solvent (water)?
2. Why did the water evaporate, and not the salt? Wasn't the salt dissolved in the water to begin with?
3. What does this tell us about evaporation and solids and liquids?
4. What would happen if the salt was evaporated with the water? How might that affect the water cycle?
5. Would another type of solute, instead of salt, ever evaporate with the water?
6. How can the existence of the Bonneville Salt Flats be explained?
7. How is our experiment a representation of what happens at the GSL?

Assessment Strategies:

- Did students write a hypothesis?
- Did they record their observations?
- Did the students records the results?

Did the students include a diagram that represented what hap