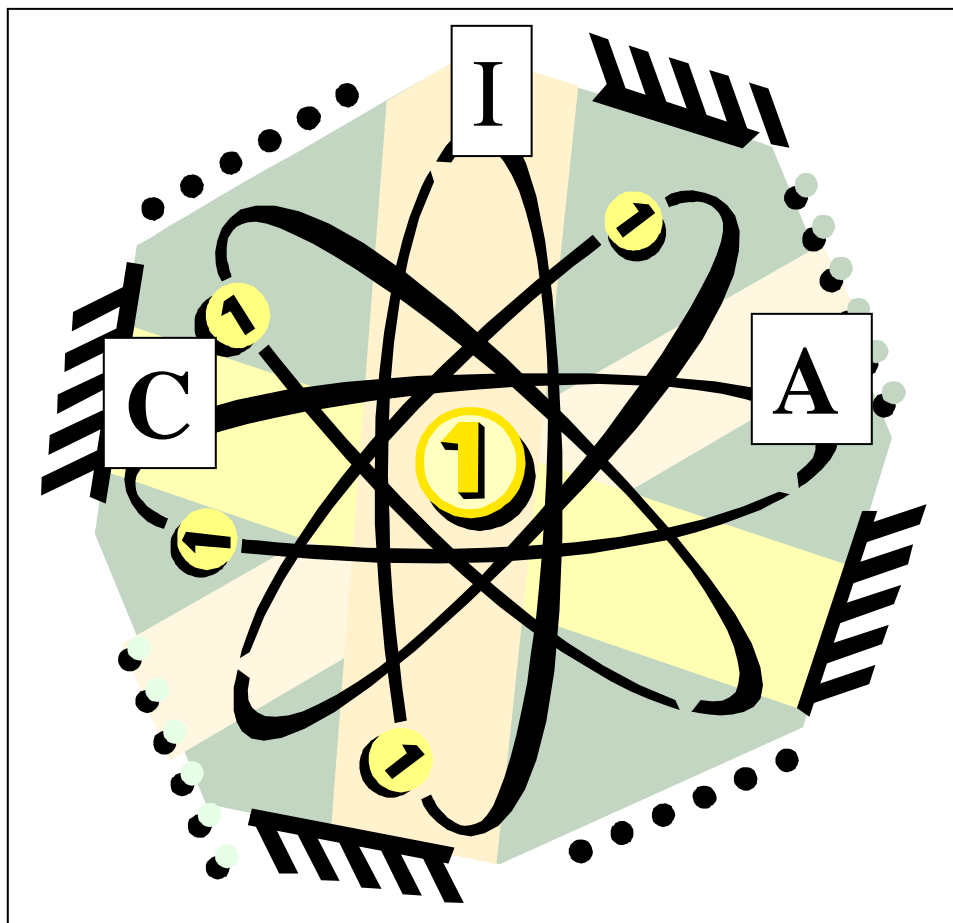


# Curriculum, Instruction, Assessment (CIA) Alignment

## Science, Grade 4 Unit 1: The Water Cycle

### Task Analysis and Hands-on Investigations



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Orange County Public Schools  
Orlando, Florida

2003-2004



**Subject Area:** Science  
**Strand D:** Processes that Shape the Earth  
**Grade:** 4

BLOOM'S TAXONOMY	
Level 1	Level 2
Knowledge	Application
Comprehension	Analysis
Application	Synthesis
	Evaluation

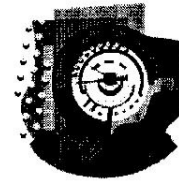
**Benchmarks**

SC.D.1.2.3: The student knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

SC.D.2.2.1: The student knows that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life.

TASK ANALYSIS	
The student...	
<b>THE WATER CYCLE</b>	
•	simulates the water cycle.
•	explains the stages of the water cycle (evaporation, condensation, precipitation) to illustrate that when liquid water evaporates, it turns into a gas (vapor) in the air and condenses as a liquid when cooled, or as a solid if cooled below the freezing point of water.
•	compares the rate at which land and water heat and cool and relates this uneven heating to the weather.
•	demonstrates that air has pressure, which can be measured and affects weather.
•	creates a model of the Floridan Aquifer to illustrate how growth and development affect the water supply.
•	assesses how our lives are affected by the water cycle and creates a plan to conserve water.

# DON'T PRESSURE ME!



## **BENCHMARK and TASK**

**SC.D.1.2.3** The student knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

- The student demonstrates that air has pressure, which can be measured and affects weather.

## **KEY QUESTIONS**

What is air pressure and why is air pressure an important indicator in predicting weather?

## **BACKGROUND INFORMATION**

Air constantly exerts great pressure, but we don't feel it because the pressure is exerted in all directions. At sea level, this pressure is about 15 pounds per square inch. Air pressure is caused by the weight of the pushing air. Temperature affects air pressure. When air is heated, air molecules move faster. They push against each other and expand. The molecules become more spread out and the air in that space weighs less, so it exerts less pressure on the earth. This is called a low in weather terms. Cold air molecules are packed together. The cold air weighs more and exerts more pressure on the earth. In weather terms, this is known as a high.

