Dry Ice Experiments

Goals:

-To teach students the different states of matter.
-To teach students the ways matter changes phase.

Standards:

- CSS: gr. 5 1.g

Primary Vocabulary:

- **State of Matter**--One of four distinct forms that a phase of matter takes on. They are Solid, Liquid, Gas, and Plasma.
- **Phase of Matter**--A region of space in which all physical properties of a substance are essentially uniform. In a system of ice water, all substances are their own phase (ice is one, water another, glass, etc.)
- **Phase Transition**--The transformation of a substance from one state of matter to another.
- **Sublimation**--A phase transition substance goes from a solid phase to a gas phase without entering the intermediate liquid phase.

Secondary Vocabulary:

- **Deposition**--A phase transition in which a substance goes from a gas phase to a solid phase without entering the intermediate liquid phase.
- **Surface Tension**--The contractive tendency of the surface of a liquid to resist an external force.
- **Viscosity**--Measure of a fluid's resistance to shear stress or tensile stress. How "thick" a liquid is

Materials:

- Dry Ice
- Balloons
- Gloves
- Hammer
- Cups
- Liquid Soap
- Small Dish for Soap
- Bubble Machine
- Fleece Blanket

Introduction:
SAFETY FIRST! Do not allow students to directly touch dry ice, as too long of an exposure will cause frostbite. Have students gather around the table, making sure all have room, leave one shorter side open to you. You will need the room to teach effectively and safely.

ASK: "What do you know about matter? Consider their answers.
Matter is any substance that has mass and takes up space.

ASK: What will happen when a water ice cube is placed in a balloon?
ASK: "Which state is the ice cube in?" (Solid)
ASK: "What state will it enter after 30 min in the balloon?" (Liquid)

EXPLAIN that there are four states of matter: Solid, Liquid, Gas, and Plasma. In a solid, atoms are closely spaced and may vibrate in position but do not change relative location. In a liquid, molecules are constantly in contact with others. In a gas, they are widely spaced, except when they collide. Plasma is like gas and does not have a definite shape or volume. It is also electrically conductive. Positively charged nuclei swim in a "sea" of free-moving dissociative electrons. Plasma is a hard concept to grasp, but the students will have seen it in neon, lightning, and plasma TVs.

Take out a piece of dry ice. You may need to break the dry ice with a hammer. You can explain how dry ice is made- Gasses with a high concentration of Carbon Dioxide are produced. This gas is then pressurized until it liquefies. Pressure is reduced and some of it vaporizes. This causes a rapid lowering of temperature to the rest of the liquid. The extreme cold causes the rest to solidify into a snow-like consistency which then is compressed into blocks!

Place dry ice in balloon, tie it off, and observe (you can pass it around as long as students hold it by the knot and do not touch the area where the dry ice is). Have them explain what they see is happening. They have just described phase transitions. And that the dry ice is going through a process called sublimation-changing directly from solid to gas.

Then have students pair up and give each pair/group an empty cup. Place a few pieces of dry ice in the cup and ask the students to observe what happens.

Once they comment on sublimation, add water to each cup. The water speeds the sublimation process, leading to more gas being vented from the cup. Allow students to interact with the gas but remind them not to inhale it, and not to touch the dry ice directly.

Add soap. Explain to students that the bubbles trap the escaping gas, since it raises the surface tension of the water and increases its viscosity, allowing it to resist the stress of the expanding gas. Allow students to play with the bubbles and add water or soap in small quantities as needed (try not to add more dry ice, there is more fun to be had next!)

Once all cups have nearly exhausted themselves, bring out the Bubble Machine. Explain that students understand phase transitions enough to have some fun with them. Place some dry ice in the machine, with warm water. Close the top and allow some of the gas to escape from the hose. Dip the nozzle of the hose in the dish of soap and observe the bubbles.

Have the students put on one glove each and stand in a single file line facing you . You can put bubbles on the gloves, and they will not pop! Try to make sure each student gets a bubble. You can then continue on or go back to their favorite dry ice activity if you have enough time.

Evaluation:

- What are the four states of matter?
    - Solid, Liquid, Gas, Plasma
- What is a phase transition?
    - When matter transforms from one state to another.
- Does dry ice melt or sublimate?
    - Dry ice does not enter a liquid state. It sublimates (goes from solid to gas).