Learning Objective: The Water Cycle and Weather Patterns

NGSS Standards:

MS-ESS2.C-1 The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.

Objective:
Students will be able to:

1. Demonstrate how air pressure causes clouds to form.
2. Explain the role of density in the formation of weather patterns
3. Understand the processes of evaporation, condensation, and precipitation.

Time Required: 60 minutes

Materials Needed:

- 1 plastic bottle per group
- Water
- Matches
- 1 computer/laptop/iPad per student with internet access
- Blue Ice Cubes
- Hot water
- Red dye
- Clear container
- Cloud Formation Handout (attached)

Teacher Preparation:

- Watch the following video prior to class and practice with matches/bottles to make sure the 'engage' demo works prior to class: https://www.youtube.com/watch?v=G70y90BVes4
- Watch the following video prior to class to make sure that the 'elaborate' demo works: https://youtu.be/bN7E6FCuMbY
- Create Playlist 1, a 13 minute playlist in Legends of Learning with the following games from the Water Cycle and Weather Patterns Learning Objective:
  - *Weather Master*
  - 5 post-game assessment questions
- Create Playlist 2, a 10 minute playlist in Legends of Learning using the following games from the Water Cycle and Weather Patterns Learning Objective:
  - *The Water Cycler*
- Copy Cloud Formation Handout for each student
- **Teacher Note:** This is not meant to be a comprehensive lesson on all aspects of weather. Instead, it can be used as an introduction or as a wrap-up (depending on how you like to structure and organize your units.) You can use it as an introduction and refer back to the demos as you go more in depth into the water cycle, cloud types,

ocean currents, weather patterns, etc. Or you can use it as a culminating exercise to tie together vocabulary and concepts taught in the prior few days.

Engage (10 mins):
Clouds in a Bottle

1. Give each group of students a bottle filled 3/4ths of the way with water, but do not hand students the matches.
2. Have each group examine their bottle and talk about the contents. Have the students shake their bottles (helps with the saturation piece explained in the video) and squeeze them to demonstrate that nothing is really happening yet. Talk about how this bottle could represent the open ocean or other bodies of water and how there is water vapor in the air that is not visible.
3. Do the demo (see the Teacher Preparation section for more details on the demo) with your own bottle and match to show the students how it works.
4. Walk around the classroom and drop matches in the bottles of each group. Have students cap the bottles after the match is dropped in.
5. Allow students to experiment with varying amounts of pressure to create the 'clouds'.
6. When students have concluded their observations, discuss the elements required to create clouds, how air pressure plays a role in cloud formation, etc. Address any basic questions about cloud formation at this point.

Explore (15 minutes):

1. Have your students sign in to Legends of Learning and enter your teacher code.
2. Launch Playlist 1 to your students.
3. After students complete *Water Master,* they should answer the assessment questions to give you a general idea of their understanding of the content.
4. Assist students as needed during game play, pause playlist if you need to address content or questions to entire class.

Explain (10 minutes):

1. Have students attempt "Cloud Formation Discussion Questions" in the handout.
2. Go over the questions with the class and let question #3 lead you into the next demo. Explain that not only does air pressure play a role in weather formation, temperature, density, and gravity play a role in moving water around our planet.

Elaborate (10 minutes):

1. Take out the clear plastic tub filled with room temperature water. Remind students that temperature was one mechanism that affects weather.
2. Add the hot red water and blue ice cubes to the system and have students make notes of their observations using the "Colored Water Demonstration" section of the handout.
3. Discuss with the class ways in which temperature affects density and how all these mechanisms combine in different ways to drive the water cycle and weather patterns.
4. Pull up a diagram of the water cycle on your projector/smartboard or draw a simple diagram on a whiteboard. Draw in arrows that will indicate areas where heat (from the sun) would cause evaporation and then cloud formation. Remind them how high versus low air pressure would affect this. Show locations where gravity would pull precipitation from the sky down to earth and over the surface of the earth. Indicate

how cooling would affect density and drive weather patterns.
Evaluate (15 minutes): 1. Have your students sign in to Legends of Learning and enter your teacher code. 2. Launch Playlist 2 to your students. 3. Use progress on *The Water Cycler* to assess student understanding of evaporation, condensation, and precipitation. 4. Assist students as needed during game play, pause playlist if you need to address content or questions to entire class. 5. Students will complete the 'Wrap-Up' question on the Cloud Formation handout as they finish the game and prepare to leave class.

Name: _____ Date: _____

Cloud Formation Discussion Questions

1. Why didn't clouds form the first time you squeezed the bottle? Why was smoke necessary?

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2. Why did you need to release pressure in order for the clouds to form? How does this model relate to air pressure and cloud formation?

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3. We have determined that air pressure affects cloud formation, but what additional factors play a role in weather formation?

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Colored Water Demonstration

* Using colored pencils, draw what you observed in the colored water demonstration. Include colored arrows that indicate any movement of the different colored water that you observed.

Wrap-Up

In your own words, try to answer the following questions in one cohesive paragraph.
What is the water cycle? What forces drive the water cycle? How does the water cycle relate to weather and our weather patterns?

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