

Western Engineering Outreach

Bouncy Polymers

Grade 3-5

Meet Today's ENG HERO!



Elizabeth Gillies - Professor with Western Engineering

Elizabeth Gillies is a professor with the Chemical & Biochemical Engineering Department at Western University. She has a PhD from the University of California, Berkeley. After obtaining her PhD, she obtained a postdoctoral fellowship at the European Institute of Chemistry and Biology. Now, her main focus is on polymer chemistry and synthesizing materials with new properties. To learn more about Dr. Gillies visit:

https://www.eng.uwo.ca/chemical/faculty/gillies_e/index.html

Learning Goal:

- Students will learn about polymers.
- Students will discuss states of matter and their properties
- Curriculum Connections: Grade 5 - Properties of and Changes in Matter

Materials Needed:

- Elmer's glue
- Ziploc bag
- Water
- Dish soap
- Cornstarch
- Jars that can seal
- Paper
- Pencil



Engineering and Science Connections:

Today, we will learn about the states of matter, the properties of matter and polymers. Matter makes up everything in the world and it comes in three different states: solid, liquid, and gas.

Did you know that many toys you've played with are made using chemistry? Toys like Gak, Slime and Silly Putty started out as chemistry experiments. In fact, some of your favorite toys may have been designed by chemical engineers who work for toy companies like Crayola, Play-Doh or Mattel.

Chemistry is the study of *matter*, and how matter behaves and interacts with other kinds of matter. There are many different kinds of matter, which can be described using the concept of *properties*. Toys like silly putty are unique because they have distinct properties that are different from the properties of other types of matter. There are two different kinds of properties matter can have: chemical and physical.

Chemical properties are qualities that can be observed during a chemical reaction. For example, when vinegar reacts with baking soda. Physical properties are qualities that can be observed during a physical change, such as the melting of an ice cube. Physical properties can be used to describe the state of some matter, which can be a solid, liquid or a gas.

Polymers are long chains of repeating molecules. They have very unique properties and both synthetic and natural polymers are important in everyday life.

Properties

There are several different properties of matter. They can be categorized as physical or chemical properties. Chemical properties are things like acidity, reactions with air/water or other chemicals. Physical properties are the kind we'll be investigating today and consist of things like colour, density, mass and many more. Some terms scientists use to describe these properties are hot, cold, squishy, hard, soft, crystalline, granular, smooth, liquid, clear, opaque and runny.

States of Matter

As previously stated, matter can be one of three states: solid, liquid or gas. Solids are hard, hold their own shape and have a fixed volume. Liquids conform to the shape of their container and have a fixed volume. Gases will also conform to the shape of their container but can be compressed.

Video Recommendation: *The States of Matter*

<https://www.youtube.com/watch?v=JQ4WduVp9k4>

Activity:

Before beginning, think about the following questions:

- What are the three states of matter?
- What are examples of each?
- What is a polymer? How does it help us?
- What state of matter is my polymer?
- What are some physical and chemical properties of matter?

Experimental Procedure

We are going to do three tests. Add the glue, dish soap, and cornstarch together in different ratios, to see what properties the final mixture will have. You can use the table provided below to write down your measurements, or make your own.

Glue	Soap	Cornstarch	Water	Observations	Properties

NOTE: Do not exceed $\frac{1}{4}$ cup of glue

- Seal the baggie, and using your fingers squish the mixture around to mix together the ingredients.
- Write down your observations in your data table.
- When the mixture begins to form a sticky glob, you can take it out of the baggie.
- Write down your description of the physical properties of the material in your table. Remember to use words like runny, slimy, sticky, hard, soft, bouncy, etc.

Debrief

- Which ratio of ingredients produced the best product? What will you call your new product?
- Are there other ways to change the recipe in order to change the physical properties of the putty?

If you need some guidance on ratios for your putty, try 2 tablespoons of cornstarch, 1/8 cup of water and 1 drop of food colouring. You may need to let your ball dry for a few hours before use. Adding heat via the microwave can also help bond your materials together

What Did You Learn?



- What is a polymer?
- What are the three states of matter?
- What are different properties of matter?

Future Learning



- You've already done a great job turning this into an experiment! Can you take it any further? Try and think of other places polymers exist in our life! A common use for polymers is to make thin sheets of materials for holding things, for example, plastic shopping bags, garbage bags, Zip-lock bags or balloons. Can you design a series of experiments to test these materials? Another polymer is the protein gelatin found in Jello. What experiments can you conduct to explore the physical properties of gelatin?

Share your creations!

We would love to see what you made. Email us at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!