

Lab 2: Developing and Testing a Hypothesis

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Objectives

By the end of this laboratory, you should have developed the skills to do the following:

- Develop a testable hypothesis.
- Formulate a new hypothesis based on experimental results.

Recommended Resources

- Handout ~ Topic 4: Writing an Organic Chemistry Lab Report
http://www.csub.edu/chemistry/organic/manual/Topic4_Report.pdf
- Handout ~ Topic 7: Using a Pasteur Pipet
http://www.csub.edu/chemistry/organic/manual/Topic7_Pipet.pdf

Background

A hypothesis is an educated guess regarding the outcome of an experiment. A good hypothesis is one that is testable and that can be modified and improved based on the outcome of experimental results. In organic chemistry lab, you will often be expected to develop a hypothesis, and test that hypothesis during your experiment.

This exercise will assist you in developing a hypothesis testable hypothesis. You will attempt to identify which organic compounds are soluble with water, then which organic compounds are soluble with hexane, finally which compounds are soluble in methanol. You will also be seeing how the ratio of hydrogen bonds to carbons before the organic compound is soluble. Finally you will see what happens when you use acid base chemistry to make ions and the solubility of ions in water.

Lab Notebook Preparation

Before coming to lab, the following items must be in your lab notebook:

1. Title of the experiment & date the experiment is to be performed
2. Structures of the seven compounds you will be testing
3. Functional groups present in each compound
4. Hazards of and appropriate precautions for the safe handling of hydrochloric acid

5. References

Directions

1. Add approximately 40mg of benzophenone to 3 clean dry test tubes
2. Number the test tubes to keep track of them
3. To the first test tube, add 1-mL of water and stir for 60 seconds and determine if the solid is completely soluble (note the time it takes to dissolve as well) is it partially soluble (about half dissolved) or insoluble.
4. Repeat step three with methanol in the second test tube
5. Repeat step three with hexane in the third test tube.
6. Repeat steps 3-5 with malonic acid
7. Repeat steps 3-5 with biphenyl
8. Obtain six new clean test tubes
9. Add 1mL of water to three test tubes
10. Add 1mL hexanes to three test tubes
11. Add one of three alcohols provided (1-octanol, methanol, 1-butanol) dropwise to a test tube of water and hexanes. Shake tube after each drop and take note of what happens. Continue adding alcohol for 20 drops in each tube. Repeat with the next two alcohols.
12. Add 1mL of water and ethyl alcohol to a test tube and shake for 10-20 seconds (determine if the solvents are miscible)
13. Repeat step 12 with water and diethyl ether, water and methylene chloride, water and hexane, and hexane and methylene chloride.
14. Add 30 mg of benzoic acid to three dry test tubes
15. Add 1mL of water, 1.0M NaOH, 6.0M NaOH, and 1.0M HCl and 6.0M HCl to each test tube. (1.0mL of water goes into one test tube etc. (you should have 4 total test tubes.)
16. Repeat step 14-15 with ethyl-4-aminobenzoate

Reporting your Results

Lab report will consist of Results and Discussion with a brief conclusion.

In the report discuss whether you think the following will be miscible acetone and water, and acetone and hexanes. Also discuss whether p-dichlorobenzene or o-dichlorobenzene will be more soluble in hexanes and water.

References & Additional Resources

(1) *Organic Chemistry Laboratory; Pavia, Reprint; Cengage Learning, 2008; pp 13-20*