

Intermediate Organic Chemistry (CHEM 2100)
Syllabus (CRN 89715)
Fall 2018

Instructor: Dr. Nilmi Fernando
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Office Hours: T 10:00 am – 12:00 pm
Pre-Lab Lecture: M 12:00 pm - 12:50 pm in PSC 362
Lab: M 12:50 pm - 4:45 pm in PSC 357

LABORATORY MATERIALS on the first day of lab:

- (1) Chem. 2100 Lab Manual (given on the first day of lab)
- (2) Experimental Organic Chemistry by Wilcox and Wilcox, second edition (recommended)
- (3) Stitched composition notebook (required)
- (4) Safety glasses/goggles (can be purchased from the lab)
- (5) Apron or lab coat (given on the first day)

GRADING

| | |
|---|-------------------|
| *Final Exam: | 100 points |
| *Final Report | 100 points |
| *Worksheets (Experiments 1-4) | 50 points |
| Quizzes, homework, *notebook, attendance, and preparation | <u>150 points</u> |
| Total | 400 points |

*Must be submitted to receive a passing grade.

DO NOT CURVE. YOU WILL BE ASSIGNED THE GRADE YOU EARN.

Course Objective

*In the **first part** of this project, you will isolate and purify compounds from natural products like tea leaves and nutmeg to learn different extraction techniques. In the **second part** of the semester, three unknown liquids will be purified by distillation and the structure analyzed. Spectroscopy is an integral part of a modern organic chemistry laboratory. Therefore, you will have lectures for most part of the semester on infrared spectroscopy (IR), and mass spectrometry (MS) where you will learn the fundamental principles behind each technique and how to interpret spectra in the assignment of organic structure. These spectroscopic techniques will be used during the laboratory portion of the course. **You will be held responsible for the material discussed in lectures and that assigned from the textbooks in all quizzes and the final exam.***

Part 1

Weeks 1-5 Techniques for isolation and characterization of organic compounds. The first 4 experiments will be concluded with four worksheets and will not be part of the final report.

Part 2

Weeks 6-13 Term project; purification and identification of unknowns (Final report)

Final Report: neat liquid, low boiler and high boiler: A good boiling point is the most valuable information you will obtain from distillation. Check what substances have the boiling points close to the one you have measured. You will find many different types of compounds with the same boiling point. Narrow down to those substances that contain the functional groups you tested in the lab. Then use the density to assign the

best candidate. If you have the MS, that gives you the molecular weight, draw structures and play with the fragmentation patterns to match the one given. When it comes to identifying your unknowns, **DO NOT LIMIT THE SEARCH TO THE DATABASES FOUND IN THE INTERNET. SEARCH THE REFERENCE BOOKS TOO** (in the lab, also available in the library).

The final written examination will test your knowledge and comprehensive of basic techniques and processes employed in an organic laboratory and also the spectroscopic techniques used during the semester.

WHAT IS IN YOUR FINAL?

1. Concepts and calculations used in first 4 experiments, extraction, such as neutralization, density, solubility(benzoic acid/ acetanilide), sublimation, recrystallization, melting points, etc.
2. All chemical tests to determine functional groups of organic compounds assigned in the book, not only those that you've carried out for your unknowns, all taught, you need to state the changes during the reactions (colors, heat, precipitates or any other observations, not just the name of the test)
3. Distillation (simple and fractional, differences, equipment used)
4. Gas chromatography, concepts and % composition determination of a mixture,
5. **IR interpretation is 35-40 % of the final.** Practice the in-class quizzes
6. Mass spectroscopy, practice fragmentations

Miscellaneous:

1. Department of Chemistry Statement on Student Integrity applies to this course (see below).
2. Attendance to pre-lab lecture and lab will be recorded. **Absences can result in loss of points and lower grades (Sign-in/out of lab required).**
3. Lab books must be recorded in ink at the time the measurements are made. **They will be graded during the lab section without announcing! Lab notebooks must be bound.**
4. **Safety glasses* are required and must be worn at all times.** *The student must bring a pair of safety glasses/goggles to the first lab. These may be purchased at the GSU Bookstore, the Georgia Bookstore, and most hardware stores. Students who are unable or forget to bring their glasses may **buy** a pair from their lab Coordinator by filling out a breakage form in the lab. Students who obtain glasses in this manner will pay for them at the time they check out of the lab. Students will not be allowed into the lab without their glasses/goggles
5. Gloves **MUST** be worn when handling chemicals.
6. Safety is extremely important. Failure to follow safety procedures will result in expulsion from that lab session with no make-up allowed and loss of credit. Nothing goes in the sink, use the hoods!!!

