**Syllabus Chem 29A, Organic Chemistry Laboratory**

**V. Cornel, Reedley College, Fall 2013 #56576**

**Lab TTh 2:00-4:50pm in PHY-77**

**Office: PHY-78, phone # 559-638-3641 ext 3449**

**email: vmcornel3@verizon.net using “CHEM29” or “O-chem” as the subject**

**Office hours: 10-11am MWF**

**Course web site: blackboard.reedleycollege.edu**

Course corequisite: Chem 28B

Textbooks:

* 1. Svoronos/Sarlo, Organic Chemistry Laboratory Manual, 2nd edition.
  2. McMurray: Organic Chemistry. A Biological Approach. 2nd edition

Required Materials:

1. A lab research notebook **or** notebook.
2. Safety glasses with Z-87 safety code
3. A lab coat or apron.
4. Box of latex gloves (or latex-free, powder free)

Course objectives and outcomes: Students will become familiar with safety procedures and lab equipment for semi-micro organic experiments. They will be capable of synthesizing and purifying organic compounds, of measuring melting points, refractive index, and optical activity. They will learn hands-on how to work with a Gas Chromatograph Mass Spectrometer, a Fourier Transform Infrared Spectrophotometer and Nuclear Magenetic Resonance Spectrometer. Extensive time will be spent on identification of unknown compounds by analyzing their MS, IR and NMR spectra. Through interactive computer programs the students will receive extensive support in thoroughly understanding the concepts taught in the organic chemistry lecture (Chem 28A).

Homework: Students are expected to come to lab well prepared. This means that the steps to be taken to properly complete the experiment are written down in the lab notebook ahead of time. Typically, the theoretical explanations in the lab manual are too brief to fully comprehend the experiment. Therefore preparation reading McMurray's text on the subject is highly recommended.

Lab reports: Your lab notebook needs to be complete at all times and could be requested by the university you are transferring to. The Aim, Method, Reaction Mechanism, Physical Data (melting point, refractive index etc.), Observations, Percent Yield, and Conclusion should all be recorded. Show the theoretical yield and percent yield calculations. Certain questions at the end of each lab also need to be completed individually using your textbook. I will give assistance, but not the answers to the questions. The lab report (including answers to the questions) or a good photocopy of it needs to be handed in within one week of the class completing the experiment.

This semester three experiments are finalized with a formal lab report using the observations and data collected in the experiment. The extensive lab reports are a write-up of the experiment, and written in the format of a research paper with an abstract (summary) and references. The student will need to use resources in the library and the internet to find appropriate theoretical background information. An electronic copy of the abstract and background needs to be e-mailed to the instructor, and a printed copy of the report must be submitted to the instructor or switchboard by the due dates in the lab schedule. Lab reports will be checked for plagiarism using “Turnitin”.

Lab materials: Expensive grounded glassware and other delicate lab supplies will be made available. Students will be held responsible for their own desk inventory.

Attendance: Attendance at all labs is mandatory. In accordance with Community College policy role will be taken every lab session. Students will only be allowed to drop one laboratory assignment (and not one that is used for a Formal Report). You will be dropped if you miss more than 25% of the classes before the drop date without contacting the instructor.

Cancelled Classes: If the instructor is absent, and official yellow “class cancellation” notice and instructions will be posted on the door of the classroom. We will try and put a timely announcement on Blackboard and the Reedley College website.

Make-up labs If you have to miss a lab you may be able to make arrangements with the instructor or lab technician to complete it (if the chemicals are still available), or complete it the next lab period. 10% will be deducted for the inconvenience of having to do a make-up lab for the student. Only one make-up lab will be allowed per student. If you do not complete an experiment (drying, purifying your product or analyzing it) you may be able to make arrangements with the instructor or lab technician to complete it (with no points deducted).

Grading: To determine the final grade in this class the average of the formal reports will count towards 30%, the average of the two lab quizzes 15%, and the individually graded labs towards 55% of your final grade. For each lab report you will also be graded on the quality and the yield of the product, the working technique and effort, the amount of assistance the student required and the efforts to reach the experimental goal. Grading breakoffs : A 90% and up; B 80-89%; C 70-79%; D 60-69%; F 59% and lower.

