It Cycles and Recycles

Science and Language Arts

Brief Description:

The water on the earth continuously cycles and recycles. It may take thousands of years to do so but, nevertheless, it is the same water recycling over and over. This lesson teaches students that fact and the details of the water cycle.

Objectives: Students will be able to:

1. Identify that water moves in a never-ending cycle.
2. Define terms that make up the water cycle.

Life Skill:

1. Understanding Systems

Time:

Introduction: 10 minutes
Activity One: 40 minutes
Activity Two: 40 minutes
Activity Three:40 minutes, plus several hours before making observations
Activity Four:15-20 minutes

Vocabulary:

- Aquifer
- Atmosphere
- Condensation
- Evaporation
- Infiltration
- Percolation
- Precipitation
- Recycle
- Replenish
- Runoff
- Transpiration
- Vaporization
- Water cycle
- Water vapor

Materials:

Introduction

- Overhead projector
- PowerPoint ***What is the Link?***

Activity One

- Whiteboard or a flip chart
- Copies of ***Water Cycle Definitions*** worksheet

Activity Two

- Drinking Glass
- Ice cubes
- Frying pan
- Sauce pan
- Hot plate or other heat source
- Copies of ***The Water Cycle*** diagram, and ***Water Cycle*** activity sheet one for each student (optional)
- Pencils/pens

Activity 3

- Potted plant or branch
- Plastic wrap
- Toothpicks

Preparation:

- Make copies of ***Water Cycle*** activity sheet, one for each student.
- Make copies of ***The Water Cycle*** diagram, one for each student.
- Download the PowerPoint ***What is the Link?*** and ***The Water Cycle*** diagram.
- Gather all of the other materials.

Background:

The water cycle is responsible for constantly replenishing the earth's water supply. The same water is being recycled over and over. The cycle includes evaporation, transpiration, condensation, precipitation, infiltration or percolation, and runoff. These component activities allow water to cycle endlessly.

With heat, liquid water turns into a gas (vaporizes), this process is known as **evaporation**. As soon as it turns from ice (solid) to a liquid, evaporation may begin to take place slowly, even from very cold water. The more heat, the faster evaporation takes place. Evaporation takes place from any surface where water is present. The **vaporized** water attaches itself to dust particles and these form clouds.

If the air cools or when the clouds become very dense with water vapor, they are saturated and **condensation** occurs. The water droplets condense in groups and these become raindrops. (Cooling makes the air more dense, molecules move closer together and this increases the likelihood of condensation.)

Once the water condenses into droplets heavier than the air, **precipitation** occurs. If the air is warm it will be rain. If the air is cold (below freezing), it will snow. If the air is mixed in layers of warm and cold, such as in a thunderstorm, the rain will freeze into hail.

As it precipitates, the water will **runoff** the land or be absorbed into it. If it runs off into the land, it will enter **surface waters**. Surface waters are available for human and animal use and some plants as well. If the water is absorbed into the land it will be used by the roots of plants, be held in the soil, or **infiltrate** or **percolate** through the soil and enter the **ground water**. In many areas of Florida, this groundwater is an **aquifer**. The aquifer is a very important source of fresh water in Florida and many parts of the United States as well as other countries. Groundwater can be pumped from wells and utilized for humans, plants and other animals. It may also find its way to surface waters or remain underground for a very long time.

At the same time that water is evaporating from any surface it is present on, water is also being transpired from plants. During the process of photosynthesis, water is produced as a by-product. This water is used by the plant if needed but excess water leaves the plant through **transpiration**. It may help students to think of **transpiration** as 'plant perspiration' since perspiration and transpiration sound similar. This endlessly repeating cycle is essential for life on this planet.

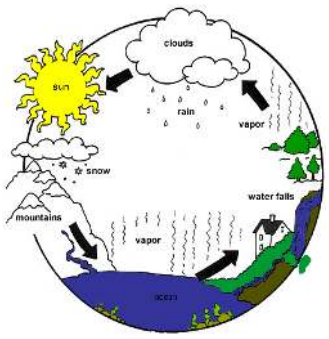
Note: The water held in the soil is most valuable to terrestrial plants. It is this water that is available to their roots. However, their roots need an equal share of air and if the ground becomes saturated the plants can suffer and even die.

Introduction:

1. Project the PowerPoint ***What is the Link?*** Ask the student to identify what links these two.
   *What do they have in common?
2. Water is the link that they both have in common. ***Water? Yes, water!***
   *How do they have water in common?
3. The water we use daily has been around since before the beginning of life on this planet. That's kind of hard to believe isn't it?
   *So does that mean that our "fresh" water could have been a drink for, let's say, the dinosaur?
4. Yes, it is possible because water moves in a never-ending cycle. In fact, water is the only substance to exist on earth in three forms: solid, liquid and gas. Water moves from one form to another naturally, given specific conditions. It moves from the sky to the earth and back to the sky again, resulting in what is called the water cycle. Let's take a look at the components of the water cycle and how it works.

