

Chemistry

Recommended for Grades K-6

Let's review atoms and molecules, and how they connect.

HERE ARE THE ACTIVITIES WE'LL DO AS WE INVESTIGATE CHEMISTRY:

- **Mentos Geyser** – Watch the reaction
- **Bouncy Ball** – Crazy polymers
- **Hot and Cold** – Cool exothermic and endothermic chemical reactions
- **Baby Diaper Secret** – Amazing absorbers – How much can they hold?

THINGS YOU WILL NEED:

1. 12 oz. can of a carbonated beverage
2. Mentos candies
3. 2 Plastic cups
4. 2 Craft sticks
5. Borax (1/2 tsp.)
6. Cornstarch (1 TB)
7. 2 Sandwich-sized sealable plastic bags and 2 1-gallon sized bags
8. Quick rising dry yeast (1 TB)
9. Epsom salts (1 TB)
10. Newspaper
11. Hydrogen Peroxide
12. 2 Disposable baby diapers
13. White glue

*Thank you to the WIN Chapter at Oak Ridge National Lab,
Tennessee for lesson plan development.*

Mentos Geyser

WHAT YOU NEED:

- 12 oz. can of carbonated soda. The soda can be cold or warm.
- 1 to 2 Mentos candies
- A large open area outside that can be hosed off or your bathtub

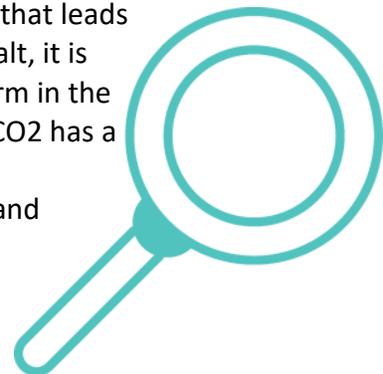
THIS WILL MAKE A MESS. BE PREPARED FOR A FOUNTAIN!

WHAT TO DO:

- 1) Open the beverage can and place on the ground.
- 2) Drop 1 or 2 Mentos into the open can quickly. If you are doing this in your tub, use only 1 Mentos candy. The more Mentos, the faster and bigger the reaction!
- 3) Jump back as the volcano action begins.
- 4) Other things to try on your own:
 - Taste the soda after the volcano dies down. Does it taste flat?
 - Put the Mentos & carbonated beverage into an open cup. You won't get a volcano, but you will see the rolling bubbles.
 - Pour salt into the bubbling Mentos/soda mixture. Do you see more bubbles?
 - Pour salt into another can of carbonated beverage. Do you see bubbles escaping?
 - For the true rocket fans, try to slide a whole roll of Mentos into a 2-liter bottle of soda at one time. Prepare to be impressed!

WHAT IS GOING ON?

The bubbles that you saw were caused by the release of all the CO₂ that was trapped inside the soda. The CO₂ is forced into the liquid soda at the bottling plant by using a lot of external pressure. The CO₂ doesn't want to remain inside the soda; it wants to escape. The addition of Mentos to the soda cause a change in chemistry that makes the CO₂ escape very quickly and completely. There is debate about the actual reaction that leads to the release of the CO₂ from the carbonated beverage. In the case of table salt, it is easier for bubbles to form around each grain of salt than it is for bubbles to form in the middle of a liquid. Each grain of salt provides a bubble formation site and the CO₂ has a way to escape. In the case of Mentos, some scientists suspect that the surface of the candies is pitted enough to create thousands of bubble formation sites and therefore the bubble formation and escape can happen very quickly.



Bouncy Ball

WHAT YOU NEED:

- 2 Plastic cups
- 2 Craft sticks
- ½Tsp. Borax
- 2 T. warm water
- 1 T. of white glue
- 1 T. of cornstarch

WHAT TO DO:

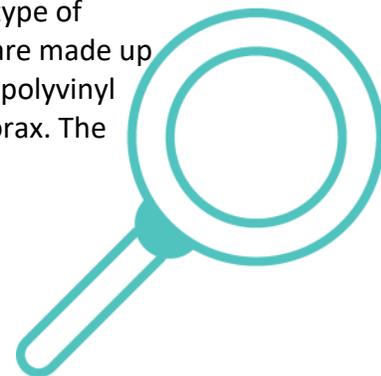
- 1) Pour 2 T. of warm water and the ½ tsp. of Borax into one of the plastic cups.
- 2) Stir to dissolve the Borax.
- 3) Pour 1 T. of white glue into the other (empty) cup.
- 4) Add 1 T. of cornstarch and ½ tsp of the Borax/water mixture into the cup with the white glue.
- 5) Let the cornstarch/Borax/water/glue mixture sit for about 10 seconds. Then stir.
- 6) When you can't stir it anymore, grab the mixture with your hands and start molding it into a ball. This can make your hands pretty messy!
- 7) As you squish the ball, it should become less sticky. Keep molding it until you can try to
- 8) bounce it. When you are done bouncing your ball, you can store it in a sealed plastic bag.
- 9) You can dispose of the excess Borax mixture and clean your hands in the sink.