DEPARTMENT OF CHEMISTRY POLICY STATEMENT REGARDING STUDENT INTEGRITY:

The Department of Chemistry follows the university policy on academic honesty published in the "Faculty Affairs handbook" and the "On Campus: The Undergraduate Co-Curricular Affairs handbook." Any suspected offenses may be referred to the Department Chair for appropriate action.

All tests taken must represent your individual, unaided efforts. To receive or offer information during an examination is cheating. The use of unauthorized supplementary materials during tests is also cheating. All laboratory work performed during this course must reflect your individual effort. Only original data obtained by your own laboratory experimentation are to be used, except when specifically authorized by your laboratory professor. Data from supplementary sources (handbooks, reference literature, etc.) must be clearly referenced (title, author, volume, page(s), etc.). Falsification or destruction of data constitutes cheating.

Very important: The following is a tentative schedule of procedures and activities for **CHEM 2100 Fall 2018**. Changes and deviations from this syllabus will come and will be announced during class (quizzes, homework, and others). Do not miss lectures to know what is going on.

Please bring me a schedule of your **RELIGIOUS HOLIDAYS OBSERVANCE** the **SECOND WEEK** of class. If you fail to do so you might miss important quizzes for this course.

| Week | Day | <i>TENTATIVE</i> SCHEDULE OF LABS | Miscellaneous/ reading assignments |
|------|-------|--|--|
| 1 | 08/20 | Safety, Lab Check-in, Students receive unknowns (Wrap the unknown bottles with parafilm to avoid evaporation) Perform extraction of trimyristin from nutmeg, calculate the crude yield and recrystallize in hot ethanol | Unknown numbers and key combinations in the notebook Safety Quiz |
| 2 | 08/27 | Introduction of liquid-liquid extraction Extraction of Caffeine from tea leaves Calculate the pure yield and %yield of recrystallization of trimyristin; IR worksheet 1 due | Quiz 1 |
| 3 | 09/10 | Introduction to IR Spectroscopy Separation and Purification of Benzoic acid and Acetanilide Sublimation of caffeine, group and individual pure yields, finish calculations on caffeine, IR; worksheet 2 due | Quiz 2 |
| 4 | 09/17 | Discussion of IR spectroscopy Esterification of acetic acid; purification of n-Butyl Acetate by simple distillation, boiling point, calculate %recovery, density and IR Weigh and measure melting points of benzoic acid and acetanilide (use given standards), calculate %composition; worksheet 3 due | Quiz 3 |
| 5 | 09/24 | IR problems; discuss peroxide testing Simple distillation: Purification of neat liquid (NL); save NL for chemical tests in week 8, use lots of parafilm worksheet 4 due | Quiz 4 |
| 6 | 10/01 | Introduction to Gas Chromatography (GC) Fractional distillation: separation of low boiler (LB) and high boiler (HB) | Quiz 5 |
| 8 | 10/08 | Introduction to chemical tests Continue separation of Low boiler (LB) and high boiler (HB), boiling Point | GC ON Quiz 6 |
| | 10/09 | Semester Midpoint-last day to withdraw with a 'W' | |
| 9 | 10/15 | Introduction Mass Spectrometry Continue separation of high boiler and low boiler Start chemical tests, measure densities, IR spectra of the three liquids | GC ON Quiz 7 |
| 10 | 10/22 | Continue discussion of Mass Spectrometry request a mass spectrum; identification of unknown liquids Microscale boiling points | GC ON Quiz 8 |
| 11 | 10/29 | MS problems; discuss final report | GC ON Quiz 9 |
| 12 | 11/05 | Finish GC; completion of work | GC ON Quiz 10 |
| 13 | 11/12 | Completion of lab work, only bp, chemical tests, IR, density and books search are allowed in this week, no distillations; Check out | GC OFF |
| 14 | 11/26 | FINAL EXAM at 12:00 PM in 362 PSC Reports and Notebooks are due; REPORT IS NOT ACCEPTED WITHOUT THE NOTEBOOK | CHECK OUT |