

Rowan College at Burlington County
Instructor: Angela S. Foy
Organic Chemistry I & II Laboratory (CHE 241 & 243)

Explanation of Notebook Protocol

Required: Three (3) 100-page college ruled notebooks. Enter your name, class and book number on the outside cover for identification (i.e., Volume 1, 2 & 3).

Save a few pages in the beginning of each notebook for the Table of Contents, and at the end of each notebook for the Chemical Hazards and Precautions Appendix.

Number every page in the top right corner (100-199 for notebook #1, 200-299 for notebook #2, etc.).

The Spill & Waste Codes Explanation sheet must be included in the back inside cover of each notebook.

For all entries:

- Enter the date on the top line (right side) of each page, under the page number. The date should reflect when data was recorded, pages should not be pre-dated.
- Entries at later dates on the same page should be dated as well.
- Each section begins on a new page, with the section title given in the header.
- Each page in a given experiment needs a header, even if a section is continuing from a previous page or if no other information is recorded on that page. This rule does not apply to pages that exist after an experiment. Leave those blank for the next experiment.

Example Header: Experiment 1: Boiling Points & Distillation (top line, left)
 Experimental Procedure

- Every mistake must be crossed out with a single line and then initialed. DO NOT use White-Out.
- Mark a line through all unused portions of a page. This includes blank pages in the middle of your experiment (these pages still require a header).
- Indicate whether each section continues or ends. Include the page number the section is continuing to, or where the section continued from:

Example: Bottom of page 2:
 Experiment 1: General Procedure, continued to page 3 (student's initials)

 Top of page 3:
 Experiment 1: General procedure, continued from page 2 (student's initials)

 If a section ends, indicate at bottom right:

Experiment 1: General Procedure, End (student's initials)

- Sources must be given for all data used to complete your Table of Physical Constants and Chemical Hazards & Precautions Appendix (website, book, supplement, etc.)
- For your Experimental Procedure section, entries must be made directly into the notebook. Scrap paper or other notebooks are NOT permitted.
- For each experiment, pages on the left side of the notebook are for your notes, calculations or instructions, and will not be graded. Pages on the right side of your notebook are graded. Use only this side for your finalized work.
- Black, water insoluble ink must be used. No pencil, gel pens, etc. are allowed.

Order of sections for each experiment:

Pre-lab-

- Purpose
- General Procedure
- Reaction Equations
- Table of Physical Constants
- Preliminary Calculations
- Preliminary Flow Sheet (if applicable)
- Chemical Hazards & Precautions Appendix (back of book)

Post-lab-

- Experimental Procedure (written in past tense as the work is completed)
- Diagram with all parts labeled (can be included in experimental procedure section)
- Data Table
- Experimental Calculations
- Supplements (Spectra, Chromatograms)
- Post-lab Flow Sheet (if applicable)
- Analysis
- Abstract

Format and content requirements for sections/reporting:

1. Purpose

The purpose/objective is given before the General Procedure for each experiment in the supplement. It should be rewritten, or word processed in paragraph format. Since we don't have access to NMR, any information stating that NMR will be used for analysis should be omitted for this section.

2. General Procedure

The General Procedure is found after the Purpose in the supplement. It may include information such as the reactants and quantities, or values needed to complete the Preliminary Calculations. The General Procedure itself will list all of the compounds and solutions used for the experimental synthesis, separation and purification. It can be copied from the supplement and taped neatly into your notebook or included in written format.

3. Reaction Equation

The Reaction Equation may be found before, after or within the General Procedure. It should be added to your notebook as a separate section (copied or written) and must include side product formation (side product names and reactions) if given.

4. Table of Physical Constants

A Physical Constants Table should be completed for each experiment. The Physical Constants template on Blackboard can be printed and the information added by hand or by using a computer to fill in the data. The compounds and solutions used in each experiment are found by reading the experiment and recording the name of each compound and chemical solution you will be using. They should be assigned a CHP# corresponding to the same compound in the Chemical Hazards and Precautions Appendix. The chemical values given in the General Procedure and calculated in your Preliminary Calculations section should be added to your table.

I recommend searching for the chemical safety data sheet for each compound used. Flinn Scientific and Fisher Scientific are websites where accurate SDS files can be found:

<https://www.flinnsci.com/sds/>

<https://www.fishersci.com/us/en/catalog/search/sdshome.html>

All data found online should be cited (source of SDS/and or where the chemical information was obtained). Standard Refractive Index values are only needed for products and reactants. The Physical Constants Table should then be neatly taped into your notebook for this section.

5. **Preliminary Calculations**

This section must include the calculations needed to conduct and understand your synthesis, including mole ratio for used values. If you are given a mole value for a reactant with a liquid physical state, the calculation from moles to milliliters are needed so you can measure the correct volume for your reaction. The physical state of your desired final product will determine the end units needed for theoretical yield calculations.

6. **Preliminary Flow Sheet**

A Preliminary Flowsheet is often given in the supplement. If required, it can be copied from the supplement and taped neatly into your notebook. A Diagram for a new technique used in class may be substituted for The Preliminary Flowsheet. When in doubt, ask the instructor.

