



The Ups and Downs of Water

Grade: 2

Subject Areas:

Physical Science, Life Science

Skills: gathering, interpreting, predicting, drawing, matching

Duration: 1 hour

Connections: adaptation, weather, clouds, waterways, states of matter, climates

Vocabulary
ice

water cycle

environment

evaporation

water vapor

condensation

clouds

precipitation

fog

recycled

ground water

spring

Objective:

To provide students with a basic understanding of the water cycle using local examples and hands-on activities.

Materials

- 2-3 sponges
- bucket of water
- poster of the water cycle
- water cycle cards and terms
- glue and scissors
- pot and large metal lid
- hot plate or gas range
- pot holder or protective glove
- small ice chest full of ice
- 15-30 small mirrors

Standards

Strands: Excellence in Environmental Education Guidelines

Strand 1 —Questioning and Analysis Skills: **A) Questioning:** Learners are able to develop questions that help them learn about the environment and do simple investigations. **F) Working with models and simulations:** Learners understand that relationships, patterns, and processes can be represented by models.

Strand 2.1 —Knowledge of Environmental Processes and Systems **A) Processes that shape the Earth :** Learners are able to identify changes and differences in the physical environment. **B) Changes in matter:** Learners are able to identify basic characteristics of and changes in matter.

California State Educational Standards:

Physical Sciences 1e: Students know objects fall to the ground unless something holds them up.

Earth Sciences 3e: Students know rock, water, plants, and soil provide many resources, including food, fuel, and building materials, that humans use.

Investigation and Experimentation 4d: Write or draw descriptions of a sequence of steps, events, and observations.

Background

H₂O in Motion

As you know fresh water is a precious commodity. Most people take clean water for granted. However, as more people populate the planet, there are more demands for water and more water pollution. In the King Range National Conservation Area (NCA) people are trying to conserve water by putting in rain water catchment systems which store rainwater instead of pulling water away from local streams.

There are three main states of matter: solids, liquids and gases. Earth is the only planet in the Solar System that commonly has water in all three of these states. The amount of water on Earth is fixed. Out of all of the water available 97% is salt water, leaving only 3% fresh water. Most of the fresh water is locked up as ice, the solid form of water. Only 1% is liquid and relatively available.

Freshwater is constantly recycled in a process called the **water cycle**. Water on the surface is evaporated off eventually condensing to form clouds in the atmosphere where it eventually falls back down and begins the cycle again. Where to begin the water cycle is arbitrary; one place to begin is with the sun.

Radiant energy received by the sun heats up water whether it is on the surface of the ocean, in waterways, or in the soil. As water is heated, it changes from a liquid state to a gaseous state through **evaporation**. Water in its gaseous state is called **water vapor**. As water cools, the molecules cluster or condense into a liquid. This process is called

condensation. This can be seen on a cold day when your car windows fog up or when someone puts ice into a beverage. Condensed water droplets build up on the glass.

Raining and Pouring

Clouds are condensed water molecules that usually surround a “seed” of some kind like dust or pollen. The darker the cloud, the less light is able to penetrate it meaning the denser it is. As clouds collect more and more water they eventually reach a saturation point and begin to release water. This saturation point of 100% humidity is called dew point. Once a cloud is saturated, water begins to fall back down in forms of precipitation.

Precipitation comes in many forms namely snow, rain, sleet, and hail.

The King Range NCA receives most of its precipitation between the months of December and May. Here in the summer, fog adds valuable moisture necessary for the famous redwood forests of the area. **Fog** is a cloud at ground level.

Environments, to a large extent, are based on their climates. Climates are directly related to how much precipitation an area receives. Deserts and tundra receive very little precipitation while tropical rainforests and many coastal regions receive abundant precipitation.

The King Range NCA is considered to have a Mediterranean climate or is in a temperate zone. This allows for large tracts of forest to thrive. Plants expire water through pores on the underside of their leaves called stomata. Through these pores, water vapor leaves in a process called transpiration. This

Local Connection

Redwoods and Fog

Redwoods are one of the only plants that can absorb water directly through their leaves. During typical dry summer months, fog is frequent along the coast. The proximity to the ocean dictates the redwoods' range. By absorbing fog drip, redwoods are able to obtain about one quarter of their yearly water needs.

Using historical weather logs from local airports, scientists have found evidence showing the amount of fog has decreased substantially over the last 100 years. The temperature difference between the foggy coast and hot dry interior of northern California is getting less and less. Could this change in climate stress redwood trees to the dying back? How may climate change affect the future of redwood trees?

process allows large forests to create their own clouds.

place is dry and parched another place is wet and saturated. This is the nature of the water cycle on our planet.

