

Community in the Classroom Presentation Plan

Lesson Name _____ Melting, Freezing, and More!: Phase Transitions
Presenter(s) _____ Steven Scroggins Ailey Crow Tom Holcombe Terence Choy

Grade Level 3 **Standards Connection(s)** _____ Matter has three states which can change when energy is added or removed

Abstract:

All matter in the universe is composed of atoms, which are very tiny particles. For example, water, air, and people are all made up of atoms. Atoms move at different speeds depending on how much energy they have. Our presentation will demonstrate how heat and cold change the energy of atoms and how this affects properties of matter that we can observe. We will perform some experiments on common materials, such as water, to illustrate the importance of phase transitions in everyday life. We will also bring in less familiar materials from the laboratory that will demonstrate the relevance of these processes in scientific experiments.

Vocabulary/Definitions: Solid, liquid gas, phase changes

Materials:

For us to bring:

Centrifuge tubes

Liquid nitrogen

Dewar

Balloons

Dry ice

Cold gloves

Empty soda bottles

Candles and matches

Worksheets

Computer with presentation

Projector

In the classroom:

Water

Rulers

Writing utensils (pens and markers)

Classroom Set-up:

The students should be arranged in 3 groups of equal size for the experimental portion of the presentation. We will need approximately 10 minutes on either end for setting and cleaning up. The talk consists partially of a Power Point presentation, so we will need access to a projection screen or white wall surface

Classroom Visit



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1. Personal Introduction: 5 Minutes

We are graduate students in chemistry and bioengineering at UC Berkeley. All of our research interests focus on using state-of-the-art science to solve real-world problems. Similarly, in the classroom we like to introduce students to fundamental scientific principles that have great relevance to their every day lives. The phases of matter and the principles of phase transitions are central to many areas of science. For example, meteorology (the study of weather) requires knowledge about the phases of water.

We are also aware of the importance of scientific exploration at a young age and the role this had in shaping our own interests in science. Many interesting experiments on the phases of matter can be performed in the classroom or at home. We hope that our presentation will provide a good starting point for further scientific exploration in the area of phases and phase transitions.

Topic Introduction: 15 Minutes

We anticipate that students will have be familiar with the phases of matter (solid, liquid, gas) that we will use as the starting point of our presentation. We will ask students for examples of these different phases and the important properties of each phase. Some knowledge of the atomic theory of matter will be important to our presentation. We will consult with the teacher beforehand to gauge the students' familiarity with this concept and adjust our presentation to encompass either a short introduction or provide a brief review.

We will introduce the concept of phase transitions and ask students if they are familiar with any common phase transitions and their names (e.g. ice melts to water). We will present other examples of common phase transitions. We will also challenge students to consider less familiar phase transitions (sublimation). We will show how all phases of matter can interconvert depending on the amount of energy we add or remove and discuss with students the ways we add or remove the energy associated with phase transitions. Finally, we will introduce students to the atomic theory behind phase transitions.

2. Learning Experience(s): 25 Minutes

The experimental portion of our presentation will build on the concepts that we have introduced in our presentation and provide opportunities for hands-on learning. We will give students worksheets with visual themes and vocabulary that should be familiar from our talk. Students can fill in the missing information on these worksheets as they move between the three demonstration stations we will set up. This information will include: 1) the name of the phase transition being demonstrated; 2) the relevant phases and direction of the transition; and 3) a drawing of the atomic basis for the phase transition. These worksheets will hopefully enrich the experiments by reinforcing what has been introduced in the opening presentation.

We will use the following three experiments as demonstrations of the principles of phase transitions:

1) Sublimation of solid carbon dioxide and gas expansion. Students can use the cold gloves to place dry ice in a soda bottle. Add water and cover the top of the bottle with a balloon and the balloon will inflate as the dry ice sublimates. This experiment illustrates a rare process (sublimation) and utilizes a cryogenic material (dry ice) that should be interesting to students.

2) Freezing of water and ice expansion. The volunteers will use cold gloves to place tubes of water in liquid nitrogen. As the water freezes it will expand and this expansion may be measured. This experiment demonstrates an important property of a very common phase transition and utilizes liquid nitrogen, a material rarely available outside of the laboratory.



3) Melting candle wax. Students will be familiar with melting candle wax, which provides a good opportunity for hands-on play and also illustrates both melting and freezing.

