

Lesson: Elementary Chemistry – Polymer Fun

Use WOW Lesson Intro to begin.

<p>Background Info for Wizards:</p>	<p>Monomer to polymer! Our bodies make polymers called proteins to serve specific functions (ex: hair, nails, saliva!). Different polymers have different properties, some are stiff, some are flexible, and some are even in liquid form! Chemists can also make polymers to be used for a variety of applications. Polymers are amazing and diverse. One of the most familiar types of polymers you might recognize are plastics.</p>
<p>Materials:</p>	<p>Paperclips...several to be linked together</p> <p>Beads - you will need @ 8 per student Pipe Cleaners – 1 per student</p> <p>Pipe Cleaner cross-linking visual Plastic measuring cup Plastic teaspoon Polyvinyl alcohol solution Borax solution Baggies for each student Food coloring (if time permits)</p> <p>Diaper Cotton Balls Bag of deconstructed diaper Sodium Polyacrylate in baggie Water Plastic bag (1 large to perform diaper experiment in) Measuring cup</p> <p>Baggie of packing peanuts Empty CD case Test Tubes – 6 that can be passed around (three with <i>plastic pellets</i> mixed in water and three with <i>packing peanuts</i> mixed in water) Safety glasses Acetone Glass flask Tray Glass jar for used Acetone</p>

<p>Lesson Time: 55 minutes</p> <p>If your class time is 45 minutes adjustments can be made. <i>For example, Students can be creating their Polymer bracelets in Activity #1 while you are calling up students to receive materials for their Slime in Activity #2.</i></p>	<p>Introduction: 3 minutes Guided Lesson and Wizard Demonstration #1: 3-5 minutes Student Activity #1: 15 minutes Student Activity #2: 15 minutes Wizard Demonstration #2: 10 minutes Wizard Demonstration #3: 5 minutes Conclusion: 5 minutes</p>
<p>Learning Targets:</p>	<p>Students will discuss the properties of objects and materials can change.</p> <p>Students will discuss that objects and substances in the world are made of matter.</p> <p>Students will learn that matter exists in different states, each of which has different properties.</p> <p>Students will learn about polymers and plastics.</p>
<p>Introduction for Students: 3 minutes</p>	<p>Today we are going to talk about a special kind of Science called Chemistry and learn some new words. Chemistry is the part of Science that studies what everything is made of and how it works. Cooking is a form of Chemistry...so is making ice cubes...medicine is the result of Chemistry...so is paint. Chemistry is all around us.</p>
<p>Guided Lesson and Wizard Demonstration #1: 3-5 minutes</p>	<p>Have you heard this Science word – Matter? Matter is anything that takes up space and has mass. Everything around you is made up of matter. Chocolate cake is made up of matter. Your desk is made of matter. You are made of matter. And all of these things, these pieces of matter, are made up of atoms.</p> <p>Two more Chemistry words that we are going to learn today are monomer and polymer. A monomer is a single atom or molecule that makes up something. Think of it as one paperclip. A polymer is when we link a bunch of monomers together. Now imagine we've connected several paperclips into a chain. (do this for the students to see)</p> <p>In Chemistry, we call that a polymer. You actually use polymers every day. Plastic is a polymer. Some of your toys are polymers. You might have a polymer in your refrigerator at home. (Look around the room and point out some plastics.)</p>

