

ORGANIC CHEMISTRY LAB I CHEM 3100 Fall 2014

Instructor: Dr. Chad LeCroix
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Office Hours: Tues. and Thurs. 1-4 pm
Pre-Lab Lecture: **Monday** 4:00-4:50 pm in PSC 362
Lab: **Monday** 5:00-8:45 pm in PSC 357

REQUIRED TEXT and LABORATORY MATERIALS needed on the first day of lab:

(1) Chem. 3100 Lab Manual (**available free during first lab**), (2) Experimental Organic Chemistry by Wilcox and Wilcox, second edition (**Required**) (3) Introduction to Spectroscopy by Pavia, Lampman and Kriz (**Optional**) (4) Organic Chemistry Lab Survival Manual 9th edition by James W Zubrick (**optional**) (5) Stitched notebook (6) Safety glasses/goggles

GRADING

| | |
|---|-------------------|
| *Final Exam: | 100 points |
| *Final Report | 100 points |
| *Midterm Report | 50 points |
| Quizzes, homework, *, **notebook, attendance, and preparation | <u>150 points</u> |
| | Total 400 points |

*Must be submitted to receive a passing grade.

**Notebooks must be picked up within three weeks after final grade deadline (after which time they will be discarded)

A+: 96% A: "90%; A-: 87%; B+: 84% B: 80% B-: 77%, C+: 73% C: 70% C-: 66%, etc.

I DO NOT CURVE. I WILL ASSIGN THE LETTER GRADE YOU EARN. YOU WILL HAVE ACCESS TO ALL YOUR GRADES IN D2L.

Tuesday October 14th is the last day to withdraw with grade "W"

Monday December 8th - Final exam (2:00-4:00 am).

Monday December 8th - Final report and Notebook are due in box outside MY OFFICE or by e-mail at 11:59 pm.

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 throughout 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 final exam.***

Part 1

Weeks 1-5 Techniques for isolation and characterization of organic compounds (Midterm report)

Midterm Report includes only the first 4 experiments 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 and refractive index (RI) 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 the time for the identification of your unknowns DO NOT LIMIT THE SEARCH TO THE DATABASE FOUND IN THE INTERNET. IT IS WRONG. SEARCH THE REFERENCE BOOKS (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 only the name of the test)
3. DISTILLATION (SIMPLE AND FRACTIONAL, DIFFERENCES, equipments used)
4. GAS CHROMATOGRAPHY, CONCEPTS AND % COMPOSITION DETERMINATION OF A MIXTURE,
5. **IR interpretation is 35 % of the final**, LOTS OF THEM. PRACTICE WITH THE HOMEWORK AND QUIZZES
6. MASS SPECTROSCOPY, PRACTICE FRAGMENTATIONS

Miscellaneous:

1. Department of Chemistry Statement on Student Integrity applies to this course (see below).
2. Attendance to **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 to 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, SAFETY, SAFETY, SAFETY, SAFETY. Failure to follow safety procedures will result in EXPULSION from that lab session with no make-up allowed and loss of credit. SAFETY, NOTHING GOES INTO THE SINK, USE THE HOODS!!! HOODS, HOODS, 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. 3100 Spring of 2014**. 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 of.. | Week | <u>TENTATIVE</u> SCHEDULE OF LECTURES AND ACTIVITIES | Miscellaneous reading assignments | Lab Text Pages |
|-----------|------|--|---|----------------------|
| 08/25 | 1 | Safety, Lab Check-in, and Instruments Demonstrations, Students receive unknowns (Wrap the caps with parafilm to avoid evaporation) Project overall: Identification of 3 Unknown Organic Compounds | Write unknown numbers in the notebook and roll Safety Quiz | |
| 09/01 | 2 | Labor day | | |
| 09/08 | 2 | Separation and Purification of Benzoic acid and Acetanilide by Extraction and Re-crystallization , | Homework 1 Issued | 104; 106; 117 |
| 09/15 | 3 | Extraction of Caffeine from tea leaves. Melting point: Melting points reading of benzoic acid and acetanilide | Homework 1 Due | 84; 118 |
| 09/22 | 4 | Sublimation of caffeine and infrared (IR) spectrum analysis. Extraction of trimyristin from nutmeg, and its re-crystallization in hot ethanol | | 84; 120 |
| 09/29 | 5 | Synthesis and purification of Butyl acetate | Quiz 1 | 315 |
| 10/06 | 6 | Simple distillation: Purification of neat liquid (NL); <i>save NL for chemical tests on week 10, use lots of parafilm</i> How to determine density Introduction to Infrared (IR) Spectroscopy | Quiz 2 | 4-68 |
| 10/13 | 7 | Fractional distillation Infrared (IR) Spectroscopy (continued) ----- (slides). Introduction to Gas Chromatography (GC) | MIDTERM REPORT IS DUE TODAY. | 4-68 |
| 10/14 | | LAST DAY TO WITHDRAW | | |
| 10/20 | 8 | Infrared (IR) Spectroscopy Fractional distillation, CONTINUE: Separation of Low boiler (LB) and high boiler (HB), Boiling Point, Gas Chromatography (GC) GC ON | Homework 2 | 4-68 |
| 10/27 | 9 | Fractional distillation: (IR) Spectroscopy, Chemical Tests Continue separation of high boiler and low boiler <i>IMPORTANT: save LB and HB for chemical tests on week 10</i> | GC ON Homework 3 | 4-68; 529 |
| 11/03 | 10 | Boiling point check up for LB. Continue separation of LB, HB, Chemical Characterization Tests | GC ON Quiz 3 IR | 529 |
| 11/10 | 11 | Chemical Characterization Tests Introduction Mass Spectrometry | GC ON | |
| 11/17 | 12 | Mass Spectrometry, slides, request a mass spectrum of the unknown you have more difficulty to identify | Last week to use GC Homework 4, Chem. tests | 208-231 |
| 12/01 | 13 | Miscellaneous Topics, How to study for the FINAL EXAM. Form of Final Report / Lab work completion, only bp, chemical tests, IR, RI, density and books search are allowed, no more distillations | GC OFF Last week to request MS of ONLY ONE of the unknowns Quiz 4, Chem. Tests, and MS | |
| 12/08 | 14 | FINAL EXAM | CHECK OUT | |
| 12/08 | | Turn in during lab time, or by e-mail (midnight) | | |