Cross-Curricular Activities Connected to Physical Science, Grade 5

The following activities from ***Structure and Properties of Matter,*** integrate math, social studies, English Language Arts (ELA), art, and more into physical science topics. These cross-curricular connections help students see how science is related to their lives, and the world they live in. These activities reinforce and extend ideas about physical and chemical changes and are perfect for learning-from-home lesson plans. Permission is granted to incorporate these activities into teacher and parent lesson plans.

Practice Displacement (Math)

Remind students that 10 mL of water has a volume equal to 10 cubic centimeters, or 10 cm3. Using that simple conversion, they can find the volume of any shape of submersible object by measuring the displacement of water. Encourage students to practice finding volume using displacement at home (but using only objects approved by a supervising adult). Students can even find the volume of their own bodies! With the help of a supervising adult, students can mark the level of water in a bathtub on the side of the tub with a grease pencil. While the student submerges briefly, the supervising adult marks the higher water level. Using a plastic pitcher of a known volume, they count the number of additional containers of water needed to raise the water from the first line to the second.

Balloons Over Broadway (Literacy)

Read Balloons Over Broadway by Melissa Sweet aloud to the class. Discuss and describe the properties of matter that Tony Sarg used to make his special balloons for the Macy's Thanksgiving Day Parade.

Investigate Compression (Science)

Compression is another characteristic that differentiates solids, liquids, and gases. Provide students with a plastic syringe and some common materials to investigate compression. Have students remove the plunger from the syringe and drop a couple marbles or small pieces of chalk into the cylinder. When they replace the plunger and press it in, students can observe that the solids do not easily compress. By replacing the solids in the cylinder with water and covering the open end firmly with a finger, students can press the plunger and observe that liquids do not compress easily, either. Finally, by covering the opening and pressing on the plunger with only air in the cylinder, students can observe that the gas compresses to a smaller volume and then expands, pushing the plunger out again when they release the pressure.

Ice Cream (Science)

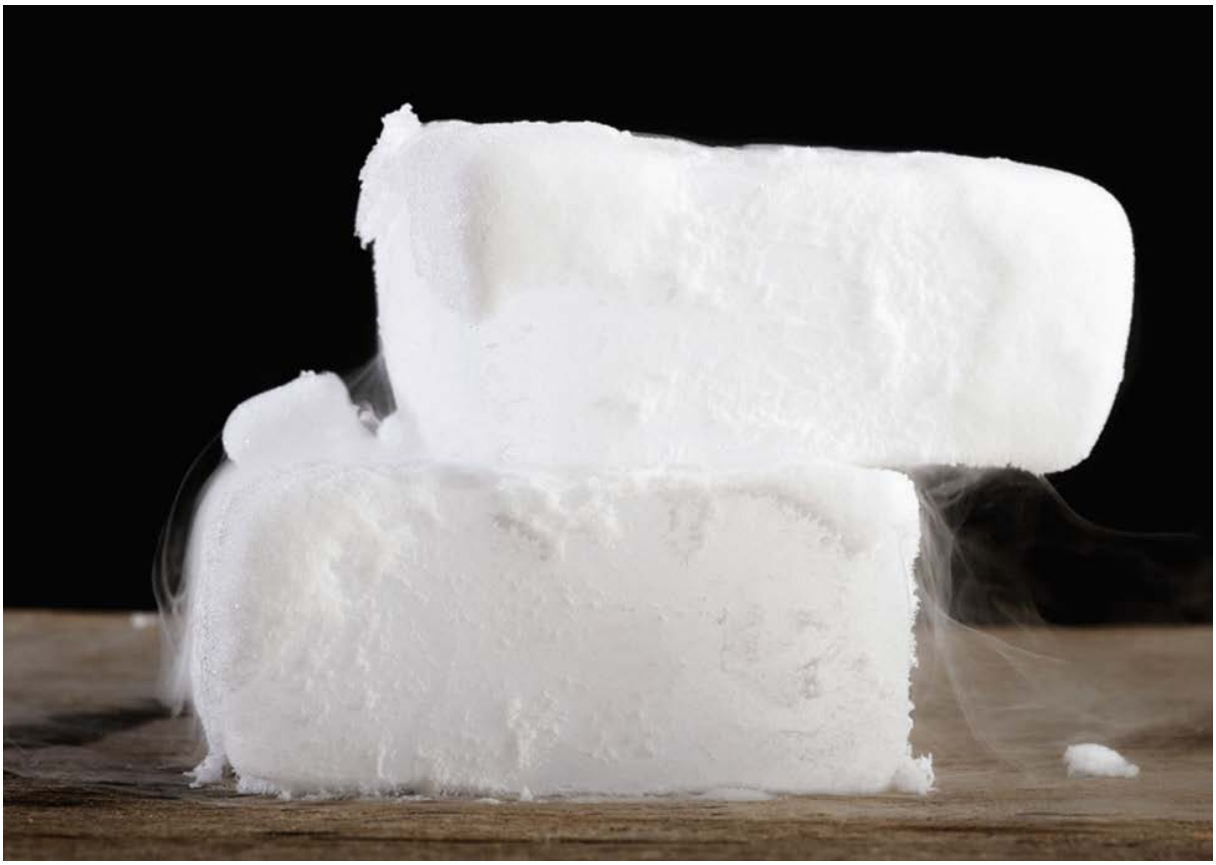
For a fun experience changing a liquid to a solid, invite students to make single portions of ice cream in plastic bags. Place one-half cup half-and-half, one-quarter teaspoon vanilla, and about one tablespoon sugar in a durable, sandwich-size, zip-top bag. Press most of the air out of the bag and zip it closed securely. Place that bag inside a gallon-size zip-top bag with two cups of ice cubes (about one tray) and six tablespoons salt. Shake and gently toss the bag for 5–10 minutes. Tips: Play music to add fun and make the time pass more quickly. Have students wear gloves or mittens. Caution students against handling the bags too roughly and spoiling their snack!

