7-2-2008

Water Cycle [2nd grade]

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UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: The Water Cycle

Grade Level: 2nd Grade

Subject/Topic Area(s): Interdisciplinary (Primarily Science)

Designed By: Anna Bley

Time Frame: 15 Days

School District: Alamo Heights ISD

School: Woodridge Elementary

School Address and Phone: 100 Woodridge Dr. San Antonio, TX 78209

Brief Summary of Unit

This unit will help students to discover how the water cycle works and the implications it has on our planet and in our lives. They will conduct a series of experiments and activities to investigate the physical explanations behind each of the processes that make up the water cycle including evaporation, condensation, precipitation, and collection. They will use their knowledge of the scientific method to plan, predict, conduct, and analyze these investigations to examine how water changes physical state to be recycled on Earth. Additionally, they will relate their knowledge of the properties of physical matter to identify how water is changed and moved by this cycle in nature. Students will also apply their prior knowledge of cycles to describe how the processes are related and the impact that people and the environment have on the cycle. Students will begin to understand the limited supply of fresh water on our planet and think about ways to maintain and preserve this water for human use. Ultimately, students will culminate the unit with one of three projects that will challenge them to think critically about a given real-world or simulated topic and comprehensively demonstrate their understanding of the information learned throughout the unit.

Unit: Scientific Method and the Water Cycle
Grade: 2nd

Stage 1: Desired Results

Understandings

Students will understand that…
1. Replicating processes in nature through purposefully planned experiments helps us to understand how the physical world works.
2. Water is essential to all life on Earth; however, there is a limited supply of fresh water available.
3. The water cycle is a recurring natural pattern with distinct processes which circulate water around Earth.
4. Water has unique properties in its three states of matter which are important to the processes of the cycle.

Essential Questions	Knowledge & Skill
1. Why is the water cycle important to life on Earth? 2. Where does water go as it cycles through Earth? 3. What is the relationship between the physical states of matter and the water cycle? 4. Why do we have a global challenge to protect and keep our water supply clean?	*(Scope & sequence; TEKS; Core; etc.)* TEKS 2.1A demonstrate safe lab practices; 2.2A ask questions about organisms, objects, and events 2.2B plan and conduct simple descriptive investigations 2.2C compare results of investigations with what students and scientists know about the world 2.2D gather information using simple equipment and tools to extend the senses 2.2E construct explanations and draw conclusions using information and prior knowledge 2.2F communicate explanations about investigations 2.5B identify, predict, replicate, and create patterns 2.7A observe, measure, record, analyze, predict, and illustrate changes 2.7B identify, predict, and test uses of heat to cause change such as melting and evaporation 2.9B compare ways organisms depend on each other and on their environments 8.A identify ways in which people depend on the physical environment, including natural resources, to meet basic needs 10.A describe and illustrate the water cycle 10.B identify uses of natural resources

Stage 2: Assessment Evidence

Performance Tasks:

Educational Exhibit for S.A.W.S.
You are a scientific consultant for the San Antonio Water System (the utility responsible for supplying water to our city). They have requested that you design an exhibit that they will use when they travel to schools with the purpose of teaching Kindergarten and First Grade children about the water cycle. They need a plan that will (1) provide something visual with detailed images to help demonstrate the cycle – could be a poster or a model that will (2) explain the water cycle in detail and include all processes and (3) show the importance of habits that will help to preserve our limited water source.

A Water Cycle Production
You are a writer and producer for the theater that hosts educational productions for elementary students. You have been asked to write a script that will help tell the story of Drip the Raindrop and his adventures through the water cycle. You should identify the characters to represent the important elements in nature that play a role in the water cycle. These characters will all be part of your story that should be entertaining but also educational. Your play should (1) creatively explain all processes of the cycle and (2) persuade the children in the audience to help preserve our limited water source.
*Note – Stage props and costumes will be supplied by the theater. You only need to provide the script.

Moon Station
You have been hired by a team working with NASA. NASA will begin construction on a lunar station where scientists will be living for 6 months while they conduct research on the moon. They will be taking with them a small greenhouse that will contain a number of plants that they need to keep alive for their research. There isn't enough room on their shuttle to take a large enough source of water to keep the plants alive. It is your mission to design an artificial "water cycle" device that will recycle the water that is used for the plants. You will need to design the plans for the cycle on poster board to be presented at the planning stages for the lunar station. It will need to be specific enough for the engineers to use as a guide when building the station, but they are the experts on materials so you don't need to give exact dimensions or quantities of materials. You will supply the "big ideas" on how to construct this cycle and which natural elements will be needed to make each process happen in a cycle that will sufficiently recycle the water that the plants use.

Other evidence:

- *Observation – Socratic Dialogue to serve as pre-assessment*
- *Brain Check – quick student self assessment of their understanding of concepts so far*
- *Planning an evaporation experiment – evidence of thinking to be assessed through Experiment Lab Sheet*
- *Reflection sheet - students will decide which physical property of a gas is most important to the process of evaporation – response sheet attached*
- *Conducting a condensation experiment – evidence of thinking to be assessed through Experiment Lab Sheet*
- *Journal entry – assess students' ability to connect understanding of evaporation to condensation by thinking about a desert*
- *Venn Diagram - compare types of precipitation to understand how conditions in the water cycle change*
- *Quick hypothesis - what will happen in a replicated water cycle (synthesizing evidence from previous isolated experiments)*
- *Brochure – persuade using factual information on necessity to protect environmental sources that affect the water cycle (self assessment and correlating teacher assessment)*
- *Quiz – matching vocabulary to illustrated processes*

Stage 3: Learning Activities

(Steps taken to get students to answer Stage 1 questions and complete performance task)

Day 1: Begin by conducting a Socratic Dialogue surrounding important questions about water. To "hook" students, explain that the water fountains at Woodridge are very interesting. In fact, the water that they drink from the water fountains is from the same water supply that the dinosaurs drank from millions of years ago – the sip you took after lunch could even have touched the lips of a T-Rex! Give them time to process and discuss this. Follow up with the question, *"Where does water come from?"* Encourage students to think about the question and constantly probe deeper. (e.g. If they say "from clouds" follow up with *"Where do clouds come from?"*) Allow students to thoroughly discuss these important questions and formulate their own. As they discuss, assess their basic understanding and record the questions to revisit later in the unit. End the dialogue with a discussion surrounding the initial topic – *How is it that the water we drink today is from the same supply of water that dinosaurs drank millions of years ago?*

Day 2: After giving students a day to reflect on the discussion, begin by explaining that we have the same amount of water we had millions of years ago, but that the usable water on our planet is a limited source. Begin a chart - Ask them *"Where on our planet can we find water?"* Don't explain to them why but as you list their answers, keep two separate columns (one that is a source that could be drinkable water and one that includes salt water and other non-potable water.) When they are finished generating ideas ask them if they can figure out the difference between the two columns and do a Think-Pair-Share. Don't tell them yet if they don't guess it – move onto the demonstration that will help them understand how limited our supply of drinkable water is. You will use 4 different containers and students will help to do a whole-class demonstration where they will measure to symbolize the relationship between *Water on Earth, Freshwater, Unavailable Water*, and *Unusable Water.* (see attached procedures in Water, Water Everywhere instructions.) Come together and look at the chart that was created at the beginning of the activity and have students think again about the relationship between the two columns and either confirm or change their initial guess. To wrap up the day, have students complete a quick "brain check" to think about their understanding. (see attached Brain Check template.)

Day 3: Now that students know that we have a consistent water supply, encourage them to think about what happens to that water. Ask the question, "Where does water go as it cycles through Earth?" Once students begin talking about large bodies of water such as oceans, rivers, and lakes, ask them *What happens to the water in these places? How do we know this? What evidence that we can see might help us to prove this? What things are necessary to make this happen? Can we copy or replicate this process?* (Define the terms PROCESS and EVAPORATION as a series of events or changes that happen from start to finish. Put the term on the science word wall.) Students will work in groups to design an experiment that could replicate the process of evaporation. (They can use the attached Experiment Lab Sheet to help them complete this by filling out the Materials and Procedures sections.) Encourage them to use materials that we either have in the classroom or could easily obtain because they will be conducting these experiments on Day 4.

Day 4: Gather requested materials and students will conduct the experiments that they planned on Day 3. They will use the forms they began on Day 3 to conduct the experiments. (Make enough copies of each group's collaborative form for each child in that group to complete the remaining sections individually.) They will begin by thinking about the question, generating an individual hypothesis. Some experiments might require more time than available in one class period, so you might begin them early in the morning to be concluded at the end of the day.

