

- 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
 <u>Preparation Time</u>: 20 min
 Activity Time: 6 x 60 min

 Setting Classroom (Individual or groups)

Skills

Identifying patterns, constructing, communicating

Standards

NGSS & MT Science Std.:

<u>5-ESS2-5/MS-ESS2.4:</u> 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..A / ESS2.C / ESS2.D CROSSCUTTING CONCEPT(S): Systems & System Models, Patterns, Energy & Matter. Stability & Change SCIENTIFIC & ENGINEERING PRACTICE(S):

Developing & Using Models

Common Core:

<u>W.5-8.4</u>: Clear, coherent writing <u>W.5-8.4</u>: Write informative texts <u>L.5-8.6</u>: Acquire and use vocabulary <u>SL.5-8.4</u>: Present ideas

Water Cycle Model

How does the water cycle differ around the world?

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 area of Earth in which it is moving through.

Objectives

Students will be able to:

- build a 3-D model that demonstrates how water moves through Earth's biosphere, hydrosphere, and atmosphere.
- describe how the amount of sunlight impacts how water cycles through biomes on Earth.
- explain how the water cycle impacts the biome climate using a climatograph.

Materials

Warm Up / Activity / Wrap Up

- Computer, projector, student worksheets
- Chromebook, laptop, or tablet for each student with printer access
- Assorted 3-D model supplies of the students' choice

Advanced Preparation

- Copy student worksheets #1-4 (double-sided) & #5 (single-sided).
- Reserve the chromebooks, laptops, or tablets for student use.
- Create a Quizizz vocabulary quiz or copy Water Cycle Vocabulary Quiz A and B (download from the FLBS website below). <u>https://flbs.umt.edu/newflbs/k12teachingmaterial</u>
- Send a note home to let the parents know about the model project, so they can help the students to gather the materials.
- Group the students into groups of 3-4. We recommend creating groups based upon similar ability level rather than grouping the students into groups of mixed ability levels. This allows the groups to work at their own pace as they design and construct their model.



FLATHEAD LAKE © 2020 Created by FLARE: Flathead Lake Aquatic Research and Education Program at the Flathead Lake Biological Station.

Background

The cycling of water of water on Earth is greatly controlled by the sun and gravitational forces. Water moves freely between the hydrosphere, atmosphere, and biosphere. As the sun shines on the Earth, the water **molecules** change from a **liquid** to a **gas** and **evaporate**, **sublimate**, **or transpire** from the Earth's surfaces and plants. The gas molecules rise up into the atmosphere, cool, and eventually **condense** back into liquid when they stick to particles in the air. The Earth's **biomes** are directly impacted by the amount of sunlight they receive and by the water cycling through them. The students will build a 3-D model of a water cycle that represents the water moving through a particular biome on Earth. By doing so, they will see that water varies greatly spatially and that the cycling of water can be different from place to place.

Lesson Vocabulary

Accumulation – Process of a substance gathering in an area (ex. a lake).

Condensation – Process of a gas changing into a liquid (ex. clouds).

Evaporation – Process of a liquid changing into a gaseous phase (ex. steam).

Expansion – When something spreads, extends, or enlarges (ex. water molecules expanding as they freeze) **Gas** – A state of matter that expands freely into any available space.

Groundwater – Water held underground in the soil or in pores or crevices in rocks.

Infiltration – Process of water moving from the ground surface into the soil.

Liquid – A state of matter that flows freely but is of constant volume.

Molecule – A group of atoms bonded together to create a basic unit of a chemical (Ex. H_2O or one water molecule is formed from the combination of two hydrogen and one oxygen atoms).

Percolation – Process of water slowly moving through a filter (ex. water moving through the soil).

Precipitation – Products of water vapor condensation in the atmosphere that fall to the ground (ex. rain, snow, sleet, grauple, or hail).

Run off – Process of water draining away from the surface of the land (ex. water that flows off the land into streams, rivers, lakes, or oceans).

Solid – A state of matter that stays fixed in a firm and stable shape.

Sublimation – Process of a solid changing directly into a gas without passing through the liquid phase (ex. glacial ice turning into water vapor).

Transpiration – Process of water moving through a plant and evaporating out of the leaves, stem, and flowers.

Water vapor – Water in the gaseous phase.

Procedure

Warm Up (10 minutes)

• Students either take the Water Cycle Vocabulary Quiz A or take the quiz online via Quizizz. Note: Taking the same vocabulary quiz throughout the unit will help to track the students' progress. Quizizz allows you to see the vocabulary words that the students are learning quickly and to see the words they are having more trouble with.