NOTE: Check for food allergies before conducting the activity. Students with dairy allergies should not participate in this activity.

Skipping a Step (Science)

Typical observations of water changing state involve the transition from solid to liquid to gas. Substances can also change directly from solid to gas (sublimation) or gas to solid (deposition). Students have observed deposition if they have ever seen frost form on a cold window directly from the winter air without precipitation of any kind. You may be able to demonstrate sublimation in the classroom by adding salt to ice water in an aluminum can. The outside of the can will “frost” from the humidity in the air in much the same way the cup of ice water formed “dew” in Investigation B of this lesson. You can show students sublimation by displaying a piece of dry ice. The solid form of carbon dioxide changes directly to carbon dioxide gas without passing through a liquid state.

NOTE: Use caution when handling dry ice. Use only in a well-ventilated space and avoid all contact with skin.



Liquid Layering (Science)

Conduct a more elaborate density demonstration by increasing the number of liquid layers. Use, in this order, honey, corn syrup, 100% pure maple syrup, whole milk, dish soap, water, vegetable oil, rubbing alcohol, and lamp oil. The water and the rubbing alcohol can be colored with food coloring for contrast. Add a few solids of varying densities to sink, float, or suspend in the different liquid layers. Select items such as a metal bolt, a die, a grape, plastic and metal beads, or a table tennis ball. If materials and workspace permit, have students build density columns themselves.

Shape, Volume, Density, and Buoyancy (Engineering)

Provide pairs of students with aluminum foil, modeling clay, and a container of water. Challenge them to make the foil and the clay both sink and float. If students need a hint, tell them to think of the shape of a boat. Have students write in their science notebooks an explanation in their own words about how they are able to accomplish this challenge and why their approach works. (Students at this level do not need to know the mechanics of how mass, volume, density, and pressure produce buoyancy. However, with a little guidance, they can grasp that a bowl or boat shape contains a volume of air. Simplified, a “bowl of air” is treated as a single object, with the combined mass, volume, and density of the bowl material plus the air. A larger bowl shape—larger volume containing more air—can have less density overall than the same volume of water and can float in it.)

Ice Oddity (Literacy)

Water defies the expectation that the solid form of a substance is more dense than its liquid form. While the particles are locked in place, making ice rigid, ice floats in liquid water, demonstrating that the solid is less dense than the liquid form. Have students observe ice floating in water and then write a paragraph that explains why ice floats in water and how this behavior differs from that of the liquid and solid states of most other substances.

