Chem F321L Organic Chem I Lab Syllabus
University of Alaska Fairbanks, Fall 2019

Course Information
Chemistry F321, Organic Chemistry I Laboratory, 1.0 Credits
Reichardt 241

Co-Requisites: Lecture component of Chem 321, Organic Chemistry I.

Pre-requisites: Chem 106X General Chemistry II.

Section	CRN	Day	Time	Instructor/TA
F01	73258	Wednesday	2:15 - 5:15	TBA
F02	73259	Wednesday	6:00 - 9:00	TBA
F03	73260	Thursday	11:30 - 2:30	TBA
F04	73261	Thursday	2:45 - 5:45	TBA
F06	73763	Friday	2:15 - 5:15	TBA

Instructor
Thomas Green, Professor of Chemistry
Reichardt 174, Phone: 474-1559 Email: tkgreen@alaska.edu
Office Hours: Tues 1-2, Wed 1-2

Teaching Assistant Office Hours

TBA

Course Materials Required:

1. Lab notebook for recording experimental data, results and conclusions. The lab notebook will be supplied by the department. Student Lab Notebook, 2012 Book Factory, Lab-050-7GSS, 50 pages.
2. Textbook: Making the Connections[3]; A How-to-Guide for Organic Chemistry Lab Techniques, 3rd edition, Anne B. Padias, 2015, Hayden McNeil.

Course Description: A laboratory designed to illustrate modern techniques of isolation, purification, analysis and structure determination of covalent, principally organic, compounds. Lab portion will include an introduction to synthetic techniques and spectroscopy. Special fees apply.

Course Goals. Learn the following practical aspects of organic synthesis.
1. Common safety procedures.
2. Reaction methods
3. Isolation Procedures
4. Purification techniques
5. Spectroscopic and chromatographic analyses
6. Introduction to computational methods in chemistry.

Student Learning Outcomes

1. Know the hazards associated with common chemicals, especially those encountered in the experiments.
2. Know how to safely assemble reaction systems using glassware commonly employed in the organic laboratory. These methods include reflux, heating and cooling of reactions, and addition of reagents.
3. Know how to isolate and purify organic products using methods such as extraction, filtration, crystallization, distillation, solvent removal, and thin layer chromatography.
4. Learn the importance of stoichiometry to a chemical reaction. Learn how to assess the efficiency of a chemical reaction (percent yield and atom economy).
5. Learn the practical aspects of spectroscopic analyses of organic compounds.
6. Learn how to build and optimize simple molecules using WebMO/Gaussian and how to measure properties of those molecules.

Instructional Methods

1. The instructor or teaching assistant will provide a brief introduction on the practical aspects of organic chemistry, using a combination of Power Point slides and Chalkboard. The Lab Schedule will be available on Blackboard and at the end of this syllabus.
2. Laboratory sessions will consist of conducting reactions of organic compounds and their isolation, purification and characterization.
3. Each experiment will require a "Lab Report" which will consist of Pre-lab and Post-lab components. The Pre-lab portion must be completed prior to coming to lab. If it is not completed, you will not be allowed to work in the lab for that day's experiment. Your TA will need to verify with her/his initials that you have completed the pre-lab questions. Students are also required to keep a laboratory notebook. The lab notebook will be collected at the midterm, evaluated but not graded, and returned with suggestions for improvement. The lab notebook will be graded at the end of the semester.
4. A lab textbook *Making the Connections*[3] by Anne Padias which describes techniques, glassware, lab notebooks, spectroscopic techniques, etc. Readings will be assigned to the student for each experiment.

Lab Notebook Guidelines:

Before each lab, you should enter the following in the notebook (with pen).

1. Title of Experiment
2. Hypothesis or Goal of Experiment
3. Overall reaction. Show structures and names of reactants, products, and reaction solvent.
4. Physical properties. Make a table of MW, boiling point (if liquid), melting point (if solid) of solvents, reactants, and products. Usually you can just copy these from your pre-lab tables.
5. Procedure. The procedure should be taken from the handout. Include amounts to be used for each reagent and solvent. If changes are made later, this can be noted later in the notebook.
   During lab, you should enter the following,
6. Data and observations. Record actual amounts (volumes or mass) used for each reagent. Record physical constants such as melting point range of the product. If you ran a TLC plate, sketch plate in the notebook and indicate what developing solvent was used. If you recrystallized a product, indicate how you did it, e.g. what solvent was used. Describe the product that you obtained (color and/or appearance). If the IR and/or NMR spectra were obtained, state this here.
7. Calculations. Include the following
   a. Identify the Limiting Reagent. To do this properly, you need to know the millimoles (mmol) of each reactant used. The limiting is the one that is not present in a stoichiometric excess.
   b. Calculate the Theoretical Yield in grams. This calculation is based on the limiting reagent.
   c. Calculate the Percent Yield.

8. Conclusions
    a. Is the product pure from the mp range and the NMR/IR spectra? Compare to literature where possible.
    b. If impure, can any impurities be identified?
    c. Is the yield consistent with expectations for this experiment? If not, why was the yield low?

