2008

Just Passing Through! The Water Cycle! Appear -- Disappear! The Magic of Water! Pre-Visit Lesson (Grade 4)

Discover Mojave: Forever Earth

GRADE 4

Just Passing Through! The Water Cycle!

PRE-VISIT LESSON

APPEAR – DISAPPEAR! THE MAGIC OF WATER!

Just Passing Through! The Water Cycle!

PRE-VISIT OVERVIEW

Water use is such an automatic and habitual daily activity that students often do not understand the consequences of its use. Seldom do they connect the water that comes out of the faucet to its sources in the natural world. Lake Mead on the Colorado River is one of the most intensely used reservoirs in the western United States, providing recreational activities and domestic drinking, industrial, and irrigation water for millions of users. The quality of this water must be maintained to guarantee a reliable and safe resource for its many uses. Inflow into Lake Mead primarily is from the Colorado River; however, about three percent of the inflow is from tributaries on the northern side of the Lake and from Las Vegas Wash on the northwest side of the Lake.

In "Just Passing Through! The Water Cycle!," students use the Forever Earth vessel to begin exploring the importance of Lake Mead by making and recording observations of how water is being used in different ways by plants, animals, and people. Then students view an animated PowerPoint presentation that follows one drop of water through Lake Mead's water use cycle and then re-create the cycle on a magnet board. Working as scientists, students determine if water is the same in all parts of the lake by comparing water samples from the middle of the lake and from Las Vegas Bay. By examining a number of scenarios, students use scientific reasoning to deduce the major reasons for the current lower lake level. In a culminating activity, students brainstorm ideas for personal actions that they can make to conserve or protect Lake Mead's water.

These pre-visit activities are designed to prepare students for their Forever Earth experience by introducing them to the water cycle and to some of the factors that affect the cycle.

THEME

Lake Mead not only plays a huge role in supporting life in our desert but also provides a scientific laboratory for understanding how the water cycle works.

KEY QUESTIONS

Where does all the water in Lake Mead come from? Is the water the same in all parts of the lake? What happens to the water?

GOALS

Students will demonstrate an understanding of the processes of condensation and evaporation and the factors that affect these processes.

OBJECTIVES

Students will:

- Demonstrate how condensation occurs when water vapor touches a cool surface and changes into liquid;
- Understand how evaporation and condensation contribute to the movement of water through the water cycle;
- Describe evaporation as the process by which liquid water changes into water vapor, a gas;
- Explain how temperature affects the rate of evaporation; and
- Explain how surface area of a volume of water affects the rate of evaporation.

NEVADA STATE STANDARDS CORRELATION

N.5.A.1. Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.

E.5.A.2. Students know water on Earth can be a liquid (rain) or a solid (snow and ice) and can go back and forth from one form to the other.

CLARK COUNTY SCHOOL DISTRICT CURRICULUM ESSENTIALS FRAMEWORK (CEF) CORRELATIONS

Students will:

(4)1.1 Generate investigable questions based on observations and interactions with objects, organisms, and phenomena.

(4)1.2 Use science notebook entries to develop, communicate, and justify descriptions, explanations, and predictions.

(4)1.3 Create and use labeled illustrations, graphs (number lines, pictographs, bar graphs, frequency tables), and charts to convey ideas, record observations, and make predictions.

(4)1.4 Conduct safe investigations with a partner and with a small group.

(4)1.5 Identify, gather, and safely use tools (magnet, thermometer, lens) and materials needed in investigations.

(4)1.10. Cooperate and contribute ideas within a group.

(4)3.1 Investigate and describe the properties of water.

(4)3.2. Investigate and describe the water cycle, including the role of the sun.

(4)3.3. Investigate and describe the factors that affect the processes of evaporation and condensation.

(4)3.4 Investigate and explain that water can be a liquid, a gas, or a solid and can go back and forth from one form to another.

(4)3.5 Investigate and describe how the earth is nearly spherical and covered with more water than land.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The pre-visit grade 4 activities support the following guiding theme developed by Clark County-based educators:

- Maintaining growth and quality of life, and protecting watershed, water quality, and adequate water supplies for all life in both developed and natural communities challenges people to resolve the issue of long-term sustainability.

VOCABULARY

collection	liquid	water
condensation	precipitation	water conservation
condense	rain	water cycle
evaporation	surface area	water vapor
gas	thermometer	

PRE-VISIT LESSONS: APPEAR – DISAPPEAR! THE MAGIC OF WATER!

Pre-Visit Lesson 1: Evaporation

TIME 20 minutes

MATERIALS

Part 1 ▸ Introduction

The teacher begins by asking the students what they already think they know about water. Following this brief discussion, the teacher introduces this lesson by communicating its objectives. “For the next few days we’re going to be looking at water. Did you know that there is as much water in the earth’s system today as there was when the earth was formed? Did you know that the water you may drink today is the same water that the dinosaurs drank? Today we’re going to be looking ways that water seems to come and go on Earth.”

