MAKING POLYMERS

INTRODUCTION

We use this polymer game either alone or along with other polymer activities, especially Poly Mers. Polymers are long-chain, sheet-like, or even three-dimensional, very large molecules made up of many smaller molecules. Polymer products in everyday life include plastic sandwich bags and soda bottles, rubber balloons and bicycle tires, Styrofoam in foam hot cups, starch in spaghetti, protein in egg whites, the plastic in a computer mouse, and many other products. This game was not originally our idea. One reference calls it Forming a Human Polymer. [1]

PURPOSE

This activity uses the linking and movement of children to illustrate how a polymer forms as well as some of the properties of a polymer.

MATERIALS

A room which has a fair amount of empty space not completely taken up by student desks, tables, or chairs (If such a room is not available, a hallway, library, or cafeteria can be used, but a gym has too much empty space)
At least 20 students

PROCEDURE

1. Point out to the children that each one in the class represents a monomer or a single small unit or molecule that is going to be used to make a giant molecule called a polymer.

Depending on the age, emphasize language arts by asking students about the meaning of mono, poly, and mer. The prefix mono comes from the Greek monos = alone or one. The word polymer comes from the Greek poly = many and meros = parts, and means many parts.

2. Allow the children to stand and move about the space individually to recognize the freedom of movement that they have as single small monomer units. Then the children should return to their seats.
3. Have one group of five or six children stand in a line facing the class. Have the children in that line join hands or link arms. Point out that this line has a number of monomer units and is like a chain polymer. *They form a chain polymer like that of polyvinyl acetate in Elmer's Glue-All.*

4. Let a leader of this chain now guide her/his line slowly through whatever space is available so that children can see how flexible the chain is but that passage is not quite so easy as it was for individual students. *This mimics the behavior when one observes*

that it is not so easy to pour Elmer's Glue-All as it would be to pour the individual molecules making up the polymer chains (for example, like pouring water).

5. Have two more groups of five or six children stand in lines in front of or in back of the first line, and join hands or link arms in each of the three chains.

   Have a leader for each of the three chains now move her line around through the space. Note that the movement of one chain does not affect the movement of another chain unless they get too close to each other.

6. Align the three lines parallel to each other and close to each other at the front of the room. Utilize a few additional children to join their hands with two individuals from two different lines so that they can hold on to both chains simultaneously. This involves some three-way clasping of hands; originally linked students do not break. *These children are functioning as cross-linkers between chains just as the borax solution does in our Poly Putty 2 experiment.*

7. Choose a leader for this cross-linked glob and have that person try to lead the glob through the same space as before. This is a much more difficult process. With the cross-linkers holding the chains together; the movement of one chain affects the movement of the whole glob.

Before the children break away from the glob and return to their seats, note carefully some of the physical properties of the glob.

EXPLANATION

The glob has spring in it as some of the arms of participants are stretched or compressed. As a result of this springiness, the glob would bounce off the wall if that were allowed.

If the glob is stretched too far and the chains move in opposite directions, the glob will break because the children will no longer be able to hold hands under the stress. Either the cross-linkers or children within a chain will have to let go.

If the chains are brought back together, the cross-linkers can again join chains or the polymer chains can reform in either new places or the original places.

REFERENCE

1. Fun with Chemistry: A Guidebook of K - 12 Activities from the Institute for Chemical Education, vol. 2, Mickey and Jerry Sarquis, editors, University of Wisconsin-Madison, WI, 1993, p. 69.

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