

**CHEM 321      Organic Chemistry Laboratory Syllabus      Fall 2009****COURSE OBJECTIVE AND PURPOSE:**

Experiments are chosen to offer practical experience with, and enhance the understanding of, topics covered in the lecture portion of the course. They also introduce students to common methods and procedures used in the organic chemistry laboratory.

On Tuesdays in the Discussion Section there may be a brief outline of the experiment to be performed that week, depending on its difficulty. Bring your lab notebook with the protocol for the experiment written in your own words and be prepared to discuss the material for that week's experiment (see below on keeping a notebook). Please note (also below) that there will be a quiz at the start of your lab period covering essential information in the protocol that you must know for success.

*Proper preparation of a laboratory notebook, complete with purpose, procedure summary, material toxicity, data tabulation and writing up of observations and conclusions is an integral component of this course. An equally important focus is on learning how to write a proper laboratory report.*

**Grading System:** **\*\*The total of all lab credit will be normalized to 150 pts of 800 total course pts, except if you fail the lab, you fail the entire course\*\*** Most experiments are worth **20 points** apportioned as follows:

**Preparation for and Doing Experiments (Raw score = 10 points EACH):**

Your teaching assistant and laboratory instructor will evaluate your:

- **Laboratory notebook** before you start the experiment. In general (more specific guidelines are given on the next page), the initial notebook check is worth **5 points**.
- Ability to pass a mini **QUIZ** given at the start of lab. Quiz questions will come directly from the current laboratory protocol. This quiz is worth **1 point**. If you fail your **first** attempt, you will **lose 1 point** from this section. You **must pass** a quiz **BEFORE** you can start the experiment.
- **Work habits & Competence at common lab skills** - timeliness, safety, overall neatness including care of glassware, common areas, bench top, etc.); ability to efficiently assemble laboratory apparatus, effectively use laboratory equipment, control reaction conditions, and obtain desired results, etc. Your competence at common lab skills is worth **2 points**
- Laboratory notebook at the conclusion of your experiment for your **data / observations**. Your data / observations are worth **2 points**.

**Laboratory Reports (Most are normalized to 10 points EACH\*\*):**

Scoring will focus on the **Report Section** emphasized that week (see "Laboratory Schedule and Report Section Focus"). **If your report is too flawed, it will be returned to you ungraded within a day or two for mandatory revision.** Your raw score for a report will be the sum of the score values for all circled rubric cells. The sum of cells in the "Meets Standard" column of the rubric equals the "MEETS STD" raw score. This value will be multiplied by a normalization factor so that it becomes 10 points. Your raw score will be multiplied by the same factor to produce your normalized score for the report, which we record in the course grade book. As you can see, it is possible to earn a normalized score of fewer or more than 10 points on a report, depending on your raw score.

**In general, laboratory report scores are based on use of proper English grammar, clarity and appropriateness of prose, scientific accuracy, and conformity to traditional scientific report format.**

**If your score on a report falls at or below 60% of the "MEETS STD" level, please make an appointment as soon as possible with the grader.** He or she will discuss with you some ways to improve your writing. You may revise, and resubmit your report. If you choose to revise, the revision is due no later than **ONE week** after the **original report** was returned to you. No revision will be accepted after that time. The submission must include the original report, the revision, and a filled out "COVER SHEET FOR ORGANIC CHEMISTRY LABORATORY REPORT REVISION" which the grader will hand you at your meeting.

\*\* Certain particularly demanding experiment reports will be worth more than 10 normalized points. You'll be told when this happens.

# LABORATORY NOTEBOOK REQUIREMENTS

The objective of the lab notebook is to encourage you to develop a habit of keeping complete and useful records of your lab work.

(A) Notebooks will be checked when you enter lab for complete **pre-lab**. All pre-labs must be complete BEFORE you are allowed to start that day's experiment. Pre-Labs should contain the following seven items:

1. TITLE OF EXPERIMENT
2. SOURCE CITATION (where did you find the protocol?) –COMPLETE URL AFTER DOCUMENT DISPLAYS, OR PROPER BOOK CITATION INCLUDING PAGE NUMBERS
3. PURPOSE STATEMENT: (Objective of experiment: chemical concepts to be illustrated, type of rxn, techniques not previously used, etc...)
4. DEFINITIONS: (Define all **NEW** concepts and techniques to the laboratory)
5. BALANCED CHEMICAL REACTION (omit spectator ions) WITH CALCULATIONS FOR FINDING LIMITING REAGENT – EXAMPLE BELOW

(USED ↓ / THEORY →)	$2X + Y \rightarrow$	$YX_2$
	TO BE USED	THEORETICAL YIELD
GRAMS	10.00      8.65	11.56
MW	132.0      173.0	305.0
MOLES	0.07576      0.050	$0.0379 * 1 = 0.0379$
"MOLES OF REACTION" THAT CAN BE RUN	0.07576/2 =0.0379	0.0379
= MOLES USED/STOICH.MOLES*	(LR)      0.050/1 =0.050	THEOR.

