### Subject/ target grade:
Middle School (8th grade) Earth Science

### Duration:
One 50 minute period

### Setting:
Classroom

### Materials and Equipment Needed:
- Per class:
  - Computer with attached projector
- Per student:
  - Student Worksheet Packet:
    - Global Water Cycle Diagram
    - Global Water Cycle Worksheet

### Learning Objectives:
- Describe that the water cycle includes evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption.
- Recognize the scarcity of freshwater on Earth.

### Michigan Content Expectations:
**E4.p1A.** Describe that the water cycle includes evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption.

### Lesson Overview:
Students will review the processes involved in the movement of water through the global water cycle. Students have already been introduced to the water cycle in grades 4 and 5. We will briefly review this concept in more detail and discuss each of the processes involved including evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption. Students will learn about the global distribution of water and the scarcity of freshwater.

### Lesson Core

#### The Guiding Question:
How does the Earth recycle water?

#### Safety precautions:
None.

#### Advanced Preparation:
Set computer to play the NOAA Water Cycle Video at [www.montereyinstitute.org/noaa/lesson07.html](http://www.montereyinstitute.org/noaa/lesson07.html). Prepare student worksheet packets.

#### Background Information for Teachers:
Teachers should preview the NOAA video and be prepared to point out important concepts presented when students are viewing the video.

Water on earth is used over and over. The water cycle, the continuous movement of water from ocean to air and land then back to the ocean in a cyclic pattern, is a central concept in meteorology. In the water cycle, the sun heats the Earth's surface water, causing that surface water to evaporate (gas). This water vapor then rises into the earth’s atmosphere where it cools and condenses into liquid droplets. These droplets combine and grow until they become too heavy and fall to the earth as precipitation (liquid if rain, solid if snow).
Water is temporarily stored in lakes, glaciers, underground, or living organisms. The water can move from these places by streams and rivers, returns to the oceans, is used by plants or animals or is evaporated directly back into the atmosphere.

**Important Terms:**
- evaporation
- transpiration
- condensation
- precipitation
- infiltration
- surface runoff
- groundwater
- absorption
- sublimation

**Engage:** Where does the water we drink come from?

**Building on prior knowledge:**
- Is there such a thing as ‘new’ water?
- What does dinosaur pee have to do with my bottle of drinking water?
- What are the processes involved in the global water cycle?
- Where do you get the water you use in your house from?
- Where is most of the water on Earth located?

**Pre-teaching:**
All life on Earth requires some for of water to survive. What are some organisms that need a lot of water to survive? How about humans? What percentage of our bodies is made up of water?

The distribution and exchange of water on Earth is represented using the global water cycle. The water cycle describes the existence and movement of water on, in, and above the Earth. Earth's water is always in movement and is always changing states, from liquid to vapor to ice and back again.

The water cycle has been working for billions of years and all life on Earth depends on it continuing to work. This means that the water we are using today could have been used by a dinosaur or ancient civilizations.

Is there such a thing as new water? No, the amount of water on Earth is and has been constant since its formation millions of years ago.

Today we are going to examine the global water cycle in more detail. First, we will watch a short video from the United States Geological Survey that explains the steps in the water cycle. Then, you are going to use what you have learned from the video to fill out these worksheets. Be sure to pay attention to the important terms mentioned in the video. We will work in pairs to complete these worksheets.

The first worksheet is a diagram of the water cycle. Here you will fill both the processes and places that contain water. Next, you will fill out the second worksheet to define and elaborate on your understanding of the processes in the water cycle. You may use a student dictionary to identify any vocabulary words that you are not familiar with.
**Explore:**
When students have finished filling out their worksheets go over the answers as a class. Have each pair switch their papers with another group. Each group will grade another group’s answers. Call on different student groups to explain each process.

Ask students to respond in writing to what they have learned about the scarcity of water. Prompt them using the questions below in ‘Lesson Closure’.

**Explain:** Discuss students’ answers as they share them in class. If needed, allow the students to use a student dictionary to look up any unfamiliar words.

**Elaboration:** If time permits, have students draw their own version of the water cycle using either colored pencils or crayons. Each water cycle must contain the 12 important vocabulary words.

**Evaluate:** Student groups will each hand in their worksheets.

**Lesson Closure:**
- What are the major steps in the water cycle?
- In our area, what processes are taking place?
- Which of the processes in the water cycle is most affected by humans?
- How do human activities impact the amount of water in the cycle?
- Can you think of any ways that we benefit from the processes in the water cycle?

**Lesson Extension**

**Assessment Options:** Have students diagram their version of the water cycle using the flowchart template in Microsoft Powerpoint or MS Word. Encourage them to be creative in their use of colors and/or fonts.

