Extending “Bubble Trouble” In Your Classroom

This study guide is meant to build on the enthusiasm and curiosity of your students about bubbles after watching or participating in the “Bubble Trouble” performance. These activities are fun and engaging and can act as an introduction to the scientific principles they demonstrate.

ACTIVITIES FOR GRADES 3 to 5

1) How Can We Prove That the Skin of a Bubble Can Stretch?

Start by eliciting student suggestions of proofs. Form small groups of students to test these proofs. If you wish to demonstrate a proof, try the following:

Materials: bubble solution, table or flat surface, straw

Process: Blow a bubble with a wet straw onto a wet table. Draw a circle around the bubble and measure the diameter. Then carefully put the wet straw inside the bubble and blow a bubble inside the bubble. Measure again to show that the outer bubble is now bigger. Repeat with bubbles within bubbles. Elicit

from students that the skin of the outer bubble keeps stretching. Ask why the skin is stretching. (Each bubble adds more air.)

An alternative method: A wet hand inside a bubble will also stretch the skin.

2) What Can Float on Water? Surface Tension and Cohesion of Water

Use this experiment for demonstrating the property of surface tension in water. Tell students that you will show how to create a “skin” on the surface of water. The skin is a film that will allow something that is heavier than water to float on top of the water.

Materials: water in a glass, paper clips, paper napkin or towel, liquid dish soap

Process:

1. Ask: “Do you think this paper clip will float on the water?” Drop paper clip in and ask why it sank. (The metal clip is denser than the water.)

2. Place a piece of absorbent paper on the water. It should be slightly bigger than the paper clip. Next, place a paper clip on the paper. Within a minute or two, the paper towel will sink to the bottom of the glass, but the clip will float on the water.

3. Ask students to explain why the denser clip can float on the less dense water.

Explain that the strong electrical attractions between water molecules creates a kind of “skin” on the surface of the water. The “skin” is a dense film that can support the paper clip.

4. Squeeze a small drop of dish soap into the water. The soap will break up the surface tension of the water molecules. The paper clip will then sink because the water now has less density. Challenge students to find other materials that float on water. (Ice cubes are an example.)

3) Why Is That Balloon Blowing Up By Itself?

Creating a Chemical Reaction That Produces Bubbles of Carbon Dioxcide

Materials:

balloons

narrow funnel

measuring spoons

measuring cup

warm water

one teaspoon active dry yeast

one teaspoon sugar

tape measure

Process:

1. Ask: Can a balloon blow up without someone putting air into it?" Demonstrate by inserting the bottom tube of a funnel into the opening of the balloon. Stretch the balloon if needed.

2. Put the yeast and sugar through the funnel into the balloon. Pour warm water through the funnel and then remove the funnel from balloon. Tie a knot to keep the yeast, sugar, and water mixture inside the balloon. Measure the balloon.

3. Put the balloon in a warm spot. Wait and watch while it keeps expanding. Measure the balloon when it is fully expanded.

4. Challenge students to explain what happened. You might give them the hint that a chemical reaction with bubbles is involved. The explanation is that the yeast uses the sugar and water to grow inside the balloon. As the yeast expands, it gives off bubbles of carbon dioxide. The bubbles burst and fill the balloon with the gas.

4) How Can We Make Fog In a Jar?

Tell students that fog is actually a cloud made up of tiny droplets of water suspended in air.

Ask: How does fog form? This experiment will show how this happens.

Materials: glass jar

black paper to wrap around jar

hot water, matches

plastic bag of ice cubes

Process:

1. Tape the black paper around the bottom half of the jar.

2. Fill the jar to the top with hot tap water. Let it heat the jar for a minute. Then pour out two-thirds of the water.

3. Light the match and hold it over the jar opening. Wait several seconds. Then drop the match into the jar and quickly cover the top of the jar with the bag of ice.

4. Ask students to observe the fog as it forms. If this does not happen, repeat the actions in step 3. Have students share their observations as they watch the fog form, next, separate into water droplets that adhere to the glass, then collect into water drops that run down the inside of the glass jar.

5. Ask: Why does the fog form inside the jar? Explain that the air inside the jar becomes warm and wet. The air rises to the top of the jar where it is cooled by the ice cubes. When warm, wet air meets cold, wet air, they create a fog of small, light water droplets.

6. Ask: Why do the water droplets adhere or cling to the glass inside the jar?

Explain that the water droplets have the property of clinging to each other. They move together and become heavier. This property is called cohesion. The heavier water drops also have the property of

clinging to other material. This property is called adhesion. The water drops adhere to the glass. Then, as the drops get heavier, they run down the side of the glass jar.

5) Research and Arts Projects: Have students work individually or in small groups to do any of these projects or another suitable one of their own design.

- construct a three-dimensional model of the molecular structure of water as a gas, liquid, and solid
- make a video of students demonstrating and discussing any of the experiments above
- use creative movement to express the different forms of water: fog, cloud, liquid water, ice and how one changes to another
- create a rap song or hip-hop dance about bubbles, fog, or water and its properties

These activities support the following standards:

Arts Standards for the Saratoga, NY Schools

Grades 3-4 Early Elementary Standards

demonstrate ways of moving in relation to people and environment.

Theater and Dance –Kinetic energy

present different forms of movement energy- work as a group

Middle School standards (Gr 5)

use language, voice, gesture, movement and observation to express their experience and

communicate ideas and feelings

Next Generation Science Core Ideas

PS1: Matter and Its Interactions; PS1.A Structure and Properties of Matter

PS1.B Chemical Reactions

PS2: Motion and Stability: Forces and Interactions

PS2.A: Forces and Motion; PS2.B: Types of Interactions

ACTIVITIES FOR GRADES 6 to 8

1) What Makes Soda Fizz?