These highs and lows greatly affect weather conditions. Low-pressure areas are created by warm air and generally indicate cloudy or stormy weather. High-pressure areas are created by cold air and indicate fair weather. Air moves from areas of high pressure to areas of low pressure. The movement of large air masses of different temperatures across regions of land plays a major role in the weather. An instrument called a barometer measures air pressure.

## **MATERIALS**

### **Teacher**

2 **full sheets** of newspaper  
1 wooden ruler or slat  
opening  
barometer  
and/or picture of a barometer  
1 hammer  
safety goggles  
1 ice pick  
*Making a Weather Station,*  
Natalie Lunis, Benchmark Educ. Co.

### **Per group**

1 plastic cup  
1 square of cardboard slightly larger than the cup  
1 bucket  
1 coffee can with a lid or a jar, a balloon, and a rubber band  
scissors  
1 straw cut in half  
glue  
1 index card  
Water  
1 metric ruler  
1 plastic soda bottle with a screw-on lid  
masking tape

## **TEACHING TIPS**

1. Use the ice pick to punch a small hole near the bottom of each plastic soda bottle.
2. A bucket at each table will help prevent accidents.

3. Call the National Weather Service to find out what is considered normal air pressure for your area.

### **ENGAGE**

Students will feel pressure using their bodies. Have students stand in front of each other with outstretched arms. They should put their palms together and press them against each other. Make sure they are applying equal force. Next, have them apply unequal force. Discuss what it felt like.

### **EXPLORE (Part 1) Teacher Demonstration**

1. Place the ruler on the table so that approximately 1/3 of the ruler extends over the table's edge.
2. Cover the ruler with two full sheets of newspaper. Smooth the newspaper out from the center of the paper to the edges so there is as little air as possible between the paper and the table.
3. Put on a pair of safety goggles.
4. Ask students to predict what will happen when you use a hammer to strike the ruler quickly and as hard as possible.
5. Strike the ruler quickly and as hard as possible! (Note: Practice ahead of time. This may take more than one attempt.)

### **EXPLAIN (Part 1)**

*What happened when you hit the ruler quickly and as hard as possible?* (The newspaper stayed in place. The ruler may have broken.)

*Why do you think the newspaper remained on the table?* (The pressure of the air pushing down over the large surface of the newspaper pushes down and keeps the paper in place.)

### **EXPLORE (Part 2)**

1. Have students fill a plastic cup about  $\frac{3}{4}$  full of water and wet the rim.
2. Next, instruct students to lay the square of cardboard on top of the cup. Hold the cardboard tightly against the cup, making sure no air bubbles enter the cup.
3. One student should turn the cup upside down over the bucket.
4. The student should gently release the cardboard.

### **EXPLAIN (Part 2)**

*Why did the water stay in the cup?* (The water should stay inside the cup because the pressure of the water against the cardboard is less than the pressure of the outside air against the cardboard.)

### **EXPLORE and EXPLAIN (Part 3)**

1. Have students place a piece of masking tape over the hole in the plastic soda bottle.
2. They should then fill the bottle two-thirds full with water and screw the lid on tightly.
3. Ask the students to predict what will happen when they remove the tape.
4. Instruct students to hold the bottle over the bucket and then remove the tape.
5. Ask: *What happened? Why do you think so?* (The pressure of the air held in the water. A little water will come out at first, but then it will stop. The level of the water drops a fraction, and the air trapped between the top of the water and the closed bottle top has to expand to fill the space. Air pressure on top of the water decreases.)
6. Ask students to predict what will happen when they remove the lid.
7. Make sure students hold the bottle over the bucket before they remove the lid.

8. Ask, *What happened? Why do you think so?* (The water squirted out of the hole because the pressure on the top of the water and the pressure on the water at the hole in the bottom of the bottle was equal. Then the weight of the water pushed the water out of the hole.)

### **EXTEND/APPLY**

1. Read *Making a Weather Station* by Natalie Lunis.
2. Refer students to a picture of a barometer or show them an actual barometer. Explain to the students that a barometer measures air pressure in millibars. Explain that *milli-* means one-thousandth and *bar* is a Greek work that means heavy. This is the metric unit of pressure. Pressure causes the needle to move. Higher or greater pressure usually indicates fair weather, and lower pressure usually indicates stormy or cool weather.
3. Students can construct a barometer using a straw, an index card, a can with a lid or a jar, a balloon, and a rubber band. Construct the barometer when the air pressure for the area is normal. (Note: A coffee can with a snap-on lid may be used instead of the jar, balloon, and rubber band. If using a coffee can, have students skip to the fourth step.)
  - Cut a piece of the balloon to fit over the top of the mouth of the jar or can.
  - Stretch the balloon piece tightly over the mouth of the jar.
  - Fasten the balloon piece to the jar with a rubber band. (Make sure there is a tight seal.)
  - Cut the straw so that one end forms a sharp point.
  - Glue the drinking straw horizontally across the top from the middle to the edge of the balloon.
  - Mark off a 10-centimeter scale on the index card. (Note: This scale is only for the purpose of making daily comparisons.)
  - Mount the index card on a wall in an area where the temperature does not vary a great deal. Set the barometer next to the index card with the sharp edge of the straw pointing to the 5-centimeter mark.
3. Ask students to predict what will happen to the balloon when pressure on it increases or decreases. (When pressure increases, it pushes down on the lid, causing a high reading.)
4. Instruct students to take regular readings about the same time each day, observing changes in the balloon and noting the barometer scale number and the kind of weather occurring.

