

Lesson Plan: The Water Cycle in a Sustainable World

Lesson plan contributed by Dr Akanksha Gupta (Sri Venkateswara College) and Dr Vinod Kumar (Kirori Mal College), Delhi, India.

As a **high school** or introductory **undergraduate Chemistry, Geography or Earth Sciences** teacher, you can use this set of tools to teach about the water cycle- its components, the distribution of natural water resources on Earth and the impact of climate change on it.

This lesson plan allows students to learn about the different stages of the water cycle and the factors that influence it. It includes resources that teach students about the different components of the water cycle in detail and how they can be affected by climate change. This lesson plan also enables students to learn about the distribution of water resources under a natural water cycle, how it could be altered due to anthropogenic practices, and what measures could be adopted for a sustainable future.

Thus, the use of this lesson plan allows you to integrate the teaching of a climate science topic with a core topic in **Chemistry, Geography or Earth Sciences**.

Use this lesson plan to help your students find answers to:

- What is the Earth's natural water cycle? Describe its components.
- Explain how the water cycle determines the distribution of the natural water resources on Earth.
- How could human activities affect the Earth's natural water cycle?
- How does the water cycle affect Earth's climate and vice versa?
- What are the effects of global climate change on Earth's natural water cycle?

About the Lesson Plan

Grade Level: High School, Undergraduate

Discipline: Chemistry, Geography, Earth Sciences

Topic(s) in Discipline: Environmental Chemistry, Water Cycle, Biogeochemical Cycles, Hydrologic Cycle, Condensation, Evaporation, Evapotranspiration, Groundwater, Precipitation, Sublimation.

Climate Topic: Climate and the Hydrosphere, Climate and the Atmosphere

Location: Global

Access: Online, Offline

Language(s): English, one resource available in several languages

Approximate Time Required: 70-120 min

1 Contents

1. Video (~8 min)

A video that introduces the natural water cycle on Earth and briefly describes the processes involved in it.

This can be accessed at:

<https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-biogeochemical-cycles/v/the-water-cycle>

2. Reading (45 min)

A reading that describes the different components of the water cycle in detail. It also includes downloadable diagrams of the water cycle with a brief summary of the water cycle in several languages.

This can be accessed at:

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

3. Reading (15 min)

A reading that explains how climate change affects the water cycle on Earth.

This can be accessed at:

<https://scied.ucar.edu/longcontent/water-cycle-climate-change>

4. Optional: Teaching Module (50 min)

An optional comprehensive teaching module that discusses the distribution of water on Earth under a natural water cycle and how this can be affected by anthropogenic activities.

This can be accessed at:

https://serc.carleton.edu/integrate/teaching_materials/freshwater/unit2.html

5. Suggested questions/assignments for learning evaluation

- What is the Earth's natural water cycle? Describe its components.
- Explain how the water cycle determines the distribution of the natural water resources on Earth.
- How could human activities affect the Earth's natural water cycle?
- How does the water cycle affect Earth's climate and vice versa?
- What are the effects of global climate change on Earth's natural water cycle?

2 Step-by-step User Guide

Here is a step-by-step guide to using this lesson plan in the classroom/laboratory. We have suggested these steps as a possible plan of action. You may customize the lesson plan according to your preferences and requirements.

1. Topic introduction and discussion

Use the video, '[Water Cycle](#)' by Khan Academy to introduce your students to the processes involved in the water cycle on Earth. Describe how the water changes through gas-liquid phases and how each phase impacts life on Earth. Finally, discuss how the water cycle results in the distribution of saltwater and freshwater resources on Earth.

This can be accessed at:

<https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-biogeochemical-cycles/v/the-water-cycle>

2. Extend understanding

Use the webpage, '[The Water Cycle for Adults and Advanced Students](#)', by the USGS (United States Geological Survey) Water Science School, to explore various aspects of the natural water cycle in detail. Use the tabs in the 'Overview' section to explain the different components of the water cycle such as condensation, precipitation, and evaporation. Stress on the importance of each component in maintaining the equilibrium of the natural water cycle and on the distribution of natural water resources on Earth. Direct your students to download the water cycle diagram for a visual representation of the natural water cycle. If required, use the interactive water cycle diagram in the multimedia section to enable better understanding of the topic.