Drop date: The drop date is Friday March 8, 2013. After this date a letter grade A-F will have to appear on your transcripts. You need to drop the class before Friday January 25 to avoid it appearing on your transcript as a "W".

Lab rules: It is MANDATORY to use a lab coat and safety glasses at any time that you are in the lab. You are required to have read each experiment, including the Safety Tips before you enter the lab. The Aim and Method needs to be written out before you enter the lab and will be checked. You will receive safety instructions on how to perform the experiment. It is imperative that you not be late in lab, you would be a hazard to others if you miss the safety instructions. Coming in late means you loose 10% for that lab. You need to go over the safety instructions with the instructor before you may start the lab. End lab time is set: 10:50 am and 4:50p.m. sharp. Copying of experimental data and answers to questions in lab reports is considered fraudulent behavior and will result in a zero grade for the copier and the originator. **Students work in pairs, but your lab reports must be done individually or both students will loose points.**

**Student Learning Outcomes**: In the process of completing this course, students will:

A. learn how to synthesize aromatic organic compounds using the Friedel-Crafts reaction

B. learn how to synthesize simple organic cyclic compounds using the Diels-Alder process.

C. gain an understanding how to set up a variety of reactions to make carboxylic acids, such as hydrolysis of benzonitrile, side chain oxidations of alkyl benzenes.

D. set up the formation of an ester followed by its basic hydrolysis, its saponification.

E. learn how to do qualitative tests for aldehydes and ketones.

F. gain an understanding how to make a simple di-peptide from amino acids.

G. prepare a soap and learn how detergents work.

H. learn how to determine the degree of unsaturation in lipids and its meaning for the structure and physical behavior of lipid molecules.

**Lab Content:**

Each of the following experiments will take 4-6 hours. Alternative experiments may be substituted.

A. Aromatic Reactions

* nitration of bromobenzene
* Friedel-Crafts alkylation: synthesis of 2,5-di-t-butyl-1,4-dimethoxybenzene
* nucleophilic aromatic substitution: synthesis of 2,5-dinitrophenylaniline
* oxidation of the side chain of an arene: synthesis of 2-chlorobenzoic acid from 2-chlorotoluene
* benzyne intermediate: synthesis of tripycene

B. Carboxylic acids and derivatives

* hydrolysis of benzonitrile
* synthesis of aspirin
* synthesis of isoamyl acetate
* imides: synthesis of N-phenylphthalimide
* saponification of an ester.

C. Aldehydes and Ketones

* qualitative tests
* oxidation of cyclohexanol to cyclohexanone
* reduction of cyclohexanone to cyclohexanol
* acetal formation: synthesis of 4,5-dimethyldioxolane

D. Carbanions and α,β-unsaturated carbonyls

* Aldol Condensations, synthesis of dibenzalacetone

E. Amines

* synthesis of acetanilide
* coupling of aromatic diazonium compounds: azo-dye formation

F. Synthesis of cyclic compounds

* Diels-Alder reaction: cycloalkenes from conjugated dienes

G. Polynuclear aromatics and heterocycles

* oxidation of 2-methylnaphthalene

H. Organometallics

* Ferrocene synthesis

I. Carbohydrates

* qualitative tests
* acid catalyzed hydrolysis of sucrose: a kinetic study.

J. Amino Acids and Proteins

* qualitative tests
* synthesis of a peptide

K. Lipids: fats, oils and steroids

* Hanus test: qualitative determination of unsaturation in lipids
* preparation and properties of a soap

**Important: If you have a verified need for an academic accommodation or materials in alternate media (i.e., Braille, large print, electronic text, etc.) per the Americans with Disabilities Act (ADA) or Section 504 of the Rehabilitation Act, please contact the Disabled Student Services as soon as possible.**

Lab Schedule Chem 29B, Spring 2013.

