



POLYURETHANE FOAM EXPERIMENT

Volunteer Instructions:

Tell the students they will mix two liquids together and watch closely as the foam expands to 30 times its original size! Don't be fooled by the looks of the foam - it actually turns into a solid material called polyurethane.

1. Have students put on their aprons.
2. Have students put on safety glasses and two vinyl gloves. Using a sharpie, have students write their name on the third glove.
3. Measure 1 tablespoon (scoop) of Part A into a disposable cup. Note: We have plastic scoops marked with Part A and Part B for the students to use.
4. Add 2 to 3 drops of food coloring to the liquid.
5. Then, add 1 tablespoon (scoop) of Part B (catalyst) into the same disposable cup.
6. Each student should then use the wooden stick to stir the two liquids (about 30 seconds). Be careful not to drip any of the liquid onto the floor, table, clothes, or anything else of value.
7. Carefully and quickly pour the mixture inside the latex glove. Have the student "work" the liquid into the fingers. The less manipulating the better. The volunteer can help hold the gloves open or the students can work in pairs. Students take turns making the mixture and pouring into their glove.
8. Put hand on the table to "rest" and WAIT!
9. The foam will expand to 30 times its original volume. The gloves will actually get warm - this indicates an exothermic reaction.

****Please keep Goggles OFF tables!!!!**

How does it work?

There are many forms of polyurethane such as fibers, coatings, elastomers, flexible foams, and rigid foams. The foam in this system is a rigid foam that is used in furniture, packaging, insulation, flotation devices, and many other items. Here, a rigid polyurethane foam is produced by mixing equal parts of two liquids, called Part A (mixed polyfunctional isocyanates) and Part B (pentafluoropropane). This lightweight foam expands to about thirty times its original liquid volume and will become rigid in about five to ten minutes.

After the hands are fairly dry put them in the bins marked with the group number. These will be transported to a predetermined spot by the student volunteers for the students to pick up at the end of the day.

Resetting the Table for next session of students:

1. Clean all bottles that may have spills on them.
2. Restock each of the tables with materials: One set of plastic cups with 3 non-latex gloves and one wooden stick (stirrer) inside for each student.
3. If the table covering is messy, go ahead and replace it with a new one.

If time permits before the Elephant Toothpaste Demonstration have the students experiment with the Insta-Worms.



Insta-Worms Experiment Instructions

Get a bowl of Worm Activator Solution and squirt a small stream of Worm Goo into the bowl. ***Use the worm goo sparingly – only the volunteer should be squirting the worm goo into the bowl.***

Students can take the worm out of the solution and play with it. The worm has elastic qualities like rubber, but can break if you tug it too hard. Have the students break the worm in half.

What do you notice about the inside of the worm? It's still a gooey liquid. Just dip the broken end of the worm back in the activator solution to repair the break.

Insta-Worms Reaction: How Does It Work?

When you make Insta-Worms, you're learning about the science of polymers. The creative scientists at Steve Spangler Science coined the name Worm Goo, but the real name of this liquid is sodium alginate. Sodium alginate is a long chain of molecules called a polymer. Polymers are large molecules made by linking many smaller molecules together. Specifically, sodium alginate is a polysaccharide isolated from seaweed. Polysaccharides, such as starch and alginate, are made by linking together hundreds of glucose (sugar) molecules. Alginate is commonly used as a thickening agent for foods such as ice cream and fruit pies. Now that you know this chemistry secret, take a look at food labels the next time you're at the grocery store to find out which other foods contain sodium alginate. Alginate compounds are also used for, among other things, dental impression materials and wound dressings.

The sodium alginate (Worm Goo) immediately changes from a liquid to a solid the moment it touches the Worm Activator solution. The Worm Activator solution contains calcium chloride, which serves to link the long polymer chains together. Scientists call this "cross-linking." Here's a more detailed description of what happens: a polymer strand is formed when the sodium alginate solution is added to a calcium chloride solution. This occurs because the Ca^{++} ions replace the Na^{+} ions and serve as a cross-linking agent to link two alginate chains together. The resulting cross-linked polymer is insoluble in calcium chloride solution and this results in the formation of the polymer strand.

Color-Changing Cup: How Does It Work?

The secret behind this fascinating phenomenon is a special thermochromic dye in the plastic cup. Thermochromic means that a color change (chromic) occurs in accordance with temperature (thermo). The color change in the plastic cup happens when the temperature of the plastic cup reaches a certain temperature. At this temperature, the pigment in the dye reacts by twisting to a new shape, changing the wavelength that it reflects. Thermochromic dyes and inks find use in a lot of objects, from color changing bath toys and coffee mugs, to child thermometers and battery indicators.



MAGIC SAND

How can something submerged in water stay dry?



How can something submerged in water stay dry? When ordinary sand gets wet, the result is a clumpy mess. However, "Magic Sand" begins as normal looking sand, until it's coated with a substance that repels water. This special coating keeps the sand dry even after it has been dumped into a container of water. Then simply pour the water off when you're finished and the sand is still dry!

EXPERIMENT

WHAT MAKES MAGIC SAND MAGIC?

- 1.) Fill a cup 3/4 full with water.
- 2.) Slowly pour Magic Sand in a continuous stream into the water. Look closely at the sand. What is that silver-like coating on the sand?
- 3.) Pour off the water from the sand into a second container. Touch the sand and see what you find. To your amazement, the sand is completely dry! To better understand how Magic Sand works, try this demonstration...

HOW DOES IT WORK?

This is a great demonstration to introduce students to the properties of substances that are hydrophobic. *Hydrophobic* substances do not mix with water. The term "water-fearing" is often used to describe the word hydrophobic.

How does Magic Sand work? Magic Sand is regular sand that has been coated with an oil-like substance that is water-hating or hydrophobic.