Dino Drool

Standard I:

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

Objective 2:

Describe the water cycle.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Communicate effectively using science language and reasoning

Content Connections:

Math V-1; Collect, organize and display data

Science Standard I

Objective 2

Connections

Background Information

Earth's water system is finite; the same water we are drinking today has been cycled over, on, and under Earth's surface for thousands of years. This continual movement of water, the water cycle, collects, purifies and distributes the water we need to live. Because water does move in a never-ending cycle, the water we are using today is the same water prehistoric creatures used for sustenance. The model in this activity illustrates the water cycle on a global level. The total amount of water inside the model is constant, like the total amount of water on Earth is constant.

The model is constructed using three clear two-liter bottles with caps. These bottles will need to be prepared beforehand by removing labels and cutting one bottle just below the curved top, (you can use a drywall screw to make a starter hole for the scissors). Label this bottle "A" with a permanent marker on the side of the bottle. Cut the other bottle just above the curved bottom; label this bottle "B" with a permanent marker on the side of the bottle. Label the third bottle "C." A quarter inch hole should be drilled in one of the bottle lids.

This activity will require a minimum of two 50-60 minute periods.

Research Basis

Ash, D., & Kluger, B. B., (1999). Identifying Inquiry in the K-5 Classroom.

Instructional models engage students in scientific questions, provide opportunities for students to explore those questions, and require students to interpret data to create explanations. Good science inquiry involves learning through direct interaction with materials and phenomena. One important sign of inquiry is the relative level of

control that the students have in determining various aspects of the learning experience.

Marzano, R. J., Pickering, D. J., Pollock, J. E., (2001) *Classroom Instruction That Works: Research-based Strategies for Increasing Student Achievement.* Alexandria, VA: ASCD.

Scientific thinking is enhanced through instructional methods such as identifying similarities and differences; summarizing and note taking; non-linguistic representation; cooperative learning; setting objectives and providing feedback; generating and testing hypotheses; and questions, cues, and advance organizers.

Invitation to Learn

The teacher invites the class to have a drink of water. As the class is sipping their cups of water, the teacher asks 5 students to each open a numbered envelope and read the contents. Each envelope contains a factoid about the water cycle that has previously been discussed in class. The fifth envelope is opened and the student reads aloud from the card, "Mr./Mrs./Ms._____, do you know you are drinking dinosaur drool?" The teacher either pretends to choke or spits out the water in a "dramatic" fashion. "How is this possible?" exclaims the teacher, "It tastes like clean, fresh water, it looks like clean fresh water, it smells like clean fresh water, how did the dino drool get in here? It is time for an investigation!"

Materials

- ❑ *Building a Water Cycle Model*
- ❑ *Fill the Water Cycle Model*
- ❑ *The Water Cycle Process*
- ❑ 2-liter bottles
- ❑ Scissors
- ❑ Transparent tape
- ❑ Cotton strips
- ❑ Potting soil
- ❑ Grass seed
- ❑ Measuring cup
- ❑ Hand shovel
- ❑ Ruler (cm)

Instructional Procedures

1. Introduce this activity of building a water cycle model to the students with a review of evaporation, condensation, and precipitation. Introduce the terms transpiration and percolation and discuss their meanings.
2. Divide the class into groups of 4. Each group will work together to make one model.
3. Give each group a copy of *Building a Water Cycle Model* instruction sheet and instruct the students to follow the written directions.
4. When each team has completed assembling their model, give them a copy of *Fill the Water Cycle Model* instruction sheet.
5. At the conclusion of each team filling their model, give them the *The Water Cycle Process* label handout. Have each team tape the labels to the model where they think each part of the water cycle is being represented in the model. Then have each

student draw the model in their science journals and label the parts in their journal. Check for accuracy.

6. Have each individual student write a prediction in their journal about what will happen in their team's model. Ask them: What is their hypothesis about the grass seed? The water? What are they observing in this model that they can relate back to the water cycle on a global level? What purpose does the soil have in the water cycle? Water is stored as it passes through the water cycle. What bodies of water does the collector in bottle "B" represent?
7. Instruct students to observe their model on a daily basis for two weeks and record their observations in their journal. Divide two journal pages into six sections with the headings, *evaporation, condensation, precipitation, collection, percolation,* and *transpiration.* Encourage the students to record their observations specific to the components of the water cycle. Ask them to articulate what is happening at each stage in their model. To accommodate all students, observations can be written, expressed verbally to the teacher or drawn in their journal.
8. Ask students if they understand why we are drinking dino drool!

