Chemistry 201 Laboratory  
Summer, 2011

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Required Materials:


Approved safety goggles with side protection. Prescription or reading glasses alone are not suitable substitutes. Safety goggles are normally designed to fit over such glasses. Also, because of the hazard associated with vapor irritation, the use of contact lenses in the lab is discouraged. Approved goggles can be purchased at the chemistry department stockroom.

A laboratory apron or lab coat will be required at all times in the lab. Black rubberized aprons can be purchased at the chemistry department stockroom.

Rubber gloves that are rated solvent resistant.

A bound laboratory notebook with numbered pages will be required. This can also be purchased at the stockroom.

A pocket calculator with basic functions is highly recommended.

Laboratory Objectives:

The primary objective of the laboratory program for the Chemistry 201-202 sequence is to exemplify, through experimentation, the basic principles of Organic Chemistry. In actuality, the Chemistry 201 lab will emphasize traditional laboratory techniques suitable for a first course in Organic Chemistry. These techniques will include recrystallization, extraction, reflux, distillation and the determination of melting and boiling points. Each of the above may be done as a discrete operation, or in combination with other techniques. These basic techniques will form the foundation for performing later experiments primarily involving synthesis and structural analysis of organic compounds. In addition, instrumental techniques including Gas Chromatography (GC), Infrared Spectroscopy (IR) and Nuclear Magnetic Resonance Spectroscopy (NMR) will be introduced in the 201 course and expanded to include additional experiments in Chemistry 202. Since a major objective of the Organic Chemistry laboratory is to learn a large number of totally new laboratory techniques, you will be carefully observed on the safe and proper methods for implementing these techniques. You will also be evaluated as to the respect that you show delicate instruments, the safe handling and disposal of chemicals, the neatness of your work area and adherence to all safety regulations.

Safety:

Please adhere strictly to all safety precautions as outlined by myself and/or your lab text. Make yourself aware of the location of emergency equipment located in the lab, and know how to use each item. Consider every chemical that you handle to be, at the very least, toxic! Read each label carefully. Rubber gloves should be wore when dispensing chemicals. Be assured that violation of any safety regulation, especially the consistent failure to wear safety goggles AT ALL TIMES in the lab, may result in your immediate expulsion from the lab, and an assigned grade of zero for that
experiment. Additionally, you may not wear sandals in the lab. Any chemistry faculty member may expel you from lab for not strictly following safety regulations.

**Recitation:**

The first 20-30 minutes of each session will be devoted to a “recitation period”. Class will meet in its assigned recitation room to review any previous experiment, and to discuss the scheduled experiment for that day. Students are expected to be prepared for lab. If there are no student questions, the class will proceed immediately to lab.

**Laboratory Notebook and Reports:**

Each student is required to have a sturdy, bound laboratory notebook with duplicate numbered pages. Upon obtaining your notebook, print your name, starting date, course and laboratory section on the front cover. Reserve the first page for a Table of Contents, and start each new experiment on a new page. The notebook will serve as an original record of everything that you observe during the experiment. The white pages will serve as the laboratory report and the yellow pages as your copy. The notebook should be organized in such a manner that another person reading it would be able to easily reproduce all of the steps that you performed in the experiment.

The following items should be recorded in your notebook **before coming to lab** in approximately the order indicated below:

1. Date experiment is performed
2. Complete title of the experiment
3. Experiment number
4. Brief statement of objective(s)
5. All balanced equations including structures (not formulas) of all organic compounds
6. An organized table listing the identity and physical properties of reagents to be used (main reactants and solvents) including molecular weight, melting point (for solids) or boiling point (for liquids), density or specific gravity (for liquids) and concentration (where applicable).

The following items should be recorded in your notebook **during lab**:

7. An organized data table listing the identities and actual amounts of reagents used in grams or milliliters, and a listing of the number of moles used for all reactants.

8. All observations, as they are made. This should consist of a complete, coherent record of every step that you perform in the experiment, followed by anything that you may have observed. This may include such things as the initiation of reflux, the observation of distillation temperature(s), the formation of two or more liquid layers, any signs of reaction such as temperature change, gas evolution, color changes, precipitation, violent reactions or anything unexpected. Any variations from the directions in the manual should also be noted. In short, write in complete sentences, everything that you do and everything that you observe.

