

Community in the Classroom Presentation Plan

Lesson Name Properties of Matter that Matter!
Presenter(s) Kim Sogi (team leader), Stavroula Hatzios, Kimberly Beatty, Kanna Palaniappan, Jason Hudak, Brian Belardi, Karen Dehnert (Bertozzi Group)

Grade Level 3 **Standards Connection(s)** Physical science: States of Matter

Abstract:

Your opportunity to tell teachers and kids what's going to be fun and interesting about your visit!

Properties of matter are illustrated through a series of demonstrations. Students will learn to identify solids, liquids, and gases. Water will be used to demonstrate the three phases. They will learn about sublimation through a fun experiment with dry ice. Next, they will learn some important properties of liquids, like density and viscosity. Finally, they will learn about gas diffusion through smell.

Activity 1 (performed in front of the whole class): The presenters will use water to introduce the three phases of matter: solid, liquid, and gas.

Discussion 1: Students will be introduced to the phases and phase changes. A diagram of phase changes will be used to illustrate the transformation of solid to liquid, liquid to gas, etc.

Activities 2-4 will be performed in small groups:

Activity 2: The presenters will demonstrate how sublimation (phase change from a solid to a gas) occurs using dry ice. Dry ice will be compared to regular (water-based) ice. Dry ice will also be used to inflate a balloon and pop open plastic film canisters, demonstrating the conversion of a solid to a gas.

Discussion 2: Students will be asked to describe their observations. They will learn more about phase change and gases.

Activity 3: The students will be introduced to the concept of viscosity by comparing the properties of honey, water, and oil. They will pipet the liquids onto an inclined surface and observe how long it takes for each liquid to flow down the side. Next, students will compare the densities of these liquids. Student volunteers will place three different solid objects (each of a different density: penny, cork, grape) into a layered solution of the three liquids to determine which item is most dense and which item is least dense. An object with unknown density will also be analyzed to "find" its density.

Discussion 3: Students will consider the density and viscosity of different liquids.

Activity 4: The presenters will discuss gas diffusion. They will also discuss how smell can be used to sense gas diffusion. Volunteers will be used to determine the rate and extent of diffusion for different materials (e.g., coffee, oranges, perfume). A fan will be used to demonstrate how the rate of diffusion can be increased.

Discussion 4: Brief discussion of diffusion and factors that might affect diffusion.

Vocabulary/Definitions:

3 – 6 important (new) words

Solid: A phase of matter that is characterized by resistance to changes in shape and volume.

Liquid: A phase of matter that is characterized by a resistance to change in volume. A liquid can change shape.

Gas: A phase of matter that can change shape and volume.

Melting: Transformation of a solid to a liquid.

Freezing: Transformation of a liquid to a solid.

Boiling: Transformation of a liquid to a gas.

Sublimation: Transformation of a solid to a gas.

Viscosity: the resistance of a liquid to flow (the "thickness" of a liquid).

Density: mass per unit volume.



Diffusion: transport of molecules from a region of higher concentration to one of lower concentration by random motion.

Materials:

What you'll bring with you

Ice
Water (hot, cold, and room temperature)
Mirror
Dry Ice
2 large glass beakers
Balloons
Plastic film canisters
Pasteur pipets
Plastic tray
Clear plastic cups
Honey
Oil
Water
Coins (nickel and dime)
Cork
Grape
Paper clip
Different smelling items (e.g., coffee, orange, perfume, etc.)
Fan to blow smells
Blindfolds for volunteers
Glassware of different shapes
Safety goggles
Lab Coat
Lab Gloves

What students should have ready (pencils, paper, scissors)
Paper and pencil

Classroom Set-up:

Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed
Overhead projector
Chalkboard or dry erase board at front of room
Table or work area in front of room and three stations
Water for experiments and clean-up
Five minutes to set up and clean up

Classroom Visit

1. Personal Introduction: _____ 3 _____ Minutes

Who are you? What do you want to share with students and why? How will you connect this with students' interests?

We're a group of students from UC Berkeley who study the chemistry of cells. Cells are made up of many different materials that have different properties. Cells contain solid components, such as fat, sugar, and protein: similar to the fat, sugar, and protein that you eat. Cells also contain liquid in the form of water. Your body is almost 60% water. While your blood is 95% water, your bones are only 22% water. Cells also need gases, such as oxygen, to live. Today we want to share with you some of the interesting properties of matter.

