

**Project FOCUS
Best Lessons
FIFTH GRADE**

Title of Lesson: States of Matter and Dry Ice

Theme: Physical Science

Unit Number: **Unit Title:** Matter/ Chemical and Physical Changes

Performance Standard(s) Covered (enter codes):

S5P2

Enduring Standards (objectives of activity):

Habits of Mind

- Asks questions
- Uses numbers to quantify
- Works in a group
- Uses tools to measure and view
- Looks at how parts of things are needed
- Describes and compares using physical attributes
- Observes using senses
- Draws and describes observations

Content (key terms and topics covered):

water, liquid, solid, plasma, sublimation, evaporation, condensation

Learning Activity (Description in Steps)

Abstract (limit 100 characters): Use heat and temperature to demonstrate state/phase changes of matter.

Details: Before the class starts, set up the hot plate and begin boiling a beaker of water. Set it up so that the hot plate rests on the base of the ring stand with the ring suspended above it. As the water is heating up open the website on the Smartboard or projector. The website offers three animations that demonstrate the arrangement of molecules in solids, liquids, and gasses. Present these to the class and ask questions to see if they know what the names of the transitions between states are. After they are comfortable with the animations you can begin the experiments. First, show the students the dry ice and ask them to determine its state. Next, place it in a beaker of room temperature water and show them how it "smokes." Discuss sublimation and the reason it sublimates more in the warm water. Next place a piece of the dry ice in a deflated balloon and show the students how the balloon inflates as the dry ice sublimates. Once the water on the hot plate is boiling discuss evaporation, and then demonstrate condensation by placing a beaker full of ice water over the boiling water. Show the students how water droplets form on the cold beaker as it rests above the beaker of boiling water on the hot plate. Allow the students to ask questions about the experiments thus far, and ask questions to ensure they are grasping the topics. Next, fill the large bowl/pot with warm water and place a large piece of dry ice in the bowl. Place the whole thing in the middle of the room and watch as white smoke (white vapor) fills the area around the bowl. Ask the students to describe what is happening and have them ask questions. As the bowl continues to

smoke, show the students the container of ethanol and ask them to describe it. Also, ask them if they think it is water and how it is similar or different. Place a piece of dry ice in the ethanol and allow it to stand on the table. As the dry ice sublimates the ethanol will get VERY cold because its freezing point is much lower than the temperature of the dry ice. Show the students how the ethanol does not freeze like the water when dry ice is added. When it is sufficiently cold, pour the ethanol from one beaker to another and show the students how it is more viscous (looks thicker). Explain why it looks this way and how this correlates to the models of molecular particles you showed at the beginning of class. After you have done all of these experiments ask the students what else they would like to see. If it is safe, ask them to make hypotheses and then test them. All in all this lesson is very open ended and gets a great response from the students. Just have fun with it and they will love it.

Materials Needed (Type and Quantity):

• ~10lb of Dry Ice • Cooler • Large bowl/pot for water • 3-5 beakers /glasses • Ring stand with one iron ring • Hot Plate • Ice (H₂O) • ~50mL of lab grade ethanol • Balloon • Hammer for breaking the dry ice into smaller pieces • Safety goggles • Gloves for handling the dry ice (I just used snow gloves.) • Smart board or projector

Notes and Tips (suggested changes, alternative methods, cautions):

Dry ice is approximately -80°C and can cause serious burns if it is in contact with the skin for extended periods of time. Ensure that the students do not handle it directly and that you use gloves when handling it. Also, make sure you wear goggles, and keep it in the cooler when you use the hammer to crush it into smaller pieces.

Sources/References:

- 1)
- 2)
- 3)