Krug Chemistry – Deep Run Daily Planning Guide

Date of Lesson: Q1 Day 9 – Dry Ice Lab

Topic /Big Questions: (Question Stems & Question Creation Chart)

- **What is matter? What is energy? How are they different?**
- **How can energy change the form of matter?**
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State SOL	Unpacking the Standards (Video explanation shown at 3:18)
CH 2 h CH 5 a, d	**CH.2** The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of: **h)** chemical and physical properties; and **CH.5** The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include: **a)** pressure, temperature, and volume; **d)** phase changes

Visible Learning (For the three items with asterisks*, think from a student perspective. Use simple language)

***What am I learning today?** Matter is made of particles. These particles contain energy. The more energy, the more the particles will move. This movement determines the state of matter: solid, liquid, or gas.

***Why is it important?** The concepts of matter and energy will be a repeating theme throughout the entire course.

***How will I know I've learned it?** Students will learn how to draw a particle diagram to represent the present state of matter. Students will understand that absorbing or releasing energy changes the arrangement of the particles.

Differentiation strategies:

Lab Notebook/ White board – sketch particle diagrams to represent current state of matter. Show energy being absorbed or released.

Modeling Instruction – ask CER questions to help students investigate properties of sublimation.

Accommodations and/or modifications are being met for students with IEP's/504's.

Work in small groups; check for understanding.

Daily Plan/Sequence of Instruction:

Randomly hand out scientist group cards to **rearrange seating**. (Modeling Technique to encourage students to get used to working in different groups. Forces students to collaborate and communicate with all classmates by the end of the year. Each station is given a scientist's name. Tiny cards with the scientist names listed are randomly passed out so that students know where to sit next. Teacher will collect the name cards once everyone is seated.)

(Do not talk about melting or subliming yet!) Teacher will use gloves to place a large block of dry ice on a cutting board. The teacher will ask students if they have ever seen dry ice before. The teacher will ask students if they know why it's called "dry" ice. The teacher will place a regular piece of ice (frozen water) on the cutting board next to the dry ice. The teacher will ignite a lighter and hold the flame near both types of ice so that the students can see the water melting and the dry ice subliming. The teacher will ask students to draw particle diagrams in their notebooks to show the difference between regular ice and dry ice. Once all the drawings are complete, teacher will ask students

to decide which drawing best represents the flow of energy and the change in matter. Students will transfer these sketches to their group's whiteboard in order to share them with the class. Teacher will ask guided questions to investigate how the particles were drawn, how energy is shown flowing into the particles, and how particles move once they absorb energy.

The teacher will ask: What is it called when a solid turns into a liquid? (Melting) What is it called when a liquid turns into a gas? (Evaporation or Vaporization) What phase change did the dry ice skip to become a gas? (Liquid) Does anyone know what it's called when a solid changes into a gas without going through the liquid phase? (Sublimation) Teacher will recommend that students record this information in their lab notebook. The teacher will explain it is called "dry ice" because it skips the liquid state.

The teacher will invite students to come up one group at a time. Students will be given a large Mason jar and a 2" x 2" chunk of dry ice. Students will be told to return to their lab station in order to fill the jar ½ full with warm water. Students will be told to record their observations in their lab notebook. Once all the students have completed this step, the teacher will ask students to identify the nature of the white vapors coming out of the jar. (Students may think that the vapors are water vapor or steam. Do not discourage their ideas. Instead ask "How can we test this?"

In order to test the nature of the white vapors, students will be told to add a few drops of food dye to the jar. Teacher will ask if the color of the solid dry ice changed. (Dry ice will not change color.) Teacher will ask "How can the water change color but not the dry ice?" (Water is polar, but dry ice is non polar. They will learn this concept later in Unit 6. So for now just let the students make their best guess and do not discourage their curiosity. Ask them to use CER techniques for their hypothesis.) Teacher will ask students if the color of the vapor changed when they added the food dye. (The vapors will still be white.) Teacher will ask students what the nature of the vapors are now that they have seen the effect of the food dye. The goal is to get students to understand that the dye mixed with the water and turned it a new color. Since the vapors began as white and continue to be white, the vapors are not from the water. The vapors are from the dry ice.

By now the water temperature will be dropping quickly. As the water cools down, the dry ice releases less vapor. Inform students of this change and ask what causes the change. Guide them to the true answer that heat energy is required to produce more vapors. The water gets colder because it's heat energy is being transferred into the ice. Ask the students to carefully decant their water and refill the jar with more warm water. They will immediately notice the water vapors increase again. If ice chunks are getting too small, and you have some leftover, cut off another chunk for the students. (Remember to save the other large blocks of ice for the other classes.)

Now just for fun, have the students fill a small cup or bowl with soapy water. Ask them to get their finger wet in the soapy water and rub the rim of the Mason jar. Next ask them to dip a piece of string in the soapy water and carefully stretch it over the surface of the jar. Slide the string across the rim of the jar to make a bubble. For better instructions, visit: https://www.youtube.com/watch?v=8tHOVVgGkpk.

Clean up and pass out the post lab question worksheet, which will be due the next class.

Assessments (List all formative/summative assessments used to check for understanding during this lesson. Summative assessments may occur during a different class period.):

Lab notebooks/ Whiteboards (formative)

Modeling Instruction (formative)

Post Lab Questions (summative) - due next class

After assessing today's lesson are you and your students comfortable moving forward with your next objective?

Yes - Students should feel more confident about drawing particle diagrams to represent the state of matter and the flow of energy; students will understand that different types of matter respond differently when exposed to the same chemical (food dye with water vs food dye with dry ice)

No, remediation required to proceed –

Teacher reflection: Kroger sells dry ice in a box freezer near the checkout lanes. Call the store a week in advance to inform the manager that you need at least 6 blocks of dry ice to do this lab. (1 for each class period and an extra just in case.) The cost of dry ice fluctuates, but usually runs around $1.90/ lb. This lab generally costs around $70 for 5 classes. **This means each class of 30 students will need a 7 lb block of dry ice.**

The Mason jars and string can be reused, year after year. Warn students not to add too much food dye, as we will need it for future labs. Two to three drops of dye are plenty.

CLEAN UP: When students are ready to clean up, they can pour their water in the sink. If the ice sticks to the bottom of the Mason jar, add more hot water to the jar. Leftover ice can be sublimed by running warm sink water over it. Encourage students to return the Mason jars to the front of the room and let the sinks run in order to sublime any ice that fell out into the sink. The idea is to hide all the vapors before the next class arrives! Don't want to ruin the surprise.