If there is evidence of evaporation on the playground or school sidewalks (e.g. dried puddle marks) the teacher may take the class on a short “field trip” to observe evidence of “disappearing” water. (If no such evidence is apparent, the teacher may want to evaporate some puddles of muddy water ahead of time for this observation.) The teacher asks, “Where did the water in the puddle go? Did it really disappear? How do you know what happened to it? Have you seen anything else that looks like this? Where did the water in the puddle come from?” After giving a minute of think-time, students share their thoughts with a partner. The teacher then asks for volunteers to communicate their ideas about the disappearing water with the class.

Back in the classroom, the teacher holds up a container of water and asks, “Where did this water come from?” In response to students’ answers, the teacher should probe for the extent of their knowledge about the source of water for Las Vegas and should guide students toward an understanding of Lake Mead as the source of water for most of the Las Vegas Valley. Questions might include:

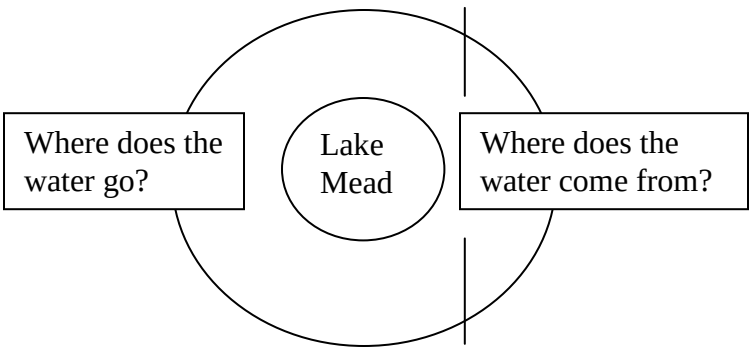
Where does the water in the faucet come from?
Where do the water pipes bring the water from?
Where does the water in Lake Mead come from?

Once Lake Mead is identified as the source of water for most of the Las Vegas Valley, the teacher asks students, “Do you think Lake Mead always has the same amount of water in it? Why do you think so?” Once students have had a minute or two to think about the questions, they should share their ideas with a partner.

The teacher then distributes two photos of Lake Mead, one pre-drought and one post-drought, to each pair of students, asking them to look for evidence in the picture to support their ideas about the amount of water in the lake. Pairs of students should share their ideas with the class, including evidence from the pictures. The teacher should ask probing questions to help students connect the evidence of evaporation from the pictures to their observations of dried puddles.

Photos of Lake Mead, pre-drought and post-drought conditions

A follow-up question is asked, “Why do you think the water level in the lake changes? Where does the water go?” The teacher should introduce the term *precipitation* as students contribute ideas about how rain, snow, etc. may fall in the lake and cause water levels to rise. The teacher collects student ideas and records them on a divided Circle Thinking Map (or other graphic organizer) on chart paper, to be used for review during the culminating activity.



Part 2 ▸ Concept Development

TIME 40 minutes

MATERIALS

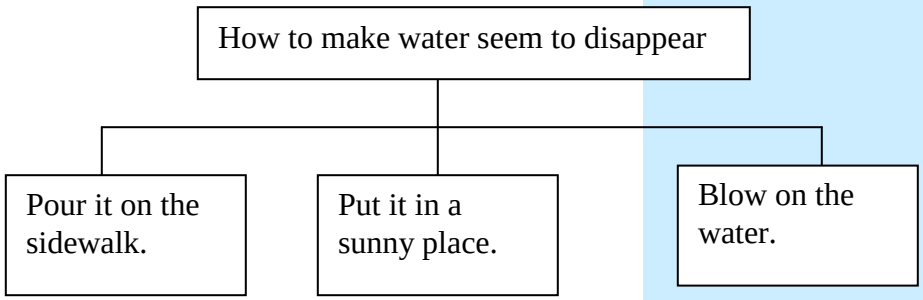
The teacher poses the problem of investigating the case of Lake Mead's "disappearing" water, and tells students that they will be looking at ways that *they* can make water seem to disappear. The teacher introduces an operational definition of the word, *evaporation*, as the process by which water becomes an invisible gas called *water vapor*. These words should be used to begin or add to an illustrated word bank.

The teacher explains that each pair of students will get some water that they will take outside and *try to make evaporate as quickly as possible*, and reviews the following procedure:

1. One student from each pair will get the materials needed from the supply table: one container of water, one graduated pipette or syringe, and one beaker.
2. Each pair of students will measure 25 ml of water into their graduated pipette or syringe and gently push it into the beaker. Students should make sure that they have exactly 25 ml of water in their beaker.
3. One student from each pair should return syringes and containers of water to the supply table.

Beakers, graduated pipettes or syringes, container of water

Each pair of students will plan how to make the water in their beaker disappear and record it in their science notebooks. For ELL students, the teacher might take some time to record and illustrate on the board as students quickly brainstorm possible procedures (see example below).



Pairs of students should then produce their own procedure, and team members should record their plan, including a list of materials, in their science notebooks.

Science Notebooks

Once all teams have written their plan, the teacher should go over any boundaries for working outside. Students should go back outside and carry out their planned investigations, recording their observations in words and pictures in their science notebooks. The teacher should circulate among the teams to guide students' ideas with questions focusing on how the process of evaporation may be affected by surface area, air movement, and temperature.

What happened to the water?
Where did it go?
How do you know?

Part 3 ▸ Linkage and Closure: Mini-Science Conference

Back in the classroom, student pairs should have time to reflect and record in words and/or pictures what they think they may have found as a result of their investigation and to record one or two questions they may have about evaporation as a result of their work.

The teachers should reorganize student pairs into larger groups of 4-6 students by putting pairs of students together according to the ways in which they evaporated their water. Student groups should compare and discuss their findings and questions in order to present to other teams.

Each group should briefly present their findings to the rest of the class. As they present, other class members should ask questions about their work, and the teacher should use questioning to guide any naïve conceptions about science content or process that were formed by students in the process of their inquiry. (For example, if a student group concludes that putting the water in a warm place made it evaporate faster, the teacher should ask them if they have any evidence that water placed in a cooler location would evaporate more slowly. The teacher could then follow up with the question, "How could you find out?") The teacher should also record student understandings and questions about factors affecting evaporation on a class content and questions chart.

Teacher and students should re-visit the divided circle map constructed at the beginning of the lesson. The teacher should ask, "What did we find out from our investigations that gave us evidence about what we thought we knew about the water in Lake Mead?" As class members discuss and compare the entries on the content chart

TIME 30 minutes

MATERIALS

Science notebooks

to their ideas recorded on the circle map, the teacher should circulate, asking probing questions about the circle map entries to help students correct any incomplete information.

The teacher should ask students to self-evaluate their work as a scientist during this investigation. Students should reflect about the level of their work in the following areas:

Was I on-task as I worked with my partner to investigate?
Did I write and draw things in my science notebook that I could use for evidence for the presentation of our findings?
Did I help my group put together a presentation that helped the rest of the class understand what we think we learned?
Did I ask questions of other groups?
Did my questions help me and other students better understand what the presentations were trying to say?
What did I learn about Lake Mead?
What did I learn about evaporation?

EXTENSION

Repeat this lesson with the following changes:

- Instead of trying to evaporate the water as quickly as possible, the teacher should challenge the students to try to evaporate the water as slowly as possible.
- The teacher should supply a number of containers of different shapes and sizes (different surface areas) for the students to use.

RESOURCES

- Full Option Science System (FOSS) Environments module materials
- FOSS Science Stories

ADAPTATIONS FOR DIVERSE LEARNERS

- Create language-supportive collaborative learning groups to allow students to work together to answer questions.
- Use a think-pair-share to encourage thought sharing and discussion and allow for language processing time.
- Record observations with words and/or pictures.
- Create illustrated word bank, thinking maps, and charts.

ASSESSMENT

The teacher may assess student learning during the mini-science conference as they present their observations and reasoning. The teacher should look at how students participate in their group's presentation; the quality of the science content (factors that affect the process of evaporation) and processes (using evidence collected in words and drawings in science notebooks) reflected in group presentations; and the number and quality of clarifying questions posed to other groups. Assessment data may be recorded as anecdotal records or checklists of learning objectives.

Pre-Visit Lesson 2: Condensation and the Water Cycle

TIME 10 minutes
MATERIALS

Part 1 ▸ Introduction (Day 1)

The teacher begins by asking students what they have already learned about know water. The teachers should also review previously introduced vocabulary during this review. Following this brief discussion, the teacher introduces the lesson by communicating its objectives. "Today we're going to be looking at how water on Earth is constantly recycled and reused. In the Las Vegas Valley, we use water stored in Lake Mead. Where did we say that the water in Lake Mead came from? (Colorado River, snow melt, rain, etc.) Where does the water come from to create *precipitation*?" The teacher should guide this discussion toward the idea that water is recycled partly by the processes of evaporation and precipitation.