Peaks to Oceans

The **sun** is the “engine” behind the water cycle. Most of the Earth’s surface is covered by ocean so most of the water in the water cycle is from the ocean. Some may ask why the ocean doesn’t get more salty if water is constantly being evaporated off of the surface. The answer again lies in the fact that water is **recycled**. It is used over and over again as it changes from one form to the other. Water is constantly falling back down onto the surface and back into the oceans keeping the salinity stable.

Once water falls back to the surface, it commonly runs off into the nearest waterways like lakes and rivers. The steepness of the terrain along with the soil type will dictate how fast this happens. For instance, clay soils can absorb a lot more moisture compared to sandy soils. The vegetative community also plays a role. Where leaf litter is thick, rain can be slowed giving soil a chance to absorb moisture. Where land is bare, water will run off very rapidly.

As the ground becomes saturated, infiltration happens. During infiltration, ground water is renewed by filling underground aquifers.

Ground water is the water found underground. An aquifer is a large underground storage area for water. Sometimes water normally flowing underground reveals itself at the surface in the form of a **spring**. The recharging of waterways and groundwater is very important in reducing the affects of drought. California has a history of repeated summertime droughts and many plants throughout California are adapted to periodic water shortages. Rest assured however, where one

Activity 1: Water Cycle Model

Preparation

Place the mirrors into the ice in the ice chest along with the metal lid to the pan. Let them sit to cool.

Procedure

1. Once the students are gathered around, turn the hotplate on and begin to heat up the water. Bring it to a low boil until you can see steam. While you and the class are waiting, ask questions to find out what the students know about water.

2. Next, write the three states of matter on the board with the corresponding state of water. Once the water begins to boil, ask about the process. They should be able to see some steam. Ask them to tell you what forms of water they see.

Modeling Condensation

1. Once steam is visible, get the cold lid and place it over the steam using a pot holder (careful steam is hot!). Instantly water will condense on to the lid. Show the students this. Ask: What made the water change from one form to another? They should understand that a change in temperature is the cause. If water is heated it turns to gas. If gas is cooled it turns to liquid. Hold the lid over the boiling water again and collect a lot of drops. Shake it like it is raining! Have the students tell you the forms in a sentence. For instance, say “When I cool water vapor down it will turn into _____”. “When I heat liquid water up, it will turn into

Materials

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_____”. Inform the students that next they will change the water vapor from their breath into a new form.

Student activity

Carefully pass out the mirrors to the students so everyone has one. Have the students model condensation by having them exhale onto a cold mirror. They should immediately be able to see water droplets form. Let them explore this for a few minutes and then collect the mirrors.

- *What will happen if I heat up the water?*
- *Is water a solid, a liquid, or a gas? What about ice?*
- *What are some ways we use liquid water?*
- *Where can we find water outside? (clouds, puddles, rivers, lakes, etc.)*
- *How is water related to weather?*
- *How many of you have been caught in a rain-storm?*
- *Where does the water in a cloud come from?*
- *What big bright hot thing starts the water cycle?*

Activity 2: Identifying Parts of The Water Cycle

Procedure

Gather the students around and begin to talk about weather.

Model precipitation

1. Explain to the students that you are going to model a cloud. Start with a dry sponge and put it in a bucket briefly. The idea is to get it damp but not soggy. Hold it up to show there is water in the sponge but it is not dripping. Next, add a little more water to the sponge and hold it up. Finally get the sponge saturated and holding it over a bucket show that the sponge is dripping. Have the kids notice that it can't hold anymore water. The weight of the water is too much. It has reached its saturation point. Explain that this is what happens when rain or snow falls.

2. If it is currently raining, use the opportunity to take the students outside to follow the path water takes. If it has rained recently, take the students outside to see if

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- 2-3 sponges
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they can find evidence of where rainwater has travelled (optional).

Procedure (continued): Show the students a poster of the water cycle and review the four main parts. (evaporation, condensation, precipitation and transpiration) Have them say these words along with a simple definition. Reinforce the fact that water moves through a cycle changing form as it goes. Pass out a picture of the water cycle and have them trace with their finger a path water can take (the path should be one you pick and describe to them). For older students, have them choose a path. Mention that water might soak into the ground where we can't see it.

them draw themselves in the water cycle following this activity. For this you will need extra paper, pens or crayons.