Assessment Suggestions

- Photograph interview. Take photos of the students building their models and the models "in progress." After the activity is completed (a week later) show the students the pictures and ask questions. You can do this as a group or individual interviews. As students observe the pictures, some questions that can be asked are:
  - What were you doing when this picture was taken?
  - What did you learn?
  - What more have you learned about the topic since the day of this picture?
  - How did you use what you learned?
  - What is happening in this picture as it relates to the water cycle?

Depending on the students and the experience being assessed some questions may be more pertinent than others. The teacher can create the questions that are the most important to measure student understanding. This type of assessment benefits students who may

struggle with writing or expressing themselves with the written word. An oral assessment allows them to demonstrate science vocabulary and concepts without getting mired in the process of writing. This type of assessment can make science learning visible by having students recall facts, concepts, applications and actions. A rubric can be created to measure the completeness of the students' answers.

- Team Evaluation – Ask each team member to evaluate their participation in the model building process and what they learned. (See *Team Evaluation* sheet.)
- Use the *Water Cycle Assessment Test* sheet to measure student understanding at different levels. The teacher can determine how many points constitute a letter grade. (See *Water Cycle Assessment* sheet)

Curriculum Extensions/Adaptations/ Integration

- To illustrate the effects of pollution on ground water add 10-15 drops of blue food coloring onto the growing grass seed. Wet each "lawn" thoroughly using the water bottle. This is to simulate rainfall. Within a minute or so, the food coloring should begin to circulate downward into the groundwater (Bottle A). Discuss with the students what dangers chemicals may pose to our water supply.
- Ask students to remove one of the components of the water cycle, i.e. light (energy source) or the water in bottle "A". Ask them to write a hypothesis about what they think will happen inside their model. Observe the model over the next week, recording observations. At the conclusion of the week have students compare their hypothesis to what they observed.
- Visual Arts – Utah State University International Office for Water Science Education sponsors a contest for elementary school students. Students from all over the state are invited to send in pictures depicting their interpretation of how they can conserve and protect our water supply. The winning entries are developed into a calendar. Each year has a different theme. The 2007-08 calendar's theme was Water and Me. This is a beneficial opportunity for students to share their water knowledge in a non-linguistic representation. For more information contact the USU Water and Science Education office. (See site address under *Web Sites*)

- Math – Have the student teams create a graph for a two-week period and measure the water that collects in bottle "B". The measurement can be in millimeters, centimeters or inches. They can empty the collector every other day so there is a baseline for each measurement. Have students take away the energy source (light) and see if the amount of precipitation is affected.
- Dramatic Arts – Students can design puppets, create characters, or use other props to act out the water cycle process.

Family Connections

- Let students take their model home and give a lesson to their parents and family. Have students include how important it is to conserve and save water. Have the students report back to class on their experience.
- "Deputize" your students and have them be "Water Waster Watcher" police officers at home. Provide "tickets" to hand out to family members who are "caught" using water unwisely.

Materials

- ❑ You Have Been Deputized letter
- ❑ Water conservation packet
- ❑ *Tickets*

Additional Resources

Books

The Water Cycle, by Trudi Strain Trueit; ISBN 0-531-16220-6

The Snowflake-A Water Cycle Story, by Neil Waldman; ISBN 0-7613-2347-3

A Drop of Water – A Book of Science and Wonder, by Walter Wick; ISBN 0-590-02319-5

A Drop Around the World, Barbara Shaw McKinney; ISBN 1-883220-72-6

A Teacher's Guide to A Drop Around the World, by Bruce and Carol Malnor; ISBN 1-883220-77-7

The Life and Times of a Drop of Water, by Raintree Press; ISBN 1-4109-1956-0

The Magic School Bus – Wet All Over, by Joanna Cole, Scholastic Inc; ISBN 0-590-50833-4

Web sites

http://www.uen.org/k12educator/

UEN has a link titled *emedia*. The videos and clips on this sight can be downloaded, burned and used in your classroom. There are hundreds of 4th grade friendly science videos. Below are some that relate to the water cycle. Instructions to access the site: Click on *emedia*, click on *Access emedia*, type in *water cycle* in the quick search

- *The Importance of Water* – Students learn that water is essential to life and discover many places that water can be found on Earth.
- *The Water Cycle* – Explains the water cycle as a whole as well as each part in detail.

