Bay Area Scientists in Schools Presentation Plan

Lesson Name Oobleck
Presenter(s) SACNAS
Grade Level 3
Standards Connection(s) Physical Science: Matter and its Interactions

Next Generation Science Standards:
2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Scientific & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. -Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-PS1-1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. -Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) **Engaging in Argument from Evidence**	**PS1.A: Structure and Properties of Matter** -Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1) -Different properties are suited to different purposes. (2-PS1-2) **PS1.B: Chemical Reactions** -Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	**Patterns** Patterns in the natural and human designed world can be observed. (2-PS1-1) **Cause and Effect** Events have causes that generate observable patterns. (2-PS1-4) Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) ---------- **Connections to Engineering, Technology, and Applications of Science** Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). Construct an argument with evidence to support a claim. (2-PS1-4) ---------- Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)		

Common Core Standards Connection:
ELA/Literacy
RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-PS1-4)
RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)
RI.2.8 Describe how reasons support specific points the author makes in a text. (2-PS1-2)
W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1-2)
W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2)
Mathematics
MP.2 Reason abstractly and quantitatively. (2-PS1-2)
MP.5 Use appropriate tools strategically. (2-PS1-2)

FOSS Connection: Solids and Liquids

Teaser: What is the difference between physical and chemical change? What are the different observable properties of matter (solid, liquid, gas)? How does the mixture of substances result in a new substance with a different property? Students will distinguish the differences between different states of matter. They will also see that some reactions are reversible while others are not. Lastly, they will attempt to build something with a Non-Newtonian fluid.

Vocabulary/Definitions:
3 – 6 important (new) words

- Matter (a physical substance like solid, liquid and gas)
- Solid (firm and stable in shape)
- Liquid (flowing freely but of constant volume, like water or oil)
- Gas (an airlike fluid substance which expands freely to fill any space available)

Materials:
What will you bring with you?

- Premade oobleck
- Cornstarch in a bag
- Piece of paper
- Lighter
- Metal bowl to contain the paper
- Paper plates
- Toothpicks
- Plastic spoons

Classroom Set-up: *Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed*
Students need to have clear desks. A small table up front for the paper demonstration A whiteboard or chalkboard would be helpful.

Classroom Visit

1. Personal Introduction: ____5___ **Minutes**
Who are you? What do you want to share with students and why? How will you connect this with students' interests and experiences?

2. Topic Introduction: ____10____ **Minutes**
What questions will you ask to learn from students? Big Idea(s), vocabulary, assessing prior knowledge…
What is matter (write definition on board)? Who can tell me the three kinds of matter? What are examples of each (write on board)? Today we are going to learn more about the three kinds of matter plus we will learn about reversible and irreversible chemical reactions.

Some reactions can be reversed, like freezing water into ice and letting it melt again. However, some cannot be reversed like baking a cake. We can't take the individual ingredients out of the cake after we stir and bake it. *Show students piece of paper.* Is this paper a solid, liquid or a gas? I am going to alter this piece of paper by applying heat to it. *Set fire to paper and place into a metal bowl*. Is this a reversible or irreversible reaction? Why?

2. Learning Experience(s): __25-30__ **Minutes**

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

Now we are going to divide up into groups for the next activity. The bowl in the middle of the table has a substance in it we like to call "oobleck". It's made out of cornstarch and water. Is cornstarch a solid, liquid or gas *(pass around bag of cornstarch).* Water is a liquid. What do you think the oobleck will be? Try poking the oobleck quickly with your fingers. What does it feel like? Try letting your finger rest on top of it. What happens? Is it a solid, liquid or gas?

Next, we are going to try and build something with our oobleck. Discuss with your team what you thing would be best to build with oobleck and toothpicks. You have __ minutes to build the best structure you can!

Basic Oobleck Recipe: 2 parts cornstarch: 1 part water

3. Wrap-up: Sharing Experiences ___10____ **Minutes**

Discussion:
We will discuss the notes/data we have gathered. First, go ahead and discuss in your group what data you have gathered.

What were the materials we started out with?
What kinds of properties did they have?
What kind of properties does this new substance have?
Why do you think this happened?
Were there any color or temperature changes?
Do you think this is a reversible or irreversible reaction? Why?

What were the challenges in building something with your oobleck?
What materials do you think would work better than the oobleck? Why?

4. Connections & Close: ____5____ **Minutes**

What else might kids relate this to from their real-life experience? How can they learn more? Thanks and good-bye! Clean-up.

Total 50 – 60 Minutes

Background Information

Why does my Ooze act like that?

Your Ooze is made up of tiny, solid particles of cornstarch suspended in water. Chemists call this type of mixture a colloid.

As you found out when you experimented with your Ooze, this colloid behaves strangely. When you bang on it with a spoon or quickly squeeze a handful of Ooze, it freezes in place, acting like a solid. The harder you push, the thicker the Ooze becomes. But when you open your hand and let your Ooze ooze, it drips like a liquid. Try to stir the Ooze quickly with a finger, and it will resist your movement. Stir it slowly, and it will flow around your finger easily.

Smack water with a spoon and it splashes. Smack Ooze with a spoon and it acts like a solid.

Most liquids don't act like that. If you stir a cup of water with your finger, the water moves out of the way easily--and it doesn't matter whether you stir it quickly or slowly.

Your finger is applying what a physicist would call a sideways shearing force to the water. In response, the water shears, or moves out of the way. The behavior of Ooze relates to its viscosity, or resistance to flow. Water's viscosity doesn't change when you apply a shearing force--but the viscosity of your Ooze does.

Back in the 1700s, Isaac Newton identified the properties of an ideal liquid. Water and other liquids that have the properties that Newton identifies are call Newtonian fluids. Your Ooze doesn't act like Newton's ideal fluid. It's a non-Newtonian fluid.

There are many non-Newtonian fluids around. They don't all behave like your Ooze, but each one is weird in its own way. Ketchup, for example, is a non-Newtonian fluid. (The scientific term for this type of non-Newtonian fluid is thixotropic. That comes from the Greek words thixis, which means "the act of handling" and trope, meaning "change".)

Quicksand is a non-Newtonian fluid that acts more like your Ooze--it gets more viscous when you apply a shearing force. If you ever find yourself sinking in a pool of quicksand (or a vat of cornstarch and water), try swimming toward the shore very slowly. The slower you move, the less the quicksand or cornstarch will resist your movement.

From the Exploratorium: http://www.exploratorium.edu/science_explorer/ooze.html

Follow-up – After Presentation

Suggest students write a letter explaining "What did we learn about the states of matter?"

In Spanish: Mateo y Cientina (Lawrence Hall of Science)
http://www.lawrencehallofscience.org/kidsite/portfolio/oobleck-2/

Worksheets and Activity Ideas and alternative recipes for Oobleck (Thomas Jefferson National Accelorator Facility – Office of Science Education) http://education.jlab.org/beamsactivity/6thgrade/oobleck/oobleck.pdf

Bartholomew And The Oobleck by Dr. Seuss http://www.amazon.com/Bartholomew-Oobleck-Dr-Seuss/dp/0833542125