### **EXTENSIONS**

Students can view daily weather reports, record the barometer readings, and investigate weather changes in connection with barometer readings. They can also record temperature readings and investigate the relationships between weather, temperature, and barometric pressure.

### **ASSESSMENT**

Have students respond in their journals to this question:

*Why is air pressure an important indicator in predicting weather?*

# TESTING WATER AND SOIL

## BENCHMARK and TASK

**SC.D.1.2.3** The student knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

- The student compares the rate at which land and water heats and cools and relates this uneven heating to the weather.

## KEY QUESTIONS

Which heats faster, soil or water?

Which cools faster, soil or water?

## BACKGROUND INFORMATION

Soil absorbs **heat energy** faster than water but also releases it more quickly. Water warms and cools very slowly. Soil is opaque; water is transparent. The **sun's** rays pass through transparent materials more readily than opaque materials, distributing the heat energy to greater depths. Since sunlight can't pass through the rough, dark surface of soil, the heat energy is absorbed only at the surface.

Water moves easily because it is a **liquid**. The water molecules help transport heat to different areas and depth. Soil, a **solid**, is more stationary and the heat remains at the surface. The heat energy absorbed in land is transferred by contact. Water has a greater capacity for heat. It takes more heat to raise the temperature of water than it takes to raise the temperature of the same amount of soil. Water is slow to take in heat but then equally slow about releasing it. Water temperatures vary less over time than soil temperatures.

Temperatures are affected by altitude or elevation, the height of land above or below sea level. The higher the altitude, the cooler the climate will be. Even near the **equator**, areas of higher altitude have cooler temperatures than do those near sea level. Oceans usually have a moderating effect on nearby land masses, because water heats up and cools down more slowly than land does. Air masses coming from the oceans can have a great cooling or warming effect on temperature over land areas, depending upon whether the air masses are coming from cold waters or warmer waters.

## MATERIALS

**Per group or whole class** (See Teaching Tips)

- 1 box lid or shallow box
- 1 Styrofoam cup of soil
- 1 Styrofoam cup of tap water
- 2 thermometers
- tape
- 1 ruler
- 1 timer or clock
- 1 lamp (unless the activity is done outdoors)

## **TEACHING TIPS**

1. This activity can be done in small groups or as a whole class lesson. The main consideration is the number of box lids and lamps that can be gathered.
2. The activity may also be done outside on a sunny day.
3. Students should have prior experience using a thermometer. Make sure students have identified the scale (Fahrenheit or Celsius) they will be using. Have them note the increments on the scale. When the liquid stops moving, students should bring their eyes level to the thermometer and read carefully.
4. Construct the following table before beginning this activity.

### **Temperature Differences of Water and Soil (Heating)**

<b>Materials</b>	<b>Beginning</b>	<b>Ending</b>	<b>Change</b>
Water (tap)			
Soil			

### **Temperature Differences of Water and Soil (Cooling)**

<b>Materials</b>	<b>Beginning</b>	<b>Ending</b>	<b>Change</b>
Water (tap)			
Soil			

## **ENGAGE**

Ask: *Have you ever been to the beach on a hot, sunny day and tried to walk across the sidewalk or sand? What did it feel like?*

*Did you run very fast to get into the water to cool off? What did the water feel like?*

## **EXPLORE**

### **Student instructions:**

1. Fill one cup with soil and one cup with tap water. Use equal amounts and fill to just below the top of the cup.
2. Set the cups next to each other in the back of the box lid.
3. Place a thermometer in each cup. The cups should be pushed against the back of the box. Make sure the thermometers are about  $\frac{1}{4}$  inch below the surface of the soil or water. Tape the thermometers to the back of the box so they do not slip inside the cups lower than  $\frac{1}{4}$  inch.
4. After 5 minutes, record the beginning temperature of both the soil and the water on your recording sheet. Do not remove the thermometers from the cups.
5. Have students predict how the temperatures of the soil and water will change during the investigation.
6. Place a lamp over the box about 10 inches away from the box. Make sure the light bulb is not touching the box!
7. Wait 15 minutes; turn off the lamp. Record the temperature of each material. This will be the ending temperature of the heating and the beginning temperature of the cooling.
8. Record the change in temperature from the beginning measurement to the ending measurement.
9. Measure the temperature again after the lamp has been off for 15 minutes.
10. Prepare a double bar graph or a double line graph to display the data.