\* limiting reagent = lowest quotient

6. MATERIAL CHART (reactants, solvents, and expected byproducts)

Substance/Solution	Physical Properties	Toxicity/ Hazards/ notes
Benzene	FW:78.11; mp:5.5C; bp:80; d:0.874	Cancer Suspect; Flammable Liquid
Aluminum Chloride	FW:133.34	Corrosive, Moisture Sensitive
2-chloropropane	FW:78.54; mp:-118C; bp:34-36; d:0.859	Irritant, Flammable Liquid

7. NON-ROUTINE EQUIPMENT SETUP; PROCEDURE (condensed but clear protocol)

<u>(left hand side, ¾ of pg width)</u> <b>APPARATUS DRAWINGS</b> (if needed) <b>PROTOCOL (Number each step)</b>	<u>(right hand side, ¼ of pg width)</u> <b>DATA</b> <b>OBSERVATIONS</b>
-----------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------

**IN LAB:** Write data and observations AS YOU SEE them. DO NOT wait until the end of lab to try to write everything down.

**LAB CHECK-OUT:** Before you leave the lab:

1. Areas you used must be **clean**. All equipment must be **clean, complete, and in its proper place**.
2. A staff member must sign your lab notebook and sign you out of lab on the check-out sheet. The staff member will check your notebook for the following:
  1. CONCISE **OBSERVATIONS** OF WHAT HAPPENED
  2. CLEARLY RECORDED **RESULTS/DATA**
  3. ALL MISTAKES STILL LEGIBLE (cross out with only a single line)
  4. YOUR SIGNATURE AND DATE

# LABORATORY REPORT GUIDELINES

All reports are **due at the start of laboratory ONE week** after the conclusion of an experiment. The report must be typed and **double-spaced** to allow room for instructor comments. In addition, a copy of the pertinent lab notebook pages must be stapled to each lab report.

Lab reports are written to answer the following four questions:

1. What were the objectives that this experiment was designed to address?
2. Exactly how did you do the experiment?
3. What did you discover? (i.e. what results did you get?)
4. How did the results serve the objectives?

The Report Section Focus for a given experiment (see the Lab Schedule) emphasizes one section of a professional report. The Report Section Focus changes to different sections as you move through the semester. We assume that you will learn how to write each section well with a little practice. When the focus moves to a new section, your report must continue to contain a quality “mastered” section. *In other words, each report section focus will build upon previous foci until a complete, well-written laboratory report is achieved.*

Since proper writing is an important component of this course, please ask someone else to proofread your laboratory report prior to turning it in for a grade. It is best to ask someone who writes well to make sure that your grammar is correct and your report makes sense. Incorporate suggestions that you think improve the report, but please be a person of integrity - what you turn in must be your own work.

A grading rubric that will be used in grading each report will be posted on the website for this course. Please consult it as an aid in learning how to write a proper lab report.

## Required Laboratory Report Journal

Comments will be made on your lab report to help you improve your scientific writing. These should be taken seriously and implemented in future reports. To aid you with this process, to each report (except the first), you will attach a document called “Laboratory Report Journal.” This is a typed running record of your responses to grader comments. When a graded laboratory report is returned, select one comment related to significant loss of credit. Decide what steps you will take in response to that comment as you write future reports. Add the response to your growing list.

In addition, answer the following question (if you can) in your running record:

**“Is there a pattern to my mistakes? If so, what steps can I take to break out of this pattern?”**

- **Your lab reports are a summary of your lab work. We may ask to see your “portfolio” of graded lab reports. Please keep them in a small 3-ring binder so that you can easily locate them.**
- **Three times each semester you will be asked to submit your report electronically as well as in hard copy.**

## Laboratory Schedule and Report Section Focus

<i>Dates</i>	<i>Report Section Focus</i>	<i>Laboratory Experiment</i>
Sept. 2 – 4		Lab Check-In ( <b>Must</b> come to assigned section - if you are in the Tues section, please come Wed or Thurs during lab.)
Sept. 7 – 11	Introduction section	Choose one of 3 options on web page <a href="http://www.linfield.edu/chem/">http://www.linfield.edu/chem/</a> (Click on “Current Course Offerings,” then “CHEM 321/L”)
Sept. 14 – 18		<b>Isolation</b> of Caffeine Experiment Part One
Sept. 21 – 25	<i>[Workshop]</i>	Organic Chemistry Nomenclature and Chair Modeling
Sept. 28 – Oct. 2	Experimental section	<b>Isolation</b> of Caffeine Experiment Part Two
Oct. 5 – 9	Experimental section	<b>Resolution</b> of Enantiomers
Oct. 12 – 16	Results/Discussion section	<b>S<sub>N</sub>2</b> : Synthesis of 2-ethoxynaphthalene
Oct. 19 – 23	Results/Discussion section	<b>E2: Dehydrohalogenation</b> of cyclohexyl bromide
Oct. 26 – 30	Results/Discussion section	<b>E1: Dehydration</b> of cyclohexanol
Nov. 2 – 6	Results/Discussion section	<b>S<sub>N</sub>1: Hydrolysis</b> of t-butyl chloride
Nov. 9 – 13	Results/Discussion section	<b>Reduction</b> of a ketone to an alcohol
Nov. 16 – 20	<i>[Workshop]</i>	NMR and IR: Deduce the Structure
Nov. 23 – 27		<b>No lab this week</b>
Nov. 30 – Dec. 4	Results/Discussion section	<b>Oxidation</b> of cyclohexene to adipic acid
Dec. 7 – 11		Check out – all students must participate

### Other important dates:

Sept. 21, 2009 – Experimental section for part 1 of Caffeine Experiment DUE  
 Sept. 25, 2009 – Referee assignment DUE