Laboratory Safety: Laboratory safety is a major concern of all chemical laboratories but is especially important in organic labs due to the presence of flammable solvents, potentially hazardous fumes, highly reactive reagents, etc. The first lecture will deal explicitly with these hazards and the appropriate safety measures you must follow. Subsequent lectures, besides covering the theory and pitfalls of the coming weeks' experiments and perhaps helping you interpret the previous week's experiment, will also cover specific hazards that you may encounter. Please attend these lectures and be prepared for the lab by doing any assigned readings and completing the Pre-lab exercises before coming to lab. If you are not prepared for lab you may be asked to leave.

Grading

Category	**Points**
Lab Reports .	35 pts x 9 = 315 pts
Lab Notebook	50 pts
Spectroscopy HW	35 pts x 3 =105 pts
Total Points	**470 pts***

*The points that you earn will be normalized to 250 pts and incorporated into your overall grade for the course. For example, if you earn 400 pts, then you will receive 400/470 x 250 = 213 pts. See the lecture syllabus for more detail.

Notes and Policies:

1. Students are expected to perform experiments following commonly accepted safety protocols.
2. Safety glasses must be **worn at all times during lab.**
3. Class attendance is expected and role will be taken.
4. Make-up labs will be allowed with a legitimate excuse. Excuses must be approved by the instructor.
5. All labs must be completed to receive a passing grade.
6. You will often be asked to work with another student in pairs. You are expected to contribute equally with your partner in carrying out the experiment. Each student is required to complete and submit a lab report.
7. **Late reports are penalized 10% per day up to 1 week and then not accepted.**

Lab Schedule – see Lab Manual for specific Experimental Procedures and Report Forms.

Experiment	**Week of**	**Concepts/Techniques**
Exp 1: Calculation of Solvent Properties; WebMO	August 26	Safety, Check-in, Lab Protocol, Glassware, Notebooks, WebMO Assignment
Exp 2: Thin Layer Chromatography Start Exp 3: Biosynthesis	Sept 2	Thin Layer Chromatography, H-bonding, polarity, functional groups
Exp 3: Biosynthesis of Ethanol	Sept 9	Fermentation, density, distillation
Exp 4: Caffeine from Tea	Sept 16, 23	Acid-base chemistry, purification by sublimation, melting point
Exp 5: Limonene from Orange Peel HW #1 IR assigned	Sept 30	Phase diagrams, green chemistry, IR spectrum

Exp 6: Adipic acid synthesis	Oct 7,14	Phase transfer catalysis, mild oxidation, recrystallization, vacuum filtration, melting point.
Exp 7: Barbier Synthesis	Oct 21	Organometallic chemistry
Exp 8: Camphor reduction HW#2 IR, ^{1}H NMR assigned	Oct 28	Reduction, stereoisomers by NMR spectroscopy
Exp 9: Stilbene synthesis HW#3 IR,^{1}H,^{13}C NMR assigned	Nov 4,11	Electrophilic addition, melting point stereochemistry, reflux, vacuum filtration
Makeup Experiments	Nov 18 Dec 2	Please schedule missed labs with your TA.

Due Dates for Lab Reports and Homework

Experiment	**Due Date (Week of)**
Exp 1: Calculation of Solvent Properties; WebMO	Sept 2
Exp 2: Thin Layer Chromatography; Functional Groups	Sept 9
Exp 3: Biosynthesis of Ethanol; Distillation	Sept 16
Exp 4: Extraction of Caffeine from Tea; Sublimation	Sept 30
Exp 5: Extraction of Limonene from Orange Peel; Liquid CO_2	Oct 7
Exp 6: Adipic Acid Synthesis; Phase Transfer Catalysis	Oct 21
Exp 7: Barbier Synthesis of Alcohols; Nucleophilic Addition	Oct 28
Exp 8: Reduction of Camphor; Nucleophilic Addition	Nov 4
Exp 9: Bromination of Stilbene; Electrophilic Addition	Nov 18
HW #1: Analysis of IR spectra	Oct 21
HW #2: Analysis of IR and ^{1}H NMR spectra	Nov 11
HW #3: Analysis of IR, ^{1}H and ^{13}C NMR spectra	Dec 2

Disabilities Services: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. Students with documented disabilities who may need reasonable academic accommodations should discuss these with me during the first two weeks of class. I will work with the Office of Disabilities Services (*208 WHIT, 474-5655) to provide reasonable accommodation to students with disabilities. You will need to provide documentation of your disability to Disability Services.

Veteran Support Services.
Walter Crary is the Veterans Service Officer at the Veterans Resource Center, 111 Eielson Building. 474-2475. (wecrary@alaska.edu) Fairbanks Vet Center 456-4238. VA Community Based Outpatient Clinic at Ft. Wainwright is 361-6370.

Amending this Syllabus: Amendments and changes to the syllabus, including evaluation and grading mechanisms, are possible. The instructor must initiate any changes. Changes to the grading and evaluation scheme can be made before the add/drop date without a vote, but after that date must be voted on by the entire class and approved only with unanimous vote of all students present in class on the day the issue is decided. The lecture schedule and reading assignments (Daily Schedule) will not require a vote and may be altered at the instructor's discretion. This Daily Schedule can be found on Blackboard. Grading changes that unilaterally and equitably improve all students' grades will not require a vote. Once approved, amendments will be distributed in writing to all students via Blackboard.