3. Wrap-up: Sharing Experiences and Building Connections 5 **Minutes**

For our wrap-up, we would like to ask the students to consider some new questions about phase transitions that they can think about after we leave. They could think about the “phase transition” associated with cooking an egg, or we might ask them what the phase of Jello is. These are the kinds of questions and experiments that they can discuss among themselves and work on with their teacher or at home with their parents. We will emphasize that kids can think about science and apply their knowledge every day and that this is a fun and educational process.

4. Close: 5 **Minutes**

We have a fun final demonstration that should provide a good close to the talk. When air-filled balloons are placed in liquid nitrogen, they dramatically contract. This allows us to place several balloons in a small liquid nitrogen container. Upon emptying the container of liquid nitrogen and the balloons, the balloons re-expand. This demonstration should provide some “fireworks”.

TOTAL 50 – 60 **Minutes**

Follow-up – After Presentation

Suggest students write a letter explaining “How we learned about _____?”

List or attach examples of activities, websites, connections for additional learning.

Attach worksheets, hand-outs, visuals used in classroom presentation.



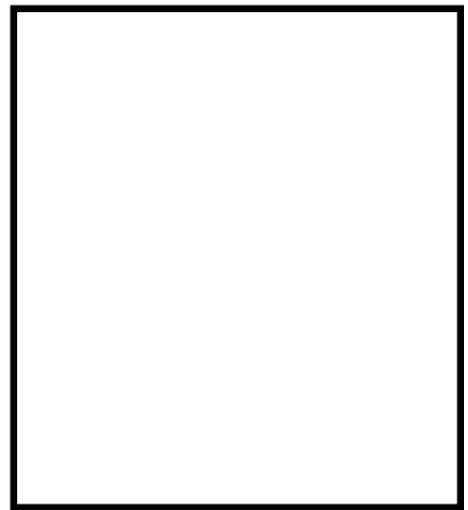
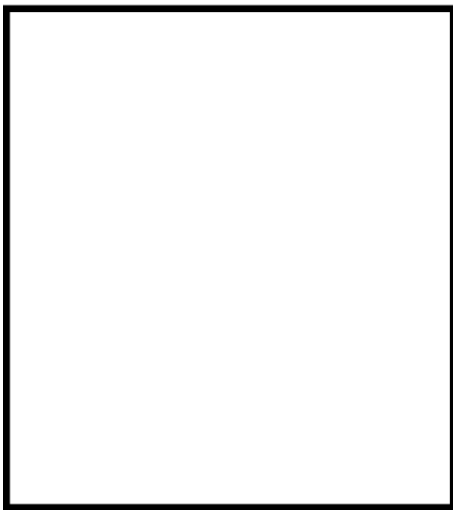
Experiment 1



Gas

Liquid

Solid



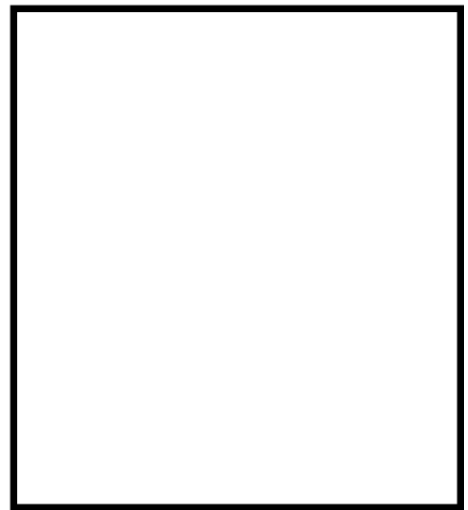
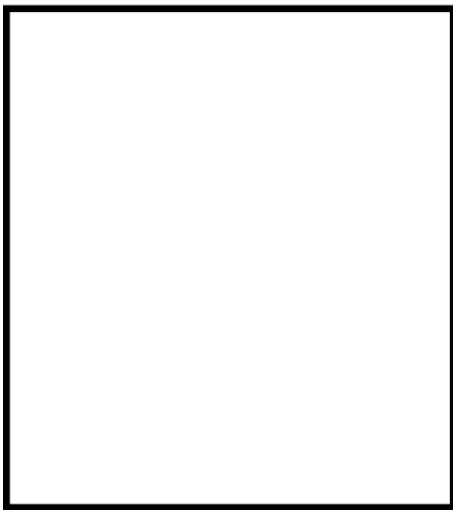
Experiment 2



Gas

Liquid

Solid



Experiment 3



Gas

Liquid

Solid