Topic Introduction: _____ 5 _____ Minutes

Big Idea(s), vocabulary, assessing prior knowledge. What questions will you ask to learn from students?

Introduction to the Properties of Matter. Different materials have different properties. What are some properties of solids? (Object has a defined shape and volume. It resists changes in shape and volume. Molecules are rigidly



packed together. Ice, dry ice, desk, chair, pencil.) What are some properties of Liquids? (Liquids can flow and change shape. They adopt the shape of the container that they are in. The molecules are close together, but can freely move around and change position. Because the molecules are close together, you can't change the volume easily: Water, oil, blood.) What are some properties of Gases? (Gases can flow, change shape, and change volume. A gas has a low density and will readily diffuse. Gases will expand to fill the space around it. Gas molecules are very loosely packed/far apart from each other: Oxygen, carbon dioxide, helium, air.) Today we will discuss some of the properties of solids, liquids, and gases.

Right now, we're going to study and observe the properties of different materials. Pay close attention to what you see. Afterwards, we're going to talk about the special features of different types of matter.

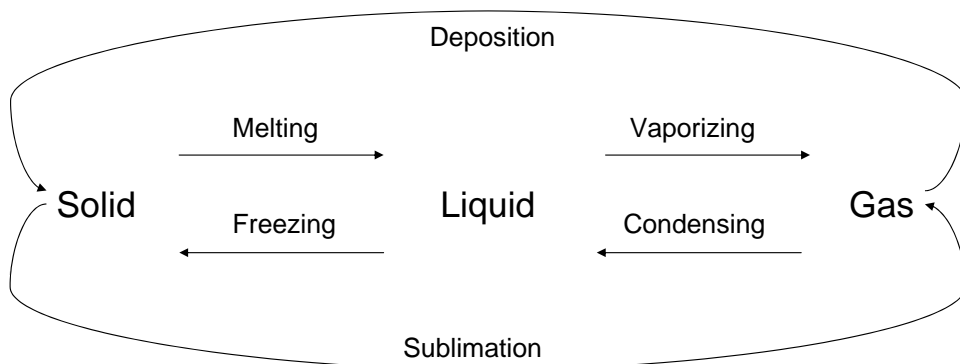
2. Learning Experience(s):

35-40 Minutes

Demonstrations, hands-on activities, images, games, discussion, writing, measuring... What will you do, what will kids do? Describe in order, including instructions to kids.

Activity 1 (to be done with the whole class): Water can be found as a solid, liquid or gas. The state of water depends on temperature and pressure. Where can you find solid water? (Snow, ice, frost. Show a chunk of ice). Where do you find liquid water? (Lakes, ocean, rain. Show liquid water. **Quick activity:** Demonstrate that the liquid water changes shape according to the vessel it is in.) Where can you find gaseous water? (Steam, boiling water, breath on cold morning, humid air in a jungle. **Quick activity:** Breathe on a mirror. What do you see? The air from your lungs is moist. When you breathe on the mirror, the gaseous water condenses to make it wet. This is similar to when the windows fog up in your car. How else can you see water vapor or condensation? Ex. A cold glass gets beads of water on it from the vapor in the air cooling down. As an exercise, dry your hand on your pants. Now gently breathe on your hand. Don't blow on your hand. Just breathe. (Do about 10 breathes, or about 30 seconds.) Now touch your hand. Is it wet?

When water changes from one form to another, it is undergoing a **phase change**. Draw a diagram on the board and let the students help you fill it out:



Questions: When water goes from liquid to ice, what do you call that? (Freezing)
 When water goes from ice to liquid, what do you call that? (Melting)
 When liquid water goes to a gas, it is called *vaporization*. When gas goes to liquid, it is *condensation*.
 What about a solid to a gas? That is a special circumstance where we can observe *sublimation*. (Gas to solid is *deposition*).

Bonus: Discuss the temperature for each transition.

The following activities will be performed in small groups at different stations.

