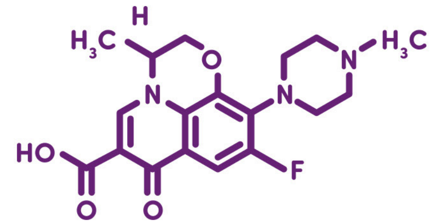
Science Museum Oklahoma

CHEMISTRY DAY



Before we get to the activities, let's explore how, whether fast or slow, chemistry makes it go. This happens to be the theme of American Chemical Society's National Chemistry Week, October 17-23, 2021. We celebrate Chemistry Day a little later here at SMO, but the goals of Chemistry Day and National Chemistry Week are the same — to promote the value of chemistry in everyday life, or as we like to say, reveal the wonder and the relevance of chemistry!

Teacher's Resource Guide

Whether continuing experiences started at the Museum or celebrating chemistry in your classroom, we have included 3 activities that really move! These activities are appropriate for the classroom or can be performed at home if desired.

Chemistry surrounds us. It can be easy to overlook this everyday wonder, but if we slow down, we might notice how chemistry makes our world go. Here are just a few examples:

1. When we wash our hands, we use soap. That soap, like almost everything else, is formed by molecules. These soap molecules have one part that is hydrophilic, or really likes water, and a chain of parts that is hydrophobic, or really tries to avoid water. When you wash your hands, the long hydrophobic part joins with the oil and other gunk that you are trying to clean away and the hydrophilic part goes to the water. This results in the oil and gunk particles becoming suspended by water, or an emulsion of oil being formed in the water. When this happens, the gunk and oil from your hands can be cleaned away by running water and a washcloth. Chemistry makes the gunk go away from our hands!
2. Hungry, but can't wait? Chemistry makes our food ready faster! A pressure cooker is a culinary device with a special lid that seals the inside of a pot completely. When the contents inside are heated, water boils, but the steam cannot escape. Nothing can escape! Pressure builds, and the cooking temperatures are able to rise much higher than they could under typical stovetop conditions. This means the food is cooked faster and is usually juicier and more tender, too. Winner, winner, chemistry dinner!
3. Chemistry makes dough grow! Baking soda, or sodium bicarbonate as it is known chemically, is naturally occurring and can be found in living things. As the name implies, it can also be used for baking. When added to a recipe and heated, sodium bicarbonate yields carbon dioxide. The carbon dioxide gas causes the dough to rise and the surface area to increase, ultimately resulting in a porous, fluffy treat. Sodium bicarbonate can also be added to an acid to create a chemical reaction resulting in carbon dioxide. Ever mix baking soda and vinegar?
4. Batteries are included! Batteries are used to store chemical energy and convert it to electrical energy. For example, alkaline batteries have three main parts, the anode, the cathode, and an electrolyte. A chemical reaction inside the battery moves electrons from the cathode, made of manganese dioxide, through the electrolyte to the zinc anode. When a battery is connected to an electrical device, those electrons continue on through the circuit from the anode to the cathode, completing the loop and providing electrical energy!
5. Chemistry even keeps us green! Did you know that photosynthesis is a chemical process that plants use to convert the energy from sunlight to chemical energy by synthesizing food from carbon dioxide and water? It is. Chemistry is everywhere, and whether fast or slow, it keeps us going.

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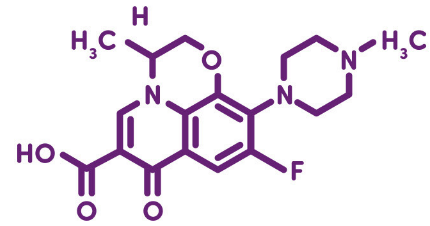

Lava-less “Lava” Lamp

Materials

- Clean and dry water or soda bottle
- Vegetable oil
- Effervescent tablets, such as Alka-Seltzer
- Funnel
- Food coloring
- Water

What to do

1. **Prepare the bottle.**
   This activity can be done individually or in groups.
   Clean thoroughly and remove the label from each bottle.
   Remove lid and place nearby.
2. **Add water to the bottle, filling it 1/4 of the way.**
   Add 3-4 drops of color. If the water is too light, add a few more drops. This can be an excellent opportunity to mix colors.
3. **Fill the remainder of the bottle with vegetable oil.**
   Use a funnel and pour slowly.
   Make sure to leave a bit of empty space at the top of the bottle.
4. **Prepare your effervescent tablet.**
   Break the tablet into six to eight pieces. This allows for the tablet to be more easily placed through the bottle opening and increases the amount of surface area of the tablet.
5. **Start the “lava” reaction.**
   Quickly drop all of the pieces of the effervescent tablet into the bottle.
   The chemical reaction will begin immediately.
6. **Return the lid to the bottle.**

What is happening?

Oil and water do not mix or dissolve one another. This is called immiscibility. Immiscible means incapable of being mixed or blended. The colored water settles underneath the oil. This is due to the water being denser than the oil. Because the food coloring is water-based, it mixes well with the water but not the oil.