Water Cycle Model Research and Design (50 minutes)

- Pass out the project worksheet.
- If not already done, place the students into 5 groups (see note in Advanced Prep.). The students write both the group name and number on their project worksheet.
- Explain the 3-D Water Cycle Model Project. Go over the requirements below:
 - $\,\circ\,$ Water must be able to flow through the model.
 - $\,\circ\,$ Examples must be provided of each of the following:
 - Evaporation from rivers, lakes, and/or an ocean
 - Precipitation (ex. rain, snow, etc.)
 - Runoff into rivers, lakes, and/or an ocean
 - Infiltration into the soil
 - Percolation from ground water into rivers, lakes, and/or an ocean
 - Transpiration from plants
 - Evaporation from soil
 - Groundwater
 - A river flowing into a larger body of water (ex. a river into a lake or ocean)
- Explain that they will be building a model that demonstrates how their biome is different than other biomes on Earth.
- Assign a different terrestrial biome to each class group.
 - o Tundra
 - Taiga or Coniferous
 Forest
 - o Desert
 - Tropical Rainforest
 - Temperate Grassland
 - Temperate Deciduous
 - Forest
 - o Savanna
 - \circ Chaparral
- Demonstrate how to search with reliable online resources (.gov, .edu, and .org sources).
- Have students use their chromebooks/computers to research and then select a SPECIFIC NATIONAL PARK found within their assigned biome. Since they will build their 3-D model to represent the national park that they choose, they need to pick carefully. *Note: The students will be able to find more reliable information if they pick a National Park.*
- The students conduct research about their selected location to get ideas for their 3-D model.
- The students conduct research about their screeted location to get local of their model and decide who will be bringing in what supplies for the next class.

• Water Cycle Model Development (3 x 60 minutes)

- Students design and build a 3-D model of the water cycle that demonstrates a water cycle in their assigned biome.
- Students label their models with all of the relevant vocabulary terms.



Topical Rain Forest
Topical Forest
Topical Rain Forest
Topical Rain Forest
Topical Rain Forest
Topical Forest
T

Water Cycle Model Presentation (2 x 50 minutes)

- Students create a script so that each student participates equally in the presentation. The students must also find a climatograph for their location and will need to explain why the climate (air temperature and precipitation) in their biome differs from other areas in the world.
- The students must answer the questions below during their presentation:
 - \circ How does the water move through the environment? Spatially? Seasonally?
 - Does water spread throughout the environment evenly? In other words, does the water stay in the same place for the same amount of time?
 - $\,\circ\,$ How does latitude impact the location's water cycle? Hint: Think about the amount of direct or indirect sunlight that the location receives seasonally.
 - $\,\circ\,$ How does the water cycle differ during the 4 seasons of the year?
- The students finalize their models and practice their model presentations.
- When all groups are ready the students present their models.

• Wrap Up (20 minutes)

- After completing the presentations, the students complete a self-evaluation (wkst #5)
- Lastly, the student complete the Water Cycle Vocabulary Quiz B.

Teacher Resources

Assessment Options

Have students:

- complete and present their Water Cycle Model as described.
- complete the Water Cycle Vocabulary B quiz.

Modifications

- This lesson can be completed individually instead of in groups so that each student can work at their own pace.
- The worksheets can be enlarged for students in need of larger text.

Extensions

Students can:

- create a water cycle journal that tracks their daily observations of the water cycle near their home.
- write a poem about the water cycle
- teach the water cycle to younger students in their school

Online Resources

USGS - The Fundamentals of the Water Cycle: https://www.usgs.gov/special-topic/water-scienceschool/science/fundamentals-water-cycle?qtscience center objects=0#qt-science center objects

Acknowledgements

Many thanks to Shelley Emslie at Swan River School for helping to codevelop this lesson and unit



Photo credit: Wasif Malik (CC BY 2.0)

Water cycles in and around a tropical biome very differently than the water cycling in a desert or tundra biome. For example, there is more humidity or water vapor in the air in a tropical biome than a desert biome. Although both tropical and tundra biomes receive a lot of precipitation, they receive different types of precipitation (ex. rain versus snow).



Group Name/#:_____

Name _____

Water Cycle Model

I

Student Worksheet (1 of 5)

Project Goal: Design and construct a 3-D model of a water cycle in a SPECIFIC BIOME on Earth.

Biomes are areas characterized by a unique climate (precipitation and temperature pattern) as well as, a specific community of plants and animals.

