

CHEM3100 LAB I SYLLABUS (CRN 88454) Fall 2016

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| Instructor: | Dr. Jianmei Cui |
| E-mail: | jcui@gsu.edu |
| Time: | 8:00-12:45pm Fridays, lecture in PSC362, Lab in PSC357 |
| Office Hours: | <u>Tuesday 9:30 am-12:30am (PSC305), please email me before your visit</u> |
| Required Texts | 1. Chem. 3100 Lab Manual (available free during first lab) 2. Experimental Organic Chemistry by Wilcox and Wilcox |
| Optional Texts | Introduction to Spectroscopy by Pavia, Lampman and Kriz |

Grading

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

*Must be submitted to receive a passing grade.

A+: 96%, A: 92%; A-: 89%; B+: 86% B: 82%, B-: 78%, C+: 76% C: 72% C-: 68% D 64%
D- 60% F<60%.

I do not curve. I will assign the letter grade you earn.

Course Objective

In the **first part** of this project, you will isolate and purify compounds from natural products and you will practice organic synthesis, liquid distillation and analysis liquid sample. 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

Labs 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

Labs 6-13 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 have carried out for your unknowns, but 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 and equipment 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). Every effort should be made to arrive on time! Students should be responsible for the timely completion of all assignments, regardless of any reason of absence.**
3. **No make-up quizzes & homework will be given! If a student misses a quiz or homework will be counted as zero.**
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. ***
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. NOTHING GOES INTO 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 **Chem3100 fall 2016**. Changes and deviations from this syllabus will come and will be announced during class (quizzes, homework, and others). **SHOW UP ON TIME** to lectures to know what is going on.

| Date | Lab | <u>TENTATIVE SCHEDULE OF LECTURES AND ACTIVITIES</u> | Miscellaneous | Reading assignments Quizzes |
|----------------------|-----|---|--|--|
| Aug.26 th | 1 | Safety, Lab Check-in, Students receive unknowns, Project Overview, Extraction of trimyristin from nutmeg | Introduction Lecture Write unknown numbers in the notebook and roll | Safety Quiz Reading 103-117, 84, 89 |
| Sep. 2 th | 2 | Natural Product Extraction Caffeine from Tea & | Lecture Instrumentation | HW1 Reading |

| | | Sublimation | Demo | 89; 103; 118-119; 97 |
|-----------------------|----|--|---|--|
| Sep. 9 th | 3 | Liquid/Liquid Extraction Separation of Benzoic Acid and Acetanilide | Lecture Instrumentation Demo | Notebook check 1 Quiz1, HW2 Reading 117, 103, 89 |
| Sep. 16 th | 4 | Esterification of Acetic acid Boiling point & Distillation | Lecture: Discussion Simple Distillation Instrumentation Demo | Quiz2 HW3 378-379 |
| Sep. 23 th | 5 | Midterm Report style Make up lab | Discussion Midterm Report | HW4 4-68 |
| Sep. 30 th | 6 | Simple distillation: Purification of neat liquid | MIDTERM REPORT IS DUE TODAY. IR | Quiz3 & HW5 Notebook check 2 4-68 |
| Oct. 7 th | 7 | Fractional distillation of unknown mixture. | IR | HW6 4-68 |
| Oct. 11 th | | <u>Last day to withdraw and receive a W</u> | | |
| Oct. 14 th | 8 | CONTINUE: Separation of Low boiler (LB) and high boiler (HB), Boiling Point, Gas Chromatography (GC) | GC ON | Quiz4 4-68 |
| Oct. 21 th | 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 | HW7 4-68; 529 |
| Oct. 28 th | 10 | Boiling point check up for LB. Continue separation of LB, HB, Chemical Characterization Tests | GC ON | HW8 529 |
| Nov. 4 th | 11 | Chemical Characterization Tests Introduction Mass Spectrometry | GC ON | Quiz5 -IR HW9 |
| Nov. 11 th | 12 | Mass Spectrometry, slides, request an mass spectrum of the unknown you have more difficulty to identify | Last week to use GC | 208-231 |
| Nov. 18 th | 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 | CHECK OUT |
| Dec. 2 th | 14 | FINAL EXAM(8:00-9:30am) Final report and notebook are due before noon(12:00pm) | Report is not accepted without notebook | Final report and notebook are due before noon |