Temperature and Solutions (Science and Math)

Provide time and materials for students to experiment with saturation in sugar-water and saltwater solutions. Include cups, measuring spoons, water (tap, warm, and room temperature), salt, sugar, ice, thermometers, and stopwatches. Prompt students to make predictions about and to test how temperature affects the quantity of each solid that will dissolve in an amount of water and the rate at which it dissolves. Coach students on the preparation of a table in which to record their data and a graph in which to display it.

Read Aloud (ELA)

Read aloud to the class Mixtures and Solutions: The Sugar in the Tea by Emily Sohn and Joseph Brennan. Have students look for text features as you show the pages. After the first reading, go back through the pages with students to discuss how the text features can help them find information or locate the answers to questions quickly.

Make Lemonade (Science and ELA)

Lemonade is a simple solution of water, sugar, and lemon juice (often served as a mixture with ice). Provide ingredients and coaching for students to find the quantities of each that make the best-tasting lemonade. Have students work in small teams to develop their recipes and hold a contest to select the class favorite. On another day, have all groups make lemonade again using the winning recipe. Facilitate a discussion about whether it matters in what order the ingredients are mixed. (For example, if sugar is added after the ice, it takes longer for the sugar to dissolve in the cold lemon-water.)

More Vinegar and Baking Soda (Science)

Have students experiment with variations of the vinegar and baking soda reaction. Provide resources, and instruct them to repeat mixing the materials, adjusting one variable at a time and recording the adjustments to compare their actions. Variations include:

- increasing or decreasing the amounts of either ingredient
- diluting the vinegar with different amounts of water
- changing the temperature of the vinegar/water solution

The materials can be mixed in open containers; the balloon setup used in class to capture the carbon dioxide is not required. Another variation is to make a "time release" paper pouch of baking soda to drop into vinegar inside a sealed zip-top bag. Coach students on controlling variables in their contrasting trials and recording their data. Encourage students to display their results in a graph.

NOTE: The bags can inflate to the point of bursting. Do this variation outdoors! Always have students wear safety goggles during chemistry experiments.

Measuring Liquids Story Problem (Math)

Have students work in pairs to solve the following word problem: Andy used a large graduated cylinder to make a mixture of juice and then divided the mixture evenly among himself and three friends. He added 260 mL of grape juice, 200 mL of orange juice and 140 mL of apple juice. Graph the milliliters of different juices on a line plot to determine the total amount of juice in the mixture. Then determine how many milliliters of the mixture each person received.

Growing Foam! (Math and Science)

Distribute safety goggles to the class. Everyone must wear safety goggles during this demonstration. Place an empty 16-oz plastic soda bottle in the center of a basin. Add 3–4 drops of food coloring to 20 mL 6% hydrogen peroxide solution and pour the peroxide into the bottle through a funnel. Add 10 mL of dish soap to the bottle. Finally, pour in 1 oz of yeast dissolved in 2 T of water and remove the funnel. Have a volunteer touch the bottle to report if the temperature changes. After a minute or two, foam will shoot up out of the bottle, run into the basin, and eventually begin to come out in a steady stream. In this reaction, the hydrogen peroxide quickly decomposes, producing oxygen gas. The dish soap catches the gas in bubbles to form foam.

Colors, Cabbage, and Chemistry (Science)

Boil a shredded head of red cabbage in about five cups of water until it is fully cooked. Strain the cabbage out, and cool and retain the purple juice. As a demonstration (or have students do this), combine half-cup portions of purple cabbage juice with one-quarter cup of each of the following: lemon juice, vinegar, water, water plus two tablespoons of baking soda, cola, liquid soap, and pickle juice. The cabbage juice is an indicator solution that turns red when reacting with acidic substances and green when reacting with bases.

Water in an Emergency (Community and ELA)

Take the class to the library to find Survivor Kid: A Practical Guide to Wilderness Survival by Denise Long and similar titles. Have students work on their own to research the literature and use text features to find more information about making a filter or finding clean drinking water in the wilderness. Invite students to prepare an illustrated report about getting water in the wilderness and other things that are needed for survival.