- *NASA. SCI Files* – The Case of the Wacky Water Cycle.
- *The Magic School Bus, Wet All Over* – In the TV show "WET ALL OVER," Arnold and Wanda are due to give a report on the town waterworks. But Ms. Frizzle thinks it's field DRIP time! She turns the bus and class into water drops and the kids evaporate, condense, become rain and rush by river into the ocean. After several trips through the water cycle, they're ready to turn back into regular kids. But the magic key that will get them out of the cycle is locked in the school bathroom! Trying to work their watery way into the bathroom, the kids go through the town waterworks and see how water is purified. Can they get to school through bathroom pipes? Or are they stuck in the water cycle forever?

http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html

This website is an animated version of the water cycle.

http://pbskids.org/zoom/activities/sci/

A gold mine of fun science experiments that lets you explore the different properties of water. Click on the water link.

http://iowse.usu.edu

This links you to the Utah State University International Office for Water and Science Education, education page. You can also access information about the coloring contest mentioned in the extensions section.

Organizations

National Science Teacher Association, http://www.nsta.org/

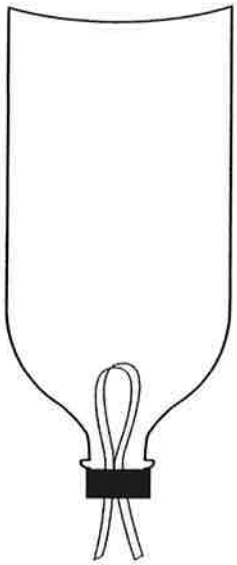
The National Science Teachers Association (NSTA), founded in 1944 and headquartered in Arlington, Virginia, is the largest organization in the world committed to promoting excellence and innovation in science teaching and learning for all. This organization is an excellent resource for seasoned and new teachers.

Building a Water Cycle Model

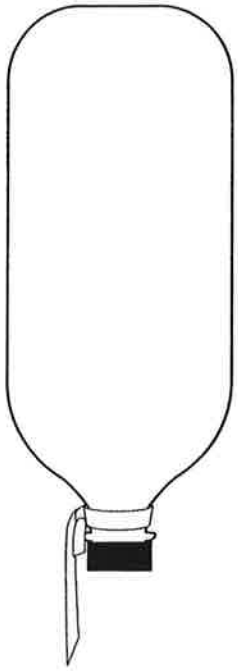
Team_____

1. Place the predrilled cap on Bottle "B". Insert a 30 cm (12") looped strip of a cotton shirt or rag through the hole so it hangs about 10 cm (4") down from the cap.
2. Tie the other 30 cm (12") cotton strip around the neck of bottle "C." Trim the piece of cloth so it hangs 5 cm (2") from the bottle opening. The piece of cloth hanging down should be trimmed like a necktie, its end cut to a point. Put a cap on bottle "C." The other cap will be used as a water collector in the model.
3. Assemble the model. Bottle "A" is the base of the model, with bottle "B" fitting "spout" first into bottle "A." Bottle "C" fits "spout first" into bottle "B." Once you know everything fits, it is time to fill the model, so you will be taking it apart.

