Build Your Own Polymer Model

Suggested Age: 5-7
Time: 15 minutes

The word "poly" comes from the Greek word "many,"and "mer" means parts. All *polymers* are made of small repeating molecules, called *monomers*. Polymers can have different properties based on both the individual monomers that form the polymer chain and the arrangement of the polymer chain. We will be using paperclips to build polymer chains in three different arrangements and exploring the differences between these arrangements.

In this activity we will:

- Identify many common household items that are polymers.
- Build models of three different types of polymers.
- Relate the polymer models to common household items.

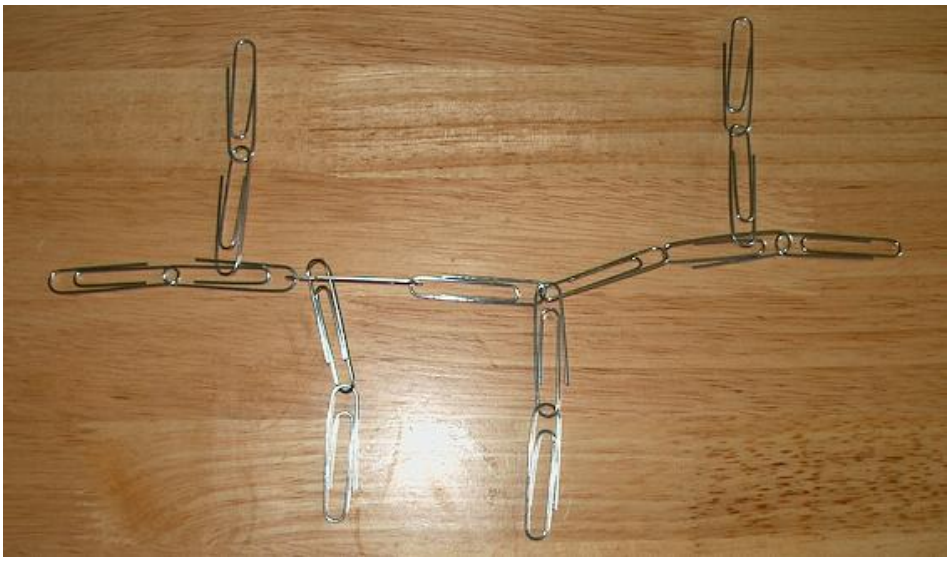
Materials needed

- Paperclips
- Play Dough or Cookie Dough

Activity

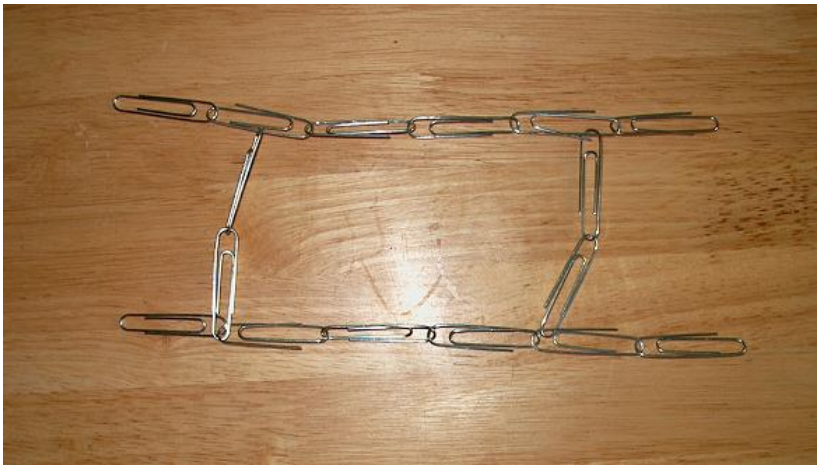
Linear Polymers: A linear polymer is made of monomers that are placed end-to-end in a straight line. Each paperclip represents an individual monomer and when linked together, the individual monomers will form a polymer chain. Linear polymers have a tight arrangement that leads to a sturdy and rigid polymer. Teflon, soft-drink bottles, milk containers and garden hoses are examples of products that are from linear polymers. Make a linear polymer using paperclips.

Branched Polymers: A branched polymer is a polymer in which some of the monomers branch away from the linear arrangement. To make a branched polymer, start with the linear polymer that you just made. Then, attach a couple of paper clips to either the top of the bottom of an existing paperclip from anywhere on the chain. Branched polymers are softer and more flexible than linear polymers because they have a looser structure. Examples of branched polymers are soft, flexible plastics such as plastic food wrap and ketchup squeeze bottles. Using the paperclips, make a branched polymer.



Cross-linked Polymers: Cross-linked polymers have two or more long polymer chains that are connected together by chemical bonds. To make a model of a cross-linked polymer, make at least two linear polymer chains and lay them parallel to each other. Then, make some "bridges" to tie one polymer chain to the other. Because all the polymer molecules are tied together, they are not easily broken apart from each other. The more cross-links between a polymer, the more rigid they become. Lightly cross-linked, it's a flexible rubber, heavily cross-linked, it's a hard plastic.

Cross-linked polymers can exhibit special properties if they form a hole in the center. This "hole" is referred to as a pore. Sometimes, this pore is able to hold water or other materials in the center of the polymer. A polymer that is swollen with absorbed water will shrink when the water molecules leave the polymer. Using the paperclips, make a cross-linked polymer.



Extension Activity

After you have made the polymers using paperclips, try making the same polymers with a softer material such as Play Dough, polymer clay or cookie dough. Roll the material into balls and make the three types of polymer chains.

When you have finished making your extension model, compare the two models.

Which polymer chain would have more uses? For example, the paperclip polymer is rigid and the Play Dough polymer is flexible.

Which polymer chain is more flexible?