Lesson 5: The Water Cycle

California Education Standards:

Kindergarten, Earth Sciences
1. Properties of materials can be observed, measured, and predicted. As a basis for understanding this concept:
   a. Students know water can be a liquid or a solid and can be made to change back and forth from one form to the other.

Grade 1, Earth Sciences
1. Materials come in different forms (states), including solids, liquids, and gases. As a basis for understanding this concept:
   a. Students know solids, liquids, and gases have different properties.

Grade 3, Earth Sciences
1. Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:
   e. Students know matter has three forms: solid, liquid, and gas.

Grade 4, Earth Sciences
6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
   f. Follow a set of written instructions for a scientific investigation.

Grade 5, Earth Sciences
3. Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept:
   a. *Students know* most of Earth’s water is present as salt water in the oceans, which cover most of Earth’s surface.
   b. *Students know* when liquid water evaporates, it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water.
   c. *Students know* water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet, or snow.
   d. *Students know* that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.
   e. *Students know* the origin of the water used by their local communities.

**Grade 6, Earth Sciences**

2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept:
   a. *Students know* water running downhill is the dominant process in shaping the landscape, including California’s landscape.

**Objective:**

Students understand the different phases of water and each stage of the water cycle. Students should have a basic idea of availability of water and where everyday water in local community comes from.

**Vocabulary:**

**Water cycle** – describes the movement of water on, above, and below the surface of the Earth

**Precipitation** – occurs when so much water has condensed that the air cannot hold it anymore

**Evaporation** – occurs when water goes from the liquid phase to the gas phase

**Condensation** – water vapor in the air gets cold and changes back into liquid, forming clouds

**Infiltration** – occurs when water leaks from the surface of the ground into the ground

**Runoff** – occurs when water flows downhill into lakes, oceans, or rivers

**Watershed** – an area of land that contains a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake, or an ocean

**Gas** – the form water takes is that of steam

**Liquid** – resembles the way water would look in the lake during spring (flowing and smooth)

**Solid** – resembles way water would look in the lake during winter (hard like ice)
Ninety-seven percent of the water on the earth is salt water. Salt water is filled with salt and other minerals, and humans cannot drink this water. Although the salt can be removed, it is a difficult and expensive process. Lucky for us, Mother Nature cleans some of it for free. How does this work? It all starts with the water cycle.

The water cycle, also known as the hydrological cycle or H₂O cycle, describes the movement of water on, above, and below the surface of the Earth. Water moves from river to ocean, or from the ocean to the atmosphere, by the physical processes known as: evaporation, condensation, precipitation, infiltration, and runoff. Through these stages, the water goes through different phases: liquid, solid, and gas.

First let’s talk about the three phases that water can go through. The best way to understand these phases is to look at a specific space. Imagine a lake, imagine it in the spring and then imagine it in winter. When water is in the liquid phase it resembles the way water would look in the lake during spring (flowing and smooth), however, when water is in the solid phase it resembles way water would look in the lake during winter (hard like ice). However when water is in the gas phase, the form it takes is that of steam, like steam from your shower.

Each phase has a different property. For example: liquids have a definite volume, but are able to change their shape by flowing, solids are relatively rigid and have a definite volume and shape, and gases have no definite volume or shape.

These are the three main phases that liquid can go through. They are important because they help water move through the five stages that make up the water cycle. Let’s go through the stages right now:
1. **Evaporation**: Evaporation is when water goes from the liquid phase to the gas phase, making it possible for water to travel from oceans, rivers, or lakes to the air. The sun heats the surface of the water and transforms it to a gas called water vapor. The process is called evaporation. When water evaporates, salt and other particles are left in the oceans, rivers, or lakes, so all that remains in the vapor form is pure water. The salt and other matter that is in the water is left behind, and only pure water is evaporated.

2. **Condensation**: Water vapor in the air gets cold and changes back into liquid, forming clouds. The process is called condensation.

3. **Precipitation**: Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the earth in the form of rain, hail, sleet, or snow. (The last three are water in the solid phase.)

4. **Infiltration**: When the clouds release the water, it lands on the ground where infiltration occurs. Water leaks from the surface of the ground into the ground. The water becomes soil moisture or groundwater.

5. **Runoff**: What happens to ground water when it’s in the ground? Where does it go? It becomes runoff. It goes downhill into lakes, oceans, or rivers. It’s important to know that water running downhill is the dominant process in shaping the landscape, including California’s landscape. The process of water running downhill is a huge factor not only in shaping the landscape, but also in where watersheds come from. A **watershed** describes an area of land that contains a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake, or an ocean. For example, the city of San Jose has six different watersheds that supply its people with water.
You can see that the water started in a body of water, such as lakes, rivers or oceans and ended up again in a body of water. That’s why it’s called a water cycle, because it cycles through over and over again. By understanding the water cycle, we are able to understand where our local water comes from. Without the water cycle, there wouldn’t be any clean water for people to drink.

**Materials:**
- plastic cups
- sharpie
- water
- access to direct sunlight
- salt

**Activities:**
Here are some helpful videos:
- [http://www.youtube.com/watch?v=_32zLS6vyZ4](http://www.youtube.com/watch?v=_32zLS6vyZ4)
- [http://www.youtube.com/watch?v=oAzEHa0tyNU&feature=related](http://www.youtube.com/watch?v=oAzEHa0tyNU&feature=related)

**Activity 1:**
Divide the students into groups of no more than 5 students each. Each group should have 2 cups of water. Each cup should have 8 ounces water. In one cup have a student add 2 tablespoons of salt. Label that cup A. The second cup shouldn’t have anything added to it. Label this cup B. Leave both cups in direct sunlight. Remember to mark both cups with a water line.

Have the students make predictions about what they think will happen to water in the cups.

*What will happen to the water if it is left in direct sunlight?*
*Will there still be the same amount of water in 1 hour? 2 hours?*
*What will happen to cup A? cup B? Why?*

After exactly an hour, have the students in each group record their findings. Remember to focus on the critical questions. Have them conduct a discussion on what they have found and why they think the salt was left behind in cup A. They should understand that because of evaporation, the water was cleaned naturally, and through the other steps, that same clean water will come back to us.

**Activity 2:**
Divide students into groups of five, each with a leaders. Each leader will do a walkthrough of the aquaponics unit and the greywater system.
Students will learn about how aquaponics is a mutually beneficial system, where water from the fish tanks is pumped into the plant area. This water is then filtered and run through and pumped back into the fish pump. The fish supply nutrients to the plants, through their excrement, and the plants provide clean water back to the plants due to infiltration. Refer to the blog created on this website: http://elsees-garden.blogspot.com/2012/08/the-magical-wonderment-of-aquaponics_20.html.

Students will also learn about the greywater system. Help students understand how the water from the sink is able to reach the small riparian area right outside the wall. Help them understand why it’s important that we use our sink water to water plants, instead of dumping it straight into the drain.

**Links and Sources:**
http://www.valdosta.edu/~dnshaner/
http://www.cotf.edu/ete/images/modules/msese/earthsysflr/EFCycleP3.gif
http://ga.water.usgs.gov/edu/watercyclesummary.html
http://www.cotf.edu/ete/modules/waterq/cycle.html
http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Watercycle.shtml