Activity One

1. Divide the class into 3 even sized groups. Have each group brainstorm all of the things they can think of about water as per the questions below.
   Group 1 - List all the things that water is or does. ***(It rains, snows, floods, freezes, evaporates, condenses, precipitates, hails, vaporizes, and boils. It is fog, raindrops, snowflakes, ice cubes, drinkable, etc.)***
   Group 2 - List all of the things you can do with, in or on water. ***(Play in it, swimming, boating, water-skiing, scuba diving, surfing, cooking, bathing, washing clothes, watering plants, drink, irrigation, paint with it, squirt it, slip on it, eat it –ice or snow cone, etc.)***
   Group 3 - List places where water is found. **(*Rivers, lakes, oceans, ponds, pools, puddles, swamps, wetlands, in a cup, estuaries, glaciers, canals, polar ice caps, fog, rain, aquariums, sink, bathtub, in mud, body tissues, etc.*)**
2. Have each group report back and make three lists on the board or on a flip chart. (The students will use this information later in the water cycle diagrams.)
3. Either project ***The Water Cycle*** or draw it on the blackboard or transparency as the diagram indicates.
4. Have the students draw their own version of this scene or have them use copies of ***The Water Cycle.***



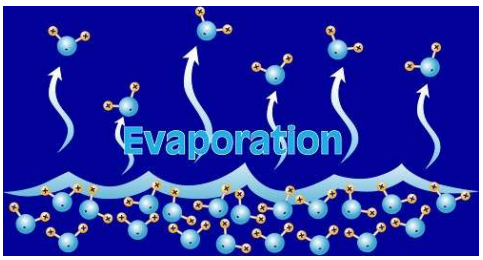
5. Present the water cycle. See the information in the background section. Use the ***Water Cycle Definitions*** worksheet. Be sure to include these components of the cycle
   - **evaporation**
   - **condensation**
   - **precipitation**
   - **runoff**
   - **infiltration** or **percolation**
   - **ground water**
   - **transpiration**
6. Have the students identify where the items on their brainstormed list fit into the water cycle. They may do this as a group on individually.

Activity Two

1. To explain the components of the water cycle, do these three simple demonstrations to depict the concepts of evaporation, condensation and precipitation. Have students take notes and complete the handout as they watch.

   A. Evaporation

   1. Heat a pan on hot plate or other source of heat.
   2. Place ice cube on heated pan.
   3. Observe ice cubes until they disappear (evaporate).
   4. What happened to the ice?
      (*Melted, the solid ice turned into liquid and disappeared or evaporated, turned into water vapor.)*
   5. Will this happen without heat or warmth?
      (*Not if it is kept in a freezer or below freezing temperatures. The ice will stay in ice form unless the temperature is above freezing. If the temperature is above freezing, water will form and the ice will melt. Once the ice is melted it begins to evaporate. If the water is cold it evaporates very slowly, the more heat that is added the faster evaporation takes place. A certain amount of water will also go directly from solid to gas. This is known as sublimation.)*
   6. What are the forms of water?
      (*Solid, liquid, vapor*.)
   7. During this demonstration, in what order did this hap pen? Why? Can this be changed? ***(Solid, liquid, vapor. The water started as a solid, changed into liq uid, then as it boiled, became a vapor.)***



B. **Condensation**

1.Fill a dry glass with a few ice cubes and a little cold water.

2.After 10 minutes observe the glass for (condensation) water collected on the outside of the glass.

3.Where did the water (condensation) on the glass come from?

Answers may include "from the inside of the glass." If this is so, ask, "Why doesn't liquid leak out? If the glass was filled with milk and ice cubes would the outside have water or milk on it?

(*Water comes from the air. Warm air has water vapor in it, particularly in a humid climate. When the air near the cold glass cools because the melting ice makes it colder, the air becomes more dense, water vapor in the air has a greater chance of coming together, the air is less able to hold as much water vapor and so, water droplets form on the outside of the glass.)*

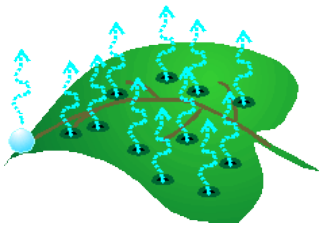
4.List other places condensation appears. **(*Cold drink cans, windows, shower doors*)**

C. **Precipitation**

1. Fill a pan 1/4 full with water and bring to a boil.
2. Fill a second frying pan with ice cubes, hold several inches above the steam until droplets form. Droplets are a form of precipitation.
3. What do we call this precipitate? **(*Rain)***
4. What other forms of precipitate are there? **(*Snow, sleet, hail*)**
5. What is so unique about the water we use today?
   (*It's been around since before life on Earth, recycling through the sky and Earth over and over.*)
6. What are some effects you think polluted water could have on the water cycle?
   (*Answers will vary. Possible answers include: decline in the quality of water, pollution traveling to sky and back to earth again such as acid rain.*)

Activity Three

1. This activity demonstrates **transpiration**. Additionally, it may be used to demonstrate the formation of oxygen during **photosynthesis**.
2. Use a potted plant or branch of a plant outdoors, cover plant or branch with plastic wrap and seal, use sticks or toothpicks to keep plastic off of the potted plant's leaves. Be sure not to cover the soil.