Day 5: Share results from the students' experiments. Have students reflect as a group on whether the experiment accomplished its purpose of replicating evaporation and debug on what they might need to fix if they were going to do it again. Encourage students to look at all experiments and decide what they had in common (i.e. there needed to be energy/heat and water.) Ask student what state of matter an ocean/river/lake is and what state of matter the water is after it has evaporated. Explain to them that this gas is called WATER VAPOR. Add the term to the science word wall. Revisit the list of properties of a gas from previous unit on matter. Distribute a copy of the list (a sample one is attached) and have them circle *which property is most important to the process of evaporation.* Have them explain *Why is this property important? Could evaporation occur if this property wasn't true? What would happen to the water if this property wasn't true?*

Day 6: When you pick students up from lunch or some other time outside the classroom, tell them that you aren't sure if you can return to the classroom because it's completely full of water vapor. (On the way back to the classroom, ideally they will be thinking about what this means and what the implications might be.) When you get to the classroom (before they can see inside), ask them if they think it would be safe to go inside. Get student responses until you can conclude that water vapor is ALWAYS surrounding us and not harmful. We even breathe in and out water vapor.

Once inside the classroom, connect to previous day's learning by asking students for evidence in nature of evaporation. *When you get water on your shirt, what happens to it over time? What happened to the puddle on the playground after last week's rain?* Encourage students to generate their own examples of situations where they knew evaporation had occurred. *What happens to the water vapor that evaporated from the water sources? How do we know the water vapor is still there? Can we "catch" the water vapor to prove it exists?* Pass out a small mirror to each student (or have 1 or 2 demonstrate if supplies are limited). Students will exhale onto the mirror. Ask all students to think with a partner about *Why can we see breath on the mirror?* Have students breathe on mirrors again then wipe their fingers over the "breath" on the mirror and describe what they felt (i.e. wet). *What happened to the water vapor they exhaled?* Have them connect this to evaporation and ask again *What happens to the water vapor that evaporates from Earth's surface?* Conduct the first condensation experiment. Introduce it by showing them a coaster (for cups) and ask how it is used. Encourage them to conclude it is because glasses get wet or "sweat" on the outside sometimes. Students will then gather materials needed for the experiment and complete the question and hypothesis section of the Scientific Method Activity Sheet. Students in pairs will have a glass or cup with room temperature water with food coloring and another with ice water mixed with food coloring. Have them predict how the cups will react differently and why these changes do or do not occur. After conducting experiment, have students observe and analyze the outcomes. Ask them *Why is the water on the outside of the cold cup clear and not the color of the water inside?* (Note: To differentiate, advanced students can plan and conduct the experiment independently using the attached guide for the Magic Moisture experiment.) Conclude with a discussion surrounding the explanation that the water on the side of the cup is actually the water vapor from the air around the cup that turned to water when it was cooled by the surface of the cold cup. The water vapor turned into droplets of water when the molecules were cooled and became a liquid again. This process is called CONDENSATION. (Add this new term to the science word wall.)

Day 7: Review what students have learned about evaporation and condensation. Tell them that this knowledge will help them answer the next question: *Why doesn't it rain very often in the desert?* (Possible misunderstanding - Students will possibly say that it is because it is too hot.) Continue guiding students through questions until someone observes that there are rarely clouds in the desert. Have students answer in their science journals *Why aren't there very many clouds in the desert?* Depending on assessed knowledge, you may need to give a clue that their answer be connected to what they know about evaporation. Assess whether students were able to connect prior knowledge and to relate evaporation and condensation. Have students share answers in small groups then formulate one agreed group response to share with the class. After students understand that there is little water to evaporate and ultimately condense into clouds, demonstrate how to make a cloud in a bottle:

Use a clear glass jar and add a small amount of warm water to the bottom. Place a dish of ice to cover the opening of the jar. The cloud will form at the top of the jar. (To isolate variables, conduct the same experiment simultaneously with two other jars – the second without the ice and a third jar using cool water.) Clarify that the ice cooled it in this case, but the cooling in nature actually takes place when water vapor rises and expands. (Relate to prior understanding about how gases behave.) Ask students the following questions to guide small group discussions: *What happened inside the bottle to form a cloud? Why didn't the cool water form a cloud? Why was the ice necessary in the experiment?* Come back together to conclude that warm air rises, it expands and cools. Some of the vapor condenses to form tiny droplets of water. When billions of these droplets come together they become a visible cloud. (Note: When teaching advanced students, an extension demonstration is possible. Use a 3 liter bottle. Drop a few drops of warm water into the bottle then *very quickly* drop a blown-out match into the bottle and replace the lid. Allow the smoke particles to fill up the bottle then squeeze it again. Students will notice that a cloud forms when the bottle is squeezed then disappears when you let go. This experiment goes into a deeper explanation of how air pressure affects the temperature and also the fact that water vapor needs to have particles in the air to condense onto in order to form a cloud – in this case it is the smoke particles.)

Day 8: Take students outside to observe and describe the clouds. Have students work with a partner to come up with 5 adjectives to describe the clouds. (Tell them to be very specific about how the clouds look *today* so that someone who was inside would be able to visualize them accurately. You don't want them to just say white and fluffy.) Ask them to predict whether it might rain today based only on the clouds they can see. Then, ask them to generate adjectives that might describe clouds that they think *would* be likely to rain. (Add words like dark, heavy, and thick to the list if nobody mentions them.) *Note: If it is already raining outside, perfect! Have students look out of the window to describe the clouds and why they think these particular clouds are raining. Ask students to review how a cloud is formed, making sure to include the processes of evaporation and condensation. Then, read aloud "The Cloud Book" by Tomie dePaolo. This book will explain that there are different types of clouds. Ask students *what different kinds of things might fall from a cloud?* Make a list on chart paper and explain that all of these are different types of PRECIPITATION. Add this word to the science word wall. As a spot check, have students complete a Venn Diagram to compare and contrast rain and snow. Have students explain *What is the difference between these types of precipitation? How are these types of precipitation alike?* There is a self-assessment attached to the Venn Diagram to encourage students to think critically about their responses rather than just included basic knowledge that they had already learned.

Day 9: Review the processes of evaporation and precipitation, then pose the question *What happens to the precipitation once it falls from the clouds?* Students will likely consider that it falls back into oceans, lakes, and rivers but encourage them to think about other places. *What happens after it falls into dirt or soil? What happens when it falls onto hills and mountains? What physical properties of water are important to how this water behaves?* Explain that some water will become RUNOFF and flow back into rivers which will flow into larger bodies of water. Add this term to the science word wall. Explain that other water soaks into the ground and is either used by plants or falls deep into the ground. All of these ways that water moves and is combined into a larger source such as a lake or ocean is called COLLECTION. Add this term to the word wall as well. You can use this website to illustrate how this water is soaked into the ground. http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

Provide a demonstration where you construct a replicated water cycle in a bowl. (Note: This is an activity that will need to be introduced early in the day and analyzed at the end of the school day.) Make the model in advance following these steps: Use a large bowl (clear if possible) and fill it with two or three inches of water that has been mixed with mud, sand, and rocks. Place a short clear glass in the center of the bowl and cover the entire bowl with plastic wrap tightly and sealed around the edge of the bowl. Place a small rock on the plastic wrap so that it is just above the glass in the center of the bowl and slightly weighing the plastic wrap down but not touching the glass. Allow the students to look closely at what is inside in the bowl and how it is arranged. Explain to students that you will be placing the bowl outside in the sun. Have students hypothesize what will happen in the bowl. They can use the attached response sheet for individual assessment purposes. Observe the bowl after it has been in the sun for several hours. Encourage students to share in small groups what they observe. *What is inside the glass? Where did the water in the glass come from? Why is the water clear? What happened to the mud and dirt in that water? Why was the rock important? How would it have been different if the rock hadn't been there? How would it have been different if the bowl wasn't covered? How is what happened in this bowl similar to what happens in nature? How is it different?*

Day 10: Ask students to recall and summarize what happened in the Water Cycle in a Bowl demonstration. Ask the questions *If this was similar to how the water cycle works in nature, what would the plastic wrap represent in the real world?* Once students make the connection between the plastic wrap and the atmosphere (or sky) follow up with *What would have happened if the plastic wrap had been dirty? What would have happened if there would have been pollutants in the glass? Why is this important to think about? What can we do to make sure that our precipitation is clean and clear? How do human choices affect the water cycle? Why do we have a global challenge to protect and keep our water supply clean?* To encourage students to relate their knowledge of the water cycle and the affect of humans on it, students will create a brochure to inform people on ways that their actions and daily behavior can help to preserve our water. Student self-assessment and teacher assessment checklist attached.

Day 11: Students will take the Water Cycle Quiz (see attached quiz). When students are finished, explain that they will be playing Water Cycle Pictionary to review the different terms and processes in the water cycle. Students will be broken up into groups to play the game. Each team will take turns sending a teammate to draw a key vocabulary term from a cup (or an empty tissue box) then illustrate the term so that their team can guess what it is to earn a point (use raindrops to represent points). If after 60 seconds the team still hasn't guessed the word, the other team has a chance to guess correctly and earn the point for the round. The teams continue until there are no more words. (see attachment for word cards)

Day 12: Introduce the performance tasks to students. Students can choose between #1 and #2. #3 is for a very small population of students with a demonstrated deep understanding of the content and a very high level problem solving ability. Clarify objectives, introduce expectations, and distribute rubrics.