 STEP 1: Select one of the terrestria Taiga or Coniferous Forest Tropical Rainforest Temperate Grassland or Deciduous Forest 	al biomes below: Tundra Desert 	Your group's biome:					
STEP 2: Pick a SPECIFIC NATIONAL PARK on Earth found within your group's biome.							
National Park:							
STEP 3: Research what the water of you conduct your research.	cycle looks like in	your assigned biome. Complete the following as					
Common plants:							
Common animals:							
Describe where water is found in y	our biome:						
How does water move through your biome? Spatially? Seasonally?							
Does the water spread throughout the biome equally? Does the water cycle at the same place for the same amount of time? Explain.							
How does your location's latitude i	mpact the water o	cycle there?					
How would the water cycle differ d	luring the 4 seaso	ns of the year?					



STEP 4: Design and build a 3D model of the water cycle for your group's SPECIFIC location on Earth that demonstrates how your biome differs from the other areas of the Earth.

3-D Water Cycle Model Requirements:

- □ Water must be able to flow through the model.
- □ Examples must be provided of each of the following:
 - □ Evaporation from rivers, lakes, and/or an ocean
 - □ Precipitation (ex. rain, snow, etc.)
 - □ Runoff into rivers, lakes, and/or an ocean
 - □ Infiltration into the soil
 - □ Percolation from ground water into rivers, lakes, and/or an ocean
 - □ Transpiration from plants
 - □ Evaporation from soil
 - □ Groundwater
 - □ A river flowing into a larger body of water (ex. a river into a lake or ocean)

Student Name	Materials I Plan to Bring from Home		

STEP 5: Find a climatograph for your location to use during your presentation. See example below.





STEP 6: Plan your Water Cycle Model presentation.

Water Cycle Model Presentation Requirements:

- □ EQUAL group member presentation.
- USE ALL 16 VOCABULARY WORDS to explain your model.
- □ CREATE a script to plan out who is saying what and when.
- □ PRACTICE your presentation!

□ <u>Answer/explain the following:</u>

- \Box How does your model represent the water cycle for your biome?
- □ Explain how your group represented all of the processes in the cycle. (ex. What did you use to represent the clouds and what process do the clouds represent?)
- □ What are the common plants and animals found in your biome?
- □ How and why is your water cycle different from other areas in the world?
 - □ How does water move through your biome? Spatially? Seasonally?
 - □ Does the water spread throughout the biome equally? Does the water cycle at the same place for the same amount of time? Explain.
 - □ Show your location's climatograph and explain its seasonal pattern.
 - \Box How does your location's latitude impact the water cycle there?
 - \Box How would the water cycle differ during the 4 seasons of the year?

Plan your presentation:

Presentation Order	Student Name	Who will present what?
1		
2		
3		
4		

STEP 7: Present your model, complete your self-evaluation, and take the unit quiz.



Water Cycle Model and Presentation Rubric

Student Worksheet (4 of 5)

Student Name _____

Group Number/Name_____

After each group presents, circle your assessment of their presentation. At the bottom, there is a place for comments. Please write one positive thing (ROSE) you like about the presentation and one thing you think could be improved (THORN).

	EXCEEDED	MET	MISSING
	Requirements	Requirements	Requirements
	The group went above and beyond in their efforts and were "off the charts" AMAZING! They included all requirements and added a bit more.	The group covered what they needed to cover, but it was just the requirements and nothing more.	The group had some of the requirements, but missed some key elements and had to be prompted to further explain their model.
Water Cycle	Exceeded	Met	Missing
Model	Requirements	Requirements	Requirements
Use of Vocabulary Words	Exceeded Requirements	Met Requirements	Missing Requirements
Oral	Exceeded	Met	Missing
Presentation	Requirements	Requirements	Requirements
Answered all required questions	Exceeded Requirements	Met Requirements	Missing Requirements

Comments:



Water Cycle Model and Presentation Self-Evaluation

Student Worksheet (5 of 5)

Student Name _____

Group Number/Name_____

The best learning comes when we reflect. Please evaluate yourself and circle where you think you would be on the rubric.

	EXCEEDED	MET	MISSING
	Requirements	Requirements	Requirements
	I went above and beyond in my efforts and was off the charts AMAZING! I collaborated and shared the workload with my group members. I gave it 110% effort	I was on task most of the time and shared the workload. I really could have put more effort into my work at times. I collaborated with my group, but could improve a bit.	I did not collaborate with my group to the best of my ability. I put effort in on certain days, but did not give it 100% of my effort consistently. I will do better next time!
Water Cycle	Exceeded Requirements	Met	Missing
Model		Requirements	Requirements
Oral Presentation	Exceeded Requirements	Met Requirements	Missing Requirements
Working in a	Exceeded Requirements	Met	Missing
Group		Requirements	Requirements

Comments:

