JSD 3D Learning Activity Template

Grade:	**Title:**
6th Grade	**What's the White Stuff?**

Utah Science with Engineering Education Standard (SEEd):

Standard 6.3.1 Develop a model to describe how the cycling of water through Earth's systems is driven by energy from the Sun, gravitational forces, and density.

Key crosscutting concept(s) (CCC):

Matter and Energy -- Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.

Key science and engineering practice(s) (SEP):

Developing and Using Models
Constructing Explanations
Engaging in Argument from Evidence

Materials:

- **Dry Ice**
- **Room temperature water**
- **Plastic cup-- clear**
- **Student observation sheet**

Time:

30 - 45 mins

Teacher background, key content information and hints:

The water cycle is driven primarily by the energy from the sun. This solar energy drives the cycle by evaporating water from the oceans, lakes, rivers, and even the soil. Other water moves from plants to the atmosphere through the process of transpiration. As liquid water evaporates or transpires, it forms water vapor and clouds, where water droplets eventually gain enough mass to fall back to Earth as precipitation. The precipitation then becomes run-off or ground water, and works its way—over various timescales—back into the surface reservoirs. The water cycle is essentially a closed system, meaning that the volume of water that is in the hydrosphere today is the same amount of water that has always been present in the Earth system.

The water cycle not only redistributes water around Earth, it also absorbs and redistributes solar energy between locations. Latent heating of Earth's atmosphere occurs as energy, primarily from the sun, causes liquid water to transform to another phase. As this occurs, liquid water absorbs energy, causing it to evaporate and form water vapor. The process of evaporation absorbs tremendous amounts of incoming solar energy. Through the process of latent heating, energy is transferred into the atmosphere when the water vapor condenses during the formation of clouds. For example, think of how a puddle, following a rainstorm, keeps a sidewalk cool until it is completely dried by the sunshine. The incoming solar radiation is being used to drive the process of evaporation. Once the water is gone, the sidewalk begins to absorb solar radiation and heat up. If you touch the sidewalk with bare feet you can feel this sensible heat.

Prior knowledge that students need:
Students need to know how heat flows through things and basic knowledge of the physical properties of water.

Learning Activity Plan

These three aspects of a lesson should be identified in your learning activity.		
Gathering: *(Obtain Information, Ask Questions/Define Problems, Plan & Carry Out Investigations, Use Models to Gather Data and Information, Use Mathematics/Computational Thinking.)*	***Reasoning:*** *(Evaluate Information, Analyze Data, Use Mathematics/Computational Thinking, Construct Explanations/Solve Problems, Develop Arguments from Evidence, Use Models to Predict & Develop Evidence.)*	***Communicating:*** *(Communicate Information, Argue from Evidence (written & oral), Use Models to Communicate).*

Phenomenon: When a piece of dry ice is placed in a cup of water, a change happens. What is the white stuff on top of the water?

Learning Activity: Students will be learning how condensation in the water cycle is affected by loss of heat and density.

Materials for Each Group
1 clear plastic cup filled with water
1 small piece of dry ice-- Remember to handle dry ice carefully by using gloves. Do not let students touch the dry ice. Have another cup for the dry ice to be placed in or the teacher will place the ice into the water.

Procedure:

1. Place 2-3 students in a group.
2. Hand out supplies for each group and student worksheet.
3. In a classroom discussion, ask students what they predict will happen when you add dry ice to a cup of water. Students will usually say that a white cloud or stuff will come out of it. Your question is what is that white stuff.
4. Ask the background questions.
    a. What is in the class? Water- H_2O
    b. What is dry ice made up of? Dry ice is frozen carbon dioxide.
5. Have students place dry ice into their cup of water. Observe 2 - 3 minutes. Remind students to use their observation skills to write down what they see. During observation students need to discuss what they think the white stuff is.
6. Bring the students attention back to the class for a vote. Ask the students what do they think the white stuff is and their justification of their decision. Use the following chart.

White stuff				
Carbon dioxide vapor				
Water vapor				
Liquid carbon dioxide				
Liquid water				
Other				

7. After class discussion, have the students return to a group discussion to see if their vote will stay the same or has changed because of arguments presented.
8. Continue procedure through 3 voting sessions.
9. During classroom discussions, ask students questions that can lead them to conclude that the white stuff is actually a cloud. The white stuff is actually liquid water. Temperature plays an important role or the release of heat.
10. After students have come to a final conclusion, see if there are any students who may have a misconception or disbelief that the white stuff is a cloud. If this does happen, have the students read the following paragraph.

What are clouds?

A cloud is a large collection of very tiny droplets of water or ice crystals. The droplets are so small and light that they can float in the air.

How are clouds formed?

All air contains water, but near the ground it is usually in the form of an invisible gas called water vapor. When warm air rises, it expands and cools. Cool air can't hold as much water vapor as warm air, so some of the vapor condenses onto tiny pieces of dust that are floating in the air and forms a tiny droplet around each dust particle. When billions of these droplets come together they become a visible cloud.

How is fog formed?

There are many different types of fog, but fog is mostly formed when southerly winds bring warm, moist air into a region, possibly ending a cold outbreak. As the warm, moist air flows over much colder soil or snow, dense fog often forms. Warm, moist air is cooled from below as it flows over a colder surface. If the air is near saturation, moisture will condense out of the cooled air and form fog. With light winds, the fog near the ground can become thick and reduce visibilities to zero.

-- Information from www.weatherwizkids.com

11. After reading the paragraphs above, let the students have another discussion to see if any votes have changed.

12. Take one last vote. Make sure students are able to explain their decisions and use evidence to support their claims.

13. Last, ask the students to label their drawing making any changes in their working definition of condensation and learning. Next, ask the question where is it warm and where it is cold? This is where heat energy is released. Have the students add any information to

Assessment of student learning

Teacher informally assesses student understanding as they are working by asking them questions about what is happening to molecules during the reactions and formally assesses them on the answers to the questions on the Student Sheet.

Students need to write a complete and complex definition what condensation with examples and evidence in their definition.

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Name:

White Stuff

Directions: Place a piece of dry ice in a glass of water. Write down your observations and label the diagram below.

Observations

What is water made up of?

What is dry ice made up of?

Group Discussion Notes

White stuff				
Carbon dioxide vapor				
Water vapor				
Liquid carbon dioxide				
Liquid water				
Other				

Working definition

Where is the temperature warm?

Where is the temperature cold?

Where is there heat release or gain?

What is your working definition of condensation? Use evidence and examples to help you with your definition.