- *Does anyone know what precipitation means?*
- *In what forms does water fall back to the ground? (accept all responses . i.e. rain, hail, snow etc.)*
- *What is a cloud made of? Is fog a cloud?*
- *What makes water fall out of a cloud? (answer: gravity or weight)*
- *What causes clouds to form?*

3. Next, pass out the water cycle cards, the vocabulary terms, and the template along with glue. The students should arrange the water cycle cards on the template correctly. Next, they should glue the terms onto the correct picture. This is a good way to broaden their vocabulary and apply it to a scientific process. For any students having difficulty with this assignment, modify it by encouraging them to draw a picture of the water cycle and label it. This is something older students and ones that finish early can do too. You may want to have

Extensions

- Record the daily weather for a few weeks.
- Have students learn about different climates and their associated plant and animal communities.
- Sing songs about water.
- Take a walk during a light rain.
- Visit Thristin's Water Cycle — the online video available at epa.gov.
- Connect the need for water to fish.
- Make the sound of a rain storm—see Project Wet
- Look at pores on the underside of leaves

References

Environmental Education for Kids (EEK), Round & Round it goes!,

The Water Cycle, <http://www.dnr.state.wi.us>, 2010

Less Fog in California Could Stress Redwoods,

<http://www.livescience.com/environment/less-fog-redwoods-100215.html>

Sanders, Robert, "Fog has declined in the past century along California's redwood coast", UC Berkeley

News, <http://berkeley.edu/news/media/releases/2010/02/16>

Water cycle poster: voicesofhumboldtcounty.com

Water Science for Schools, Earth's Water, <http://ga.water.usgs.gov/edu/>, 2010

Images: www.dnr.state.wi.us/org/caer/ce/eeek/earth/groundwater/watercycle.htm and www.osovo.com

