

# A Piercing Experience

## “You’ll get the point”

A lesson adapted from Operation Chemistry, sponsored by the American Chemical Society.

### OBJECT OR PURPOSE:

“It is possible to punch a bamboo skewer through an inflated balloon without popping it if one first considers the properties of the balloon. Balloons are made out of thin sheets of rubber latex which in turn are made from many long intertwined strands of polymer molecules. The rubber is stretchy because of the elasticity of the polymer chains. When the balloon is blown up, the polymer strands are stretched. The middle area of the balloon stretches more than the tied end and the nipple end opposite the tie. A sharp, lubricated point can be pushed through the strands at the tie and nipple ends because the polymer strands will stretch around it. A sharp lubricated point pushed through the strands at the side of the balloon will (usually) pop the balloon because the strands are already stretched and will break. Once a tear begins, it enlarges as the air rushes out of the balloon.

### MATERIALS REQUIRED:

1. A 10 or 12-inch balloon for each participant.
2. A bamboo skewer 10-12 inches long. (Usually the smaller Shish Kabob skewers work well and are available at many grocery stores)
3. A large bottle of cooking oil.
4. A 3 ounce cup for every five people (the cups are for the oil)

### EXPLANATION:

1. Identify and explain monomers and polymers as molecules and chains of molecules respectively.
2. Explain the polymer structure of a balloon in general terms (e.g., plate of spaghetti).
3. Understand and illustrate that there is space between molecules.
4. Hypothesize and relate other polymer substances.

### EVALUTION:

The students will be able to identify and understand the concept of polymers as chains of molecules by role playing chains of molecules and through piercing a balloon with a bamboo skewer.

Have the students go home and find another polymer surface or container that they could also pierce with a sharp object without the object leaking (while the sharp object remains in the surface or container). Possible suggestion: A Zip Lock bag full of water.

#### TEACHER TIPS:

1. Teacher holds up a balloon and a bamboo skewer and asks the class what is going to happen when the skewer is pushed into the balloon. This is a partially inflated 12 inch balloon inflated to about 6 inches.
2. Dip the skewer into the oil and gently twist and push the skewer through the thick nipple end of the balloon. Continue to gently twist and push the skewer until it penetrates the surface of the balloon.
3. Continue to gently twist and push the skewer through the balloon until it starts to poke out through the area around the knot. Continue to gently twist and push until the skewer penetrates the knot end of balloon.
4. Ask the students if this is what they thought that the balloon and skewer would do.
5. Allow each student to try this activity until they are successful. (note: you might have to tell them where to pierce the balloon to be most successful). Try to set a new record of skewers through the balloon. The record is seven!!
6. Once all students have successfully pierced the balloon, initiate a conversation about why this phenomenon occurred. (refer to background knowledge below).
7. To illustrate that polymers are chains of molecules – group the students into chains of 7-10 by holding hands. Allow each chain to freely move around the room. Note that the beginning and end of each chain has a free “hand.”
8. Say that you are going to add a stimuli or charge and the free ends will bond with another chain (Ideally in the middle of another chain). This simulates the polymer chains all hooked together to form a surface. This is easily explained by comparing it to a plate of spaghetti.
9. Explain to the students that they are on the molecular level and that they are extremely small. Then using your finger pointing out of the top of your head, role-play a bamboo skewer and use the spaces between the chains to pierce the balloon all of the way through.
10. Conclude the role-play by pretending your skewer breaks one of the polymer chains- POP!!!

Caution the students that the bamboo skewers are sharp and could cause bodily harm if point or jabbed into another person either on purpose or by accident. Discourage any movement around the room holding skewers.