7. **Experimental Procedure**

Your Experimental Procedure is a documentation of all the actions performed: times, temperatures, quantities, transfers, separations, spills, reaction techniques and analytical procedures utilized. It should be written in past tense following each step of your procedure as you complete the work. It should be repeatable, meaning someone else should be able to use your experimental procedure to conduct the same experiment with similar results. The Experimental Procedure can be written in bulleted or paragraph format, it cannot be typed or written at a later time.

8. **Diagram**

If a diagram is required in your notebook for an experiment, this will be stated by your instructor. Diagrams may be included in the Experimental Procedure or as a separate section and should be hand drawn with all parts labeled. A photo or online diagram can be used if it is an exact replica of the set-up used in class, and the source must be cited. If there are differences, the missing portions must be included (hand drawn) in the photo or online version and labeled.

9. Data Table

A template for Data Tables 9, 10 & 11 are available on Blackboard. They can be filled in by hand or typed, and then printed and taped neatly into your notebook. You will format your own Reverse Engineering Project Data Table to accommodate your data.

10. Experimental Calculations

This section should show all the calculations required to complete your post-lab for each experiment: Percent Yield, Refractive Index temperature corrections, calculations for average melting point range, or average refractive index (if more than one trial was completed), and corrections to theoretical yield (if conducted in Experiment 11).

Theoretical yield (ml):

Experimental yield (ml):

Percent yield (%) = $\text{experimental} / \text{theoretical} \times 100$

**For Experiment 10, your values should be given in grams of solid product.

11. Post-lab Flow Sheet

Start with the reactants and quantities of each. From there, list all the actions completed to achieve your synthesis in flow chart format - this means that following your initial reaction and after every separation/purification step, all compounds and trace ions in your reaction mixture should be listed, either shown together or in separate aqueous or organic portions.

For example, following a separatory funnel or filtration separation procedure, two lines should branch off showing the compounds which then exist in the resultant aqueous and organic layers. You must understand the reaction to determine what is occurring. Include the location of possible side products, as well as the measured quantity of all compounds used, temperatures and amount of time it took to complete a distillation, reflux, or ice bath submersion, and actions completed during each step (i.e. shaking and venting). Your flow sheet should end with your final product volume or weight.

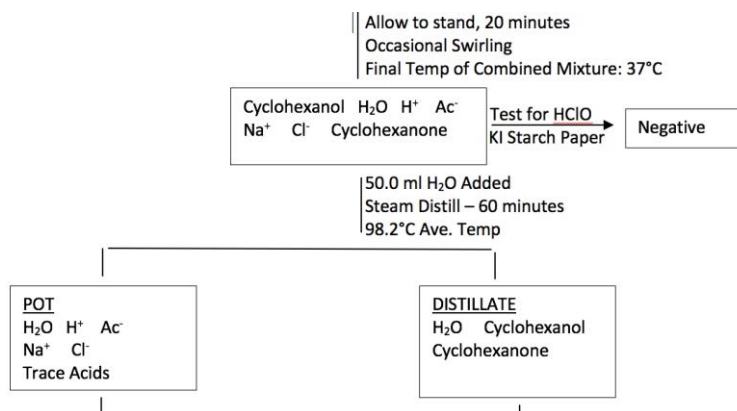


Figure 1: The basic structure of a post experimental flow sheet (above).

12. Supplements

Your Supplements section should include all experimental and standard IR spectra or GC chromatographs to support your results. Each supplement should be neatly taped into your notebook.

13. Analysis – must be a minimum of one full page (single spaced, 11 pt. font)

Introduction/Purpose

Body/Experimental Procedure

Results and Discussion

Conclusion – supported by your results

14. Abstract – 1-2 paragraphs max

Purpose/Objective

Results (data)

Conclusion (supported by your data)

Notes:

*Your Abstract should not include procedural or discussion details such as how the experiment was completed, or sources of possible error in your experiment. The purpose of your abstract is to provide a snapshot of the main points of your experiment only. All other details belong in the full Analysis /Synthesis.

*Your Analysis and Abstract should be written in past tense – you have already completed the experiment and are now reporting on your work. Both the Analysis and Abstract should be word processed (12 pt. font, single spaced), printed, and then taped neatly into your laboratory notebook.

*If in doubt whether a section should be included for a specific experiment, ***CHECK THE RUBRIC***. If the section is included in the rubric, you will be receiving a grade for this part.

*Every notebook page used in your experiment must have a Header and Date, even if documents are taped in with no other writing on that page.

15. Chemical Hazards and Precautions Appendix.

Your CHP Appendix must include the following data as well as the basic hazards and precautions for each compound or solution used in the experiment:

<u>CHP#</u>	<u>Compound</u>	<u>CAS#</u>	<u>NFPA Rating</u>	<u>S</u>	<u>W</u>	<u>Flash Point</u>	<u>Reference</u>
11-7	Sodium Carbonate	497-19-8	H-2, F-0, R-0	n	h	n/a	http://www.fishersci.com
	Signal word: Warning. Causes serious eye irritation. Harmful if swallowed or inhaled. May cause irritation to skin and respiratory tract. Exposure may result in nausea, headache, shortness of breath, or lacrimation. White, odorless solid.						

The compounds and solutions used in each experiment should be assigned a CHP# corresponding to the same compound in the Table of Physical Constants. The SDS sheets where data was obtained previously will likely contain information for you CHP appendix.