

# CLAW At-Home Experiments: Organic Chemistry, Introduction to Solubility

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## Description:

In this out-of-class activity, students will perform at-home experiment to qualitatively evaluate and understand solubility behavior. Students will be able to determine conditions and properties that favor solubility. See a full description [here](#).



Out of Class (Instructor)

Out of Class (Students)

In Class (Instructor)

In Class (Students)

### Introduce Activity

- Present topic/theory to the whole class
- Distribute the [protocol](#)
- Demonstrate the at-home experiment with a walk through the procedure synchronously, or by sharing a pre-recorded video asynchronously

### Gather Materials

Gather necessary materials and tools:

- Spatula (or popsicle stick)
- Teaspoon
- Aluminum foil
- Transparent containers (such as test tubes, shot glass, narrow drinking glass, etc.)
- Water
- Rubbing alcohol
- Baby oil
- Nail polish remover (ultra-powerful),
- Table salt (NaCl)
- Table sugar (sucrose)
- Petroleum jelly (vaseline)
- Packing peanuts
- Styrofoam pieces (from cups, or packages, etc.)

### Set up and Conduct Part A of Experiment

Conduct Part A for each pair of compounds, following the steps in order:

1. Choose a pair of compounds (water, rubbing alcohol, nail polish remover or baby oil)
2. Record the brand name and the ingredients of the rubbing alcohol and nail polish remover being used.
3. Use a clean and dry tube to add equal amounts of each liquid to the same tube.
4. Rigorously shake the tube for 10–20 seconds. Then let it stand for 30 seconds.

### Analyze Part A Mixture and Record Results

- Check mixture to determine if the two liquids are miscible (forms one layer) or immiscible (forms two layers).
- Record your results (miscible or immiscible) on the Data sheet provided

Repeat for each pair of compounds

### Set up and Conduct Part B of Experiment

Conduct Part B three times with three different solids (salt, sugar, then petroleum jelly heated for 20–30s until liquid). Follow these steps each time:

1. Use clean and dry tubes. Then, using the tip of the spatula (or popsicle stick, or coffee stick), place a small amount of table salt (sodium chloride, NaCl) into each of five tubes. The amount should be approximately the same.
2. Label tubes according to compounds: water, baby oil, rubbing alcohol, nail polish remover and label the fifth tube

## Legend

### Context Icons:



Individual Work

### Task Icons:



Analyze



Write



Experiment/Inquiry



Instructor Orchestration

control.

3. Add about 2 mL of each compound to each tube according to its label. (e.g. add the compound water to the tube labeled water) The fifth tube will be used as a control to visualize the starting quantity of the solid.
4. Cover the top of each tube with aluminum foil and shake it vigorously for 30 seconds. Then, let it stand for 30 seconds.

Note: When using petroleum jelly (Vaseline), heat solid in a microwave for 20 to 30 seconds to get a liquid solute before mixing it with the liquid solvents.

**Analyze Part B Solubility and Record Results**

- Compare each tube with the control to determine solubility.
- Record on the data sheet whether the compound is soluble (dissolves completely), insoluble (none of it dissolves), or partially soluble.

Note: use the following cases to guide determinations:

- If a significant amount (at least 50%) of the solid has dissolved, the sample is partially soluble.
- For the purpose of this experiment, if it is not clear that a significant amount of solid has dissolved, then state that the sample is insoluble.
- If all but a couple of granules have dissolved, state that the sample is soluble.

Repeat using 2 substitute solids

**Set up and Conduct Part C of Experiment**

Follow these steps in order using styrofoam pieces the first time and then substituting styrofoam with packing peanuts:

1. Clean and dry three tubes and place a piece of Styrofoam into each of three tubes
2. Label tubes according to compounds: water, baby oil, nail polish remover
3. Add about 5 mL of compound to each tube, according to its label.
4. Cover the top of the tube with aluminum foil and shake vigorously for 30 seconds. Then, let it stand for 30 seconds.

**Analyze Part C Solubility and Record Results**

Record on the data sheet whether the compound is soluble (dissolves completely), insoluble (none of it dissolves), or partially soluble.

Repeat using 1 substitute

**Set up and Conduct Part D of Experiment**

Follow these steps in order three time, first using tap water, then substituting tap water with ice water, and then substituting with boiling water.

1. Add a 1/2 cup of tap water to a transparent cup.
2. Gradually add table salt, one teaspoon at a time, to the tap water and stirring the solution between each addition. Stop adding salt when it no longer dissolves.

**Analyze Part D and Record Results**

For each type of water, record the number of teaspoons of salt added on the Data sheet.

Repeat twice with different water

**Complete and Submit Data**

Once data sheet is complete, submit to the instructor, including a picture of the experimental set up.

Optional: Test Solubility of an Egg Shell in Vinegar

1. Delicately place an egg into a transparent glass.
2. Add a large amount of vinegar ( $\text{CH}_3\text{CO}_2\text{H}$ ) to cover the egg.
3. Observe the egg after 24, 48 and 72 hours to see if the vinegar has dissolved the eggshell, which is made up of calcium carbonate ( $\text{CaCO}_3$ ).

Note: Be careful, the egg will break very easily once the shell has dissolved

Review and Discuss Lab Reports

- Review the student lab reports
- Discuss the results with the class