Bay Area Scientists in Schools Presentation Plan

Lesson Name: Exploring States of Matter!
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Grade Level: 1st

California Science Standards Connection(s):
1-PS: States of Materials
1) Solids, liquids, gases have different properties
2) Substances change properties with mixing, cooling, heating

Next Generation Science Standards:
2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

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<th>Science &amp; Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
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<td>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. •Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1-ESS1-2)</td>
<td>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)</td>
<td>Patterns •Patterns in the natural and human designed world can be observed. (2-PS1-1) Structure and Function •The shape and stability of structures of natural and designed objects are related to their function(s). (1-LS1-1)</td>
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<td>Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. •Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1-ESS1-1)</td>
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Common Core Standards:

ELA/Literacy:
W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Mathematics:
MP.2 Reason abstractly and quantitatively. MP.5 Use appropriate tools strategically.

FOSS Connections:
Grade 1 Module: Solids and Liquids
Abstract:
Students will have fun exploring solids, liquids, and gases at three stations. To develop definitions and understanding they will record their observations and experiences in their own science notebooks.

Vocabulary/Definitions:
Matter - the stuff everything around you is made of
State of Matter - separable types of matter
Solid - a phase that is difficult to change the shape of; has structure
Liquid - a phase that takes the shape its container, and won’t escape from the container
Gas - a phase that completely fills its container, needs a lid to hold it in!

Materials:
We will bring:
- Hot plate
- Ice
- Beaker
- Tank
- Pumice
- Chopsticks
- Plastic silverware
- Cotton
- Coins
- Notebooks, printout folded in half
- Blue water
- Oil
- Yellow rubbing alcohol
- Beakers
- Pipettes
- Pipette bulbs
- Corn syrup
- Honey
- Baby oil
- Paper towel
- Balloons
- Argon balloon
- Helium balloon
- Analytical balace
- Liquid nitrogen
- Filter flask
- Aerosol
- Sand
- Foam (shaving cream)
- Jello

We will need:
☐ Water

Classroom Set-up:
☐ We will be flexible with student seating; we will talk to the teacher in advance to learn about their classroom setup and get tips from the teacher about the best way to divide the class into three groups for the stations segment of the lesson.
☐ Access to power and water would be helpful. If water is not available we can bring our own.

Classroom Visit

1. Introduction

Personal Introduction:
We are graduate students from UC Berkeley studying organic chemistry! We are originally from all over the country but the one thing we share is a passion for science.
Topic Introduction: 8 Minutes
Introduce vocabulary, starting by asking the students “what is matter?” Discuss what matter is and move on to phase using solid, liquid and gas as examples of different phases. To demonstrate the three phases we will use H$_2$O.

Demo: First ask, who knows what water is? Ice? What happens when ice is left out? What happens when water evaporates? These are predictions that scientists make. We will demonstrate these changes in matter. A beaker of liquid H$_2$O will be placed on a hot plate, as the water is heated and begins to boil the bubbles are H$_2$O as a gas. Next, a watchglass with ice will be held over the steaming beaker. The ice is a solid but will quickly melt into liquid water. This exercise is to demonstrate that one type of matter (H$_2$O) can exist in three phases: solid, liquid and gas.

2. Learning Experience(s): 25 Minutes
For the bulk of the lesson, the students will be divided up into three groups to visit stations (~8 minutes/station). The students will be armed with a notebook to record their observations, just like real scientists!

Solid Station:
Introduction to solids- What makes something a solid? Some solids are hard, others are soft and squishy; some are heavy, others are light.

Activity- Float or Sink? Students will have the opportunity to touch several different solids and describe their properties. One specific property that will be explored is density. Students will predict whether an object will float or sink, then place the object in a tank of water to test their hypothesis. Objects will include but are not limited to: pumice, wood (chopsticks), plastic (plastic silverware), cotton, metal (coin). The students will be encouraged to record their findings in their notebook in the solids section.

Liquid Station:
Introduction to liquids- Definition- takes the shape of its container, but the liquid will stay in the container on its own, without a lid.

Demonstration- Exploring the mixing of liquids. Some liquids will mix with each other and others will not. To demonstrate this property of liquids (a) water colored blue will be poured into a beaker containing oil, the students will observe two layers because water and oil will not mix and (b) water colored blue will be poured into a beaker containing rubbing alcohol colored yellow, the two liquids will mix to make a green solution!

Activity- To explore another property of liquids, how thick they are, students will have liquid races. Students will pipette a drop of liquid onto Plexiglas on an incline. Potential liquids include: baby oil, water, honey, corn syrup, etc. Students will be able to observe the different speeds of the different liquids.
Gas Station:
Introduction to gases- Definition- gases expand to fill their container and have mass

Demonstrations-
Gas has mass! Two balloons, one containing He and the other Ar, will be demonstrated. The Ar balloon will sink and He will float. They weight different amounts. The Ar balloon weighs more.
Gas takes up space! Liquid nitrogen will be poured into a filter flask that has a balloon over the side arm. When the flask is capped, the balloon will quickly begin filling with nitrogen gas demonstrating that gas takes up space.
What is that smell? To demonstrate that gases expand to fill the container they are in, an aerosol will be sprayed at one side of the room. Students will be asked to raise their hands when they can smell it, soon everyone will be able to smell the diffused aerosol.

3. Wrap-up: Sharing Experiences and Building Connections 5 Minutes
We will bring everyone back to one group to review the exciting things learned that day. Students will be asked what types of properties each state of matter has.
We will review vocab
Students will be given challenging items and asked to classify them, such as:
Sand
Foam
Jello
Questions?

4. Close & Clean-up
2 Minutes
TOTAL 42 Minutes

Differentiated Instruction:

English Learners: Repeat directions, if necessary, and physically model how to perform activities at each station. Write vocabulary, e.g. solid, liquid, gas, on the board and read words aloud. Vocabulary words can also be visually demonstrated, e.g. using an illustration, and/or redefined in very simplistic terms.

Advanced Learners: Have students think of other other examples of solids, liquids, and gases. Students can draw/write about their examples in their science notebooks.
Follow-up Possibilities

ELA Activity:
Students respond to the following journal prompt:
- Write a letter to a friend telling them about what you learned about solids, liquids, and gases. Give an example of each.

Reading:
- Everything Is Matter by David Bauer (also available in Spanish) [http://www.amazon.com/Everything-Matter-Yellow-Umbrella-Books/dp/0736829423]

Mathematics Activity:
- Have students count and add the number of liquids, solids or gases they can find in their homes. Students can also graph the data.

Other:
Students explore outside play area and record what states of matter they observe.