



# Stony Brook University

## Women in Science and Engineering Honors Program



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## **What is STEM? Why is STEM important?**

STEM stands for science, technology, engineering, and mathematics. STEM is important because it is everywhere! Science helps us understand the world around us and improve our living standards like finding a cure for cancer. Technology is extremely relevant and necessary for our society to function nowadays. As you are reading this, do you have a light turned on to help you see? When was the last time you used your phone? Engineering helps our society function the way it does, because it is needed to design things like roads/bridges and deal with climate change. Mathematics is used in almost every job and in your daily life whether you realize it or not: “If I watch another episode, I have three more hours to work on my assignment before I have class.” If there was no math, you would not be able to Snapchat your friends and family because in order for Snapchat to work it needs its mathematical algorithms.

These are just a few small examples showing why STEM is important. New problems arise everyday that can only be solved with STEM. Innovation in STEM leads to new products and processes that can further our society. STEM education is important because not only does it benefit society in the long-run, but it helps you become a critical thinker, sparks creativity, and gives you a better understanding of the world around you. Even if you choose to go into a career not relating to STEM, you will still see STEM applications in your daily life! For this reason, it is very important for everyone to have some background in STEM.

## What are some careers in STEM?

When you envision yourself having a career in STEM, you may imagine yourself mixing test tubes in a white lab coat or solving complicated math problems on a white board. Although these types of careers are certainly STEM jobs, there are so many more cool careers in all different industries that you may not even be aware of! Here are just some of them:

- Acute care nurse
- Aerospace engineer
- Allergist
- Anesthesiologist
- Animal Scientist
- Archaeologist
- Architect
- Astronomer
- Biochemist/ Biochemical Engineer
- Chemist
- Civil Engineer
- Clinical Psychologist
- Computer Programmer
- Conservation Specialist
- Dentist
- Dermatologist
- Dietician/Nutritionist
- Economist
- Electrical Engineer
- Energy Engineer
- Environmental Engineer
- Forensic Science Technician
- Geneticist
- Geoscientist
- Hearing Aid Specialist
- Industrial Engineer
- Marine Scientist
- Mathematician
- Nuclear Engineer
- Optometrist
- Orthodontist
- Physical Therapist
- Pharmacist
- Physicist
- Robotics Engineer
- Software Developer
- Solar Energy Engineer
- Speech-Language Pathologist
- Statistician
- Veterinarian
- Water Resource Specialist
- Web Developer
- Zoologist
- And so many more!



Here's what we'll need to make Elephant Toothpaste:

- An empty plastic bottle
- Yeast
- Warm water
- Dish Soap
- Hydrogen Peroxide
- Measuring cup
- Measuring spoon
- Bowl
- Goggles
- Gloves
- Food dye, glitter or whatever you would like to put into your Elephant Toothpaste
- A large container, like an aluminum pan, to catch the elephant toothpaste
- A funnel, or something that will help you pour your materials into the plastic bottle

Now, we make our Elephant Toothpaste!

Our first step is to put on our safety goggles and gloves as we will be working with hydrogen peroxide and dye, and we don't want to get those ingredients in our eyes or on our hands. Make sure you have your plastic bottle placed in the large container. Now, pour  $\frac{1}{2}$  cup of hydrogen peroxide into the plastic bottle. Then, squeeze about a tablespoon of dish soap into the bottle. Add in your dye and glitter as you'd like. Measure a tablespoon of yeast and three tablespoons of warm water. Now, we mix them together in the bowl and, once mixed, pour it into the bottle. Step back quickly! Now, watch what happens and enjoy!

Why does this work?

Hydrogen peroxide is a liquid made from hydrogen atoms and oxygen atoms. Its chemical formula is  $H_2O_2$ . When hydrogen peroxide breaks down, it turns into oxygen ( $O_2$ ) and water ( $H_2O$ ). Usually this happens very slowly, but you can speed up the process by using a catalyst. A catalyst is a substance that increases the rate of a chemical reaction. Yeast is an organism that contains a special chemical called catalase that can act as a catalyst to help break down hydrogen peroxide. So when you add the yeast to the hydrogen peroxide, the hydrogen peroxide will quickly break down into water and oxygen gas. The oxygen gas forms bubbles. These bubbles would usually escape from the liquid and pop quickly. But adding a little dish soap provides additional surface tension, allowing the bubbles to get trapped and creating lots of foam. This foam looks like a giant squeeze of toothpaste—almost big enough for an elephant!





Here's what we'll need to make slime:

- Non-toxic/School Glue
- Borax
- Water
- Measuring cup
- A bowl
- Popsicle stick, or something to mix with
- A tablecloth, or something you can make a mess on
- Food dye, glitter, or whatever you'd like to add into your slime

First, we place the bowl onto the tablecloth to catch our mess. In the bowl, pour in about  $\frac{1}{4}$  of the glue bottle (roughly an ounce). Then add in a  $\frac{1}{4}$  cup of water. You can add in whatever dye or glitter you want. Now, we pour in  $\frac{1}{4}$  cup of borax into our mixture. Stir the mixture with the stick and watch as your slime forms!

Why does this work?

To understand the science behind silly putty or slime, we need to understand what polymers are. A polymer is a molecule made from combining or linking smaller, similar molecules together. We are surrounded by polymers on a daily basis. There are natural polymers (such as wool, silk) and there are synthetic polymers (such as polyethylene or plastic and synthetic rubber). They have many uses in all kinds of engineering.

Silly putty or slime is made up of such polymers. To make slime we use glue which is a polymer called polyvinyl acetate. When we add water to glue, it allows the long polyvinyl acetate polymers to slide past each other easily. When we add borax to the glue and water mixture, chemical bonds are formed and the position of the glue molecules change in a process called cross-linking! Did the slime become harder when you played with it? It becomes harder because it thickens with forces. The borax linked the polymer molecules together which gave it the properties of slime. Polymers can be made to be really strong and they can increase the strength of materials that you are trying to build (as seen while making slime).



## References for More Fun Experiments!

8 Simple Science Experiments You Can Do At Home – Business Insider

<https://www.businessinsider.com/8-awesomely-simple-science-experiments-you-can-do-at-home-2016-7#tornado-in-a-bottle-1>

Some fun experiments include tornado in a bottle, rainbow in a glass, homemade lava lamp, and ferromagnetic fluid. There is also a short little explanation on why each experiment works.

32 Easy Home Science Experiments the Look Like Pure Magic – 5-Minute Crafts

[https://www.youtube.com/watch?v=6xz\\_b\\_Tl3II](https://www.youtube.com/watch?v=6xz_b_Tl3II)

This video tutorial includes some quick and fun experiments, including tricks with aluminum foil, cool things to try with static electricity, as well as some “magic” with balloons.

Experiments – Science Bob

<https://sciencebob.com/category/experiments/>

This page contains a variety of fun experiments to conduct. Each experiment has pictures, videos, an explanation on what is happening, and some insightful questions that allow you to do some further research on the subject if you are interested. Plastic milk, magic ketchup and - if you are looking for a more difficult project - a hovercraft that you can ride, are a few of the experiments from Science Bob.