Organic Chemistry
Chemistry 204
Supplemental labs
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Laboratory Write-up's

1. Write a theory, background and procedure, as you would before any lab in your laboratory notebook. If you have questions about what that implies, see your instructor.
2. Collect data throughout the lab, write everything down in your notebook.
3. Do the Reports for each experiment you did.
4. Answer any addition questions provided by your instructor.
5. Include Spectra when available.
6. If you include spectra, always indentify major peaks, with the structure of the compound you think you’ve isolated.

Experiment 3

Perform parts A, B and D.

Using a melting point apparatus, determine the melting point of your purified compound as well as your starting material. Look up the melting point of your compound. And record three values in your lab notebook.
Experiment 4 Extraction

Do parts A-C

Part B: reading the lab manual, this can be a bit confusing. It talks of 3 solvents. Start with methylene chloride. In methylene chloride you must run 4 TLC plates, one for each of the 3 combo’s and one for your unknown. Next, switch solvents to acetone (on the bench) and run the same 4 TLC plates as you did with methylene chloride. For the third solvent, use ethyl acetate.

Let me iterate, that all of the mixing has been done for you.

Part C:
Test-tube #1: water and n-butyl chloride
Test-tube #2: water and n-butyl bromide
Test-tube #3: n-butyl bromide and saturated sodium bromide

Addition questions:
1. Find the formula and molecular structure of methylene chloride
2. For water and methylene chloride find:
   a. dipole moment
   b. dielectric constants
   c. density

Give a reasonable explanation why water and methylene chloride are not miscible.

Exp 6 A & B

In part A only do the simple and not fractional distillation unless instructed otherwise.

Also, no Gas Chromatograph in this experiment

Exp 12

Do 12 A only.
Chem Draw Lab

The purpose of this lab is for you to become familiar with commonly used chemistry software. The software used is called Chem Draw. This is the standard software for drawing molecules and writing chemical equation for documents.

Theory: In this lab you will learn the following procedures using Chem Draw:

1. Write a Condensed formula and equation
2. Write a Dash formula and equation
3. Build molecules and learn how to:
   a. Make multiple bonds
   b. Turn a molecule into a 3D structure
   c. Check a structure
   d. Clean up a structure
   e. Include text
   f. Convert the structure to name
   g. Find the analysis
   h. Find the chemical properties
   i. H-1 NMR and C-13 NMR
4. Use the templates
5. Build a virtual experiment

Demonstration

\[ \text{CH}_3\text{CH}_2\text{CH(OH)}\text{CH}_2\text{CH}_3 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \text{ and Fuse Rings} \]

1. Write a Condensed formula and equation
2. Write a Dash formula and equation
3. Build molecules and learn how to:
   a. Make multiple bonds
   b. Turn a molecule into a 3D structure
   c. Check a structure
   d. Clean up a structure
   e. Convert the structure to name
   f. Include text
   g. Find the analysis
   h. Find the chemical properties
   i. H-1 NMR and C-13 NMR
4. Use the templates
Procedure:

Using a computer with Chem Draw:

A. Go to Experiment 14 and using Eugenol and Caryophyllene as an example:
   1. Write a Condensed formula
   2. Write a Dash formula
   3. Build the molecule
      a. Check a structure
      b. Clean up a structure
      c. Convert the structure to name
      d. Find the analysis: Paste to document
      e. Find the chemical properties: Paste to document
      f. H-1 NMR and C-13 NMR

Save your work to a file and print it out

B. Under Experiment 17, ethanol from sucrose
   1. Construct the reaction for Sucrose converting to Fructose and Glucose
      a. Check a structure
      b. Clean up a structure
      c. Convert the structure to name

Save your work to a file and print it out

C. Go to Experiment 25
   Replicate the reaction of 4-Methycyclohexanol to 4-Methycyclohexene
   1. Write a Condensed formula and equation
   2. Write a Dash formula and equation
   3. Build molecules and learn how to:
      a. Make multiple bonds
      b. Turn a molecule into a 3D structure
      c. Check a structure
      d. Clean up a structure

