CHEMICAL CHANGES (K-G2)

Students explore chemical engineering by testing different "mystery" chemicals to see which best cleans up a mock oil spill. They learn chemistry lab procedures while putting together a cup of separate ingredients that combine to form a new substance—gooey glow-in-the-dark slime they get to take home! See p. 3 for standards this workshop supports.

SCIENCE CONCEPTS

Students learn about **chemicals**.

- They are in everything we touch and see, and can be helpful or harmful, both or neither.
- They can also combine with each other to make new substances that don't act like any of their component parts.

When mixing mystery chemicals, students will learn about **safe laboratory procedures.**

- Scientists keep track of the materials and steps in their experiments.
- Scientists explore many different approaches when trying to solve problems.
- Scientists handle and measure chemicals carefully.

Educators might highlight the importance of **style** or **aesthetic** in engineering.

- It takes only three materials to create the slime itself, but we choose to make it glow and give it a color because it makes the slime more enjoyable and more likely to be used.
- Engineers often make these decisions when designing cars, buildings, or even devices like prosthetic limbs. It can be valuable to highlight the artistic and often unsung creative side of engineering.

BEFORE YOU VISIT

What are chemicals?	Most things we encounter are chemicals or are made up of chemicals. Water is a chemical. So are cleaning solutions, medicines, and many other substances.
Does the order matter when we mix chemicals and perform actions on them? Why or why not?	Sometimes it does! It often helps to think of chemistry like following a recipe, since cooking is a kind of chemistry. When making cookies, we can add flour, sugar, and baking powder in any order, but we have to mix everything together before we bake it. We could add chocolate chips after we bake cookies, but they would not turn out the same as if we added them before cooking.
What are things students might mix together that react to form new things?	Students may have many ideas. For example, combining sugar and water simply makes sugar water, which is mixing, but does not make anything truly new. But adding powdered gelatin makes a totally new jelly substance. Similarly, most kinds of baking make things that are new and unlike their individual parts.

AFTER YOU VISIT

Questions

- Was there a particular moment when the students' cups of chemicals became slime? Could we have skipped any steps? (Answer: Yes! Adding glow powder or dye.) How would the slime be different in that case?
- Are there other ways to make slime? Common recipes use borax and Elmer's glue, and students may have tried them on their own. It can be helpful to discuss how engineers explore different paths to arrive at similar goals.
- Why was it important to keep track of what chemicals students mixed in the first part of the workshop? (Answer: So we knew which ingredient did the best job in cleaning up the spill.)

Activities

- Teachers might compare how different colors of slime glow. Educators will advise students during the workshop that red dye makes the slime glow poorly, while blue and yellow do better, and no dye at all is best.
  1. Turn lights off.
  2. Have students arrange slime in order from brightest to least bright glow.
  3. Turn lights back on.
  4. Do students notice a pattern in the colors?
- For a big project, students might make slime using a different recipe. How do the two types of slime compare? How are they the same, and how are they different?

CAREERS THAT USE ENGINEERING

Chemical engineer: These engineers often get to be hands-on, mixing chemicals in a laboratory or perhaps while out doing fieldwork. They might create new fertilizers, foods, or fuel cells. Without chemical engineers, we wouldn't be able to grow enough food to feed the world or deliver the energy people need to live.

Water safety: Technicians who make sure our water sources are safe for drinking use chemistry every day. They may travel around cities and towns testing water, or work from a lab designing new ways to test and filter water. They might work here in the United States, or travel abroad to help establish and maintain safe drinking water in other countries.

Color or art specialist: A chemist might also cross into the world of art by making new dyes and pigments to give color to the world. They might try to make new ink for clothing or home printers that is brighter, longer-lasting, or cheaper. Or they might try to make new colors for artists to use in their work.

Learn about **more careers** that use engineering!

MINNESOTA ACADEMIC STANDARDS FOR SCIENCE K-12

0.1.1.2.1 Use observations to develop an accurate description of a natural phenomenon and compare one's observations and descriptions with those of others.

1.1.1.1.1 When asked "How do You Know?", students support their answer with observations.

1.1.1.1.2 Recognize that describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.

2.1.2.2.2 Describe why some materials are better than others for making a particular object and how materials that are better in some ways may be worse in other ways.

2.2.1.1.1 Describe objects in terms of color, size, shape, weight, texture, flexibility, strength and the types of materials in the object.