The effervescent tablet contains sodium bicarbonate and citric acid. Sodium bicarbonate is a base. As the name implies, citric acid is an acid. When dropped into the water, the tablet dissolves, creating a chemical reaction that releases carbon dioxide in bubbles through the water and into the oil. This is what causes the “lava lamp” effect. The released bubbles carry small amounts of water with them as they are formed. When the bubbles reach the top of the water, they continue through the oil to escape. The bubbles bring water with them through the oil and when they reach the top, they burst. The water sinks back to the bottom. The “lava lamp” effect will continue as long as gas is being created through the chemical reaction.
Chemistry Day

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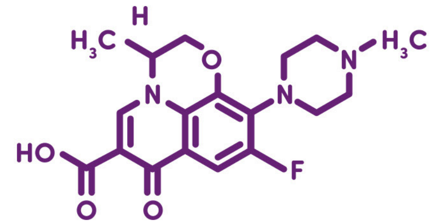

Reaction Rocket (for outdoor use)

What you need

- White distilled vinegar
- Baking soda
- Tissue paper
- Plastic 2L soda bottle
- Chopsticks, wooden skewers, or pencils
- Tablespoon for measuring
- Duct tape
- Cork
- A flat, outdoor launch site
- Safety goggles

What to do

1. **Get outdoors and provide safety goggles.**
   Before you get started, move outdoors and find a flat area to be the launch pad.

   Ensure that students have safety goggles and that they fit properly. No student should be near the launch site until wearing safety goggles. Rockets are projectiles. The vinegar and baking soda mix will spray out of the rocket and should not come into contact with eyes.

2. **Prepare the rocket.**
   Rinse out the 2L soda bottle. Find a cork that fits into the bottle opening snugly. Using the duct tape, place three or more chopsticks or pencils around the plastic bottle so each sticks up 10cm or more above the bottle's opening. Secure the chopsticks in place, making sure they are as level as possible.

3. **Provide students with a launch tutorial.**
   Test the cork to ensure it fits snugly into the opening of the bottle. Remove the cork. Practice replacing the cork and flipping the bottle (rocket) over so you can quickly place the rocket on the flat launch site.

4. **Fuel the rocket.**
   Fill the bottle about a quarter of the way with distilled white vinegar.

   Place a couple of tablespoons of baking soda, or sodium bicarbonate, on a piece of tissue paper. Wrap it up tightly so it can fit into the opening of the plastic bottle.

5. **Prepare for launch!**
   Help students safely drop the tissue paper-wrapped baking soda into the bottle, snugly insert the cork, and flip it over so that it is standing on its chopsticks.

   Make adjustments with each launch to improve results.

What is happening?

Baking soda, the compound called sodium bicarbonate, is a base. Vinegar, a solution that contains acetic acid, is an acid. As the tissue paper dissolves, the baking soda, or NaHCO3, mixes with the vinegar, or CH3COOH, an acid-base reaction occurs. Hydrogen ions from the vinegar replace the sodium ions in the baking powder. This reaction results in two new chemicals, carbonic acid and sodium acetate. The carbonic acid immediately begins to decompose, making carbon dioxide gas. That gas requires a lot more space than the solids and liquid originally put into the bottle. Eventually, enough pressure builds inside the bottle that it can no longer be contained and the rocket launches into the air.

SCIENCE MUSEUM OKLAHOMA

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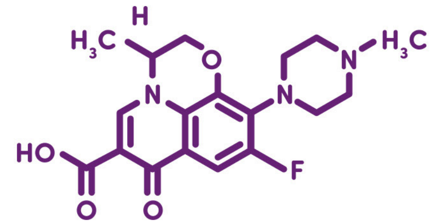

Magic Milk

Materials

- Whole milk
- Food coloring
- Dish soap
- Cotton swabs
- Shallow dishes
- Towels to clean up later

What to do

1. **Pour milk into a shallow dish until it covers the bottom completely.**
   This can be done individually or in small groups.
2. **Add food coloring to the milk.**
   Food coloring should be added near the center of the shallow plate but not the exact center.
   Encourage students to add 3-4 drops of each color used.
   The more colors used the better.
   Do not mix the food coloring into the milk.
3. **Prepare the cotton swab.**
   Place a drop of dish soap on the end of a cotton swab.
4. **Make the magic happen.**
   Push the soap-covered end of the cotton swab into the milk at the center of the shallow dish.
   Hold the cotton swab in place and count slowly to 10.
   Watch the color burst!

What's happening?

Milk is colloid, or a mixture in which small particles of one substance, in this case mostly fat, are evenly distributed in another substance, in this case mostly water. Included within milk are water, fat, vitamins, proteins, and minerals. That suspended fat in the milk is non-polar, which means it will not dissolve in water. Water molecules, like those in the milk, are polar and can dissolve other polar molecules. When the food coloring is added, not much happens until the soap is added. Soap molecules have a hydrophilic, or "water-loving" end and another end that is hydrophobic, which tries to avoid water. The hydrophobic end of the soap molecules breaks up the suspended non-polar fat. The hydrophilic end of the soap molecule attaches to the water. The hydrophobic end of the soap is attracted to the oil. The suspended fat becomes linked to the water by the soap molecule. As the soap molecules attach to the water, the suspended fat gets carried along for the ride, causing the food coloring molecules to get bumped around and moved in all directions.