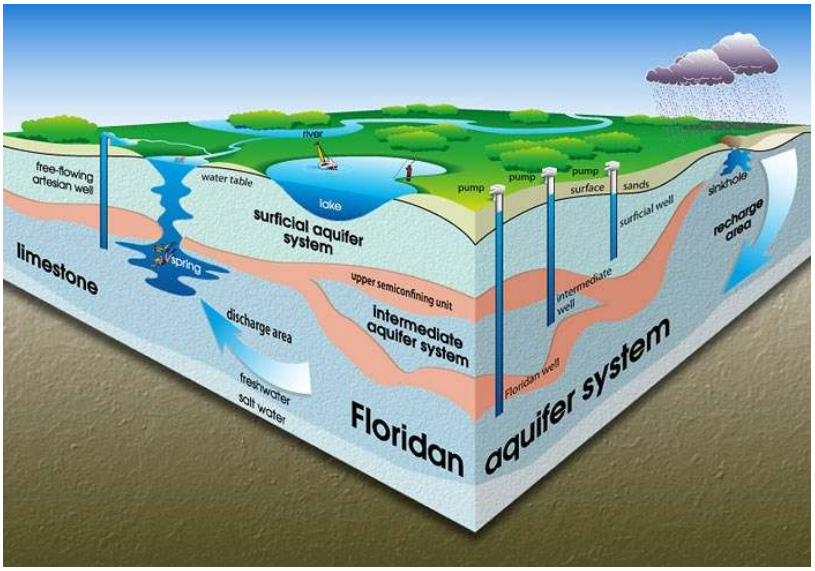


3. Place the plant in a sunny window and observe water drops form on the inside of the plastic (time will vary). **Transpiration** occurs when water comes through plant leaves.

3. Where did the water drops (condensation) on the plastic come from? ***(Leaves of plant)***
4. How does water get into the plant? **(*Plant's roots take up water from the soil.*)**
5. How does the plant use water? **(*To carry nutrients, cell processes*)**
6. When we eat plant leaves, stems, or fruits where does the water go? (***In us.***)
7. Assign the water cycle definitions for homework.

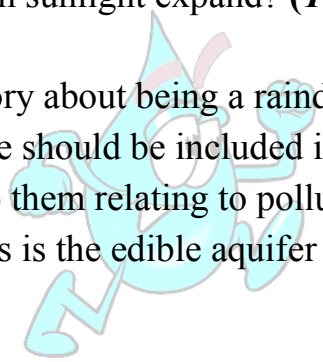
Activity Four

1. Discuss with the class the last portion of the water cycle. This concerns water once it reaches the earth. Ask:
   A. What happens to the water after it precipitates*? (**Soaks into the soil. Runs off the land and into a body of water. Lands as snow or ice and remains that way for a while on top of a mountain, in the polar ice caps or melts and runs off or seeps in.)***
   B. What happens to the water that seeps into the soil? ***(It remains there and plant roots take it up into plants. It evaporates back into the air. It percolates or infiltrates into the earth and enters groundwater.)***
   C. What type of underground water storage is important in Florida? ***(Aquifers)***
2. To discuss Florida's concern over aquifer recharge ask:
   A. What happens to the water if the land is paved over by a shopping mall or a large building is built on it? ***(The water runs off and into surface water.)***
   B. What happens if the aquifer is not recharged because too much building and paving is done? ***(The aquifer will shrink, less water will be stored, the aquifer can collapse and a sink- hole develops.)***
   C. Does this occur in Florida? ***(Yes)***
   D. Should we be concerned about this? What should we do to recharge the aquifers? ***(Answers will vary, but it is a grave concern as Florida's development continues and population grows.)***



Extensions or Alternatives:

1. Expand **Activity Three** to demonstrate the production of oxygen during photosynthesis. This may be accomplished by using two plants, set up in the same fashion but remove as much air from the plastic bags as possible with both plants. Place one of the plants in sunshine and the other in shade or darkness. Observe the differences after a day. Compare the two plants. Did any of the bags in sunlight expand? **(*The production of oxygen during photosynthesis)***
2. Have students write a creative story about being a raindrop and traveling through the water cycle. All steps of the water cycle should be included in the story. They may want to include something that happened to them relating to pollution.
3. A great hands on treat for students is the edible aquifer activity.



Evaluation Options:

1. Have the students draw their own version of the water cycle and explain it for a test.
2. Have the students write a report about the importance of the water cycle and how their lives require it.