SN EDUCATOR GUIDE

May 8, 2021 & May 22, 2021

Physics Helps Alien Rain Stay In Shape

Student Discussion Worksheet

Directions: Read the online *Science News* article "How the laws of physics constrain the size of alien raindrops." A version of the story, "Physics helps alien rain stay in shape," appears in the May 8, 2021 & May 22, 2021 issue of *Science News*. With a partner, discuss the following questions using outside resources if needed. Use the information you find to predict the conditions on another planet and create a short weather forecast for that planet.

Rain: alien or not

1. How would you define rain? What is meant by the phrase "alien rain?"

2. Based on the first generalized physical model of alien rain covered in the *Science News* article, how do droplet shape and size vary across planets? How does the rain's chemical makeup affect these attributes?

3. In the table below, compare and contrast the makeup, shape and maximum size of raindrops on Earth with raindrops on another planet mentioned in the *Science News* article. Consult outside resources as needed, and be sure to cite your sources. Use the last column to explain why you think each similarity or difference occurs.

Rain attributes	Earth	Planet:	Explain
Makeup			
Shape			
Maximum size			

Sources:

4. What affects the evaporation rate of a raindrop? Which do you think would evaporate faster: Earth raindrops or raindrops falling on the planet you chose?

Chemical breakdown

Answer the following questions with your partner to explore the molecular composition of rain on different planets compared to rain on Earth. This information will help you predict conditions that might exist on the planet you chose.

1. Make a list of the planets and moons mentioned in the *Science News* article that have rain. State what the rain is made of for each celestial object, whether the substance is an atom or a molecule and give its chemical formula. If the substance is a molecule, state how many atoms of each element are within one molecule of it and what types of bonds exist between the atoms.

2. Using your knowledge of Lewis Dot Structures and the Valence Shell Electron Pair Repulsion model (VSEPR), explore the shape of each molecule in the table below. Make sure to include bond angles and the common name for the molecule's shape in your VSEPR model. Finally, state whether you would expect the molecule to be polar or nonpolar and why. Note that iron is not a molecule, rather it is a metal atom.

Molecule	**Chemical formula**	**Lewis Dot structure**	**VSEPR model**	**Polarity**
Methane				
Ammonia				
Water				

3. Draw the general shape of a rain drop. Then draw a zoomed in view of the atoms or molecules within each type of raindrop. Indicate the forces of attraction between the atoms or molecules within the liquid raindrops.

Make it rain

Discuss the following questions with your partner, then create a short weather forecast about a planet other than Earth that you will present to your class. Be sure to include high and low temperatures, and whether you expect there to be a chance of rain.

1. Could the various types of alien rain mentioned in the *Science News* article exist as rain on Earth? Explain why or why not. (Hint: Consider each type of rain's intermolecular forces of attraction and the typical conditions on Earth.)

2. Based on the intermolecular attraction forces in an alien raindrop, predict a few conditions that might exist on your chosen planet that would allow rain to form. Examples of conditions include high and low temperatures, air pressure, weather patterns, wind speed and direction, and humidity. Use those conditions to create a short weather forecast. Note that you may need to look up additional information, like the boiling point, or full phase diagram of a substance.