



Martin Luther King Jr. Day 2021 Science Explorations Kit

"Science gives man knowledge, which is power..." --Martin Luther King, Jr., 1963

These instructions will help you complete the chemistry experiments in your kit. If you did not get a kit, or would like to experiment further, the inexpensive materials listed may be purchased at a grocery store or pharmacy.

Experiment #1 Secret Messages

Materials:

- Lemon juice packet (or a spoonful of lemon juice)
- Bowl or cup
- Cotton swab
- Plain white paper
- Heat source (incandescent light bulb or hair dryer)

Directions

What You Do:

1. Decide what you will say in your secret message.
2. Put your lemon juice into the cup or bowl.
3. Soak an end of the cotton swab in the lemon juice. You'll use this to write your message.
4. Write your message on the plain paper. While it is wet, you will be able to see it, so let the lemon-juice message dry completely.
5. Once the lemon juice dries hold the paper up to a light bulb or use a hair dryer to heat up the paper.

Let's talk about science:

When you wrote your message using the lemon juice, carbon-based compounds in the juice were absorbed into the paper's fibers. Lemon juice, like most fruits, contains carbon compounds. If the carbon comes in contact with the air, a process called oxidation occurs, and the substance turns light or dark brown. (Think of a piece of apple, banana, or pear left out on a plate for a while.) Heat can speed up this process, breaking down compounds and releasing the carbon, which is why you apply heat and reveal your secret message!

Experiment # 2 Epsom Salt Crystals

Materials:

- $\frac{1}{4}$ cup Epsom salts
- Small shallow cup or bowl
- Hot tap water
- (optional) food coloring

Directions

What You Do:

1. In the cup or bowl, stir 1/4 cup of Epsom salts with 1/2 cup of very hot tap water until the solid salt is fully dissolved. If you are adding food coloring, do so now.
2. If you have some sediment, or undissolved solid, you may pour your liquid through a coffee filter or paper towel. Be very careful since the water is hot. Asking an adult for help with this step is a good idea.
3. Place your cup or bowl with the liquid in it in a shallow location or the fridge.
4. The shape and size of the crystals depends on their growing conditions. Larger crystals grow if the container is placed in a sunny location, where the temperature is warm and evaporation concentrates the liquid. These crystals may take a few hours to a couple of days to grow. Quick crystals, which are smaller and delicate-looking, grow when the liquid cools quickly in a refrigerator. Quick crystals usually grow within 30 minutes to a couple of hours.

Let's talk about science:

Epsom salt is an inexpensive, non-toxic salt. Epsom salt is another name for the chemical magnesium sulfate. (MgSO_4), but the crystals incorporate water to form magnesium sulfate heptahydrate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$). The temperature of the water determines how much magnesium sulfate it can hold; it will dissolve more in hotter water. As the solution cools, the magnesium sulfate atoms run into each other and join together in a crystal structure. It forms monoclinic crystals that can assume a variety of shapes, but most often look like crystal shards or needles. Left undisturbed, your crystals should last for a few months or more.