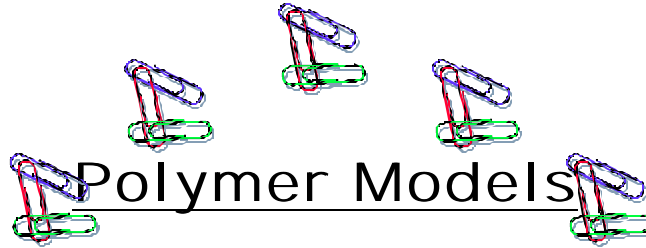


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Concept: Understanding polymer structures

National Science Standards:

A	B	C	D	E	F	G

Background:

A polymer is a giant molecule made up of many smaller units, sometimes called mers. Polymers can vary in size from 50 mers to tens of thousands of mers. These chains can be well organized like a box of uncooked spaghetti or very entangled like a bowl of cooked spaghetti, and the way they organize themselves greatly influences a material's properties. These macromolecules can link with the same kind of molecules or with different kinds of molecules.

Polymers are found in nature (skin, tree bark, cotton, silk, latex) and also in synthetic materials (plastics, nylons, polyesters, Teflon, glass, slime).

Objectives: Students will be able to define the term "polymer."

Students will develop an awareness of polymer in our everyday lives.

Students will develop an understanding of polymer structures through the use of models.

Suggested grade levels: 4-6+

III. Estimated time:

- Teacher prep: 10-15 minutes
- Activity: two 40-minute sessions

Materials needed:

- polymer product list
- Choose from:
- ethylene paper chains (approx. 500 loops)
 - safety pins
 - magnetic marbles
 - plastic links
 - pop beads
 - paper doll chain
 - plumber's chain

- Christmas bead garland
- paper clips
- cooked spaghetti
- uncooked spaghetti
- scissors (may be necessary for some options)
- glue stick or stapler (may be necessary for some options)

Safety: Use appropriate safety precautions for the materials used, such as scissors, safety pins, etc.

Procedure:

Day One:

1. Provide list of common polymer products with directions to circle items which the student has used in the last week.
2. On visual display, jot down brainstorming ideas to the question: “All of these things have one thing in common; what is it?” Don’t discuss at this point.
3. Introduce the following terms: monomer, polymer, covalent bond, and entanglement. Depending on the level of the audience, explain polymers using various visual aids from the materials list; for example, use one paper clip for a monomer and have many paper clips linked together for a polymer. Start with examples of simplest things and go to more entangled ones.
4. Standing in one long row, have students pair up, holding both hands. Teacher (acting as activator) breaks one pair of clasped hands. With that free hand, the student now joins the released hand of the student next in line.

Day Two:

1. Review terminology from Day One (monomer, polymer, covalent bond, entanglement).
2. Students brainstorm ideas as to how they would model a monomer and a polymer.
3. Compare polymer structures of high density (HDPE) and low density (LDPE) polymers. (High density polymers have elongated or straight chains and can stack tightly together. Low density polymers have chains that branch out in all directions. They cannot stack as tightly as the elongated chain polymers. These can form low density materials.)

Wrap-up:

- Return to list of commonly used items and re-raise question, “What do all these things have in common?” Answer: They all have polymer components.

Resources:

Van Cleave, Janice. A+ Projects in Chemistry. New York: John Wiley and Sons, Inc., 1993.
 Whitney, Jay, ed. The Best of Wonder Science. United States of America: Delmar Publishers, 1997.
 Alder, Joseph, and Gordon L. Nelson. Polymeric Materials. Washington, D.C.: American Chemical Society, 1989.
 Web page <http://www.psrc.usm.edu/macro//>