Days 13-14: Students will use these days to work on their projects. As they finish, they will use rubric to self-assess and make additions or changes to projects as desired. When completely finished, students will use highlighter to self-assess each category of their projects. Students can extend their thinking through technology connections or additional activities attached in this unit.

Day 15: Students can do a gallery walk to look at classmates' projects. Next to each project, post a graffiti board where students can provide positive feedback to each other's projects.

Water, Water Everywhere

Materials
20 L water (5.3 gal)
large container (10-gal aquarium)
medium container (quart size)
3 small containers (pint size)
graduated cylinder
eyedropper
marker

Purpose To understand that water is a limited resource and to demonstrate where usable water can be found on the Earth

Teacher Note: This activity can be done as a class demonstration or in small groups.

Background Although water covers about 75% of the Earth's surface, water is not as abundant as you may think. The amount of freshwater available on Earth for human use is only a small fraction (0.003%) of the total amount of water on the planet.

Procedure

1. Label the large container,"Earth's Water."
2. Label the medium container,"Freshwater," and the small containers,"Unavailable Water" and "Non-Usable Water."
3. Place 20 L of water in the "Earth's Water" container, which represents all the water in the world, including oceans, lakes, rivers, and groundwater.
4. Using a graduated cylinder, measure and pour 500 mL of water from "Earth's Water" into the "Freshwater" container, which represents the total amount of freshwater on the planet.
5. Create a second label,"Ocean Water," and place it over the "Earth's Water" label.The remaining 19.5 L in the large container now represents the water in the oceans, too salty for human beings to use. The oceans make up 97.5% of the total water volume on Earth.
6. Using a graduated cylinder, measure and pour 375 mL of water from the "Freshwater" container into the "Unavailable Water" container, which represents all the freshwater in glaciers, ice caps, the soil, and the atmosphere. This container is also unavailable for human use.
7. Using an eyedropper, remove 5 drops from the remaining "freshwater" container.
8. Pour the remaining water from the "Freshwater" container into the "Non-Usable Water" container, which represents all the water that is not readily available because it is very deep in the ground, in remote places, or polluted.
9. Place the five drops of water back into the "Freshwater" container, which represents the amount of clean water that is available for human use, only 0.003% of the 20 L you had in the beginning!

Conclusion
1. Where does our drinking water come from?
2. Why can't we use the majority of the water on the planet?
3. Is water a renewable resource?
4. Why is it important to manage water resources?

Extension 1. Develop a television commercial telling reasons why water is a limited resource.
2. Research a water habitat, such as the oceans, wetlands, or rivers. Find out what kind of animals and plants live there. Make a mural about these habitats.

Materials
20 L water (5.3 gal)
large container (10-gal aquarium)
medium container (quart size)
3 small containers (pint size)
graduated cylinder
eyedropper
marker

http://scifiles.larc.nasa.gov/docs/guides/Water_Cycle.pdf (page 26)

Brain Check

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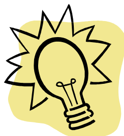
Name



I really understand ____

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I don't quite understand *or* I still wonder______________________________

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Brain Check

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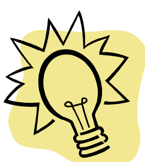
Name



I really understand ____

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I don't quite understand *or* I still wonder______________________________

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Experiment Lab Report

Names of scientist(s):____

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What is the QUESTION you are trying to answer? ________________

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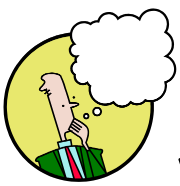
What is your HYPOTHESIS?______________________________

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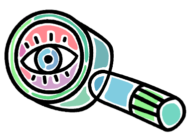
What MATERIALS will you need?

- ____
- ____
- ____
- ____
- ____
- ____
- ____

What are the PROCEDURES that you will follow? ________________



What did you OBSERVE? ______________________________________

ANALYZE what happened. (*WHY* do you think it happened?)

Name:____

Physical Characteristics of a Gas -

Why are they important in evaporation?

- Molecules are spread far apart
- Molecules are full of energy and are constantly moving around
- Molecules spread out to completely fill up its container
- No shape of its own
- No size of its own
- Colorless
- Usually invisible

Directions: Circle the characteristic of a gas that you think is most important to the process of evaporation. Answer the questions to convince someone that your answer is the best possible choice.

Could evaporation occur if this property wasn't true? ***YES*** *or* ***NO***

How would water after evaporation be different if gas didn't have this property?

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Name:______________________________ Date:_________________________

The Scientific Method

What is the QUESTION you are trying to answer? _________________

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What is your HYPOTHESIS?_________________________________

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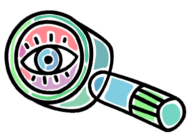

What did you OBSERVE? ___________________________________

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ANALYZE what happened. (*WHY* do you think it happened?)

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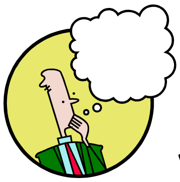
Name:________________________________ Date:__________________________

The Scientific Method

What is the QUESTION you are trying to answer? When a glass is "sweating," where do the drops of water on the outside of the glass come from?



What is your HYPOTHESIS? (Example: I think the drops of water come from outer space.)____

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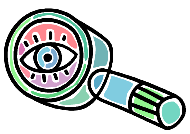

What did you OBSERVE? ____

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ANALYZE what happened. (*WHY* do you think it happened?)

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Experiment: Magic Moisture

<u>Question:</u> When a glass filled with liquid is "sweating," where do the drops of water on the outside of the glass come from?

Activity

1. **First your group needs to discuss where the drops of water come from and come up with a theory or hypothesis. (*For example: We think the drops of water on the outside of the glass come from the planet Venus.*)**
2. **Write your hypothesis in the section "Hypothesis" on your Lab Sheet.**
3. **Next: Create an Experiment!**
   You and your group will be given the following items:
   - **food coloring**
   - **ice-cubes**
   - **1 empty tin can**
   - **tap-water**

   Your task is to design and carry out an experiment using all of these items to test your hypothesis about where the drops of water you see on the outside of the glass come from.

On your mark, get set, go!

4. **When you have finished your experiment, think of the things you did step by step. Pretend that you are explaining the experiment to a friend.**

   Write these steps on your Lab Sheet in "Steps Of Your Experiment."

5. **What happened? What did you observe or learn from your experiment?**

   Record your observations in the section "Observations" on your Lab Sheet.

6. **Does your first hypothesis "fit" your observations or do you need to change your hypothesis?**

   Follow the instructions for "Hypothesis Revisited" on your Lab Sheet.

   Then answer the question "Why did you change (or not change) your hypothesis?"

Let's Talk About It!

7. Open Class Discussion

   Your group's task now is to share your experiment and your findings with the other groups in an open all-class discussion.

   You will also present your hypothesis (where the drops of water come from).

   Different groups may have come to different conclusions. It is important to listen carefully as each group shares its' information and to re-think your own findings.

   After the class discussion, you and your group may want to redo your experiment. When you feel ready, you will:

   Write your Concluding Hypothesis on the Lab Sheet.

8. Now, turn in your Lab Sheet
9. Write definitions in your Science Journal for these words:
   - water vapor
   - condensation

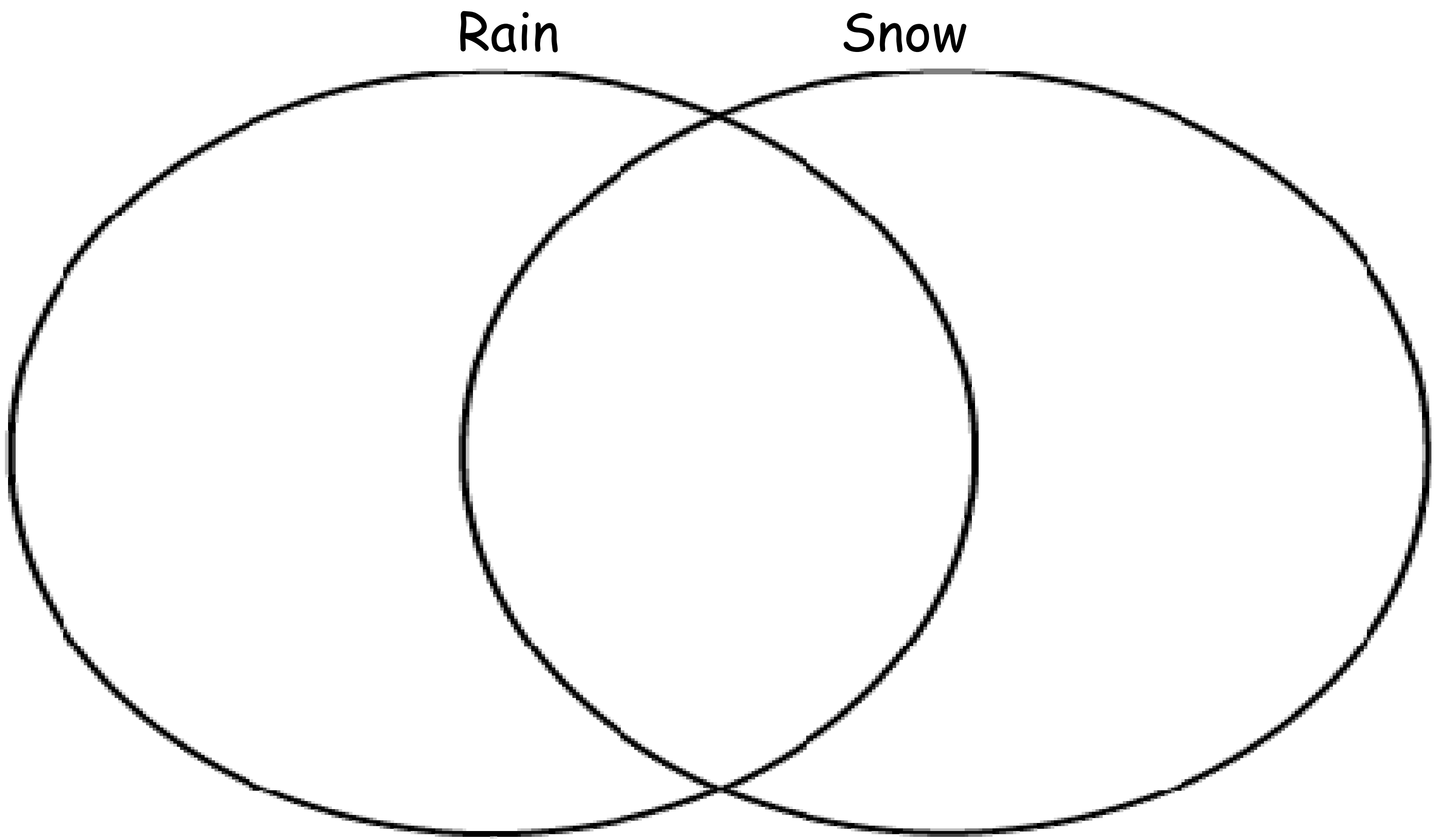
Congratulations! Your Group is all done.