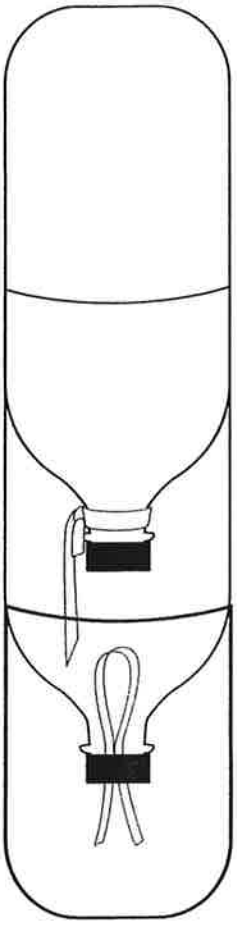
Bottle B



Bottle C



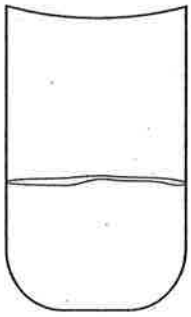
Bottles C, B, A



Fill the Water Cycle Model

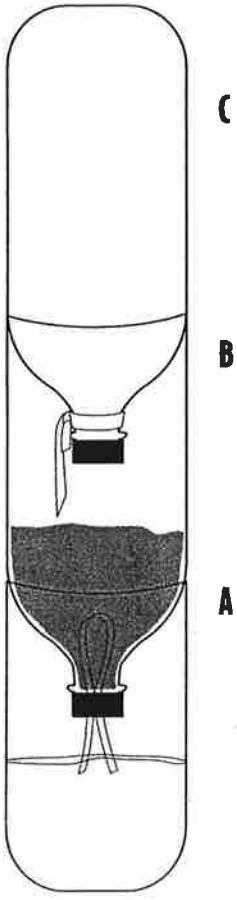
1. Generously wet both strips of cloth. The moistness allows the water to travel along the cloth. This is called capillary action, which is the natural upward movement of water in confined areas, like the spaces between soil particles.
2. Add 250 ml (1 C) of water to bottle "A". This water will be the source of water for the cycle in the model.
3. Fill bottle "B" with a generous cup of pre-moistened potting soil. The soil should cover the loop of cloth.
4. Sprinkle a bottle cap of grass seed into the soil in bottle "B."
5. Take the remaining bottle cap and press it into the soil in bottle "B." This acts as a collection receptacle for water.
6. The cloth strip on bottle "C" should be adjusted so it hangs over the "pond" in bottle "B." this allows the water to collect in the cap.
7. Fill bottle "C" with 200 ml (2/3 C) of water and tightly close the lid. Do not put more water in Bottle "C" than directed. The weight of too much water can make the model top heavy and at risk of toppling over. Assemble the model and put it near a light source.

Bottle A

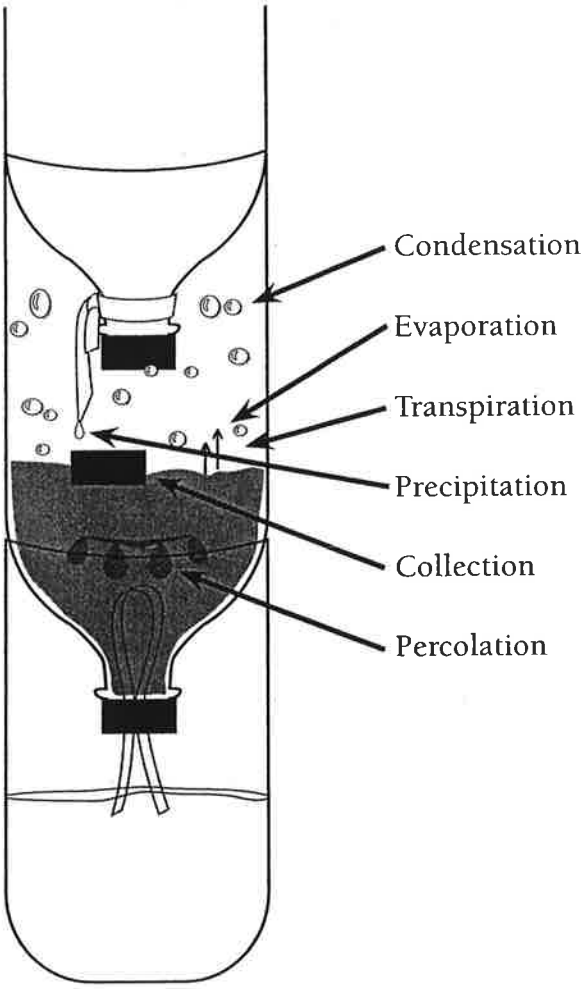


Bottle C

Bottles C, B, A



The Water Cycle Process



Write the six water cycle processes on the small labels below and attach them in their appropriate locations on the model. Use the above drawing as a guide.

Evaporation: Water traveling upward as vapor (gas).
Condensation: Water vapor turning back into a liquid.
Precipitation: Water falling from the sky as snow, rain, sleet, or hail.
Collection: Water collecting in puddles, ponds, rivers, oceans, glaciers, etc.
Percolation: Water mixing with soil.
Transpiration: Water evaporating from the leaves of plants.