Save your work to a file and print it out

D. Fused Rings
   1. Go to Experiment 5, Thin Layer Chromatography
   2. Construct the Fluorene, Fluorenol, and Fluorenone
   3. Construct a forth fused ring of your own making, no more than 3 rings all, however, you can make them 4, 5 or 6 carbon rings, with or without double bonds, no triple bonds, or simply add another alcohol group to one of the previous structures.
   4. Check a structure
   5. Clean up a structure
   6. Convert the structure to name
   7. Find the analysis: Paste to document
   8. Find the chemical properties: Paste to document
E. In your textbook, Solomons/Fryhle, 9th ed, turn to page 233. There you will see A Mechanism for the Reaction. Specifically, they are showing The Stereochemistry of an SN2 Reaction. Reproduce the equation shown. Save your work to a file and print it out.

F. From the Clipware template, construct a simple lab setup with:
   1. Hotplate
   2. Beaker on a hotplate
   3. Thermometer in the beaker
   4. Ring stand with clamp holding the thermometer
Save your work to a file and print it out.

G. From the template paste one each from the DNA, RNA, Hexose/Sugar, Aromatic and nanotube templates. Resize and rearrange them to fit on a single page. Save your work to a file and print it out.

Save your printouts, and save your files.

Experiment 24

Replace butanol with either 1-heptanol or 1-octanol, depending upon what is available for reagents. Increase the size of the reaction to 2 mL of the alcohol and scale up the acid mixture to 3.00 mL, 50:50 phosphouric/sulfuric. Do NOT use the setup with syringe and J-tube. Instead, setup a standard microscale reflux, 25 mL round bottom, with water condenser. Before coming to lab, look up the boiling point of 1-octanol, 1-heptanol, 1-octene, and 1-heptene, so you know the temperature of your product. Get FTIR of reagent and product.

Techniques 25-27

Technique 25, problem #2 a-l, hand draw these in your lab notebook, and write either the stretching for bending frequency’s used to identify the difference between the two molecules.

Technique 26, problems 5-10. In your lab notebook write the structure you think is correct, show your instructor. Next use Chem Draw’s NMR feature to verify your structure, keep the Chem Draw printout, with structure, in your lab notebook.

Technique 27, problems 1-3. Write problem 1 a-k in your lab notebook. For 2 and 3 follow a similar procedure you did in Technique 26, first determine the structure in your lab notebook, show your instructor, than use Chem Draw to determine the if you were correct.
**Unknown Lab**

See Experiment 55

You have will have one of the four following mixtures. Below are the solvents available.

1. 50% 4-aminoacetophenone, 40% 1,2,4,5-tetrachlorobenzene, 10% 1.4-dibromobenzene
2. 50% benzoic acid, 40% benzoin, 10% 1.4-dibromobenzene
3. 50% fluorene, 40% O-toluic acid, 10% 1.4-dibromobenzene
4. 50% phenanthrene, 40% methyl 4-aminobenzoate, 10% 1.4-dibromobenzene

Solvents and Procedures Available.
1M NaOH 200 mL
1M HCl 200 mL
6M NaOH 50 mL
6M HCl 50 mL
1M NaHCO₃ 100 mL
Saturated aqueous sodium chloride 200 mL
Diethyl ether 200 mL
95% Ethanol 50 mL
Methanol 50 mL
Isopropyl alcohol 50 mL
Acetone 50 mL
Hexane 50 mL
Toluene 50 mL
Methylene chloride 50 mL
Anhydrous sodium sulfate (granular) 25 g
Other solvents may be needed for crystallization
Melting point capillary tubes
Filter paper for Büchner or Hirsch funnels
Chemicals and supplies for infrared