### **EXPLAIN**

*What was the temperature of the water and the soil at the beginning of the experiment?*

*How did the temperatures of the water and the soil change after they were heated?*

*Which heated up faster, the water or the soil? (soil)*

*Which cooled faster, the water or the soil? (soil)*

*What conclusion can you make about the heating rates and cooling rates of water and soil? (Water heats up more slowly than soil. Heat energy travels through transparent water and heats up the entire cup of water. Water also takes longer to release the heat energy. Heat energy does not travel easily through the opaque soil; the heat energy stays near the surface. For this reason, soil releases the heat energy more quickly than the water.)*

### **EXTEND/APPLY**

1. Discuss:

*According to the double bar graph, which material cools faster, the water or the soil? How can you apply this knowledge to the way the land and oceans heat? Do you find that it is cooler at the beach than in the middle of the city? Why?*

*(Inland areas usually have greater temperature extremes from day to night because land absorbs and loses heat energy quickly. Locations along an ocean usually have more moderate daily temperatures. Heat energy released from the soil makes the air temperatures heat up quickly in the sun and cool down quickly in the shade. The air temperature right above the water would not change as much since the water doesn't heat up and cool as quickly as soil.)*

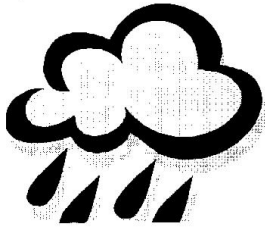
2. Check the newspaper for some high and low temperatures of both inland and coastal cities and discuss.

### **EXTENSIONS**

1. Test different types of soil and graph the results.
2. Read *Weatherworks* by Jeri Cipriano.

### **ASSESSMENT**

*Ask: What conclusions can you make about the heating and cooling rates of water and soil? Use data from the investigation to support your answer.*



# THE TEACHER...THE RAINMAKER!

## **BENCHMARK and TASKS**

**SC.D. 1.2.3** The student knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

- The student simulates the water cycle.
- The student explains the stages of the water cycle (evaporation, condensation, precipitation) to illustrate that when liquid water evaporates, it turns into a gas (vapor) in the air and condenses as a liquid when cooled, or as a solid if cooled below the freezing point of water.

## **KEY QUESTION**

How do temperature changes affect the water cycle?

## **BACKGROUND INFORMATION**

The **water cycle** is a never-ending cycle that includes **evaporation, condensation,** and precipitation. The **sun** is the **energy** that keeps the cycle moving. The **heat** energy from the sun changes water into vapor. This invisible vapor then condenses and forms billions of droplets that make up clouds. The moisture from the clouds returns to the earth as rain, snow, or other forms of precipitation. Temperature plays an integral role in this never-ending process by affecting the rate of evaporation and the type of precipitation (e.g., rain, snow, ice). **Topography**, the shape of the land caused by differences in elevation, can affect the amount of precipitation an area receives.

Evaporation is the process in which matter changes from a liquid state to a gaseous state (vapor). Condensation is the process in which matter changes from a gaseous state (vapor) to a liquid state. Condensation occurs as air with water vapor in it cools; clouds are evidence of condensation. Precipitation forms when water droplets in clouds become too heavy to stay in the atmosphere. The water droplets fall in some form, such as snow, ice, or rain, to the earth's surface.

## **MATERIALS**

### **Teacher**

1 hot plate

1 pie pan

1 teakettle or small pot

ice cubes

oven mitt

*Water Dance* by Thomas Locker

## **ENGAGE**

Read *Water Dance* by Thomas Locker. Share the beautiful illustrations and the factual information about the water cycle with the students. Tell them you are going to create a mini water cycle right in the classroom!

### **EXPLORE (Teacher Demonstration)**

During the teacher demonstration, students should be recording what is happening in a journal. Have them draw and explain what is happening during the activity.

- Fill the teakettle or small pot half full with water.
- Use the hot plate to heat the water to the boiling point.
- Put the ice cubes in the pie pan.
- Using an oven mitt, hold the pie pan just above the steam coming from the pot.
- Look at the bottom of the pan. What's happening?
- Water droplets will form on the bottom of the pie pan. These droplets are just like rain.

### **EXPLAIN**

*Describe what you observed during the investigation.*

*How is this model like the water cycle?*

*What did the teakettle or coffee pot represent? (a source of heat energy – the sun)*

*Why do you think the water in the teakettle had to be hot? (The hotter water gets, the faster its molecules move, and the faster it evaporates.)*

*Why do you think the water in the saucepan had to be cold? (Cooler air cannot hold as much water vapor as warmer air. As the air cools, the water vapor condenses - changes from a gas into a liquid - and forms water droplets on the saucepan.)*

### **EXTEND/APPLY**

Discuss with students that we can connect our model to the water cycle that occurs naturally on earth. Introduce vocabulary - precipitation, condensation, and evaporation. Discuss that when liquid water evaporates, it turns into a gas (vapor) in the air and condenses as a liquid when cooled, or as a solid if cooled below the freezing point of water. Remind students that the investigation done earlier involved temperature differences.