Borrowed from:

http://www-k12.atmos.washington.edu/k12/modules/nw_wx_watch/experiment1.html

Name:____

Comparing Precipitation



Checklist: ____ My ideas show that I understand how precipitation is related to evaporation and condensation.

____ My ideas show that I am connecting what I already knew to something I just learned.

Name:______________________________

Water Cycle in a Bowl

What do you think will happen inside the bowl when it is placed in the sun for several hours? (Be as specific as you can.)________________________________

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Use the following checklist to be sure that you include the following terms and explain how each one relates to your prediction.

_____ I explained how evaporation will take place.

_____ I explained how condensation will take place.

_____ I explained how precipitation will take place.

_____ I explained how collection will take place.

_____ I used plenty of details to explain all my thinking.

Brain stretching question: Why do you think I used a rock in this experiment?

____

____

____

____

Conservation Brochure Self-Assessment

Name _______________________________**Date**________________

Did you include both complete sentences and pictures to make it appealing?

❒Yes ❒No

Did you include reasons to persuade the reader to make responsible choices?

❒Yes ❒No

Did you use correct spelling of words you know how to spell?

❒Yes ❒No

Did you check for correct use of capital letters and punctuation?

❒Yes ❒No

Did you share your brochure with a friend?

❒Yes ❒No

Is your brochure something *YOU* would find interesting and helpful?

❒Yes ❒No

Conservation Brochure Teacher Assessment

Name ______________________________

Included both complete sentences and pictures to make it appealing.

❒Yes ❒No

Gave convincing support based on the information we've learned.

❒Yes ❒No

Used correct spelling of known words.

❒Yes ❒No

Successfully utilized capital letters and punctuation.

❒Yes ❒No

Shared brochure with friend.

❒Yes ❒No

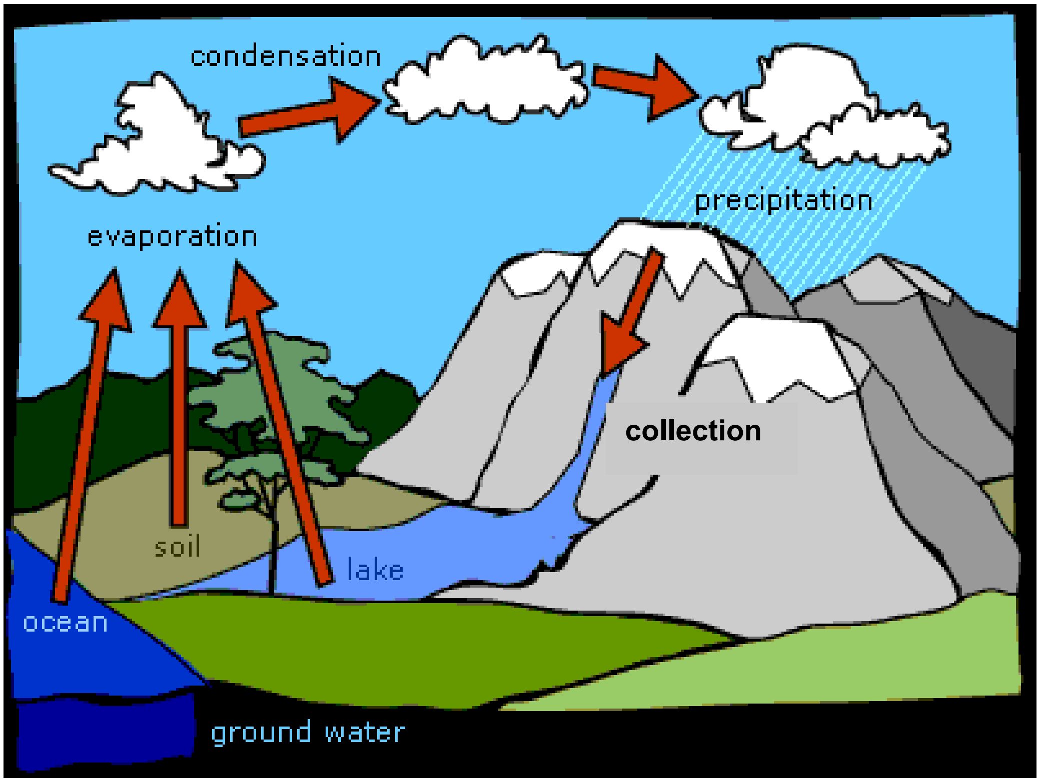
Really thought about the topic and took pride in his/her work.

❒Yes ❒No

6 Yes Responses = Excellent
5 Yes Responses = Good
4 Yes Responses = Satisfactory
3 Yes Responses = Needs Improvement
2 Yes Responses = Unsatisfactory

Total Points: ___________
Grade: _________________

Illustrated Water Cycle



http://www.cotf.edu/ete/modules/msese/earthsysflr/water.html

Online Animated Water Cycle

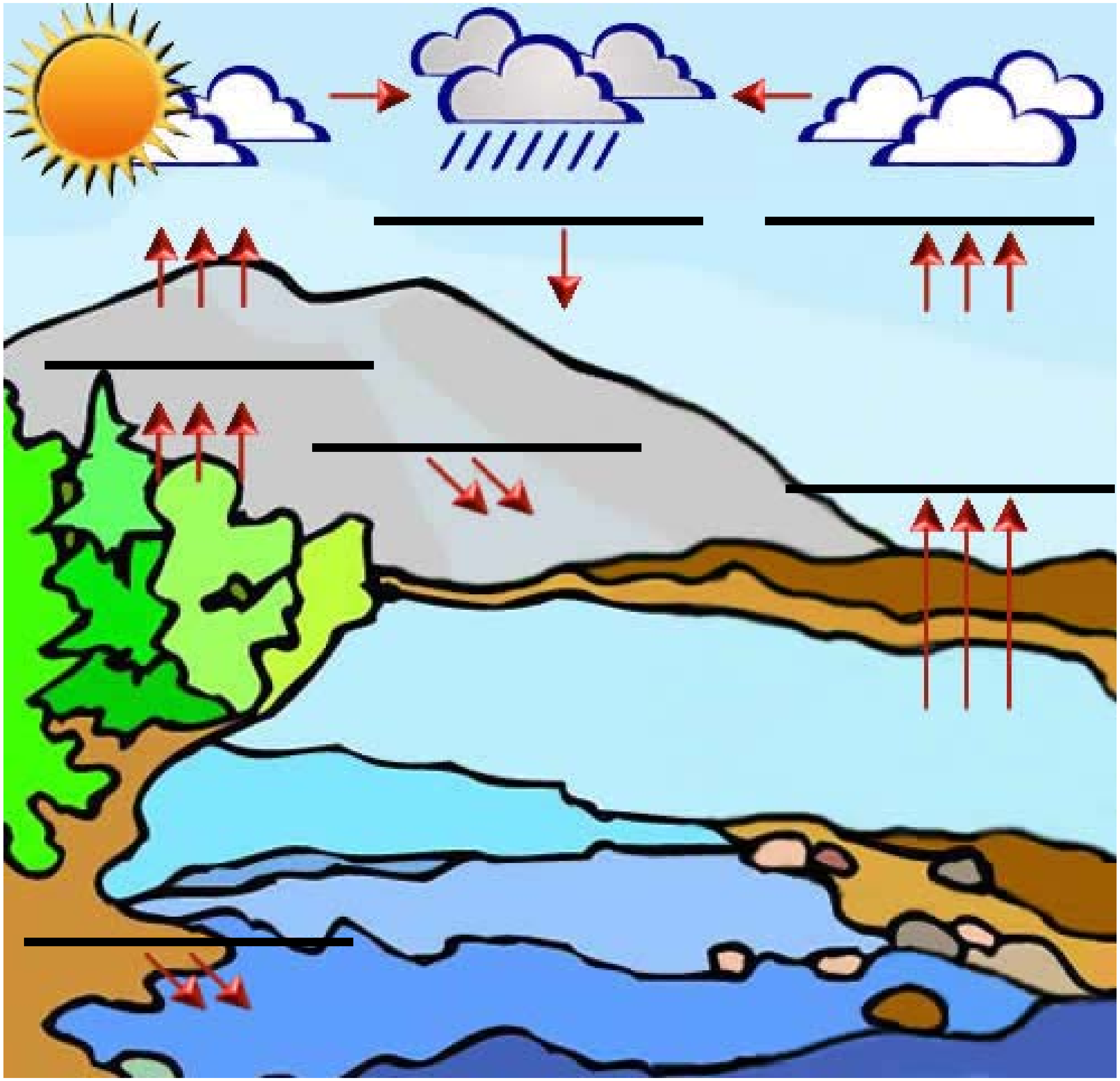
http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