Activity 2: Fun with Dry Ice. Now we are doing to look at a special material called dry ice. (**Caution:** Dry ice is really cold! It can burn your skin very quickly so we can't hold it with bare hands or eat it!) Is dry ice a solid, liquid or gas? (Students may observe that they can see the solid (white) dry ice as well as vapor/gas.) Why is it called dry ice? **Quick demonstration:** Put a chunk of frozen water/ice into one beaker. Put a similar chunk into a second beaker. Let sit out for 10-40 minutes. What happens? Ice will melt, dry ice will sublime. Since there is no liquid phase in the dry ice to carbon dioxide transition, we call it dry ice. The dry ice will "disappear" as it forms a gas and diffuses through the room.



Dry ice undergoes a special phase transition called **sublimation**. That means that it goes from a solid to a gas. We can use this property to blow up a balloon. **Quick demonstration:** Put a few chunks of ice in a balloon. Seal balloon. What is happening? (The solid carbon dioxide is sublimating to form a gas, which occupies a larger volume. This inflates the balloon.) Why does the balloon grow as carbon dioxide forms? (Gases fill up the volume that they are in.) Can we change the shape of the gas in the balloon? (Yes, gases can change shape and volume.) The speed of sublimation depends on temperature. What happens if we put the dry ice in cold water/room temperature water/hot water? (Demonstrate to test hypothesis.)

We know now that dry ice can sublime to a gas. What do you think will happen if we put a small chunk of dry ice in a plastic film canister? (Have students try this.)

Activity 3: Properties of Liquids. The presenter will demonstrate the concept of viscosity using honey, oil, and water. Students will first make observations about each liquid. They will be allowed to stir the liquids and drip them out of Pasteur pipets onto a flat, inclined surface to see how quickly they run down the side. They will observe that certain liquids like honey are very “thick” (viscous) whereas others, like water, are very “thin.”

Next, these liquids will be used to illustrate the concept of density. Which is the most dense? Which is the least dense? If they are combined, which will be at the bottom/middle/top? The presenter will prepare a clear graduated cylinder with each liquid layered by density. Students will discuss why the liquids are separated the way they are. Three volunteers will each add one item to the vessel: a coin, a cork, and a grape. Students will discuss what happens to each object. Do they sink or float? Why do they separate into different layers? The presenter will work with the students to summarize how this experiment demonstrates how different materials have different densities. Then, the presenter will lead a discussion on how we could use this experiment to estimate the density of an unknown material. A paperclip will be used as the unknown. Students will guess which layer the paperclip will settle in based on their guess for its density. This experiment will be repeated to compare the density of a nickel and a dime.

Activity 4: What’s that smell? The presenter will demonstrate the diffusion of gases using materials with different smells. The presenter will explain the concept of diffusion. Diffusion happens when particles mix with each other through random movement. As an example, gases can rapidly diffuse to fill a room (e.g. you can smell popcorn or burnt toast several feet from the microwave or toaster!). Different items, such as food or perfume, have distinct smells from the gases they give off. When the gas reaches our nose we can smell the item.

Demonstration of Diffusion: Volunteers will be asked to stand several feet away from the work station and be blindfolded (or close their eyes). A series of vials containing items with distinctive smells will be opened (e.g. herbs, coffee, vinegar, peanut butter, cinnamon, perfume, citrus fruit, etc.). The students will be asked if they can identify the items by smell. If not, a fan will be blown over the item in the direction of the students. What did the fan do? (The fan makes the smell move faster through the air.)

3. Wrap-up: Sharing Experiences and Building Connections 8 Minutes

Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

- Summarize the properties of matter: solids, liquids, gases.
- Emphasize the observations we made to study the properties of the different phases of water and dry ice.
- Discuss how we could observe the differences in density between different solids/liquids.
- Encourage students to study the properties of matter on their own, either when thinking about things in the classroom or in daily life.

4. Close: 5 Minutes

How can kids learn more? Thanks and good-bye! Clean-up.

If you are interested in applying what you have learned with new experiments, here are some websites you can check out:

<http://www.sciencebuddies.org>

http://www.chem4kids.com/files/matter_intro.html

<http://ga.water.usgs.gov/edu/mwater.html>



<http://www.west.net/~science/co2.htm>

You should also feel free to contact us with questions!

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, and connections for additional learning.

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

Write a letter summarizing the properties of matter and give a specific example of how you can describe a material using the concepts we discussed.