Name _____ Date _____

Team Evaluation

1. Explain at least two specific ways that your team worked well during this activity.

2. Explain one specific way you would like to see your team improve for future activities.

3. State one specific way you contributed to your team in a positive way during this activity.

4. Describe in detail, what you learned about the water cycle and how the earth has a finite amount of water to fill the needs of everyone and everything on our planet.

The Water Cycle Assessment Test

Complete ____ points in answers on a separate sheet of paper. Place a checkmark by the choices that you complete. Due_____

Knowledge (5 points each)

_____ Define the terms percolation, transpiration, and energy. Tell where the water cycle gets its energy.

_____ Define the term water cycle. Explain the meanings for each of the six major processes that take place in the water cycle.

Comprehension (10 points)

_____ Write a paragraph that explains how the water cycle works on earth. Use all six water cycle terms in your response.

Application (15 points)

_____ Write a paragraph that explains how the water cycle works in your front yard.

Analysis (20 points)

_____ Brainstorm a list of 10 ways your family uses water and 10 ways your family can reduce water use to encourage water conservation. Write a contract for your family that will put three of these ideas into practice. Report back to the class after 3 weeks to let them know how your contract worked.

Synthesis (25 points)

_____ Create a song, poem, or rap that illustrates the water cycle. A 25 point response will use the following words in a meaningful way; evaporation, condensation, precipitation, collection, percolation, and transpiration. Be prepared to share your artistic rendition with the class.

Evaluation (30 points)

_____ Respond to this statement; "If we are not careful, one day Earth will run out of water." Write a 100+ word response that uses research to support your informed opinion. Include your rough draft with your final copy and a bibliography of your research.

Family Water Conservation Checklist

YOU HAVE BEEN DEPUTIZED! IT IS YOUR DUTY TO ORDER ALL WATER WASTERS TO CEASE AND DESIST THEIR WASTEFUL WAYS!! You have the power to ticket any and all family members who you find wasting water. Discuss with your family ways you can save and conserve water.

Bathrooms	Suggestions
1. Have toilet tanks been checked for leaks? ❑ Yes ❑ No	Place a few drops of blue food coloring in the toilet tank. If you can see the color in the toilet bowl without flushing, a wasteful leak needs to be repaired.
2. Is the toilet being used as a wastebasket? ❑ Yes ❑ No	Extra toilet flushes can waste up to 7 gallons of water with each flush.
3. Do you turn the water off while brushing your teeth? ❑ Yes ❑ No	Before you begin brushing, wet your brush and fill a glass for rinsing.
Kitchen/Laundry	**Suggestions**
1. Are dishwashers and washing machines used only for full loads? ❑ Yes ❑ No	When you run full loads in your appliances you save water and energy, and your machines will last longer.
2. Is water left running for rinsing produce or dishes? ❑ Yes ❑ No	Keep the water in the sink with a stopper, a great conservation idea!
3. Have your faucets been checked for leaks? ❑ Yes ❑ No	Repair leaks as soon as possible. One drip per second wastes more than 2,400 gallons of water per year.

Outdoor Use	Suggestions
1. Are lawns and shrubs watered only when it's really needed? ❑ Yes ❑ No	Check your lawn before watering. A lawn that springs back after being stepped on doesn't need water. Most shrubs need only one monthly deep watering during the summer.
2. Is your lawn watered before 10 a.m. or after 5 p.m.? ❑ Yes ❑ No	Water only during the cooler parts of the day. The sun can cause most of the water to evaporate before it is absorbed into the soil.
3. Are your walkways or driveways swept for cleaning? ❑ Yes ❑ No	Sweep your driveway and walkways instead of using a hose to clean them off.
4. Is water left running while washing your car or RV? ❑ Yes ❑ No	Fill a bucket with soapy water and wet down your vehicle. Turn off the hose and wash your car with the soapy water from the bucket. Rinse with the hose. A hose left running can waste up to 10 gallons of water per minute.

Water Waster Violation

Uh Oh! You are being cited for wasting water!

Date: _____

Name: _____

Infraction:	Ways to fix the problem:

Water Waster Watcher Deputy: _____