

LESSON 1: GOOFY PUTTY

• DESCRIPTION

A borax solution is mixed with glue to create a polymer.

• OBJECTIVE

This lesson compares and contrasts the properties of mixtures and solutions. By making goofy putty, students learn about measurement, mixtures, and solutions, as well as polymers.

• CONTENT TOPICS

Chemical reactions; mixtures (solutions); polymers

• MATERIALS

- White school glue
- Borax (found in the laundry detergent aisle)
- Measuring spoons
- Clear bowls, Ziploc® bags, or small cups
- Spoons
- Water

OBSERVATION & BACKGROUND

A molecule is the simplest structural unit of an element or compound. It is composed of two or more atoms bonded together by an exchange or sharing of electrons. At the beginning of the 20th century, chemists learned how to create special molecules by combining many smaller molecules (monomers) in a regular pattern. These large molecules are called polymers. The most common polymers are made of long chains of carbon atoms.

When you combine the glue and the borax solution, you start a chemical reaction. The glue molecules and the borax molecules react with each other and combine to make a tangled structure of long, flexible, cross-linked chains. This giant molecule, a polymer, is made up of thousands of smaller molecules. Both nylon and plastic are polymers, much like the goofy putty created in this lesson.

Borate ions, provided by the borax (sodium borate), cause the vinyl molecules in the glue to form cross-linked bonds. The process of cross-linking further alters the physical properties of the polymer. As more and more bonds are formed, the characteristics of the polymer change. The polymer will eventually become brittle as additional cross-linked bonds are formed.

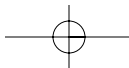
HYPOTHESIS



►The mixing of white school glue and borax will create a polymer that has different characteristics from the original substances.

SAMPLE: Not to be reproduced without express permission from the Chemical Educational Foundation (CEF).

For more information, please contact CEF at comments@chemed.org.



EXPERIMENTAL PROCEDURE

1. Put one teaspoon of water into your cup or bowl. Add one teaspoon of white glue and mix well. (This may be a good time to discuss mixtures.)
 2. In another container, create your borax solution. Mix one teaspoon of borax with four teaspoons of water. Stir well. Feel the temperature change as the borax dissolves. Since we are forming a saturated solution, all of the borax will not dissolve. (This could be a good time to explain the difference between solutions and mixtures.)
 3. Add one teaspoon of the borax solution to your original cup of glue and water. Stir for 60 seconds.
 4. Remove the goffy putty and knead it with your hands for one or two minutes.
- !** *During this activity, you will be measuring and mixing solutions. If the measurements are not exact, the experiment will not work correctly.*

ANALYSIS

Use the questions from the activity sheet to discuss the experimental data to accept or reject the hypothesis.

GOALS

Upon completion of this activity, students should be able to...

- Explain the differences between a solution and a mixture.
- Identify the physical differences of the substances before and after the experiment.
- Understand the importance of observation and measuring the correct quantities to obtain desired results.

EXTENSION

Challenge your students with the question: is goffy putty a solid or liquid? It is actually a viscoelastic liquid, which is a material that demonstrates viscous (resistance to flow) and elastic properties.

If done correctly, the goffy putty should resemble Silly Putty®. Have your students explore the history of Silly Putty®, which was created when engineer James Wright was attempting to create a synthetic rubber for truck tires. Use this example to explain that when doing experiments, scientists do not always get the result they want.

NOTES

SAMPLE: Not to be reproduced without express permission from the Chemical Educational Foundation (CEF).

For more information, please contact CEF at comments@chemed.org.

Fun Facts

Initially, Silly Putty® was a novelty item marketed toward adults. In 1955, the market for the item changed, and Silly Putty® became a popular toy among kids between the ages of 6 and 12.

