OXBOW "I See, I Wonder" Teacher Notes

Cloud Formation

Grade	Standard/Element
2	S2P1c – Provide evidence from observations to construct an explanation that some changes in matter caused by heating or cooling can be reversed and some changes are irreversible.
4	S4E4a – Plan and carry out investigations to observe the flow of energy in water as it changes states from solid (ice) to liquid (water) to gas (water vapor) and changes from gas to liquid to solid.
5	S5P1b - Construct an argument based on observations to support a claim that the physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently.
6	S6E3b – Plan and carry out an investigation to illustrate the role of the sun's energy in atmospheric conditions that lead to the cycling of water.
6	S6E4d - Construct an explanation of the relationship between air pressure, weather fronts, and air masses and meteorological events such as tornados and thunder-storms.
8	S8P1d – Construct an argument based on observational evidence to support the claim that when a change in a substance occurs, it can be classified as either chemi-cal or physical.
Meteorology	SM2. Obtain, evaluate, and communicate information about energy transfer and its role in precipitation, cloud formation, and air mass formation.

Main Ideas:

- Cloud Formation
- Pressure
- Evaporation
- Condensation

Misconceptions: **(from https://beyondpenguins.ehe.osu.edu/issue/weather-and-climate-from-home-to-the-poles/common-misconceptions-about-polar-weather-and-climate)**

- Clouds form because cold air doesn't hold as much water as warm air. [Correct: Cloud formation depends on the balance between water evaporating and condensing. Water molecules are continu-ally changing state between solid, liquid, and gas. Clouds form when more molecules evaporate into the atmosphere than can condense on earth].
- Clouds are made of water vapor. [Correct: Clouds are mainly tiny water droplets or ice crystals. Wa-ter vapor is invisible].
- Clouds always predict rain. [Correct: Clouds may predict rain but do not guarantee rain].
- Humidity is moisture I the air. [Correct: Humidity is the amount of water vapor in the air].

OXBOW "I See, I Wonder" Teacher Notes

Cloud Formation

- Humid air is heavy or more dense that dry air. [Correct: Humid air is less dense than dry air].

What You Need to Know: **(from https://scied.ucar.edu/learning-zone/clouds/how-clouds-form)**

- Clouds are made of water droplets or ice crystals that are so small and light they are able to stay in the air.
- The water or ice that make up clouds travels into the sky within air as water vapor, the gas form of water. Water vapor gets into air mainly by evaporation – some of the liquid water from the ocean, lakes, and rivers turns into water vapor and travels in the air. When air rises in the atmosphere it gets cooler and is under less pressure. When air cools, it's not able to hold all of the water vapor it once was. Air also can't hold as much water when air pressure drops. The vapor becomes small water droplets or ice crystals and a cloud is formed.
- It's easier for water vapor to condense into water droplets when it has a particle to condense upon. These particles, such as dust and pollen, are called condensation nuclei. Eventually, enough water vapor condenses upon pieces of dust, pollen or other condensation nuclei to form a cloud.

From https://www.stevespanglerscience.com/lab/experiments/cloud-in-a-bottle-experiment/

- Even though you can't see them (even when it's raining), water molecules are in the air all around you. These invisible, airborne water molecules are called water vapor. When water vapor is bouncing around in the atmosphere, it has a lot of motion energy and doesn't normally stick together.
- Pumping air into the bottle forces water vapor to squeeze together or to compress. Releasing the pressure quickly allows the air in the bottle to expand quickly. In doing so, the temperature of the air in the bottle becomes slightly cooler. This cooling allows the water vapor to stick together – or condense – more easily, and form tiny droplets. Clouds are nothing more than gazillions of groups of tiny water droplets! By the way, rubbing alcohol forms a more visible cloud because alcohol evaporates faster than water. Alcohol molecules have weaker bonds between them than water molecules so they let go of each other easily. As a result, there are more evaporated alcohol molecules in the bottle that are able to condense at a lower pressure. That's why you see the alcohol cloud more clearly than the water vapor cloud earlier on in the pumping process.
- Clouds on Earth form when warm air rises and its pressure is reduced. The air expands and cools, and clouds form as the temperature drops below the dew point. Invisible particles in the air in the form of pollution, smoke, dust, or even tiny particles of dirt, become a nucleus on which the water molecules can attach themselves and go from invisible to visible as a cloud.