



# Thermoplastics and Thermosets

**Concept:** Comparing the thermal properties of polymers

**National Science Standards:**

A	B	C	D	E	F	G

**Background:** Thermoplastics can be cooled and reheated so therefore recycled where thermosets can only be heated once and are therefore not recyclable by melting. (Teacher note: Thermosets are sometimes recycled by grinding or shredding but not by melting and reforming.)

**Objective:** Students will observe the difference between thermoplastics and thermosets.

**Suggested grade levels:** 4-6

**Estimated Time:**

- Teacher prep: 1 hour
- Activity: 1 hour

**Materials needed:**

- hot pot or hot plate
- tongue depressors
- hot pads
- plastic fork
- teacher-prepared worksheets
- GOGGLES
- Prepared bags containing samples of the following materials:  
(Note: These are suggested materials, but other similar, appropriate items may be substituted or added.)
  - friendly plastic
  - Styrofoam™
  - recyclable plastics 1-7
  - plastic buttons
  - pot handles
  - kitchen utensil handle
- plastic toys
- switch or electrical outlet plates
- Formica™ counter top pieces

**Safety/Disposal:** Students should be careful to avoid getting hot or molten plastic on their skin. If a student does get molten plastic on skin, run cold water over the affected area. In severe cases, do not attempt to remove the plastic from skin; seek medical attention.

**Procedure:**

Part I: Demonstration:

1. Boil a cheap plastic picnic fork in a sauce pan.
2. Remove it with tongs, and carefully bend it into a new shape.
3. Repeat the demonstration and mold the fork into yet another shape.

Part II: Activity:

1. Divide students into groups of four and pass out prepared bags of plastics to each group.
2. Each group will test plastics at a station equipped with hot water (60 degrees Celsius, not boiling), hot pads, two tongue depressors and worksheets. Goggles must be worn! Students will test each piece of plastic for flexibility by placing each piece of plastic in the hot water and, using the tongue depressors, submerging it for 60 seconds.
3. Students will record results on worksheet.

**Wrap-up:**

- Expected results: Students will understand the difference between thermoplastic and thermoset.
- Discuss observations.
- Follow-up question: Why do some plastics soften and others not?

**Extensions:**

- What would happen if things normally made from thermoplastics were made from thermosets instead? Cite examples.

**Resources/Bibliography:**

<http://www.polysort.com/akron.html> (Polymer Information Center of U. of Akron)  
<http://eetsg22.bd.psu.edu/links/www.html> (Penn State's Polymers Web site listing)