**Additional Resources:**
- Set the cycle to a song! Teach your students the "Water Cycle Song." This is a song that teaches the terminology of the water cycle with hand movements. Set the song to the tune of ‘Oh My Darling Clementine’.

"THE WATER CYCLE Song"
Evaporation,
Condensation,
Precipitation, on my mind.
It is part of the Water Cycle,
And it happens all the time.
Repeat twice.

- Perform the water cycle!
The Water Cycle
The heat from the sun (arms in big circle over head)
Shines down on the lake (bend knees and use flat palms to push downward)
And causes some water to evaporate (stand back up again, rolling your shoulders one at a time)
Evaporated water rises up to the sky (raise hands with fingers pointed up and wiggling)
And changes into clouds that we see passing by (make a big circle with your arms again like you did for the sun)
Along comes a wind (blow)
And blows them around (sway back and forth - arms are still making a cloud)
And that is what makes the rain that falls to the ground (bend knees, fingers pointing up and wiggling as you go lower).
- Set the cycle to a skit! Have students act out the water cycle song or come up with their own rap or song to remember the processes.
The Global Water Cycle

- Rivers and streams
- Glaciers
- Runoff
- Groundwater
- Condensation
- Transpiration
- Sublimation
- Evaporation
- Oceans
- Atmosphere
- Precipitation
- Infiltration

Water is stored in 5 places on Earth. Name each place and note the phase that water is in (i.e., liquid, solid, or gas).

<table>
<thead>
<tr>
<th>Place</th>
<th>Phase?</th>
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<tbody>
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<td>1)</td>
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</tbody>
</table>

There are 7 processes involved in the water cycle. Name and define each process. Include the phase change that water goes through during each process.

<table>
<thead>
<tr>
<th>Process</th>
<th>Definition</th>
<th>Water phase?</th>
<th>Place?</th>
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</table>
The Global Water Cycle [ANSWER KEY]

- Lakes and Streams
- Glaciers
- Runoff
- Groundwater
- Condensation
- Transpiration
- Sublimation
- Evaporation
- Oceans
- Atmosphere
- Precipitation
- Infiltration

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</thead>
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<tr>
<td>1) Lakes and Streams</td>
<td>Liquid (water)</td>
</tr>
<tr>
<td>2) Glaciers</td>
<td>Solid (ice)</td>
</tr>
<tr>
<td>3) Groundwater</td>
<td>Liquid (water)</td>
</tr>
<tr>
<td>4) Oceans</td>
<td>Liquid (water)</td>
</tr>
<tr>
<td>5) Atmosphere</td>
<td>Gas (vapor)</td>
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<th>Water phase?</th>
<th>Place?</th>
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<tr>
<td>1) Runoff</td>
<td>Precipitation runs over land into a water body</td>
<td>Liquid → Liquid</td>
<td>Any area adjacent to a water body</td>
</tr>
<tr>
<td>2) Condensation</td>
<td>Water vapor turns into liquid water</td>
<td>Gas → Liquid</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>3) Transpiration</td>
<td>Loss of water vapor from plants</td>
<td>Liquid → Gas</td>
<td>Plant surfaces, atmosphere</td>
</tr>
<tr>
<td>4) Sublimation</td>
<td>The conversion of snow or ice directly into water vapor</td>
<td>Solid → Gas</td>
<td>Glaciers and Icecaps</td>
</tr>
<tr>
<td>5) Evaporation</td>
<td>The conversion of liquid water into water vapor</td>
<td>Liquid → Gas</td>
<td>Surface of water bodies</td>
</tr>
<tr>
<td>6) Precipitation</td>
<td>The condensation of water vapor into liquid water droplets</td>
<td>Gas → Liquid</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>7) Infiltration</td>
<td>Water that is absorbed into the Earth</td>
<td>Liquid → Liquid</td>
<td>Land</td>
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</tbody>
</table>
The Water Cycle

Directions: Identify the locations where water is found on Earth and the transfer process for how water moves in the water cycle.

A. ________________  H. ________________  I. Ocean
B. ________________  C. ________________  J. ________________
C. ________________  D. ________________  K. ________________
D. ________________  E. ________________  L. ________________
E. ________________  F. ________________  M. ________________
F. ________________  G. ________________

Watershed Connections  Lesson 2
The Water Cycle

Directions: Identify the locations where water is found on Earth and the transfer process for how water moves in the water cycle.

A. Transpiration
B. Lake
C. Sublimation
D. Atmosphere/Clouds
E. Condensation
F. Precipitation
G. Runoff
H. River/Stream
I. Ocean
J. Evaporation
K. Groundwater
L. Infiltration
M. Icecaps/Glaciers