Dublin San Ramon Services District
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Lesson Plan

4th Grade: The Incredible Journey

Suggested Time of Year

This lesson fits nicely into any unit on Earth Science, the water cycle, graphing, or scientific investigation. It is especially well-suited for math because students produce a graph and interpret results.

Basic Concept

This lesson demonstrates the complexity of the water cycle. In earlier grades students were introduced to the water cycle as a one-dimensional process. This lesson builds on that knowledge with an exciting involvement activity that shows the complexity, efficiency, and beauty of the water cycle.

Contents

Lesson Plan

Organizational Considerations

Classroom time: 50 minutes

- 5 minutes, introduction
- 5-8 minutes, instruction, especially how to fill in the graph
- 15 minutes, student activity
- 15 minutes, observations and discussion
- 5 minute, closing and assessment

✓*See the Preparation Checklist (at the end of the Lesson Plan) a week in advance. Contact DSRSD Public Information (925-875-2282) to borrow items for this lesson if needed.*

Pre-class set-up

Follow instructions on Preparation Checklist to set up the room. Fill the "Liquid" jar with water. Set up all three jars so they will be in front of you for the demonstration. Place posters and spinners around the room.

Classroom organization

Initially whole class; then students work in pairs for the activity. Conclude with whole class.

Required student skills

Students must know what a graph is and how to fill one out. They must be able to work independently with a partner and follow verbal instructions.

Major Objectives

Learning Statement

We want the students to learn the complexity of the water cycle. This means understanding how the states of matter affect where water is on the Earth and how heat (through the sun) is a major factor in regional water availability.

Behavioral Statement

Students will have understood the goals of this lesson if they can use their graphs to explain that the water cycle is complex. The largest quantities of water are in the oceans and clouds and may stay there for long periods. Water travels to many other places on Earth as it moves through the water cycle.

Child Development Statement

Children in 4th grade are in transition from Piaget's Concrete Operations stage to the early stages of Logical Propositional Thinking. This lesson plan is well-suited for this age group.

"Acting out" the water cycle helps students understand its complexities. Working in pairs is beneficial because peer learning is strong in this age group.

Vocabulary

Precipitation (rain): Water falling, in a liquid or solid state, from the atmosphere to Earth.

Evaporation: The conversion of a liquid into a vapor (ex. water to water vapor), usually through the application of heat energy; the opposite of condensation.

Condensation: The process by which a vapor becomes a liquid.

Groundwater: Water found in spaces between soil particles underground.

Percolation: To spread gradually (ex. allow the water to percolate through the soil).

Transpiration: The process by which water absorbed by plants (usually through roots) is evaporated into the atmosphere from the plants' surfaces (usually the underside of leaves).

Delivery of Instruction

1. Set (Intro or Warm-up)

Start with two important questions. **"Where did the water you drank this morning come from? And where will it be tomorrow?"** Take about three guesses. **"Today we're going to answer those questions."**

Put Overhead One on the projector and allow only "What is the Water Cycle?" to show (put a piece of paper over the rest).

"Who can tell me what the water cycle is?" Take guesses. (You want them to say water evaporates, goes into clouds, then it rains. The water eventually goes to the ocean and evaporates again.)

"That's right! However, the water cycle is a bit more complex than this and that is what we're going to explore today."

2. Teacher-directed instruction

Slide the paper to reveal "Matter has 3 states:" and "Gas (water vapor)."

"Before we can do that, we need to look at water on a molecular scale. "Molecular" means the little tiny particles that make up all matter on Earth. These particles are called molecules."

Ask the students to think about what is causing the molecules to do the things they do.

Pick up the "Gas" jar. Shake it very fast while you explain that the gas molecules are like the balls in the jar, far apart and warm so they move very quickly. Take a step or two around the front of the room while saying, **"There is water vapor, a gas, in this room right now but we can move about because the water molecules are far apart."**

Now uncover "Liquid (water)" on the overhead. Move the Liquid jar to move the balls slowly. Explain how the molecules in liquid are cooler and closer together than in gas. That is why when you walk or swim through water, it is harder than walking through air. Finally, uncover "Solid (ice)" on the overhead and hold up the "Solid" jar. Explain that there is virtually no space between the molecules and they are very cold. **"We can't walk through solid objects, can we?"** Walk into a desk to show them.

"So who has thought about what forces are making the molecules do what they do?"

Take guesses. On the overhead uncover, "What causes water to change forms?" and "Mostly heat (the sun)." Explain that heat is the main force that changes water's state of matter. Heat from the sun *evaporates* water from the oceans, change water from liquid state to gas.

Gas molecules have lots of energy and movement so they spread out in the atmosphere as water vapor. They lose heat in the colder atmosphere, causing another state change. This process is called *condensation*. The water vapor gathers into clouds. Eventually, the clouds become cold enough for water molecules to change into liquid state. Then gravity causes water to fall back to ground. This is *precipitation*.

Reveal "Where are places on Earth we find water?" on the overhead and ask, "**Where are different places on Earth where we might find water as it goes through the water cycle?"** Take guesses and use the posters around the room to illustrate student's guesses (the posters will also promote guesses). Write answers on the whiteboard or a blank overhead slide.

3. Modeling/Guided Practice

"We're going to play a fun game now where you become water molecules traveling through the water cycle. You've seen the posters around the room. Each one of these is a station, a place where water spends time during the water cycle. Already you can see that the water cycle is not as simple as it seems.

You will start the activity in pairs, but you will not stay in these pairs as the games progresses. There are also some other rules."

Put Overhead Two on the projector. **"First, you must mark your starting location on the log I'm going to give you. I'll give you the log right before we start.**

"Second, you must lock arms with your partner AT ALL TIMES. Water molecules like to stick close together. The only exception is when you are at the cloud station, which I'll explain in a minute.

"Third, at each station, you will spin a spinner to find out where to go next. The spinner sometimes will make you stay at the same station. In that case, return to the back of the line at that station and wait to spin again. Don't forget to mark your location after each spin.

Fourth, remember the bouncy balls? At the cloud station you are water vapor, a gas. Water vapor molecules separate from each other At the cloud station YOU MUST SEPARATE FROM YOUR PARTNER AND GO TO THE END OF THE SINGLE-FILE LINE.

Fifth, when you leave the cloud station you must take the person behind you as your new partner and lock arms with them."

Now pass out the Student Log (graph) and place the overhead of the Log on the projector. Tell them you will put the game instructions back up after explaining the graph.

"When you arrive at your first station, mark your starting location with an X. Then every time you move to a new station mark an X at that station." Show them on the overhead.

"Every so often I'll say, 'Round and round.' You respond with, 'The water cycle.'"

4. Check for Understanding

Now ask if they are ready to get started. "Does anyone have any questions? What do we do when we travel with our partners? (Lock arms.) **How do we line up at the cloud station?** (Single file.) **What is the first thing we do when we get to a station?** (Mark it on your log.) **How do you know where to go next?"** (Spin the spinner.)

5 Practice

"Okay, let's get started." Divide student pairs evenly among all nine stations. Remind them to mark their starting locations on their log sheet. The first pair in line at each station spins the spinner, moves to the indicated location, and marks the new location on their log.

Every few minutes during the activity, say, "Round and round." They should respond with, "the water cycle." Make sure they all say this correctly the first time so the rest of the activity will go smoothly. Use these times to pause and have students notice where the water molecules are accumulating.

An aide needs to be at the cloud station to insure that the students partner with the person behind them and to handle the traffic at this station.

Stop when there is about 20 minutes left so you have time to share observations and have a whole class discussion.

6. Assessment and Closure

Have the students return to their seats and look at their logs. Ask questions to stimulate discussion.

1. **Did you ever return to the same station?**
2. **Did you get stuck at the same station for multiple spins?**
3. **At which station did you spend most of your time?**
4. **In what state of matter did you spend most of your time (solid, liquid, gas)?**
5. **Any other observations or questions?**

The assessment for this lesson is the graph activity and discussion which follows it. It is important to save enough time for it because much student learning occurs during the post-activity discussion.

PREPARATION CHECKLIST

Important Note
Contact DSRSD Public Information (925-875-2282) to borrow items for this lesson.

Pre-class Preparation

- ☐ Print Student Log (graph), 1 per student, plus one as an overhead
- ☐ Print Overheads One and Two
- ☐ Print Extension Activities (if using)
- ☐ 3 large plastic jars filled with bouncy balls, labeled Gas, Liquid, Solid
- ☐ Masking tape and scissors (to tape up posters)
- ☐ 9 posters illustrating the nine stations
- ☐ 10 spinners (2 spinners for the cloud station)

✔ *Scheduling before or after recess, break, pull-out program, or lunch is especially helpful for set-up time.*

THE INCREDIBLE JOURNEY EXTENSION ACTIVITIES

- **Creative Writing**
  Use you travel log to write a creative narrative about their adventures as a water molecule traveling through the water cycle. Where did they start? To where did they travel? Did they return to a familiar place? How long did they stay? How did it feel? Have them get creative. They may also include a description of what conditions were necessary for water to move to each location and the state water was in as it moved. An illustration may also accompany their story.

- **Graph**
  Have students use their travel records to create a bar graph, displaying the amount of time a water molecule spends at each station. Plot the nine stations along the x-axis. Plot the "number of turns" at each station along the y-axis. A sample graph is given below. For a greater sample size, combine the data from the entire class.