Here are some other experiments you can try on your own:

- Make another ball using more cornstarch. This should make it stretchier.
- Make another ball using less Borax. This should make it stickier.
- Make another ball using more glue. This should make it slimier.

WHAT IS GOING ON?

The very earliest balls were made of stones or wood. They were used for games that involved throwing or kicking. These balls didn't really bounce at all. The first bouncing balls were made after the discovery of natural rubber which comes from a special type of tree sap. Now rubber is mostly made from petroleum and bouncing balls can be made from a variety of materials. The bouncing ball in this activity is made from a type of material called a **polymer**. Polymers are very long chain-like molecules that are made up of smaller repeating chemical units or molecules. Glue contains the polymer polyvinyl acetate (PVA), which can cross-link or connect to itself when reacted with Borax. The resulting substance is made up of a spider's web of polymers.



Hot and Cold

WHAT YOU NEED:

- 2 sandwich size plastic bags
- 1 T. of quick rising dry yeast (or 1 pkg.)
- ¼ cup of hydrogen peroxide
- 1 T. of Epsom salts
- 1 T. or so of tap water, neither hot nor cold

WHAT TO DO:

The exact quantities are not important in these two experiments, just get close!

1) Part 1: The Hot Spot!

- a. Place the yeast into one of the sandwich bags. Do not seal the bag shut!
- b. Pour the hydrogen peroxide into the bag.
- c. The mixture will start to foam immediately, and you should feel something on the outside of the bag.

2) Part 2: The Cold Spot!

- a. This reaction is more subtle than Part 1, so pay close attention to the temperature of your water before you start!
- b. Place the Epsom salts into the other (empty) plastic bag.
- c. Feel the water temperature before you add it.
- d. Add the water, seal the bag, and shake a little bit.
- e. Feel the outside of the bag. You won't see anything, but you should feel a change.

WHAT IS GOING ON?

In Part 1, the bubbles you saw were from oxygen being released from the hydrogen peroxide by a reaction with the yeast. The yeast encourages the molecules in the hydrogen peroxide to break down into oxygen and water. The resulting reactions produce heat, and reactions that produce heat are called **exothermic reactions**. Exothermic reactions are used in places where there is a lot of snow and ice in the winter. Road salt is thrown out on the roads and sidewalks and the heat created by the reaction of the road salt with the water melts the ice and snow. In Part 2, the water encourages the Epsom salts, also known as magnesium sulfate, to break down into molecules of sulfate and magnesium. This reaction won't occur without the addition of heat and the heat is being drawn out of the water making the water colder. This is called an **endothermic reaction**.



Baby Diaper Secret

If you've ever changed a diaper and noticed what looked like tiny crystals on the baby's skin, you've uncovered the secret of superabsorbent, disposable diapers. Those tiny crystals actually come from the lining of the diaper and are made out of a safe, non-toxic polymer that absorbs moisture away from the baby's skin.

WHAT YOU NEED:

- 2 Disposable baby diapers
- Sealable plastic bag
- Scissors
- Water
- Newspaper
- Salt (1 tsp)

WHAT TO DO:

- 1) Place a new, unused diaper on the piece of newspaper. Carefully cut through the inside lining and remove all the cotton-like material. Put all the stuffing material into a clean, sealable plastic bag.
- 2) Scoop up any of the polymer that may have spilled onto the paper and pour it into the bag with the stuffing. Blow a little air into the bag to make it puff up like a pillow, then seal the bag.
- 3) Shake the bag for a few minutes to remove the powdery polymer from the stuffing. Notice how much (or how little) powder falls to the bottom of the bag.
- 4) Carefully remove the stuffing from the bag and check out the dry polymer you just extracted from the diaper. Amazing stuff!
- 5) Grab a new diaper and slowly pour about one-fourth cup warm tap water into the center. Hold the diaper over a large pan or sink and continue to add water, a little at a time, until it will hold no more. Keep track of how much water the diaper can absorb before it reaches its limit.
- 6) Gather the pieces of gel into a cup and smooch it down with your fingers. Add a teaspoon of salt, stir it with a spoon, and watch what happens. Salt messes up the gel's water-holding abilities! When you're finished, pour the saltwater goo down the drain.

HOW DOES IT WORK?

The secret, water-absorbing chemical in a diaper is a superabsorbent polymer called sodium polyacrylate. A **polymer** is simply a long chain of repeating molecules (monomers). If the prefix poly means many, then a polymer is a large molecule made up of many smaller units, called **molecules**, that are joined together. Some polymers are made up of millions of monomers. Superabsorbent polymers expand tremendously when they come in contact with water because water is drawn into and held by the molecules of the polymer. They act like giant sponges. Some can soak up as much as 800 times their weight in water!