Water Cycle Pictionary Cards

evaporation	condensation	precipitation
collection	sun	ocean
river	lake	pollution
water vapor	heat	rain
snow	Earth	water cycle

Name:______________________________ Date:__________________________

Water Cycle Quiz



Directions: Fill in the missing blanks in the picture to correctly label the water cycle.

Word Key
Collection
Condensation
Evaporation
Precipitation
Runoff
Hint: You will use one word *twice.*

Celebrations

What I really liked about your project was…

Name:____ Date:__________________________________

My Water Cycle Rubric – Project 1 and 2

My Score	Information (Processes)	Information (Cycle)	Critical Thinking	Quality of Work	Final Result
4	I thoroughly explained how *evaporation, condensation, precipitation,* and *collection* work. I understand each of these so well that I put it into my own words.	I understand that each process works together to form a cycle. I clearly explained how each process is related to the other processes in a way that told a story that "flows" naturally.	I was really stretching my brain on this project! I connected and applied what I learned through the class experiments, and I effectively showed my understanding of why the water cycle is so important.	I was creative and presented my project in a unique way that I knew people would enjoy seeing. I did my very best work and it looks polished.	I truly put my heart and my mind into my project. It contains valuable information that would entertain and really helps others understand the importance of the water cycle and successfully persuade them to conserve water.
3	I understand that water changes and goes through several processes. I explained how most of these processes work but didn't always go into details.	I showed that I know the sequence of each of the processes. I presented them one at a time rather than as parts of a whole cycle.	I put some thought into my project. I remembered the information that we learned and tried to put it into my own words somewhere in my project. I tried to connect my ideas to come up with new ones.	I was creative but I could have done better work. I know that my project would teach someone the information but I could have spent more time on it.	I am proud of my project. It has all the parts I needed to include and it could effectively teach someone about the water cycle and tell them about ways to conserve water.
2	I know that water changes and that these changes have something to do with liquids, solids, and gases.	I know that water changes in important ways but I didn't demonstrate how these happen in an order that tells a story.	My goal was to finish the project. I made sure to complete all parts of it but didn't try to push my thinking. I included facts but didn't connect them very well with the information I've learned.	There are several mistakes and my work is quite sloppy. These mistakes and the quality of my work could make it hard for others to understand.	I finished the project. I put some important information in it about the water cycle, but I don't know if it will help them to understand how the water cycle works or change their habits to conserve water.
1	I know that water changes but I didn't explain how or why.	I don't quite understand how any of these changes are related so I had a hard time explaining a cycle.	I didn't really understand the project and didn't ask questions so that I could put my best thinking into my work.	My work is messy and there are so many mistakes that others wouldn't be able to read or understand it.	I tried to complete the project. It is unfinished, but isn't work that I am very proud of. It won't help teach others about the water cycle or habits that will help them conserve water.

Name:____ Date:________________________________

My Water Cycle Rubric – Project 3

My Score	Information (Processes)	Information (Cycle)	Critical Thinking	Quality of Work	Final Result
4	I thoroughly included how *evaporation, condensation, precipitation,* and *collection* work. I understand each of these so well that I was able to put it into my own words.	I understand that each process works together to form a cycle. I clearly explained how each process is related to the other processes in a way that told a story that "flows" naturally.	I was really stretching my brain on this project! I connected and applied what I learned through the class experiments, and I effectively showed my understanding of why the water cycle is so important.	I was creative and presented my project in a unique way that I knew people would understand. I did my very best work and it looks polished.	I truly put my heart and my mind into my project. It contains valuable information that would serve its purpose in being a reasonable way to recycle water and conserve a limited supply of water.
3	I understand that water changes and goes through several processes. I explained how most of these processes work but didn't always go into details.	I showed that I know the sequence of each of the processes. I presented them one at a time rather than as parts of a whole cycle.	I put some thought into my project. I remembered the information that we learned and tried to put it into my own words somewhere in my project. I tried to connect my ideas to come up with new ones.	I was creative but I could have done better work. I know that my project would teach someone the information but I could have spent more time on it.	I am proud of my project. It has all the parts I needed to include and it could effectively teach someone about the water cycle and tell them about ways to conserve water.
2	I know that water changes and that these changes have something to do with liquids, solids, and gases.	I know that water changes in important ways but I didn't demonstrate how these happen in an order that would become a functional cycle.	My goal was to finish the project. I made sure to complete all parts of it but didn't try to push my thinking. I included facts but didn't connect them very well with the information I've learned.	There are several mistakes and my work is quite sloppy. These mistakes and the quality of my work could make it hard for others to understand.	I finished the project. I put some important information in it about the water cycle, but I don't think it will actually work in recycling the limited water supply.
1	I know that water changes but I didn't explain how or why.	I don't quite understand how any of these changes are related so I had a hard time explaining a cycle.	I didn't really understand the project and didn't ask questions so that I could put my best thinking into my work.	My work is messy and there are so many mistakes that others wouldn't be able to read or understand it.	I tried to complete the project. It is unfinished, but isn't work that I am very proud of. I know it wouldn't be a reasonable way to recycle the limited supply of water.

Additional Activities and Resources

Activities

- Thirstin's Groundwater Movement Activity - Learn how water must move underground (see attachment)

http://www.epa.gov/safewater/kids/grades_k-3_groundwater_movement.html

- Thirstin Builds an Aquifer in a Cup (see attachment)

http://www.epa.gov/safewater/kids/grades_k-3_thirstin_builds_an_aquifer.html

- Thirstin's Water Cycle Activity - Students can build a working model of a replicated water cycle (see attachment)

http://www.epa.gov/safewater/kids/pdfs/activity_grades_k-3_watercycle.pdf

- Students will be “detectives” to identify, observe, and analyze substances in water.

http://www.globe.gov/tctg/hydro_la_waterdetectives.pdf?sectionId=161

- Students can become hydrology experts. They can use a nearby body of water to analyze several aspects of the water for data collection and submit their data to a worldwide network of other schools doing the same thing.

http://www.globe.gov/tctg/hydro_chapintro.pdf?sectionId=145

- A very comprehensive and interactive illustration of the water cycle where students can click on different processes and elements to learn more information on each.

http://ga.water.usgs.gov/edu/watercycle.html

- A more basic interactive illustration of the water cycle where students can click on different processes and elements to learn more information on each.

http://www.dnr.state.wi.us/org/caer/ce/eek/earth/groundwater/watercycle.htm

- Students will be “detectives” to identify, observe, and analyze substances in water.

http://www.globe.gov/tctg/hydro_la_waterdetectives.pdf?sectionId=161

- Students can become hydrology experts. They can use a nearby body of water to analyze several aspects of the water for data collection and submit their data to a worldwide network of other schools doing the same thing.

http://www.globe.gov/tctg/hydro_chapintro.pdf?sectionId=145

- A NASA site with an exciting simulation where students will act as The Treehouse Detectives to solve a case of the Wacky Water Cycle.

http://scifiles.larc.nasa.gov/docs/guides/Water_Cycle.pdf

- Here is a simulated “adventure” where students will act as water molecules and encounter several different places on the planet. They will understand that water undergoes a cycle but that several factors affect when and how.

http://www.projectwet.org/pdfs/Incredible%20Journey.pdf

Internet Sources

- http://www.brainpop.com/science/ecology/watercycle

An animated lesson on the water cycle

- http://www.scdhec.net/water/html/watershd.html

A comprehensive site on water, purification, conservation, etc.