Introduce the activity by asking: What makes soda fizzy? Explain that soda contains the gas carbon dioxide, which has been mixed under pressure with the liquid during manufacturing. This process is called carbonization. Without carbonization, sodas would taste flat and boring. When you open the can, the pressure is released. Carbon dioxide gas bubbles burst free from the soda and pop out of the can as fizz.

Materials: One can of very cold soda and two cans at room temperature.

Process:

1. Open the very cold soda can quickly. Note the amount of bubbles of carbon dioxide gas or “fizz.”

2. Then, open the can that is room temperature and compare the fizz. Ask: What makes the very cold soda more fizzy than the room temperature soda?

Explain that when the soda is cold, the carbon dioxide gas molecules are more tightly held in the liquid. When the cold can is opened, the pressure drops and the carbon dioxide gas bubbles rush out. In the room temperature can, the pressure holding the gas inside the liquid is much less. So there is little or no fizz when you open the can.

3. Ask: Why does shaking a can of soda increase the amount of fizz? Have a student shake the room temperature can rapidly and then note the amount of fizz when the can is opened. Have students form small groups to use the information they have learned in this activity to explain why. Answer: Shaking the can provides carbon dioxide molecules with more “energy” to break free from the liquid. Opening the can produces more fizz.

2) Build a Bubble-Powered Paper Rocket

Materials: regular notebook size paper (8 ½ by 11”), plastic 35-mm film canister

Warning: Everyone involved must wear eyeglasses, sunglasses, or safety glasses.

Process: Make the Rocket

- Adapted from www.nasa.gov "NASA's The Space Place," which contains a pattern and more details.

(must have cap that fits INSIDE rim, not outside), cellophane tape, antacid tablet that fizzes, scissors, paper towels, water.

Blast-off must occur outdoors on a sidewalk or driveway.

Students can work in pairs or small groups and decide how to cut the paper to make a long, thin or short, fat rocket. They can make a sharp or blunt nose cone and decide whether or not to add fins to the rocket. (See website for paper patterns, if needed.)

1. Cut out pieces for rocket from sheet of paper.

2. Tape the canister to the edge of an 11-inch long piece of paper. Roll paper around edge of canister and tape into place. Be sure to position the lid end of the canister at the bottom of the rocket. The lid will be blown off to make the rocket shoot into the air.

3. Tape fins to the rocket body. Tape a nose cone to the top of the rocket.

Blast-Off

1. Put on eye protectors. Remove lid from bottom of canister. Fill canister one-third with water.

2. Quickly: Drop one-half of antacid tablet into canister. Snap lid on tight.

Put rocket on outdoor flat surface such as sidewalk or driveway.

Then, STAND BACK!

3. The rocket should blast off!

Ask: What powered the rocket? What did bubbles have to do with it?

Explain that the tablet, when placed in water, begins to fizz or allow tiny bubbles of gas to escape. The bubbles move up, not down, because they weigh less than water. At the surface of the water, the bubbles break open. The gas that is released then presses on the sides of the canister and pops the bottom lid open. Water and gas rush out of the bottom of the rocket and blast the rocket into the air.

3) Bubbles, Colors, and Light

Review that light is made up of different colors. Different wave lengths create different colors to the human eye.

Activity:

Materials: strong bubble solution sufficient to create large bubbles large bubble wand

Process: Have students create the largest bubble they can. Tell them to keep blowing on bubble until it breaks up and fades.

Ask: What colors do you see on bubbles and where? What happens to the colors of the bubble over time? Which colors last longest and why?

Discuss these questions with students and share these principles:

Why do bubbles have color? Bubbles reflect the light waves in their surroundings. The light waves hit the outer surface of the bubble and then, in a split second, the inner surface. The two light waves reflect back to our eyes as color.

Why does the color of the bubble fade?

Light waves create color, but they can also make the bubble lose color. A bubble wall can get thinner over time because the bubble solution is weak or the chemicals have fallen to the bottom of the bubble. The walls of the bubble keep getting thinner and closer together. The two reflected waves of light get closer until they meet. Then, they cancel each other out and the bubble loses its color.

Why are there different colors on different parts of the bubble?

Different parts of the bubble wall have different thicknesses. The thicker the section of wall, the more intense color is created by the light waves.

4) Research and Share

Have students work in pairs or small groups to research the scientific principles of chemistry and physics that answer the following questions and report back to class.

- What are the physical and chemical forces that create and maintain a bubble?
- How do light waves reinforce or cancel out each other? Research constructive and destructive interference.
- How do the colors of a bubble change over time? Which colors last the longest? the shortest? Why are some colors more intense than others?

5) Creative Projects

- take still photos or videos of bubbles and bubble experiments
- create bubble demonstrations for students in lower grades
- create a colored fog show using light gels
- demonstrate how to create a rainbow by breaking white light into its spectrum of colors
- use the computer to create bubble art
- start a class blog about science experiments and discoveries
- encourage students to use their creative imaginations to create a project

These activities support the following standards:

Arts Standards for the Saratoga, NY Schools

Middle School Standard 1: Creating, Performing, and Participating in the Arts

Next Generation Science Core Ideas

PS1: Matter and Its Interactions; PS1.A Structure and Properties of Matter

PS1.B Chemical Reactions

PS2: Motion and Stability: Forces and Interactions

PS2.A: Forces and Motion; PS2.B: Types of Interactions