DIY Spider Web Slinger: With Impossible Science and Spider-Man: No Way Home

Objectives: Students will be able to identify examples of and define the properties of polymers. Students will work in groups to create polymers and compare their properties. Students will create a Spider Web Slinger.

IMPOSSIBLE SCIENCE

In collaboration with:

SPIDER-MAN No Way Home

Putty Materials:

- Elmer's white glue (¼ cup per putty)
- Water (¼ cup per putty)
- Additional ⅛ cup of water
- 1 tablespoon of Borax
- Two bowls
- Stirrers such as popsicle sticks
- Food coloring

Slime Materials:

- Metamucil (Psyllium husk powder)
- Water

Hook

1. Show students a video clip from Spider-Man: No Way Home that includes a Spider Web Slinger.
2. Tell students that spider silk is extremely stretchy and stronger than steel.
3. Ask students if they can think of any other materials as stretchy as spider silk, and how they think spider silk might be made. Share answers.
4. Ask: Who has chewed gum today? Brushed teeth? Bounced a ball? Sat in a chair?
5. Tell students that all of those things are made of polymers, and today they will be creating polymers and also building their own Spider Web Slingers.

Procedure

1. Show students Impossible Science E321: video clip up to the part where Jason begins making the cardboard Spider Web Slingers. Pause for students to record definitions.
2. Review vocabulary: Polymer, Polymerization, Mer, Elastomer, and Hooke's Law.

Vocabulary

Polymer: A substance made from a large number of flexible similar parts bonded together (poly=many, mer=parts)

Polymerization: This occurs when small molecules combine to produce a large, chain-like molecule called a polymer.

Hooke's Law: Discovered by 17th century physicist Robert Hooke, it is a theory of elasticity that states that the extension of a spring is proportional to the force applied to it. So if you applied twice the force to a spring or elastic band, you'd get twice as much stretch from it.

Elastomer: A type of polymer that springs back to its original shape after being stretched or pulled.

3. Ask students to list some polymers they can think of and write them on the board. Explain that silk is a natural polymer, but synthetic polymers are created by people and are all around us. They include all plastics such as teflon, nylon, classroom furniture, toys, polyester, and more.
4. Explain that polymers are made up of many parts, or mers, bonded together. Invite six students to stand in front of the class, each representing a mer.
5. Ask how they could create a bond to create a polymer.
6. If students don't come up with it, suggest students link arms to create a bond, and explain that this bond makes them a strong polymer. If they were just touching arms lightly, it'd be a weaker bond and a weaker polymer.
7. Tell students that today they will begin by creating a putty and a slime and comparing their elastic properties.
8. Distribute ingredients for putty.

9. Have students mix ¼ cup of glue and ¼ cup water in one bowl. Add a drop or two of food coloring if desired.
10. Explain that glue is a liquid polymer called polyvinyl acetate resin, and the Borax links the polyvinyl acetate molecules, creating a large, flexible polymer.
11. Mix ½ cup of water and slowly add Borax a teaspoon at a time until the Borax will no longer dissolve.
12. Slowly add the Borax solution to the glue solution, stirring constantly.
13. Knead putty and pour off excess water. Set aside.
14. Make slime: Mix 1 tablespoon of Metamucil with 1 cup of water.
15. Microwave on high for four minutes, pausing if it starts to bubble over the top.
16. Let it cool slightly and repeat.
17. Stir and let cool completely.
18. Ask: What linked the polymer strands together? Explain that the Borax linking the polymer strands together is called cross linking.
19. Compare the putty and the slime with the following tests:
    1. Form each into a ball and try to bounce. Record what happens.
    2. Poke each ball with your finger. How long does it take to reshape?
    3. Stretch each ball as far as you can. Which stretches farthest without breaking?
    4. Quickly pull the slime and putty apart. What happened?

Assessment:

Compare results and write a paragraph summarizing how each is a polymer, if either might be an elastomer, and if either demonstrates Hooke's law.

Extension:

1. Show the rest of the Impossible Science video.
2. Distribute Spider Web Slinger materials and have students follow along with the steps to create their own cardboard Spider Web Slingers.
3. Test Spider Web Slingers on different surfaces!

Spider Web Slinger Instructions

Spider Web Slinger Materials

- Template on 8.5 x 11 paper
- ¼" plastic washer
- 6mm magnets
- 1" magnets
- 2" spring
- 2.25" long ¼" dowel
- Tape
- Jumbo popsicle sticks
- Baking soda
- String
- Exacto knife
- Superglue

1. Print out the template and instructions.
2. Transfer the template to cardboard, and then cut out all pieces.
3. Roll the piece around the spring making sure it slides through the paper roll, creating the barrel.
4. Secure it with super-glue. Coat the outside in both super-glue AND baking soda 3-4 times to harden.
5. Glue a plastic washer to the back of the barrel and harden with super glue and baking soda.
6. Wrap the next piece around the barrel and glue to complete the barrel.
7. Take the dowel piece and glue your magnet to one end.
8. Wrap a piece of tape around the magnet and dowel and harden with a layer of super glue and baking soda.
9. Slide the spring on the dowel and glue the spring to the tape.
10. Glue another magnet to the bottom of the dowel, completing the projectile.
11. Curl the outer portions of the wrist piece leaving the middle flat. Curl this piece from the template and glue around the completed barrel.
12. Glue this to the middle of the wrist piece. Glue the square piece to the back to complete this portion of the slinger.
13. For the trigger, cut a jumbo popsicle stick to match pieces from the template and glue to the corresponding cardboard pieces.
14. Transfer the holes from the cardboard pieces to the wooden pieces.
15. Tape these two pieces together to make a hinge.
16. Make a small "I-Beam" from the jumbo popsicle stick, place through the hole and glue.
17. Next, trace your larger magnet shape onto this piece, cut away the cardboard, and glue the magnet to the popsicle stick.
18. Place a second magnet on the first and repeat to the opposite piece making sure to pay attention to the polarity of the magnet.
19. Glue the circle piece to the end, completing the trigger.

20. Glue the finished trigger to the bottom of the wrist piece making sure it's positioned in front of the barrel with the "I-Beam" acting as the pin to hold the projectile.
21. Cut out the pattern for the box to hold the string acting as the web. Score the dotted lines, fold into the top and sides of the box.
22. Glue the rectangle piece to the bottom of the folded piece from the template to complete the box.
23. Attach to the Spider Web Slinger using small magnets.
24. Test out your Spider Web Slinger on a variety of surfaces!

Safety Notes:

Adult Supervision Recommended

Wear Safety Googles when using projectiles

Watch the companion video here:

YouTube

Lesson Plan by Whitney Gallagher based on the "Impossible Science" series.
Find more at impossiblescience.com