Note: The water cycle diagram and a summary text are available in over 60 different languages.

This can be accessed at:

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

3. Discuss further

Use the reading, '[The Water Cycle and Climate Change](#)' by UCAR (University Corporation for Atmospheric Research) Center for Science Education to explain the effects of climate change on the natural water cycle on Earth. Discuss using the text, how processes such as evaporation, precipitation, and cloud formation are affected by climate change. Further explain how these changes in turn could exacerbate global warming, leading to increased changes in the Earth's climate.

This can be accessed at:

<https://scied.ucar.edu/longcontent/water-cycle-climate-change>

4. Optional: Teaching Module on the Water Cycle and Freshwater Resources

Use the teaching module, '[Unit 2: The Hydrologic Cycle and Freshwater Resources](#)' by SERC (The Science Education Resource Center at Carleton College) to discuss the different components of the water cycle, the distribution of Earth's water resources and the possible effects of anthropogenic activities on the quality and availability of water. Use the teaching notes to enable discussions on how human beings could optimize the use of water resources to facilitate environmental justice globally and adopt sustainable practices in keeping with Earth's natural water cycle. The teaching module has several downloadable documents such as pre-class activity sheet, assessment rubric, instructors' notes, and lecture notes. The entire teaching module is also available to be downloaded for offline use.

This can be accessed at:

https://serc.carleton.edu/integrate/teaching_materials/freshwater/unit2.html

5. Questions/Assignments

Use the tools and the concepts learned so far to discuss and determine answers to the following questions:

- What is the Earth's natural water cycle? Describe its components.
- Explain how the water cycle determines the distribution of the natural water resources on Earth.
- How could human activities affect the Earth's natural water cycle?
- How does the water cycle affect Earth's climate and vice versa?
- What are the effects of global climate change on Earth's natural water cycle?

3 Learning Outcomes

The tools in this lesson plan will enable students to:

- learn about the fundamentals of Earth's natural water cycle
- understand the importance of every component of the natural water cycle
- describe the distribution of the natural water resources on Earth
- discuss the possible impact of climate change on the natural water cycle and distribution of water resources
- explain how anthropogenic activities could affect the natural water cycle

4 Additional Resources

If you or your students would like to explore the topic further, these additional resources will be useful.

1. **Interactive Quiz; 'Precipitation and the Water Cycle'**

A quiz by NASA's Global Climate Change website to enable your students' to test their knowledge about the natural water cycle and its role in Earth's climate.

This can be accessed at:

<https://climate.nasa.gov/quizzes/water-cycle/>

2. Video micro-lecture; 'How Will Climate Change Affect It? - The Water Cycle'

A brief video micro-lecture by Dr Jeff Dozier, Hydrologist, UC Santa Barbara to explain how climate change can affect the water cycle on Earth.

This can be accessed at:

<https://www.youtube.com/watch?v=fI5b5bwpdVE>

5 Credits/Copyrights

All the teaching tools in our collated list are owned by the corresponding creators/authors/organizations as listed on their websites. Please view the individual copyright and ownership details for each tool by following the individual links provided.

We have selected and analyzed the tools that align with the overall objective of our project and have provided the corresponding links. We do not claim ownership of or responsibility/liability for any of the listed tools.

1. Video; 'Water Cycle'

By [Khan Academy](#)

2. Reading; 'The Water Cycle for Adults and Advanced Students'

By the [USGS \(United States Geological Survey\) Water Science School](#)

3. Reading; 'The Water Cycle and Climate Change'

By [UCAR \(University Corporation for Atmospheric Research\) Center for Science Education](#)

4. Teaching Module; 'Unit 2: The Hydrologic Cycle and Freshwater Resources'

By [SERC \(The Science Education Resource Center at Carleton College\)](#)

5. Additional Resources

Quiz by [NASA's Global Climate Change website](#)

Video micro-lecture by [Dr Jeff Dozier](#), UC Santa Barbara. Hosted by [National Science Foundation \(NSF\) YouTube Channel](#).