### **EXTENSION**

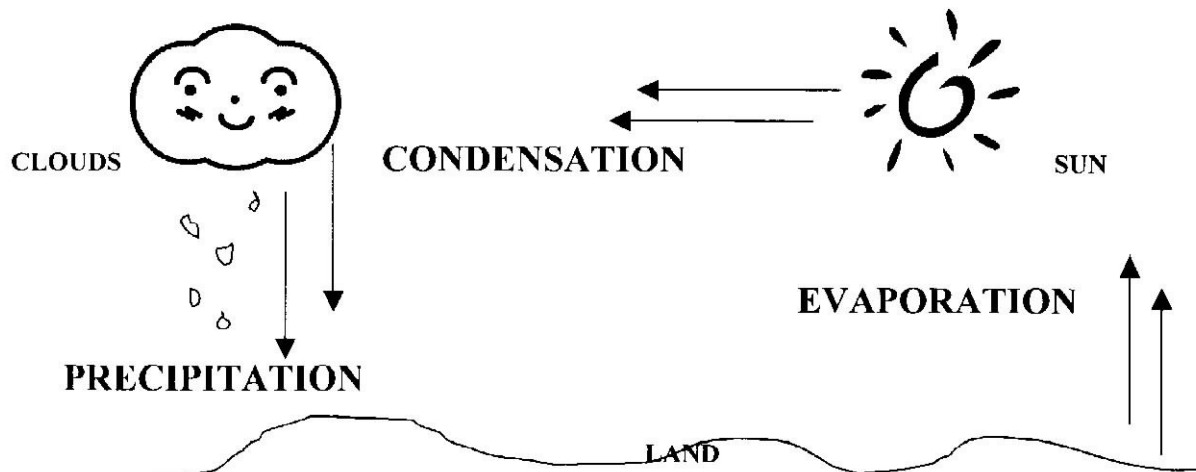
Share some trade books to reinforce and extend this lesson.

- *The Trip of a Drip* by Vicki Cobb
- *Weather* (Eyewitness Books) by Brian Cosgrove

### **ASSESSMENT**

Have students illustrate and label a diagram of the water cycle in their science journals. They should describe each stage using the appropriate vocabulary – precipitation, condensation, and evaporation.

# RAINMAKERS



## **BENCHMARK and TASKS**

**SC.D.1.2.3** The student knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

- The student simulates the water cycle.
- The student explains the stages of the water cycle (evaporation, condensation, precipitation) to illustrate that when liquid water evaporates, it turns into a gas (vapor) in the air and condenses as a liquid when cooled, or as a solid if cooled below the freezing point of water.

## **KEY QUESTION**

How can we create a mini water cycle?

## **BACKGROUND INFORMATION**

The **water cycle** is a never-ending cycle that includes **evaporation**, **condensation**, and precipitation. The **sun** is the **energy** that keeps the cycle moving. The **heat** energy from the sun changes water into vapor. This invisible vapor then condenses and forms billions of droplets that make up clouds. The moisture from the clouds returns to the earth as rain, snow, or other forms of precipitation. Temperature plays an integral role in this never-ending process by affecting the rate of evaporation and the type of precipitation (e.g., rain, snow, ice). **Topography**, the shape of the land caused by differences in elevation, can affect the amount of precipitation an area receives.

Evaporation is the process in which matter changes from a liquid state to a gaseous state (vapor). Condensation is the process in which matter changes from a gaseous state (vapor) to a liquid state. Condensation occurs as air with water vapor in it cools; clouds are evidence of condensation. Precipitation forms when water droplets in clouds become too heavy to stay in the atmosphere. The water droplets fall in some form, such as snow, ice, or rain, to the earth's surface.

## **MATERIALS**

### **Per group**

1 quart-size, resealable bag  
1 clear medicine cup  
1 permanent marker

masking tape  
water  
log for recording observations

## **Teacher**

*A Drop Around the World*, Barbara Shaw McKinney, Dawn Publications

## **TEACHING TIPS**

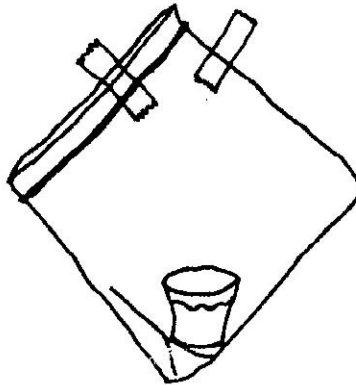
1. You will need access to a large window for this activity.
2. Each student will need to create a log for recording observations.

## **ENGAGE**

Share the book *A Drop Around the World* by Barbara Shaw McKinney. The author takes the readers on a journey from Maine to Mumbai with one raindrop as it touches plant, animal, and human life all around the world.

## **EXPLORE**

1. Distribute materials to each group
2. Each group should fill a medicine cup 1/3 full. Then students should mark the water line with a permanent marker.
3. The cup should be placed in the bottom corner of the resealable bag. Taping the cup to the baggie from the inside will secure it.
4. Instruct students to tape their bags to a window. Make sure the bag is taped at an angle.
5. Students should observe and record the changes in the bag each day for a period of seven to ten days.



## **EXPLAIN**

Discuss during the investigation:

*What does the model represent?* (a mini water cycle)

*What is occurring inside the bag?* (The water is evaporating and condensing.)

*What is happening to the water level in the cup?* (It is gradually getting lower.)

*What energy source causes the water cycle to occur?* (the sun)

*What is evaporation?* ( the process in which matter changes from a liquid state to a gaseous state - vapor)

*What is condensation?* (the process in which matter changes from a gaseous state (vapor) to a liquid state.)

*What is precipitation?* (Precipitation forms when water droplets in clouds become too heavy to stay in the atmosphere. The water droplets fall in some form such as snow, ice, or rain to the earth's surface.)

*Does the outside air temperature play any role in the rate of evaporation?* (The hotter water gets,

the faster its molecules move, and the faster it evaporates.)

*Does the outside air temperature affect the type of precipitation that occurs (e.g., rain, snow, or ice)?*

### **EXTEND/APPLY**

Explain to the students that they have created a mini water cycle that demonstrates the process of evaporation, condensation, and precipitation. Relate the investigation to the natural water cycle.

### **EXTENSIONS**

1. Take students outside to a paved area. Pour a small bucket of water on concrete. Have students draw a chalk line around the puddle. Periodically, the students should draw a new chalk line around the existing puddle. Eventually the puddle will be partially gone or totally gone (depending on time and the sun). Discuss what has occurred. To extend, have students measure the circumference of the circle at different intervals and report the results.
2. Explain to the students that the water on earth now has been recycled over thousands and thousands of years. Make sure the students understand that the water cycle is a never-ending cycle. Students can take the point of view of a raindrop and detail through writing their adventures through thousands of years.

### **ASSESSMENT**

Have students think about where rain comes from and then explain why the earth never runs out of rain.

# SAVE ME! SAVE ME!

## **BENCHMARK and TASKS**

**SC.D. 2.2.1** The student knows that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life.

- The student creates a model of the Floridan Aquifer to illustrate how growth and development affect the water supply.
- The student assesses how our lives are affected by the water cycle and creates a plan to conserve water.

## **KEY QUESTIONS**

How is water stored in an aquifer?

How can groundwater become contaminated?

## **BACKGROUND INFORMATION**

Florida, a peninsula, is surrounded by water, a precious **resource**, but most of it is salty. We can remove the salt through desalination, but the process is very, very expensive. Only three percent of the world's water is drinkable, so it is important that we conserve as much water as we can. In Florida, we are truly connected to the **water cycle** through rainfall. This rainfall replenishes the Floridan Aquifer and supplies all of our drinking water.

The water cycle begins with water falling from the clouds to the ground in the form of precipitation. When the water reaches the ground, some of it will run into lakes, ponds, or other reservoirs. A reservoir is a place where water collects. Some of the rainwater will sink into the earth until it reaches a natural underground storage area called an aquifer. Florida has five main aquifers, which serve nearly all of the state's water needs. The largest, the Floridan Aquifer, underlies just about all of Florida. This aquifer averages 1,000 feet thick. It took form over 60 million to 70 million years as the skeletons and shells of sea life died and stacked up. Eventually, sands and clay from northern mountains washed downstream into Florida, covering up the dead sea life. The animal remains formed layers of limestone.

Water percolates down and seeps into the pores of the limestone like water soaks into a sponge. The top of the water is called the water table and the water that fills the empty spaces and cracks is called ground water. Water stored in the aquifer is sent through underground pipes to our homes to provide our drinking water. Some people are concerned, however, that Florida's growth is depleting our water supply. With growing numbers of people and buildings, we are decreasing the amount of water that makes it into the aquifer.

## **MATERIALS**

### **Per group**

3-4 ounces of aquarium gravel  
1 small piece of clay  
sand to cover the bottom of the cup  
1 clear, plastic cup  
water  
food coloring

### **Per group (continued)**

masking tape  
1 small piece of nylon stocking  
1 drinking straw

### **Per student**

1 cup of drinking water

### **Per teacher**

1 cookie sheet or tray  
cardboard cut into various shapes/sizes  
1 Styrofoam cup  
1 push pin  
sponges cut to cover the cookie sheet

### **TEACHING TIPS**

1. The St. Johns River Water Management District is a good contact for resources and information. Their program is called *Water Ways*. The address is:  
Division of Public Information  
St. Johns River Water Management District  
P.O. Box 1429  
Palatka, Florida 32178-1429
2. *The Orlando Sentinel* published an informative 12-part series in 2002 called “Florida’s Water Crisis.” The series may be available online at [www.orlandosentinel.com](http://www.orlandosentinel.com).
3. Before class, fill the film canisters with sand and gravel for each group.

### **ENGAGE**

Make sure each student has a cup of water to drink. Have students drink the water. Ask: *Where do we get our water?*

### **EXPLORE (Part 1)**

1. Explain to students that they will be making a model of the Floridan Aquifer.
2. Students should tape a small piece of nylon stocking to the bottom of the straw. This will act as a screen. Next, the straw should be taped to one side of the cup so that it does not touch the bottom. The straw represents a well.
3. Have students pour sand into the bottom of the cup, completely covering the bottom until it is about  $\frac{1}{4}$  of an inch high. Students should then pour water over the sand, wetting it completely, but leaving no standing water on top. Students should observe how the water is absorbed into the sand but remains around the sand particles as it is stored in the ground and ultimately in the aquifer.
4. Students should flatten the clay like a pancake and cover  $\frac{1}{2}$  of the sand, pressing the clay to one side of the container to seal off that side. The clay represents a confining layer that keeps water from passing through it. Ask students to pour a small amount of water onto the clay. Have students observe how the water remains on top of the clay, only flowing into the sand below in areas that the clay does not cover.
5. Students should use the aquarium rocks to form the next layer of earth. Have them place the rocks over the sand and clay, covering the entire container. On one side of the cup, have students slope the rocks forming a high hill.
6. Have students model a rainstorm by gently pouring water into the “aquifer.” Have students pour water into the aquifer model until just the hill is above water. Students will see the water trickle into the spaces between the rocks. Tell students that this process is called percolation. Explain that the rocks are porous, allowing the storage of water within the pores and openings between them. They will also notice a surface supply of water (a small lake) has formed. This will give students a view of both the ground and surface water supplies. Tell students that this is our source of water. We take the water given to us through the water cycle, process it, and use it as our drinking water.

7. Tell students that the food coloring represents pollution. Have students pour a few drops of food coloring into the straw, which represents an old well, and watch as it slowly pollutes the water supply. The color will spread not only through the rocks but also to the surface water and into the sand at the bottom. Explain that people often use old wells to dispose of farm chemicals, trash, and used motor oils.

### **EXPLAIN (Part 1)**

*Where do we get our water?*

*How are our lives affected by the water cycle?* (The water cycle is essential for life. We're dependent on this cycle to recharge our fresh water aquifers.)

*What might happen in the aquifer if we had a drought - a period of no rainfall?*

(There would be less and less water. This is how a sinkhole occurs. During times of drought, underground water levels get too low and create hollows in the limestone. The ground then collapses and forms a sinkhole. A drought in 1981 caused a sinkhole ten stories deep in Winter Park. This sinkhole "swallowed" five cars, a truck, a house, half of a public swimming pool, and several businesses! A sinkhole in 2002 swallowed a portion of I-4, a major highway in Central Florida.)

*How is an aquifer able to hold so much water?* (The earth materials are porous and permeable, so the aquifer can store large amounts of water that can move through it fairly easily.)

*How does pollution affect our water supply?*

*What can we, as individuals and as a community, do to protect our water supply?*

### **EXPLORE (Part 2)**

Tell students that Florida is growing every day - new neighborhoods, new buildings, new roads, new theme parks, and new schools. Some people see this as progress, yet many people do not. Why?

#### **Teacher Demonstration**

1. Lay the sponges on the cookie sheet to cover it completely.
2. Cover some of the sponges with cardboard pieces to represent schools, theme parks, buildings, neighborhoods, roads, and schools. Make sure that at least 75% of the area is covered.
3. Use a push pin to punch several holes in the bottom of the Styrofoam cup. Cover the holes with masking tape. Pour some water in the cup.
4. Hold the cup over the model and remove the tape, allowing the water to "rain" over the entire area.
5. Discuss what happens. (Some water will sit on top of the cardboard; some water will soak into the exposed sponges.)
6. Remove the cardboard.
7. Observe how the area under the schools, theme parks, buildings, neighborhoods, and roads is dry. Less water is getting into the aquifer. Instead of going into the aquifer, the water may collect on the road, for example, and cause flooding. Also, this unabsorbed water runs off into oceans, lakes, and streams. When the aquifer becomes depleted, this forces us to get our water from another source, such as the ocean, which is very expensive to desalinate.

### **EXPLAIN (Part 2)**

*How does the model show a reduction in the amount of water that gets into the Floridan Aquifer?* (Too much building and development is preventing rainwater from entering the aquifer.)

*Where does the water go when it does not pass into the aquifer?* (Water that falls to earth as

precipitation may land on a body of surface water such as a lake or a river and go with the flow; it might run off the land into a nearby water body or storm drain; or it might seep into the ground.)  
*What other factors might influence the amount of water in an aquifer?* (droughts, hurricanes, over-pumping by users)

### **EXTEND/APPLY**

*What would be the advantages of continuing to build?* (More development would bring more money into our area.)

*Do you think pollution increases as we build? Why or why not?* (Yes, because more and more people create more and more pollution!)

*In your opinion, are the advantages positive enough to outweigh the negative effects of depleting the Floridan Aquifer?*

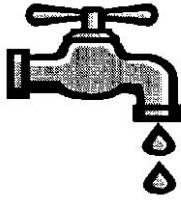
*What ideas do you have for conserving our water supply?*

### **EXTENSIONS**

1. Have students research the Floridan Aquifer and discuss current steps that are being taken to conserve it.
2. Have students simulate a sinkhole. First, blow up a small balloon and place it in a plastic shoebox. Next, fill the shoebox with sand, making sure the balloon is covered. The balloon represents a hollow in the limestone. Then insert a needle through the sand and poke the balloon. The balloon will break causing a depression in the sand, thus resulting in a sinkhole.

### **ASSESSMENT**

Students will complete a Multi-Flow Thinking Map showing the causes and effects of depleting water from the Floridan Aquifer.



# WISE USE OF WATER

## **BENCHMARK and TASK**

**SC.D. 2.2.1** The student knows that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life.

- The student assesses how our lives are affected by the water cycle and creates a plan to conserve water.

## **KEY QUESTIONS**

How are our lives affected by the water cycle?

How can we conserve water?

## **BACKGROUND INFORMATION**

Luckily, unlike other **resources**, we are in no danger of running out of water. We have the same amount of water now as we did billions of years ago. This is because of the **water cycle**. We cannot destroy water, but we surely do waste it and pollute it. We use huge amounts of water for agriculture, industry, and in our homes. Believe it or not, the most water is used in toilets! A lot of water is wasted. Faucets also make it easy to waste water. A simple turn and water just pours out and if you don't pay attention, a lot of water is just going down the drain!

## **MATERIALS**

### **Per class**

tape

1 index card labeled *WATER*

markers

### **Teacher**

1 push pin

### **Per group**

1 9 oz. cup with a large mouth and a hole in the bottom

1 10 oz. cup with a narrow mouth

water

paper towels

clock or timer

### **Per student**

1 sheet of paper

1 index card

2 lengths of string each about 5 feet long

## **TEACHING TIP**

Use a push pin to pre-punch a hole in the bottom of each 9-ounce cup.

## **ENGAGE**

1. Have students write this question on the top of a sheet of paper: *How do we use water?*
2. Next, the students should write a letter of the alphabet on each line, line 1 – a; line 2 – b; line 3 – c; and so on until they have written the entire alphabet a-z. Give students 3 minutes to brainstorm uses of water that begin with the corresponding letters, a-agriculture; b-bathing, c-cooking, etc.
3. Emphasize that water is an important element in our everyday lives and that we all need it. Some of the uses listed are interrelated.

4. List the names of some water users on the board (e.g., farmer, chef, rancher, builder, lawn maintenance worker, pool cleaner).

### **EXPLORE (Part 1)**

1. Students should be in a circle with a chair in the middle labeled with an index card that says *Water*.
2. Each student should then write what type of water user (e.g., chef, farmer, rancher) he or she is on an index card and hold it up.
3. One at a time, have students tie their string to the water chair and then walk back about five feet, still holding on to the string. Continue until all students in the group are connected to the water chair. The strings will look like the spokes of a wheel.
4. Discuss how we all need water in some way – no matter who we are or what we do.
5. Next, discuss how each water user in the group may need to connect with another water user (e.g., the chef needs the goods that the farmer provides).
6. Individual students should try to think of someone else in the group that they may rely on or are connected to in some way (e.g., the restaurant owner relies on the farmer for produce). Then they should connect themselves to that person by handing them one end of the second length of string.
7. Strings will now connect the students to each other. Have each of them gently tug on the strings. This will show how all water users are connected.

### **EXPLAIN (Part 1)**

*What did the strings in the activity demonstrate?*

*What can you conclude about the importance of water to our daily lives?*

Conclude: We have learned that water is important to all of us. So, therefore, it is vitally important that we conserve water. We need to use it wisely. Did you know that...

- every time you flush the toilet, you use 20 liters of water?
- a shower may take as much as forty large glasses of water per minute?
- if you leave the water running while you brush your teeth you can waste enough water to fill 10 soda cans?
- if you leave the water running while you wash dishes, you could be wasting enough to wash the car?
- leaks in the toilet or in faucets may waste up to 15 gallons per day?

### **EXPLORE (Part 2)**

Students will use plastic cups to simulate a leaky faucet:

1. Each group will need two cups – one 9-ounce plastic cup with a large mouth and a hole punched in the bottom and one 10-ounce plastic cup with a narrow mouth - and some paper towels.
2. Place the 9-ounce cup inside the 10-ounce cup and place the cups on a paper towel.
3. A student from each group should volunteer to keep time for the investigation. When the timer says *Begin*, students should pour enough water in the 9-ounce cup to reach the top of the 10-ounce cup.
4. Drips should begin falling out of the hole in the 9-ounce cup into the 10-ounce cup. Students should count the number of drips wasted by the leaky faucets during the one-minute period.
5. The timer should call time at the end of one minute.

### **EXPLAIN (Part 2)**

*What did you learn about leaky faucets?* (They waste water. Leaky faucets may waste up to 15 gallons per day.)

*If we know a faucet leaks at home, what can we do until it is fixed?* (Place a container under the leak and use the water for plants! Have an adult turn the water off outside. Call a plumber!)

*Are there other ways to conserve water?* (Take shorter showers, turn off the water when you brush your teeth, water your lawn only when necessary and on your designated days, etc.)

### **EXTEND/APPLY**

Students can be leaky faucet detectives by searching for leaky faucets at home and at school.

### **ASSESSMENT**

Each student will create a personal plan to conserve water both at home and at school. (Optional planning sheet is provided.)

# How Can I Help?

My plan is...	

We all need to do our part to conserve Florida's water. Using what you learned during the investigation, explain your plan to conserve water.

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