- http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

Illustrated water cycle

- http://www.mbgnet.net/fresh/cycle/index.htm

An informative site on the cycle, its elements, and cloud formation

- http://lvwater.org/tour_cycle.html

Choose your own adventure

- http://www.dnr.state.wi.us/org/caer/ce/eek/earth/groundwater/index.htm

A site with several resources to understand groundwater

- http://www.dnr.state.wi.us/org/caer/ce/eek/earth/groundwater/gquiz.htm

An online water quiz

- http://www.cotf.edu/ete/modules/msese/earthsysflr/cycles.html

A website with graphics to illustrate and explain the water and rock cycles

- http://njawwa.org/kidsweb/

A comprehensive site that teaches about water, treatment, and conservation

- http://www.leonardodicaprio.org/whatsimportant/watermovie.htm

A movie from Leonardo DiCaprio about water and conservation (It will give them topical evidence of someone they know trying to make a difference)

- http://www.projectwet.org/pdfs/Storm%20Water%20layout.pdf

An informative graphic flyer with activities to show students the different elements and impurities that can be found in precipitation (specifically storm water)

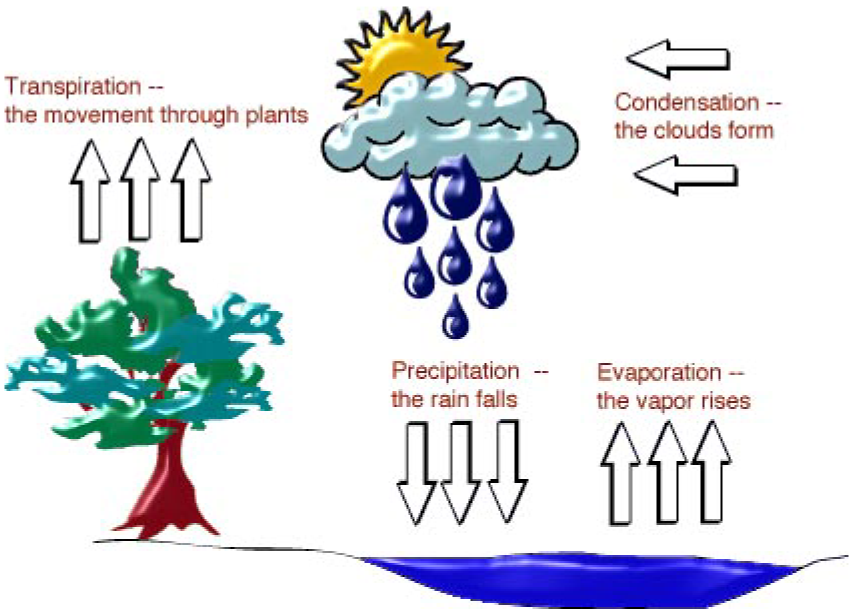
- http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/index.html

This site provides an animated water cycle that can change between one that illustrates elements and one that illustrates the processes. It also includes a quiz that can be found at: http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/watercycleq.html

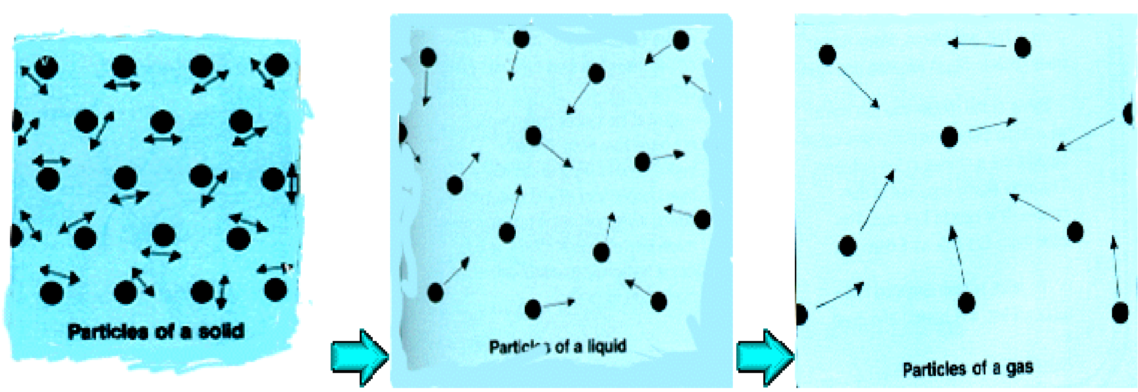
- http://www.livingclassrooms.org/slurrp/watercycle.html

Here is a drag-n-drop quiz where students will match the processes to the corresponding picture.

Graphics and Visual Aids

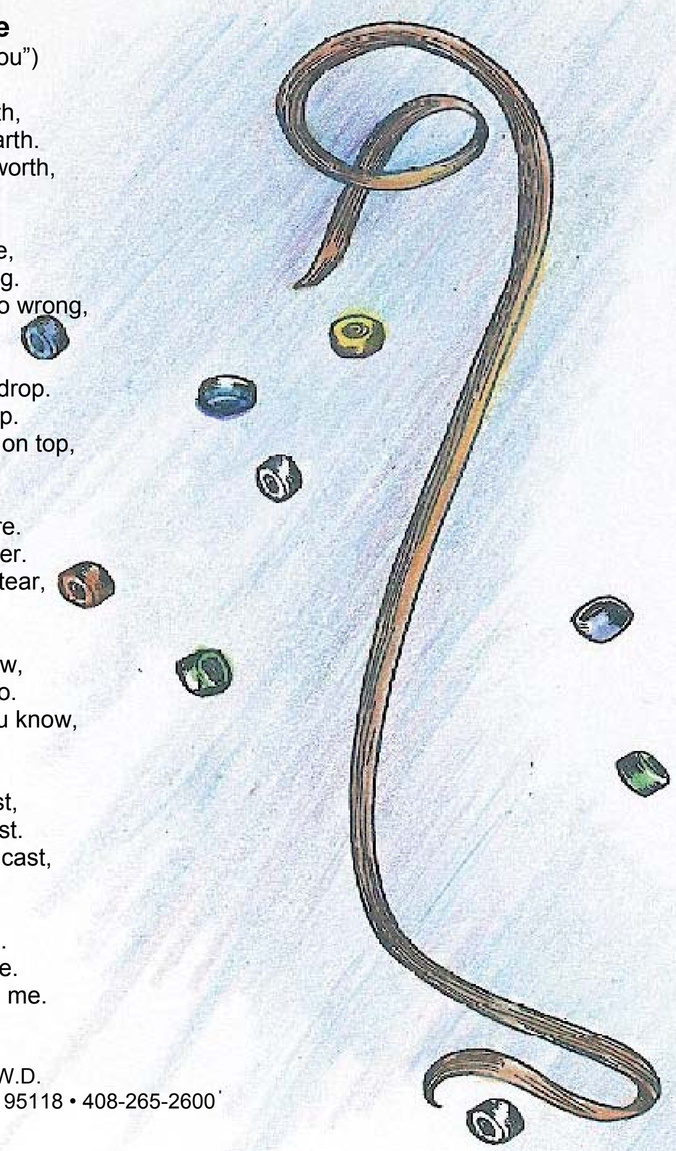


http://www.mbgnet.net/fresh/cycle/cycle2.jpg



http://www.nyu.edu/pages/mathmol/textbook/slg.html

For auditory learners who learn best through song and rhythm, they can make a tangible summary of the processes with a corresponding song:



Water Cycle Boogie
(Sing to tune: “Skip to My Lou”)

Sun a shining, from its birth,
Dries the water, dries the earth.
A YELLOW bead, shows its worth,
Water cycle boogie.

Evaporation, water’s gone,
To a vapor, won’t take long.
Choose a CLEAR bead , can’t go wrong,
Water cycle boogie.

Clouds are forming, drop by drop.
Vapor moving, will not stop.
WHITE beads show us, what’s on top,
Water cycle boogie.

Condensation, water’s here.
No more vapor, give a cheer.
A LIGHT BLUE bead, like a tear,
Water cycle boogie.

Precipitation, rain and snow,
Shows us water, on the go.
A DARK BLUE BEAD, don’t you know,
Water cycle boogie.

See the water, moving fast,
Runoff on the ground at last.
BROWN Beads also join the cast,
Water cycle boogie.

Transpiration from a tree.
Water vapor, you can’t see.
GREEN beads show it, all to me.
Water cycle boogie.

