**VANDERBILT STUDENT VOLUNTEERS FOR SCIENCE**

**http://studentorgs.vanderbilt.edu/vsvs**

**Solids, Liquids and Gases and Lava Lamps**

**Elementary school**

**Fall 2012**

**Materials**

12 JUMBO test tubes and holders

36 ¼ pieces of Alka Seltzer tablets

10 extra Alka Seltzer tablets (whole)

12 2oz bottles water

12 jars full of beads

12 jars half full of beads

12 jars containing 3 beads

12 2oz bottles vegetable oil

2 dropper bottles food coloring

12 plates

**The following terms may be introduced throughout the lesson – these are for your information only, and should be introduced only if appropriate for the grade level.**

1. **chemical reaction** When one or more substances break apart, and then recombine in a different way.
2. **density**  A measure of the amount of matter in a substance.
3. **gas bubble** One type of gas bubble has a thing liquid film that is filled with gas.Example: soap bubbles, bubbles formed in soda
4. **soluble** Able to thoroughly mix with another substance. Salt is soluble in water. The salt breaks into parts that spread evenly throughout the water.
5. **insoluble**  Not able to mix. Separate when added together. Oil and Water are not soluble, thus oil is insoluble in water or vise versa.
6. **state of matter** Four common forms of matter: solid, liquid, gas, and plasma

**A. The States of Matter: Solids, Liquids, and Gases**

* Ask students to name the 3 states of matter are? *Ans. Solid, liquid, gas*
* Ask students to name the 3 states of water are? *Ans. Ice (solid), liquid, and water vapor (gas).*

**Note**: Write the different states on the board. Ask the students to identify the processes involved in each change of state, and add to diagram. (melts, vaporizes, condenses, freezes)

**Solid (*melts)* 🡪Liquid (*vaporizes)*  🡪Gas**

**Gas (*condenses*) 🡪Liquid (*freezes*) 🡪Solid**

* Pass out the jars of beads to the groups. Tell students that the beads represent water molecules.
  1. Tell students to pick up the jar that is completely filled and have them gently shake it. The beads can hardly move - this is like the molecules in a solid, like ice. Solids can change to liquids by **melting**.
  2. Tell students to pick up the jar that is half filled and have them gently shake it. The beads are able to move more freely. This like the molecules in a liquid such as water. Liquids changes to a gas by **vaporization** (boiling).
  3. Tell students to pick up the jar that has only 3 beads in it and have them gently shake it. The balls are far apart and can move a lot. This is like the molecules in a gas, like the steam that comes out of a boiling pot of water.

Tell students they are going to do an experiment involving a solid, liquid and gas. The Alka Seltzer or effervescent tablet is the solid, water is the liquid, and a gas is given off when the 2 are added together.

Ask students what they know about Alka Seltzer or effervescent tablets.

* Effervescent tablets contain 2 chemicals called citric acid and sodium bicarbonate. When water is added, these ingredients dissolve and react with each other to produce carbon dioxide gas.
* They are often used to help people with upset stomachs.
* Remind students that the tablets and water must be treated like chemicals, and kept away from mouths.
* What state of matter is the water? *Liquid*
* What state of matter is the Alka-Seltzer pill? *Solid*

**B. Activities**

**Experiment I – Observing the Reaction When an Alka Seltzer Tablet is put into Water.**

Pass out 1 test tube, 1 rack, ¼ alka seltzer tablet, and 1 2oz bottle filled with water to each pair.

Ask students to tell you which chemical is the solid (the alka seltzer tablet), and liquid (water). How do they know?

Tell students to:

1. Put the test tube in the rack.
2. Pour the water into the test tube. Remind students that liquids take the shape of a container.
3. Add the Alka Seltzer tablet piece to the water and observe what happens.

Ask students:

1. To tell you their observations and record them on the board. (bubbles, fizzing, solid disappears,..)
2. What is the scientific term for the bubbles? *Gas being given off.*
3. What happens to the gas bubbles? *They rise to the surface.*
4. Why does the gas rise to the surface? *The gas bubbles are lighter (ie less dense) than the water.*
5. What color is the gas? *Colorless.*

Give students another ¼ alka seltzer tablet and tell students to repeat the experiment and to look closely for all the observations mentioned above.

1. Ask students what are other examples of a gas being given off.

*Bubbles from a soda pop, boiling water,….*

**Explanation (adapt to the grade level)**

1. The Alka-Seltzer tablet reacts with the water to make bubbles of carbon dioxide gas.
2. The gas bubbles have a thin skin of water.
3. The bubbles are lighter than water and rush upwards.
4. Once at the surface, the skin breaks and carbon dioxide bubbles burst into the surrounding air.

**Experiment II – Making a Lava Lamp**

**Safety Considerations: DO NOT seal the bottles while the Alka-Seltzer reaction is in progress.**

1. A VSVS member will add 1-2 drops of food coloring to the water in each test tube.
2. Pass out a 2oz bottle of oil to each pair and another ¼ tablet. Tell students to add the 2 oz bottle of oil to the test tubes.
3. Ask the students what they observe. *They should see the 2 layers.*

Explain that both the oil and water are liquids, and that oil always sits on top of water because it is less dense (lighter) than water. Oil and water don’t mix because water

molecules are not attracted to oil molecules.

1. Note that the food coloring stays in the water and not the oil.
2. Tell students they are going to add another piece of Alka Seltzer tablet to the test tube. Ask students if the can predict what might happen. (*Write predictions on the board.)*
3. Tell them to add the ¼ tablet to the water/oil and ask students to tell you their observations – write them on the board.
4. Ask students: how do you know it is the water falling back down (*it is blue*)?

Explanation

1. When the Alka-Selzer tablet is dropped in the oil and water, it sinks to the bottom because it is denser than oil and water.
2. The tablet begins to dissolve in the water and the chemicals in the tablet react with each other creating bubbles of carbon dioxide gas.
3. The bubbles have a thin skin of **colored** water.
4. These bubbles are filled with carbon dioxide gas, which is lighter than the water AND oil so they not only rise through the water and oil layers but break through the oil's surface into the air above it.
5. Since the skin around the carbon dioxide bubbles is make of colored water, As the bubbles rise through the oil layer, bits of oil stick to the colored bubbles giving them odd shapes. When the bubbles break at the oil's surface, the gas escapes into the air and colored water skin as well as the oil stuck to it sink. The oil stays in the top layer and the colored blobs of water return to the bottom water layer. ,
6. So the ball of water sinks down through the oil and joins the rest of the water.

**C. Review**

Ask students to tell you what materials used today were solids, liquids and gases.

Tell students they can make their own lava lamps at home using vegetable oil, a soda bottle or jar, water and food coloring. Caution students to NOT cap the soda bottle after the tablet is added.

References/Citations

1. Make Your Own Bubbling Lava Lamp, http://www.stevespanglerscience.com/experiment/00000035Lava Lamps (4 of 4)
2. ACS