

FLARE Lesson



Four Seasons of the Water Cycle

How does the uneven heating of the Earth's surface impact the water cycle, climate patterns, and biome distribution?

◆ Grade Level(s)

5th to 8th grade

◆ Subject Areas

Life Science, Earth Science

◆ Key Topics

Water cycle, solid, liquid, gas, precipitation, evaporation, condensation, sublimation, transpiration

◆ Duration

Preparation Time: 10 min

Activity Time: 1 x 50 min

◆ Setting

Classroom (Individual or groups)

◆ Skills

Making observations, identifying patterns, communicating

◆ Standards

NGSS & MT Science Std.:

MS-ESS2.4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

ESS2.C: The Roles of Water in Earth's Surface Processes

CROSSCUTTING CONCEPT(S):

Patterns, Energy and Matter

SCIENTIFIC & ENGINEERING

PRACTICE(S): Obtaining, Evaluating, and Communicating Information

Common Core:

W.5-8.4: Produce clear, coherent writing

W.5-8.4: Write informative texts

L.5-8.6: Acquire and use vocabulary

Overview

Water is necessary for all living organisms on the planet. Water's unique properties allow it to move seamlessly on Earth. In doing so, it shapes the Earth's surface, creates unique permanent and seasonal habitats, and helps to control the climate globally. This lesson will help students to understand that water moves through every environment but how that water moves can greatly vary depending upon the Earth's rotation, tilt, as well as, the amount of direct and indirect sunlight available throughout the year. The students will also explore how climate patterns produced by the uneven heating of the Earth's surface impact the distribution of the Earth's biomes

Objectives

Students will be able to:

- describe how the rotation and tilt of the Earth help to create the 4 seasons.
- explain how the climate patterns produced by the uneven heating of the Earth's surface impact the global biome distribution.

Materials

Warm Up / Activity / Wrap Up

- Computer, projector, and presentation
- One 8 ½" x 11" white paper for each student
- Globe and flashlight or globe that rotates around an illuminated sun
- Ward's weather tank (if available)
- Hot and cold water
- 2 beakers
- Food coloring

Advanced Preparation

- Gather the materials needed for the weather tank.
- Download the Four Seasons of the Water Cycle Presentation from the FLBS website:
<https://flbs.umt.edu/newflbs/k12teachingmaterial>



Procedure

◆ Warm Up (5 minutes)

- Turn on the projector, display the Four Seasons of the Water Cycle Presentation, and pass out one 8 ½" x 11" white paper to each student.
- Slides 2-3: Introduce students to sketchnote taking and explain how to take effective visual notes. Ask students to draw one image that represents how they see the water cycle.

◆ Four Seasons of the Water Cycle Presentation (40 minutes)

- Slide 4: Review the difference between latitude and longitude and explain that many of the global climate patterns can be seen as you cross from one latitude to the next.
- Slide 5: Review how the Earth's rotation and tilt help to create differences in the length of daily sunlight, which helps to create the four seasons.
- Slide 6: Discuss how the Earth's rotation and tilt causes the Northern and Southern Hemispheres to have opposite seasons. Turn off the lights. Use the flashlight and globe to demonstrate the rotation and tilt.
- Slide 7: Describe how the equator receives the most direct sunlight throughout the year and that the areas north and south of the equator receive more indirect light. Shine the flashlight at the "equator" of the globe and discuss how the sunlight hitting the center of the globe is brighter than the polar areas.
- Slide 8: Explain how the global winds help to move the heat at the equator towards the poles. The warm, moist air rises at the equator, cools in the atmosphere, and then the dry, cold air sinks back down at the 30°N and 30°S latitudes. As this dry air moves across the land it warms and picks up moisture again. So it then rises again at the 60°N and 60° S latitudes, cools one last time, and finally sinks at the poles. The uneven heating of the Earth therefore causes the air and water to be distributed away from the equator, which helps to moderate the equatorial climate.
- If available, use a Ward's weather tank to show how temperature impacts water density. With the center partition in place, pour cold blue water and hot red water into the opposite sides of the tank at the same time. Ask the students to predict what will happen. Lift the partition and explain why the colder water slid under the warm water. Explain how the warm and cold weather fronts behave in the same way. Talk about how the cool arctic air slides into the bottom of the Flathead Valley during the winter. This cold, dense air slides under the warmer layer. The inversion layer of clouds forms where these two air masses meet.
- Slide 9: Due to the uneven heating of the Earth, there are three distinct climate zones. Explain how the tropical zone is characterized by warm, moist conditions year-round, the polar zone is characterized by cool, dry conditions year-round, whereas, the temperate zone in between is characterized by four distinct seasons.
- Slides 10-11: Introduce the students to what biomes are. Explain how a biome is characterized by a specific climate (precipitation and temperature pattern), which in turn leads to specific types of plants and animals that can live in the biome climate. For example, the tropical rainforests in the Amazon will have a completely different community of animals than the Taiga or Coniferous Forests in Canada.
- Slides 12-16: Review the terrestrial biome characteristics and discuss where they are found.
- Slide 17: Explain how the geography, amount of sunlight, and climate patterns create the unique terrestrial ecoregions in the western United States. Flathead Valley is a unique mix of Northern



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Central Rockies Forests north of Flathead Lake and the Montana Valley and Foothill Grasslands south of Flathead Lake. We see high levels of biodiversity due to the unique climate regime in this region.

- Slide 18: Discuss how the Rocky Mountains create a distinct rain shadow effect East of the Rocky Mountains. For example, the stormy winter clouds hit the Swan and Mission Mountain ranges often sit for longer periods of time than the other areas nearby. This creates large amounts of snow accumulation in the Swan Valley.
- Slide 19: Flathead Lake can also create “Lake Effect” snowfall. When the below freezing winter air flows over the warmer lake water, the moist air above the lake rises, meets the cool arctic air and then freezes to create snow. For example, Woods Bay often gets snow produced from the lake water.
- Slide 20: Water is ultimately necessary for all life on Earth. Ask the students to share ways they can protect this precious resource here in Montana.

◆ Wrap Up (5 minutes)

- Slide 21: Show the videos of the retreating glaciers. Ask students to share how else they think climate change will impact the global water cycle.

Teacher Resources

Assessment Options

Have students:

- **complete the Four Seasons of the Water Cycle Sketchnotes** as described.

Modifications

- The students can take notes on this lesson at home to free up class time.
- The students can take more traditional notes instead of Sketchnotes.

Extensions

Students can:

- **create a Flipgrid video** to explain in their own words how seasonal sunlight impacts the water cycle in Montana.

Online Resources

USGS - The Fundamentals of the Water Cycle:

https://www.usgs.gov/special-topic/water-science-school/science/fundamentals-water-cycle?qt-science_center_objects=0#qt-science_center_objects

Acknowledgements

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Photo credit: Holly Church / FLBS

Steam often rises from the lakes in the area during the fall. The steam appears when the air temperature drops below freezing. As the lake cools in the fall, water evaporates into the air, which then condense when the cool air flows over it.



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