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Reading List, Courtesy of Regional Water Providers Consortium:
http://www.conserveh2o.org/pdf/BN_book_list.pdf

1. ***Bear Loves Water.*** (Preschool) By Ellen Weiss. Bear teaches readers about water in all its forms - puddles, bubbles, snowflakes and clouds.
2. ***Brother Eagle, Sister Sky: A Message from Chief Seattle.*** (4-8 years) Illustrated by Susan Jeffers. A story about Native American beliefs and how each generation deserves to breathe fresh air, drink pure water and to enjoy all the beauty that the earth offers.
3. ***Common Ground: The Water, Earth, and Air We Share.*** By Molly Garrett Bang. Explains how everyone in the world depends on each of us individually to protect resources and maintain respect for the environment.
4. ***The Drop in My Drink.*** (9-12 years) By Meredity Hooper and Chris Coady. Water takes on fascinating new significance as readers discover the amazing complexity of a substance we take for granted. Includes a detailed depiction of water cycles, amazing facts and important environmental information.
5. ***A Drop Of Water: A Book of Science and Wonder.*** By Walter Wick. Shows the different forms of water in amazingly detailed photographs; explains water's properties.
6. ***The Earth and I.*** (4-8 years) By Frank Asch. Explains the friendship between the earth and a young child and what each can do for the other.
7. ***Follow the Water from the Brook to the Ocean.*** By Arthur Dorrors. Explains how water flows from brooks, to streams, to rivers, over waterfalls, through canyons and dams to eventually reach the ocean.
8. ***The Four Elements: Water.*** (Preschool) By Carme Solé Vendrell and J.M. Parramón.Text and illustrations explain the properties of water and its uses. Includes a special section to help adults answer children's questions.
9. ***Gullywasher.*** (4-8 years) By Joyce Rossi. In English and Spanish. A grandfather tells tall tales of his life as a cowboy (vaquero) and of the harsh life in the desert, flash floods, and wildlife.
10. ***I Am Wate.r*** (4-8 years) By Jean Marzollo. A first book about water in its different forms and uses.
11. ***Magic School Bus: At the Waterwork.s*** By Joanna Cole. Mrs. Frizzle, the science teacher, drives the magical school bus into a cloud where the children shrink to the size of water droplets and follow the course of the water through the city's waterworks system.
12. ***Magic School Bus: Se Salpica Toda.*** (4-8 years) By Joanna Cole. In Spanish, experience the earth's water cycle first hand as Mrs. Frizzle's class rises into the air, forms a rain cloud, a drizzles down to earth just like rain.
13. ***Magic School Bus: Wet All Over.*** (4-8 years) By Joanna Cole. Experience the earth's water cycle first hand as Mrs. Frizzle's class rises into the air, forms a rain cloud, a drizzles down to earth just like rain.
14. ***One Small Square: Cactus Desert.*** (6-10 years) By Donald M. Silver. Teaches about all the plants and wildlife that exist in one small square of desert - an excellent introduction to ecosystems and biodiversity.
15. ***River Ran Wild: An Environmental History.*** By Lynne Cherry. A history of New Hampshire's Nashua River starting 7,000 years ago until its recent reclamation. This is a good explanation of what can happen over time to a body of water and its wildlife -- what people can do to the environment and what they can do for it.
16. ***Snail Girl Brings Water.*** (6-10 years) By Geri Reams. A retelling of a traditional Navaho creation myth which explains how water came to earth.
17. ***Splish, Splash, Splosh.*** (4-8 years) By Mick Manning and Brita Granström. Join the adventures of a young boy and his dog and ride the waves, float on rain-filled clouds,

shoot down fast-flowing rivers, and splash through sewers until you get where all water ends…and begins.

18. ***This Place is Dry.*** By Vicki Cobb, Barbara Lavallee (Illustrator). Surveys the living conditions in Arizona's Sonoran Desert for the people and the unusual animals that live there. Also describes the engineering accomplishment of the Hoover Dam.
19. ***Water.*** By Frank Asch. Aimed at very young children, this book artfully describes water in it many forms, its uses, and its role in our lives.
20. ***Water (My First Nature Book).*** By Andrienne Soutter-Perrot, Etienne Delessert (Illustrator). Explains water in its different form and why every living thing needs water.
21. ***Water Science, Water Fun: Great Things to Do with H2O.*** (9-12 years) By Noel Fiarotta and Phyllis Fiarotta. Lessons and experiments teach about floating, refraction, leaching temperature gravity, buoyancy, flow and other water properties.
22. ***Water, Water Everywhere (Discovery Readers).*** By Melvin Berger, Gilda Berger, Bobbi Tull (Illustrator). A book about the water cycle, treatment, distribution, and wastewater treatment.
23. ***Where Do Puddles Go?*** (4-8 years) By Fay Robinson. An early book to explain water cycles and water in all its forms.
24. ***Where Does Water Come From?*** (6-10 years) By C. Vance Cast. Clever Clavin shows how much water there is on earth, how wells are dug to bring it out of the ground, and how water treatment plants work.
25. ***The*** *Woman Who Outshone the Sun/La Mujer Que Brillaba Aún Más Que el Sol.* By Alejandro Cruz Martinez, Fernando Olivera (Illustrator). A bilingual tale from ancient Mexico that tells of a beautiful woman who arrives in a mountain village and is driven out because she is different, taking the river with her.
26. *The Wonder Thing.* By Elizabeth Hathorn, Peter Gouldthorpe (illustrator), and Libby Hathorn. In a poetic guessing game comprised of pictures and words, young children can guess what the "wonder thing" is, as well as identify landscapes and places.

Thirstin's Groundwater Movement Activity

Introduction

Ground water must be able to move through underground materials at rates fast enough to supply useful amounts of water to wells or springs in order for those materials to be classified as an aquifer. For water to move in an aquifer, some of the pores and fractures must be connected to each other. Water moves through different materials at different rates, faster through gravel, slower through sand, and even slower through clay. Gravels and sands are possible aquifers; clays usually are not aquifers. The following activity demonstrates how different sizes of rock materials that make up an aquifer affect water movement.

Objectives

Students will:

1. Identify several sources of rock materials that make up an aquifer.
2. Discuss how water moves through gravel, sand, and clay.

Materials

1. At least 10 students.
2. Large area to conduct activity

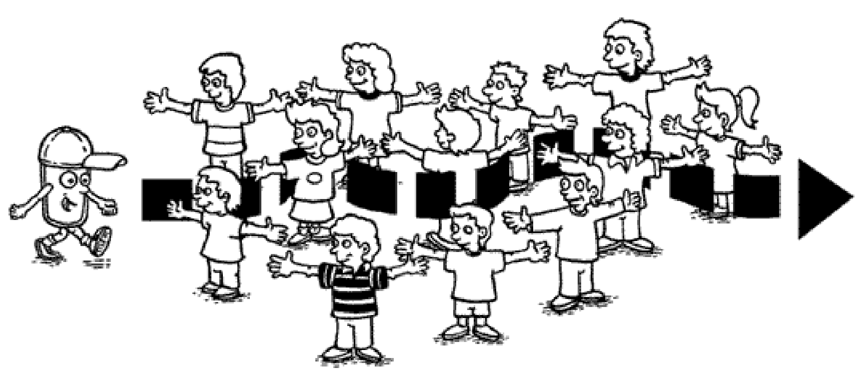
Teacher Preparation

This activity can be conducted in the classroom, gymnasium, or outside the school building. If conducted in the classroom, move all furniture to allow for sufficient room for the movement of students. This is a three-part demonstration that may create some excitement.

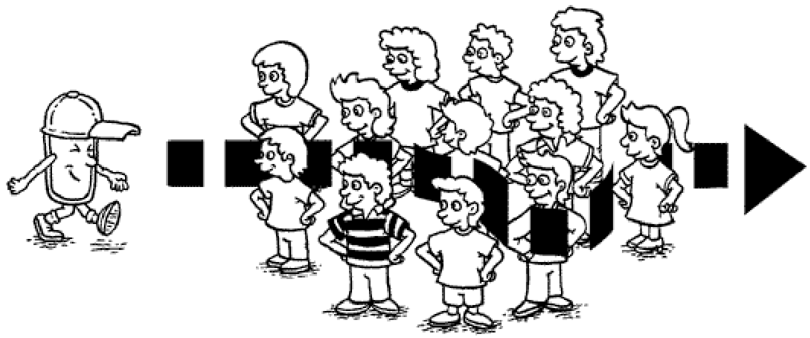
Procedures

Select two or three students to be molecules of water. The remaining students will be rock materials.

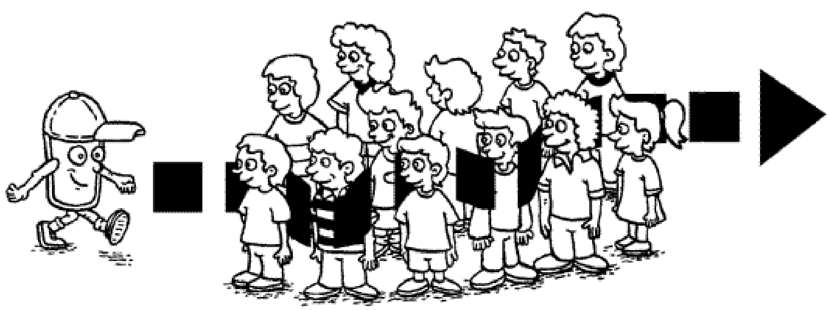
1. **Activity One:** Water movement through gravel. The students represent gravel by holding arms outstretched, leaving a 15- to 30- centimeter (cm) space between their outstretched arms. Locate these students in the center of the activity area. The students representing water molecules are to start on one side of their "gravel" classmates and move through them, exiting on the other side. The water molecules will move easily through the gravel.