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| Date | Lab |
| 1/8 | Syllabus, check-in to lockers and sign the safety agreement. |
| 1/10 | Lab 15.3 Synthesis of 2,4-dinitrophenylaniline. Q1-4. **Do Formal Report on this reaction. Due Tuesday 1/29.** Dry glassware for lab 17.2 |
| 1/15 and 1/17 | Lab 17.2 Reduction of cyclohexanone to cyclohexanol. Q1 (a,b,d,e,f) Due 1/29 |
| 1/22 | Lab 12. Diels-Alder reaction. Q2(a-d), 3(a-e). Leave for 2 weeks for crystals to form. |
| **1/24 (Q1)** and 1/29 | Lab 15.4. Oxidation of the side chain of an arene: Synthesis of 2-chlorobenzoic acid from 2-chlorotoluene. Q1(a), 3, 5. Due 2/5 |
| 1/31 and 2/5 | Lab 15.5 Benzyne, the synthesis of triptycene. Q1,2 and 3(b,c). Due 2/12 |
| **2/7** | Finish Lab 12: The Diels-Alder reaction. Q 2(a-d) and 3(a-e). Due 2/19  **Lab Quiz 1** |
| 2/12 | Lab 16.2. The hydrolysis of benzonitrile. All questions. Due 2/19 |
| **2/14 (E1)** | Lab 16.3 Synthesis of aspirin. Q 1(not f), Due 2/23 |
| 2/19 and 2/21 | Lab 16.4 Synthesis of isoamylacetate. Q 1,2,4. Due 2/28 |
| 2/26 | Lab 16.5 Imides: synthesis of N-phenylphthalimide. Q 1,2. Due 3/5 |
| 2/28 | Lab 16.6 The saponification of an ester Q 2,3,5 Due 3/12 |
| 3/5 and  **3/7** **(Q2)** | Lab 17.1 Oxidation of cyclohexanol to cyclohexanone. Q 1,2(a,b),3 Due 3/14 |
| **Friday 3/8** | **Last day to drop a course in person to receive a “W”** |
| **Sunday 3/10** | **Last day to drop a course on Webadvisor to receive a "W"** |
| 3/12 and 3/14 | Lab 17.3 Acetal formation: synthesis of 4,5-dimethyloxolane Q 2,3a,6. Due 3/21 |
| 3/19 and 3/21 | Lab 17.4 The Pinacol-Pinacolone rearrangement. Q 1 Due 3/29 **Formal Report 2 on this reaction due 4/9** |
| **3/26 and 3/28** | **Spring Recess. No labs** |
| 4/2 | Lab 17.5 Qualitative tests for aldehydes and ketones. Q 5,8. Due 4/9 |
| **4/4 (E2)** | Lab 18.1 The aldolcondensation: synthesis of dibenzalacetone. Q 2(a,b),3. Due 4/11 |
| 4/9 | Lab 19.1 Reduction of a nitro compound to an amine. Q 3,4,5. Due 4/16 |
| 4/11 | Lab 19.2 Synthesis of acetanilide. Q 1,2,4,5. Due 4/19 **Formal Report 3 on this reaction due 4/30** |
| 4/16 | Lab 20.2 Synthesis of benzimidazole Q 3a. Due 4/23 |
| 4/18 and 4/23 | Lab 22.2 Qualitative tests for amino acids and proteins. Q 1,3(a,b,d,e,g),4 Due 4/30 |
| **4/25 (Q3)** | Lab 21.2 Qualitative tests for carbohydrates. New Q1. Due 5/2 |
| 4/30 | Lab 23.1 Preparation and properties of a soap. Q1(a,d),2(a,b),3(a,b). Due 5/2 |
| **5/2** | Lab 23.2. Qualitative determination of unsaturation in lipids. Q1,2. Due 5/9 and **Lab Quiz 2** |
| 5/9 | Lab 19.3 The coupling of diazonium compounds, azo dye formation. Bring a T-shirt to dye. Q1. Due 5/9 |