TIME 45 minutes
MATERIALS
Plastic cups
Post-it notes
Science notebooks
Blue food coloring
Water
Ice
Graduated pipette or syringe
Water container
Dome lid

Part 2 ▸ Concept Development

The teacher should have one student from each group get two plastic cups and 2 post-it notes. The students should use the post-it notes to label their cups "ice water" and "room temperature water." The teacher should circulate through the class, filling one of their cups with blue-colored, ice-water and the other with blue-colored, room-temperature water. Students should draw both of these cups in their science notebooks.

After a few minutes, the teacher asks, "What do you notice about the cups?" followed up by questions guiding the students to think about what is happening to the ice-water cup.

How did water get onto the outside of the ice-water cup? Where did it come from?

Did water form on the outside of both cups? Why? Why not?

Compare the water on the inside and outside of the ice-water cup. How are they different? How are they the same?
What happens when you breathe on the outside of each cup?
What happens if you wipe the outside of the ice-water cup dry?
Where else have you seen water droplets like this form?

The teacher asks each group of students to agree on at least three ideas about what they are observing and then asks them to share those observations with one other group. Once groups have had time to share, the teacher should ask volunteers to share their group's ideas with the whole class, making sure to listen for naïve understandings about condensation. (For example, if a group of students claim that the ice-water somehow traveled through the inside of the cup to the outside, the teacher might ask them to explain why the water on the outside of the cup is not blue.)

The teacher should tell the students that the droplets of water on the outside of the ice-water cup came from the water vapor in the air and that they are observing *condensation*. Condensation happens when warm water vapor touches a cool surface and changes from a gas into liquid water. The teacher should ask students to think of situations in their own life when condensation occurs and ask students to identify what made the warm water vapor cool and condense into liquid.

Students should record their observations in words and pictures in their science notebooks, and they should note one or two further questions related to their findings about condensation.

The teacher asks students to consider this challenge, "How could we get water droplets to form on the outside of the cup of room-temperature water?" The teacher should ask students to talk briefly to a partner about how they might accomplish this. The teacher should then ask volunteers to share their ideas with the class, giving time for other class members to respond to these ideas.

The teacher should introduce the materials for building a *condensation chamber,* a tool for looking at how condensation helps the Earth to recycle water. The teacher should show the students the dome lid, the cup, and the graduated pipette or syringe, and explain that they will put 50 ml of water *into the dome lid.* Explain that they will put the plastic cup upside-down on the top of the dome lid to make the condensation chamber. Then they will let the chamber sit in a sunny place and

observe what happens after a day (or a few hours).

The teacher should ask one student from each group to get a dome lid, a plastic cup, a graduated pipette or syringe, a sticky note, and a container of water for their group. The students should assemble and label their condensation chambers and put them in a sunny place.

Part 3 ▸ Linkage and Closure (Day 2)

The teacher should ask one student from each group to get their group's condensation chamber from its sunny location.

The students should observe and talk about what they see. They should then record their observations in their science notebooks using words and pictures.

The teacher should ask groups to share their observations with the class, asking each group probing questions about how the water moved to the top of the cup.

The teacher should ask the class to generate a definition for condensation, and should record this on the board or class content chart.

TIME 30 minutes

MATERIALS

EXTENSION

Cut the top off of a large soda or water bottle, below the narrow neck. Pour sand or soil into the bottle to create hills and valleys. Add a small plant (optional). Add enough water to this ecosystem to create a small lake (about 250 ml). Cover the top of the bottle with a sheet of plastic wrap and keep it in place with the rubber band. Set your mini-earth in a sunny place and observe what happens. (It won't take long, especially if the day is warm, for things to start happening.) Observe water droplets collecting on the underside of the plastic wrap (condensation). Where did this water come from? Will the water stay on plastic wrap? Where might it go? (This is a result of water molecules in the system becoming warm enough to evaporate and become vapor. The vapor rises until it meets with the plastic wrap at the top of the bottle, where the air is cooler- similar to the way the air on Earth rises until it meets the impermeable layer in the stratosphere. Since the vapor can't move through the plastic, it condenses to its liquid form.)

RESOURCES

Full Option Science System (FOSS) Environments module materials
FOSS Science Stories

ADAPTATIONS FOR DIVERSE LEARNERS

Create language-supportive collaborative learning groups to allow students to work together to answer questions.

Use a think-pair-share to encourage thought sharing and discussion and allow for language processing time.

Record observations with words and/or pictures.

Create illustrated word bank, thinking maps, and charts.

ASSESSMENT

To assess how students might be making connections between these activities and their own experiences, pose the following tasks:

- List 5 places where you have observed condensation in your home or in your neighborhood.
- Choose one of these places. How do you know that condensation happened in this place? What caused the water to condense?

Allow students to share their ideas with one another and then write down their ideas. Check student responses for evidence of understanding. Did students correctly identify examples of condensation? Were they able to explain the process of condensation?