**Procedure**

1. Using Chem Draw, make a list of each molecule in each of the 4 test-tubes to give you an idea of the different functional groups on each molecule
2. Make a table, with each molecule in the column and solvents in the header. Use this table as a check list to help you find the best solvent to dissolve and recrystallize your compounds in.
3. Write a step by step scheme outlining the different solvents you’re going to use, and the purpose of that solvent
4. Since you’re going to try to find the percent of each compound, always weigh your sample before doing the experiment.
5. You will have 2 lab periods to complete this
6. On the 3rd lab period you will present to the class, your findings.
SLO Formal Lab write-up procedure

Students do not often think about what it means to present formal findings for a review process. You are being asked, to perform a lab, collect data, interpret that data to confirm, conclusively, that you have indeed isolated the correct compound. When you hand in your results for review/grading, there should be no doubt in the reviewers mind that **you have indeed done the experiment**, and have **correctly indentified your results**.

To show the reviewer **you have indeed preformed the experiment** you must carefully outline all the steps in the experiment so that any other person, looking at our procedure will get the *exact* same results. Include a detailed:

1. Purpose, Theory, Background, Procedure, Observation, Data, and Calculations
2. Supporting spectroscopy data such as IR spectra, perhaps melting point, if applicable

Interpret your data by **indentified your results**. This means that your results, such as an IR spectrum, must correlate to the structure you believe you have isolated. Therefore, you should indentify all major peaks in and IR spectrum and identify them as part of the structure you believe you isolated. This task often takes the most time and if done well, is solid evidence you have the compound you believe you have.

See below for the grading rubric.

DUE: the Following Lab Period.
<table>
<thead>
<tr>
<th>Levels of Implementation</th>
<th>SLO Grading Rubric for Formal Lab-Write-up</th>
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</thead>
<tbody>
<tr>
<td><strong>Awareness</strong></td>
<td>• There is a preliminary procedure.</td>
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<tr>
<td></td>
<td>• The student’s ability to collect</td>
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<td>experimental data is limited by their</td>
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<td></td>
<td>inability to follow experimental</td>
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<td></td>
<td>procedure</td>
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<td></td>
<td>• The student modifies their</td>
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<td></td>
<td>experimental procedure during lab</td>
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<td></td>
<td>• The student ability to complete the</td>
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<td></td>
<td>lab is due to their preparedness</td>
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<td><strong>Development</strong></td>
<td>• The student established a thorough</td>
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<tr>
<td></td>
<td>summary for the experiment including</td>
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<tr>
<td></td>
<td>theory and background with some</td>
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<tr>
<td></td>
<td>references noted</td>
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<td></td>
<td>• There is some evidence outside</td>
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<td>resources are used to complete the</td>
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<td>summary and procedure.</td>
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<td>• The experimental procedure’s</td>
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<td>organizational structure is supported</td>
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<td>with all necessary data table.</td>
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<td>• The student is careful to note</td>
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<td>experimental data in their laboratory</td>
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<td>notebook during the experiment.</td>
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<td><strong>Proficiency</strong></td>
<td>• The student’s experimental procedure is</td>
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<td>authentic according the either the</td>
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<td>laboratory manual or laboratory</td>
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<td>handout</td>
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<td>• There is dialogue in the experimental</td>
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<td>theory and background that is</td>
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<td>purposefully directed toward improving</td>
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<td>the student knowledge of the</td>
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<td>experiment.</td>
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<td></td>
<td>• The student has clearly allocated</td>
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<td>time and resources to develop their</td>
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<td>procedure which shows a thorough level</td>
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<td>of comprehension.</td>
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<td>• The student demonstrates an awareness</td>
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<td>of goals and purposes of how this</td>
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<td>experiment is to be completed, usually</td>
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<td>by incorporating tables, charts, within</td>
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<td>the procedure.</td>
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<td>• Experimental data includes observations</td>
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<td>relating to physical and chemical</td>
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<td>changes, physical and chemical</td>
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<td>properties</td>
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<td>• The student works carefully and</td>
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<td>efficiently</td>
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<tr>
<td><strong>Sustainable Continuous Quality Improvement</strong></td>
<td>• The student’s experimental procedure includes a theory and background which encompasses the topic thoroughly and is pervasive and robust, that is well documented including outside sources found outside of classroom recourses.</td>
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<tr>
<td><strong>15-20 points</strong></td>
<td>• The student discusses further yet</td>
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<td>related ideas on how to modify the</td>
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<td>experimental procedure that.</td>
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<td>• The student identifies alternative</td>
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<td>methods for achieving the same</td>
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<td>outcome for the experiment.</td>
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<td>• There is evidence that the student</td>
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<td>has fine-tuned their procedure, to</td>
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<td>allowed them to complete the</td>
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<td>experiment in minimal amount of time.</td>
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<td>• The student’s experimental procedure</td>
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<td>is clear, including tables, and or</td>
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<td>charts all in the correct order as</td>
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<td>directed by the experimental procedure.</td>
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<td>• The student’s has an area set aside</td>
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<td>for calculations, including all necessary</td>
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<td>formula and supporting examples of</td>
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<td></td>
<td>calculations</td>
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<td></td>
<td>• Experimental data includes detailed</td>
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<tr>
<td></td>
<td>observations relating to physical and</td>
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<td></td>
<td>chemical changes, physical and</td>
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<tr>
<td></td>
<td>chemical properties</td>
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<tr>
<td></td>
<td>• The student completes the experiment</td>
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<tr>
<td></td>
<td>in a minimal amount of time</td>
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<td>• The calculations are thorough, accurate</td>
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<td>and require not further modifications</td>
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<td>when submitted</td>
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</table>
## Chemistry 204, Presentations Evaluation Rubric