9. Results, including observed melting or boiling points (distillation temperature), actual yield, theoretical yield and percent yield should be tabulated. All calculations should be shown. Note: Product yield and purity will be included, where appropriate, as part of the lab report grade.

10. Your signature at the bottom of each page, along with my initials as witness, should be completed before you leave lab.
At this point, you will have about 90% of your report completed. The following items should be added to your report before submitting it for grading:

(11) **A discussion** (one-half to three-fourths page) of the experiment paying particular attention to an explanation of why each procedure or technique was used, e.g. “the organic layer was washed with 5% sodium bicarbonate in order to remove any acidic contaminants”, or “the organic layer was treated with saturated NaCl in order to salt-out (remove) any water”. It is not necessary to repeat items covered in the supplemental questions.

A brief discussion of your observed results and any non-human sources of error should also be included, e.g. “the observed melting point of my product was 140-146 compared to the literature value of 152-154. This difference may be due to the presence of byproduct (speculate on what it may be) and/or incomplete drying.” “The observed 30% yield reflects a significant amount of unreacted starting material (name) and the formation of significant byproduct (name if possible). The yield may be increased by …”

(12) **Supplementary questions** for each experiment will be assigned at the end of each recitation period. These should be answered, and included as the very last part of the laboratory report. These can constitute up to 20% of the report grade.

All work must be done neatly, and in ink, with no scribbles, erasures or white-out (draw a single line through mistakes). Gross errors in spelling or grammar will be penalized on the report. Illegible or sloppily submitted reports will be returned to you for resubmission with a 10% penalty. **IMPORTANT:** Make sure that you write legibly and that you press hard when writing so the duplicate copy will be legible.

All work in the lab is to be performed in pairs, unless otherwise instructed. The report is considered officially due during the next scheduled laboratory period following completion of the experiment. 10% of the maximum attainable grade will be deducted from the report for each week late. No reports will be accepted after the last scheduled lab period.

Grade breakdown:

1. Lab Reports 90%
2. Lab Technique 10%

Any missed lab may not be made-up as a matter of course. Only reasonable excuses for absence will be accepted. If permission is given to make up work, that work should be made-up within one week of the time the work was scheduled to be done.

**A passing laboratory grade is necessary to pass Chemistry 201 and/or 202!**

**Check-in:**

At the beginning of each semester, you and your lab partner will be assigned a locker. This locker will be used by only yourself and your partner. The locker will contain the common laboratory equipment necessary to perform most experiments, including an expensive ground glass kit. On the first day of lab, you will be asked to check the contents of your locker and kit against a master list. Any missing or broken items may be replaced at no charge on the day of check-in only.
**CHL 201- Laboratory for Organic Chemistry I**  
*Summer Session I, 2010*

**Instructors:** William A. Price, Ph.D.; Laura Grande, M.S.  
**Location:** Holroyd Hall 305  
**Text:** Custom Lab Manual by Mohrig, Hammond, Schatz, and Morrill  
*From Modern Projects and Experiments in Organic Chemistry*

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<thead>
<tr>
<th>Date</th>
<th>Experiment</th>
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<tr>
<td>May 16-17</td>
<td>Introduction, Check-in, Safety</td>
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<td>May 18-19</td>
<td><strong>EXP 1</strong>, Extraction of Caffeine from Tea, pp 3-6.</td>
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<td>May 23-24</td>
<td><strong>Handout</strong>, Extraction and Evaporation: Separation of the Components of “Panacetin”.</td>
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<td>May 31-June 1</td>
<td><strong>PROJECT 3.1</strong>, Hydrolysis of an Unknown Ester: Hydrolysis and Azeotropic Distillation, pp 247-252.</td>
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<td>June 2-3</td>
<td><strong>PROJECT 3.2</strong>, Extraction and Recrystallization, pp 252-254.</td>
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<td>June 6-7</td>
<td><strong>PROJECT 3.3</strong>, Distillation, Boiling Points, Melting Points, and Identification, pp 254-258.</td>
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<td>June 8-9</td>
<td><strong>EXP 16.2</strong>, Stereochemistry of Bromine Addition to <em>trans</em>-Cinnamic Acid, pp 136,139-142.</td>
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