	<p>Our bodies make polymers called proteins. Just like some of the polymers we've seen in the room, the polymers in our body do different jobs. For example, there are polymers/protein in our hair, our fingernails, and our saliva.</p> <p>Different polymers have different properties, some are stiff, some are flexible, and some are even in liquid form! Chemists can make polymers to be used for different things.</p>
<p>Student Activity #1: 15 minutes</p>	<p>Tell students: "Let's build a polymer together. We will use beads and a pipe cleaner. We will pretend our beads are a monomer unit and we will string them together to make a polymer."</p> <p>Depending on class number and age of students, you can bring them the materials to do at their desk, or have them come to you in small groups, or set up stations for them to go to.</p> <p>Have students thread 8 beads onto a pipe cleaner.</p> <p>You (and the teacher) may need to help the students tie off polymer chain at the bottom, so beads don't fall off. Ask teacher where they should be put so students can continue to concentrate.</p>
<p>Student Activity #2: 15 minutes</p> <p>Students should not handle pre-mixed chemicals. Wizard/teacher pours into baggie.</p> <p>Formula: 1 oz: PVA solution</p> <p>1 tsp: Borax solution</p>	<p>Say to students: Some polymers can be linked together to alter their properties further. (Demonstrate the idea of crosslinking by showing the sample of pipe cleaners tied together.) The white pipe cleaners are our polymers. When we add a certain chemical, it can cause units to link together. (the yellow ones)</p> <p>Explain to the students that they will now perform this chemical reaction and transform a liquid polymer into a solid polymer. Review the states of matter with them...solid, liquid, and gas. Review that energy is needed to change a state that matter is in.</p> <p>Tell the students that after they receive their mixture, NOT to open the baggie.</p> <p>Students will line up and come on-by-one to get their polymer. Wizard will add 2 solutions to each students' baggie. Make sure to seal the baggie, and hand to the student.</p> <p>They should return to their seat and knead the bag to mix it.</p> <p>Depending on time, you may also let them pick a color to add.</p>

	<p>Reiterate the idea of chemists designing a polymer to serve a specific purpose → structure and function.</p>
<p>Wizard Demonstration #2: 10 minutes</p> <p>Formula: 1 tsp NaPA 8 oz water</p> <p>Do not add entire 20 oz bottle at once.</p>	<p>Here is another example of polymers being designed to do a job. Hold up a Diaper. Ask students what a diaper is used for. Ask students if they can explain how it might work. Let's show them.</p> <p>Using deconstructed diaper show the pieces... discuss how the outside is a polymer (plastic), there is adhesive (a different polymer), and padding. Use cotton balls to show how poorly they hold the water. What is doing the job of absorbing the liquid???</p> <p>Explain to students that there is a specific polymer in the padding that is used to absorb the liquids. Hold up a baggie of the powder (Sodium polyacrylate) and tell the students that this is the only part of the diaper they need! Have them estimate how much water it might be able to hold. Pour 4-8 oz of water at a time, let them observe, and then pour in more. "Let's see how much water this can absorb!"</p> <p>Set it aside to show during the conclusion. (You'll pass it around at the end.)</p>
<p>Wizard Demonstration #3: 5 minutes</p> <p>Do not let Students handle Acetone.</p> <p>Make sure bottle is sealed at the end of the demo.</p>	<p>Now, even if we have the same materials, how they are prepared changes their properties. The same polymer can do different jobs. For example... who knows what this is? (hold up packing peanut). And this? (hold up CD case) These are both made of the same polymer! (polystyrene)</p> <p>Hold up 2 different test tubes. Explain to the students that the same materials behave differently depending on how it is prepared. Pass the tubes around. Let students examine them for a minute. (If you are concerned about time...skip the passing.)</p> <p>Tell students: It is the same material, but the chemist prepared it in a different way! As you can see, one floats and one sinks. The peanuts are manufactured by blowing them with air like cotton candy. When used like this they float (show floating in water) because it is less dense, there is more air, so it takes up a different amount of space. (You can learn more about density in future lessons). In its more dense/solid form the same material sinks. Collect the wandering test tubes. (**in case kids notice, they sometimes stick at the top due to surface tension)</p> <p>Place empty jar on the tray. Ask a volunteer student to assist you – both of you will need to put on your safety glasses.</p>

	<p>Pour a small amount (100-150 mL) of acetone in the jar. Explain to the students that this is a liquid that is used in Chemistry to break polymers apart. It is also used at lower concentrations to remove nail polish (another polymer)!. Ask the students to hypothesize/predict what will happen to a packing peanut once it is dropped into our Chemistry liquid. Have your assistant drop one in. Show the class that the peanut dissolved. Have other volunteers put in other chunks, time permitting.</p> <p>Please use jar for returning used Acetone.</p>
<p>Conclusion: 5 minutes</p>	<p>Return to the diaper demo and show how the powder has gelled up!</p> <p>Review that polymers are all around us from the utensils we use, to bags and diapers, to airplanes and rocket ships! They are designed to do different jobs, and as we've seen the same material does different things.</p> <p>We need future chemists to design new materials for everything from cars to renewable energy.</p> <p>Follow up questions for discussion: What is a polymer? How can a chemist change them?</p>