Lab: A Sticky Situation

FOR THE TEACHER

Summary
In this lab, students will try to separate plastic spoons that have been attached together with different adhesive materials using a variety of solvents.

Grade Level
Middle school

Objectives
By the end of this lab, students should be able to
- better explain the concepts of solvents and solutes.
- distinguish between adhesive bonding and chemical bonding.
- remove adhesives from a variety of surfaces.
- describe and differentiate between the chemical and physical changes taking place.

Chemistry Topics
- Solvents
- Solubility
- Physical Change
- Chemical Change

Time
Teacher Preparation: 60 minutes
Lesson: 40 minutes plus discussion afterwards

Materials
Each station will need:
- 4 sets of two clear polystyrene plastic spoons that have been glued together with Super Glue®.
  - The teacher should prepare these in advance by putting one drop of Super Glue® between two spoons and letting set for 1 minute.
- 4 sets of two white polystyrene plastic spoons that have been previously glued together with epoxy.
  - The teacher should prepare these in advance by putting a small amount of epoxy between two spoons and letting it set overnight.
- 4 sets of two black polystyrene plastic spoons that have been previously melted together with a flame (this will be the control sample).
  - The teacher should prepare these in advance by heating lightly on the edges of the two spoons with a lighter or Bunsen burner until they have welded together. This takes some practice.
- Four 50ml beakers
- Acetone (nail polish remover)
- Water
- Soapy water
- Rubbing alcohol
- Lab trays or Rubbermaid® tubs to catch the mess (there will be a mess)

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Students should wash their hands thoroughly before leaving the lab.
- Clean up materials and dispose of chemicals as directed.
- Make sure you are working in a well-ventilated area; avoid inhaling the acetone and rubbing alcohol.
- Keep acetone and rubbing alcohol away from heat sources and direct sunlight.
- Replace lids on containers for both acetone and rubbing alcohol when they are not in use to minimize vapors and odor.

Teacher Notes
- Students should have already learned about and discussed chemical and physical changes as well as solubility and solvents.
- You should have separate containers ready to dispose of the used plastics spoons and the used chemicals.
- There will be a stink. If students are irritated or do not like the smell, they can go into the hall/leave the room. Open windows, and ventilate the area properly: turn on exhaust fans during the lab.
- We are looking for discovery and discussion in this inquiry lab. They should discover that the spoons themselves are dissolving in the solvent. This is an interesting discussion.
- The students should note that the acetone will easily break down the Super Glue, but it doesn’t work quickly on the epoxy or welded control. They should also note the spoons themselves will begin to get very flexible and ‘dissolve’ as the polystyrene is soluble in acetone. This should lead to a further discussion on adhesives, how plastics are made, and consideration of how they are bonded together.
- I tell my students this is a challenge; I have ice cream, but they must separate the spoons so that they have something to eat it with. No spoon, no ice cream. At the end of the lab we eat ice cream (with new spoons) outside of the lab setting.

FOR THE STUDENT

Lesson

A Sticky Situation: The Science of Solvents

Background
You are on your way to an ice cream social and have been given the task of providing the plastic spoons for the evening. Obviously, everyone is counting on you. Unfortunately, your devious lab partner has glued your spoons together for a prank, leaving you in a lurch. Can you separate the spoons? Can the party succeed? How am I going to eat my chocolate triple fudge ripple sundae?

Materials
- 4 sets of two clear polystyrene plastic spoons, glued together with Super Glue®
- 4 sets of two white polystyrene plastic spoons, glued together with epoxy
- 4 sets of two black polystyrene plastic spoons, welded together
• 4 - 50ml beakers
• Acetone (nail polish remover)
• Water
• Soapy water
• Rubbing alcohol
• lab trays or Rubbermaid® tubs to contain the mess

Safety
• Always wear safety goggles when handling chemicals in the lab.
• Wash your hands thoroughly before leaving the lab.
• Follow your teacher’s instructions for cleaning up your materials and for disposal of chemicals.
• Make sure you are working in a well-ventilated area; avoid inhaling the acetone and rubbing alcohol.
• Keep acetone and rubbing alcohol away from heat sources, and direct sunlight.

Procedure
1. Your lab station should contain three sets of bonded spoons:
   • 4 clear pairs that have been glued together with Super Glue®.
   • 4 white sets that have been epoxied together.
   • 4 black sets that have been welded together.

2. You will attempt to use the following four solvents to release the spoons from each other.
   • Acetone
   • Water
   • Soapy water
   • Rubbing alcohol

3. Fill each of the 50ml beakers about half way with each of the solvents provided.

4. Place one set of each color spoons into each of the four beakers of solvents. Take note of the time and include it in your observations.
   Please note:
   o You can’t break the spoons..... (or you can’t have ice cream)
   o You can swirl, stir or otherwise manipulate the spoons in any way to facilitate your task of separating them but don’t break them or no ice cream.

5. Observe any changes in the materials and record your findings in the data table attached. Don’t forget to keep track of the time.
   Some ideas....
   Is the change physical or chemical?
   Is anything different than you thought would happen?
   How can you use the words “solute” and “solvent” in your observations?
   How long does it take to see changes?

Observations
Write down all observations for each solvent and spoons below:
Please answer the following question and be ready to share with the rest of the class:
Is there a method (or material) that you could use to save the ice-cream social?

Why or why not?

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<tr>
<th></th>
<th>Water</th>
<th>Soapy Water</th>
<th>Acetone</th>
<th>Rubbing Alcohol</th>
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<tr>
<td><strong>Clear Spoons</strong></td>
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<td><strong>Super Glue®</strong></td>
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<td><strong>White Spoons</strong></td>
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<td><strong>Black Spoons</strong></td>
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