**What Solvent Cleans Crayon Best?**  
**An Exploration of Intermolecular Forces**

**Background**
“Like dissolves like” is a phrase often repeated in chemistry classrooms and carried over into everyday experience. But what exactly does this phrase mean? The act of dissolving a material (the *solute*) in a liquid (*solvent*) involves attractive forces between the solvent and solute molecules that overcome the attractions among the solute molecules. The forces between molecules of any given substance depend on the molecular structure of the substance and the distribution of electron density in the molecules. In order for a solute to dissolve in a solvent, the attractive force between the solute and solvent molecules must be sufficient to overcome the attraction of solute molecules for one another. In addition, the solvent molecules must be separated from one another, as shown in Figure 1. This balance of forces leads to the rule of thumb “like dissolves like.”

**Figure 1. Schematic Illustration of Solute and Solvent Interactions During the Dissolution Process**

**Objective**
In this experiment you will determine which solvent is most effective at removing wax crayon from a glass slide. The most effective solvent is the one that has similar intermolecular forces to the intermolecular forces between the wax molecules.

**Safety**
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow the teacher’s instructions for cleanup of materials and disposal of chemicals.
- Glass slides may have sharp edges.
- The materials used in this experiment are common household materials. However, these materials can pose hazards if not handled carefully.
- Avoid skin contact; wash with soap and water and notify your teacher if skin contact occurs.
- Avoid breathing the solvent vapors and work with adequate ventilation. Do not expose these materials to fire or flames.
Materials
- selection of solvents
- glass microscope slides (one for each solvent)
- glass beakers, 50mL, or disposable plastic pipets, one for each solvent
- wax crayon
- cotton swabs
- paper towels

Procedure
1. Record your prediction below: which solvent do you expect to be best at removing wax crayon, and why?

Prediction: I predict that ___________________ will be best at removing crayon from glass because ____________________________________________________________________________________.

2. Coat the middle one-third of one microscope slide with the wax crayon.
3. Obtain 10-20 mL of a solvent to be tested in a labeled 50-mL beaker or in pre-filled plastic pipets.
4. Dip a fresh cotton swab into the solvent.
5. Rub the cotton swab back and forth on the crayon-coated slide for a set number of times. You decide how many. Try to keep the pressure on the swab constant.
6. Note how effectively the solvent removes the crayon and record your results in the data table.
7. Repeat steps 2-6 for each solvent to be tested

Data

<table>
<thead>
<tr>
<th>Slide number</th>
<th>Solvent Type Used</th>
<th>Cleaning effectiveness</th>
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Analysis
1. How many wipes with the cotton swab did you use in your experiment?

2. Which solvent was most effective at removing crayon? Did it match your prediction?
3. Do you expect this solvent to be most effective at removing every kind of stain? Why or why not?

4. If you had a stain to remove, how could you figure out what stain remover is best to use?

5. Were your results consistent with other groups? If not, why not?

6. How could you improve this experiment so you have more confidence in the results.