Additional Resources

Live Science Topics: Trees, <http://www.livescience.com/topic/trees>

Project Wet Curriculum & Activity Guide, Water Education for Teachers, 1995

The Water Cycle: <http://www.kidzone.ws/water/>

FOSS Connection

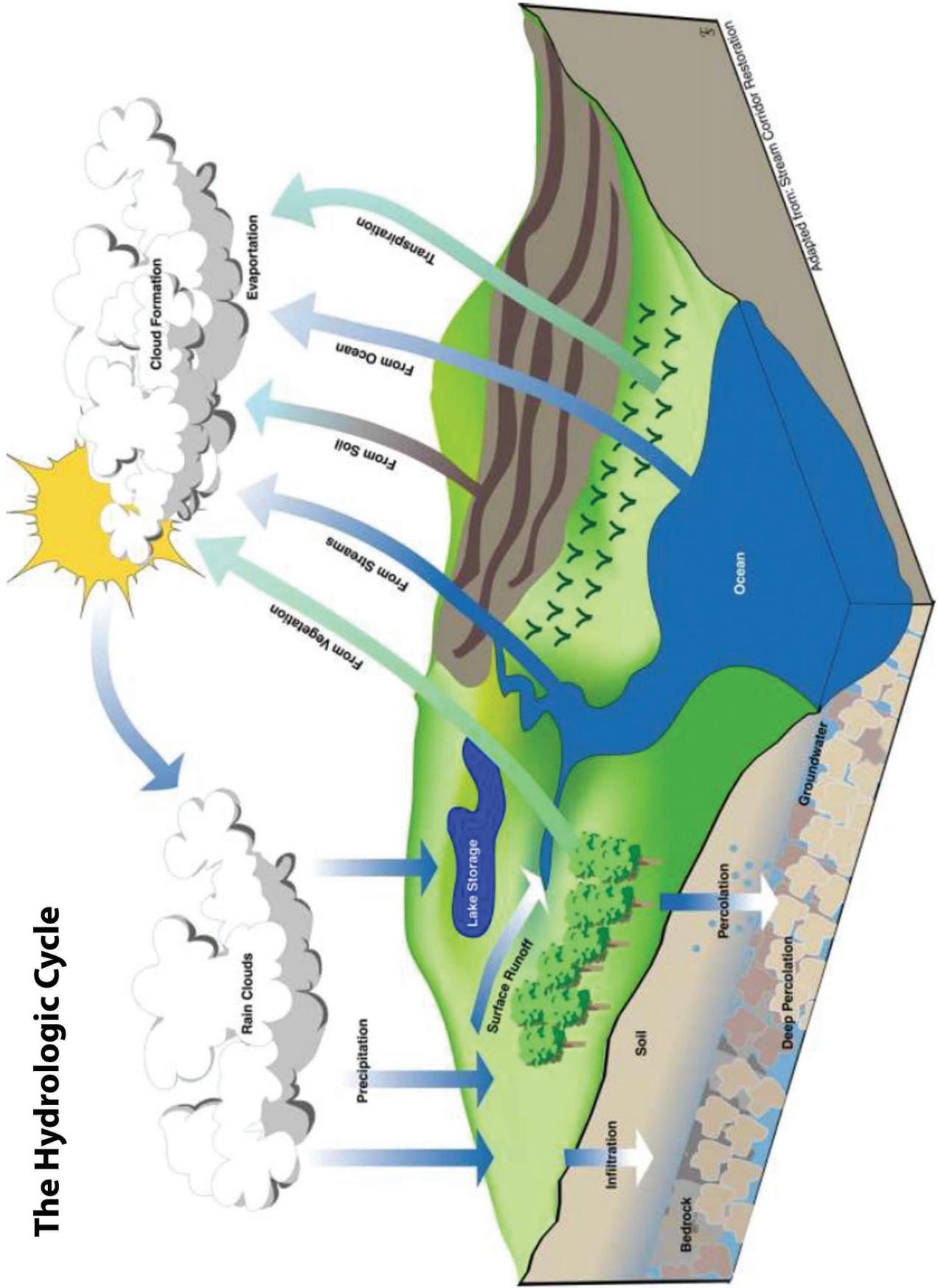
Grades 1-2 Physical Science

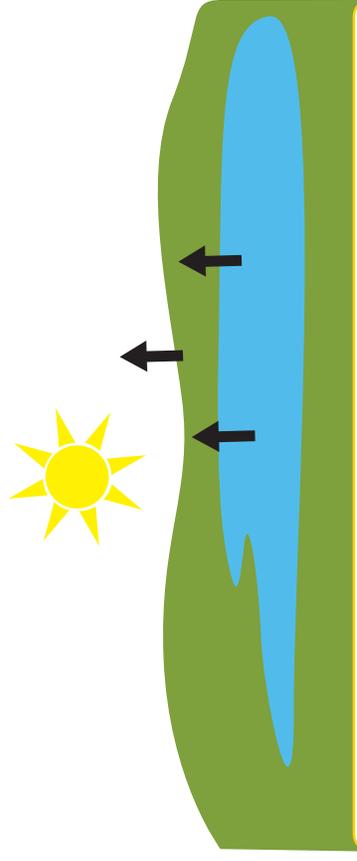
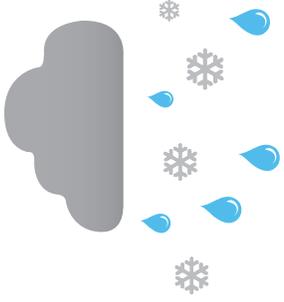
Solids and Liquids

Grades 1-2 Earth Science

Air and Weather

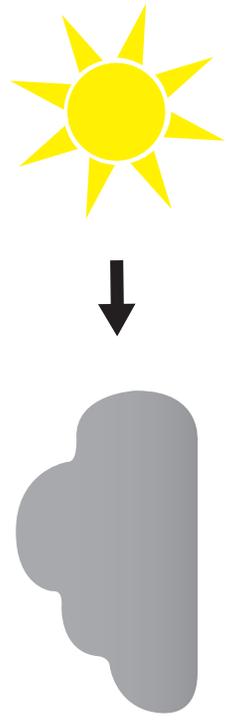
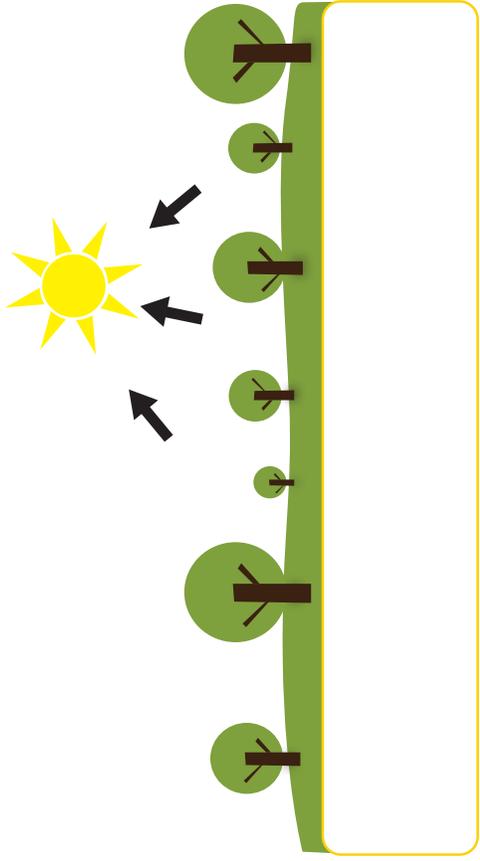
The Hydrologic Cycle





Transpiration

Precipitation



Condensation

Evaporation