2. **Activity Two:** Water movement through sand. The students represent sand by extending arms, bending them at the elbows and touching their waists with their fingers. Locate these students in the center of the activity area, spacing them approximately 15cm apart. Once again, have the water molecules slowly make their way through their "sand" classmates. The water molecules will experience some difficulty, but should still reach the other side.



3. **Activity Three:** Water movement through clay. Students become clay particles by placing their arms straight down the sides of their bodies and standing approximately 10cm apart. Locate these students in the center of the activity area. It will be a formidable task for water molecules to move through the clay. The water molecules may not be able to move through the clay at all.



Interpretive Questions

1. Which one of the materials - gravel, sand or clay - was the easiest for the water molecules to move through? (Answer: Gravel, then sand, then clay.) Why? (Answer: Because there are larger spaces between the gravel particles.)
2. If there were three rock units, one of gravel, one of sand, and one of clay, all containing the same quantity of water, in which would you drill a well? (Answer: Gravel. Water moves easier through gravel than sand or clay.)

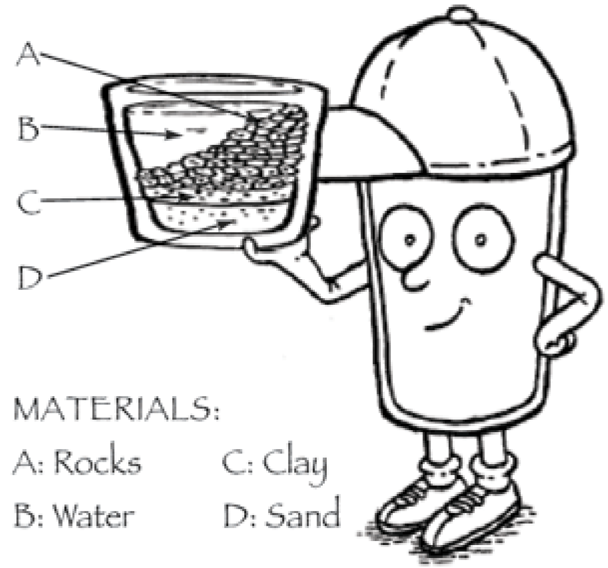
Extension

Obtain 250 milliliters (mL) of sand, 250 mL of pea-size gravel, 250 mL of clay, and three large funnels (top diameter approximately 12cm). Force a piece of cheesecloth into the top of the spout of each funnel. This will prevent material from going through the funnel spout. Put each funnel into separate clear containers so that the spout of the funnel is at least 5cm above the bottom of the container. Pour the sand into the first funnel, pea-size gravel into the second funnel, and the clay into the third funnel. Pour equal amounts of water (approximately 200 mL) onto the materials contained in the funnels. Select three students to pour the water, creating a permeability race. Time how long it takes the water to flow through the materials. Record on a data sheet. Which material did the water flow through the fastest? Why?

This activity was adapted from "Get the Ground Water Picture," National Project WET.

http://www.epa.gov/safewater/kids/grades_k-3_groundwater_movement.html

Thirstin Builds an Aquifer in a Cup (Aquifer on the Go)



Background

Many communities obtain their drinking water from underground sources called **aquifers**. Water suppliers or utility officials often drill wells through soil and rock into aquifers for the ground water contained therein to supply the public with drinking water. Home owners who cannot obtain their drinking water from a public water supply, will have their own private wells drilled on their property. Unfortunately, ground water can become contaminated by harmful chemicals, such as lawn care products and household cleaners that were used or disposed of improperly, and any number of other pollutants, that can enter the soil and rock, polluting the aquifer and eventually the well. Such contamination can pose a significant threat to human health. The measures that must be taken by well owners and water plant operators to either protect or clean up contaminated aquifers are quite often costly.

Note: This demonstration should follow a class discussion on potential sources of pollution to drinking water supplies.

Objectives

To illustrate how water is stored in an aquifer, how ground water can become contaminated, and how this contamination ends up in a drinking water well. Ultimately, students should get a clear understanding of how careless use and disposal of harmful contaminants above the ground can potentially end up in the drinking water below the ground. This particular experiment can be done by each student at their work station.

Materials needed per student

1. **1 clear plastic cup** that is 2 3/4" deep x 3 1/4" wide for each student
2. **1 piece of modeling clay or floral clay** that will allow a 2" flat pancake to be made by each student for their cup
3. **White play sand** that will measure 1/4" in bottom of each student's cup
4. **Aquarium gravel** (natural color if possible) or small pebbles (approximately 1/2 cup per student) *(HINT: As many small rocks may have a powdery residue on them, you may wish to rinse and dry them on a clean towel prior to use. It is best if they do not add cloudiness to water.)*
5. **Red food coloring**
6. **1 bucket of clean water** and **small cup** to dip water from bucket

Procedure

1. Pour 1/4" of white sand in the bottom of each cup completely covering the bottom of the container. Pour water into the sand, wetting it completely (there should be no standing water on top of sand). Let students see how the water is absorbed in the sand, but remains around the sand particles as it is stored in the ground and ultimately forming part of the aquifer.
2. Have each student flatten the modeling clay (like a pancake) and cover 1/2 of the sand with the clay (have each student press 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. Pour a small amount of water onto the clay. Let the students see how the water remains on top of the clay, only flowing into the sand below in areas not covered by the clay.
3. Use the aquarium rocks to form the next layer of earth. Place the rocks over the sand and clay, covering the entire container. To one side of the cup, have students slope the rocks, forming a high hill and a valley (see Thirstin's illustration). Explain to students that these layers represent some of the many layers contained in the earth's surface. Now pour water into your aquifer until

the water in the valley is even with your hill. Students will see the water stored around the rocks. Explain that these rocks are porous, allowing storage of water within the pours and openings between them. They will also notice a "surface" supply of water (a small lake) has formed. This will give them a view of both the ground and surface water supplies which can be used for drinking water purposes.

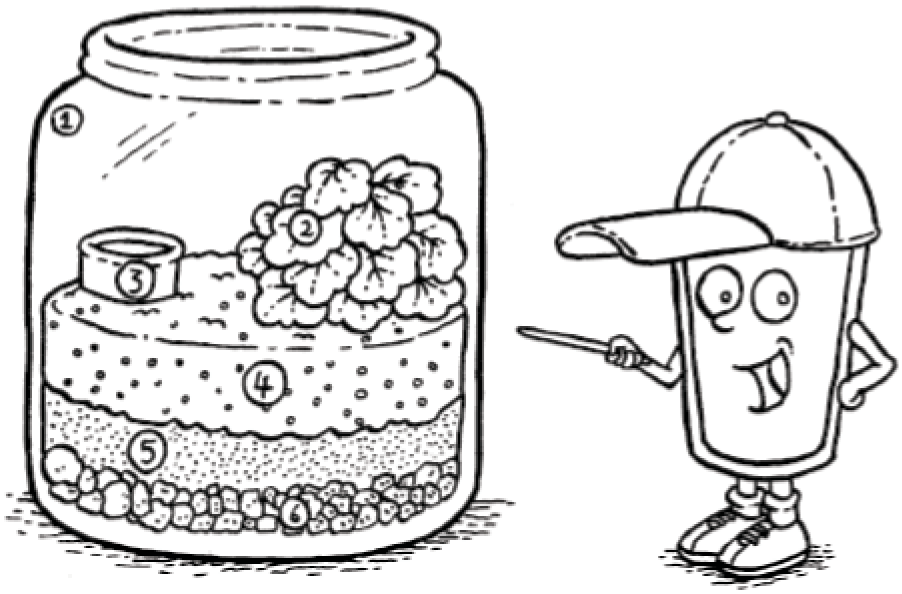
4. Use the food coloring and put a few drops on top of the rock hill as close to the inside wall of the cup as possible. As an example, explain to students that often old wells are used to dispose of farm chemicals, trash, and used motor oil. This practice can show up in the ground water and their drinking water. They will see that the color spreads not only through the rocks, but also to the surface water and into the white sand at the bottom of their cup. This is one way pollution can spread throughout the aquifer over time.

Follow up

Discuss with students other activities that could pollute their aquifer. Assign students the task of locating activities around the school or their own homes that could pollute their drinking water sources if not properly maintained. Allow students to drain off the water in their cups and carry home their container to refill with water and show their parents surface and ground water and how the food coloring illustrates pollution activity above their aquifer can affect all water. Students should discuss with parents what steps they can take as a household to prevent water pollution.

Original activity can be found at:
http://www.epa.gov/safewater/kids/grades_k-3_thirstin_builds_an_aquifer.html

Thirstin's Water Cycle Activity



YOU WILL NEED:	DIRECTIONS:
1. jar 2. plants 3. bottle cap or shell of water 4. soil 5. sand 6. small rocks	1. Fill jar as in the picture and put the lid on 2. Put the jar in a sunny place. 3. See how the water cycle works.

Original activity can be found at:
http://www.epa.gov/safewater/kids/pdfs/activity_grades_k-3_watercycle.pdf