**Student Name: ___________________ Topic: ___________________ Date ________________**

<table>
<thead>
<tr>
<th></th>
<th>Presentation</th>
<th>Organization</th>
<th>Strategy</th>
</tr>
</thead>
</table>
| **Excellent (40 pts)** | ☐ Presenter is comfortable without notes  
☐ Presenter makes good eye contact with audience  
☐ Presenter shows enthusiasm  
☐ Presenter has clearly fine-tuned presentation | ☐ Presenter has thoroughly investigated the topic using multi sources and references  
☐ Presenter demonstrates a clear logical flow of ideas  
☐ Presenter’s summary is effectively ties all points together | ☐ Presenter presentation has a clear effect on audience who seem thoroughly engaged  
☐ Presenter effortlessly makes presentation  
☐ Presenter’s presentation is pervasive and robust  
☐ Presenter finishes within allotted time, making adjustments as needed to finish |
| **Good (30 pts)** | ☐ Presenter makes some reference to notes  
☐ Presenter makes eye contact with audience  
☐ Presenter seems comfortable talking  
☐ Presenter has made a clear effort to practice | ☐ Presenter investigated topic from a couple of sources  
☐ Presenter ideas are presented skillfully  
☐ Presenter presents an effective summary | ☐ Presenter noticeable engages audience  
☐ Presenter makes most points clear  
☐ Presenter’s presentation is thoughtful  
☐ Presenter finishes in allotted time |
| **Average (20 pts)** | ☐ Presenter relies on notes  
☐ Presenter makes some eye contact  
☐ Presenter seems uncomfortable talking  
☐ Presenter has practiced the talk | ☐ Presenter does not have extended research  
☐ Presenter follows a basic framework to present topic  
☐ Presenter has a basic summary | ☐ Presenter makes audience engaged in some fashion  
☐ Presenter has trouble making all points clear  
☐ Presenter’s presentation lacks motivation  
☐ Presenter finishes early and abruptly |
| **Poor (10 pts)** | ☐ Presenter refers to notes frequently  
☐ Presenter is not comfortable making eye contact  
☐ Presenter is not comfortable, fidgeting, nervous  
☐ Presenter has made no effort to practice | ☐ Presenter has done only a preliminary investigation of the topic.  
☐ Presenter seems to wonder aimlessly  
☐ Presentation seems to end abruptly | ☐ Does not engage audience  
☐ Presenter makes little effort to convey ideas to audience  
☐ Presenter’s presentation is lifeless  
☐ Presenter finishes without a clear ending |

**Overall score (maximum 40 points)**