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

**V. Cornel, Reedley College, Spring 2011, #57011**

**Lab TTh 8:00-10:50 pm in PHY-77**

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

**email:** [**vmcornel3@verizon.net**](mailto:vmcornel3@verizon.net) **using “CHEM29B” or “O-chem” as the subject**

**Office hours: 11-12am MWF or find me in lab 82 from 11:00-1:50 TTh**

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

Course corequisite: Chem 29A

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 ordinary 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, optical activity. They will learn hands-on how to work with a Gas Chromatograph Mass Spectrometer, an FTIR (a Fourier Transform Infrared Spectrophotometer) and a 60MHz NMR. 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 28B).

Homework: Students are expected to come to lab well prepared. This means that the steps to be taken to properly complete the experiment are underlined in the text of the lab manual or 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 Title, Method (Procedure), Reaction Mechanism, Physical Data (melting point, refractive index etc.), Observations, Percent Yield, and Conclusion should all be recorded as well as any IR, GCMS or NMR spectra obtained. The Aim and Method should be completed before coming into the lab. Certain questions at the end of each lab also need to be completed 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. Late reports will be accepted up to 1 week late, but 2% will be deducted for every day it is late.

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 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 have to complete all the laboratory assignments – no labs will be dropped this semester. You will be dropped if you miss two weeks 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. A maximum of two make-up labs 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%, and the individually graded labs towards 70% of your final grade. In addition, I will also take into account 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. General grade break-off : 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 11, 2011. After this date a letter grade A-F will have to appear on your transcripts.

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 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.

**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 me as soon as possible.**

Lab Schedule Chem 29B, Spring 2011. Every experiment takes 1-2 lab sessions.

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| Date | Experiment |
| 1/11 | Sign the Safety Agreement (again). Experiment 15.3 Synthesis of 2,4-dinitrophenylaniline. Q1-4. Write **Formal Report** on this experiment. **Due Tuesday 1/25** (by 5pm at switchboard) |
| 1/13 and 1/18 | Experiment 17.2 Reduction of Cyclohexanone to Cyclohexanol. Q1 (a,b,d,e,f) Due 1/27 |
| 1/20 | Exp 12. Diels Alder Reaction. Q2(a-d), 3(a-e). Due 2/1 |
| 1/25 and 1/27 | Experiment 15.4. Oxidation of the side chain of an Arene: Synthesis of 2-chlorobenzoic acid from 2-chlorotoluene. Q1(a), 3, 5. Due 2/3 |
| 2/1 and 2/3 | Experiment 15.5 Benzyne, the synthesis of triptycene. Q1,2 and 3(b,c). Due 2/10 |
| 2/8 | Experiment 16.2. The hydrolysis of benzonitrile. All questions. Due 2/15 |
| 2/10 | Experiment 12: The Diels Alder Reaction. Q 2(a-d) and 3(a-e). Due 2/17 |
| 2/15 | Experiment 16.3 Synthesis of aspirin. Q 1(not f), Due 2/24 |
| 2/17 and 2/22 | Experiment 16.4 Synthesis of isoamylacetate. **Formal Report II due on this experiment. Q 1,2,4. Due 3/8** |
| 2/24 | Work on Formal Report II |
| 3/1 | Experiment 16.5 Imides: Synthesis of N-Phenylphthalimide. Q 1,2. Due 3/10 |
| 3/3 and 3/8 | Experiment 17.1 Oxidation of cyclohexanol to cyclohexanone. Q 1,2(a,b),3 Due 3/15 |
| 3/10 and 3/15 | Experiment 19.2 Synthesis of acetanilide. Q 1,2,4,5. Due 3/22 |
| **Friday 3/11** | **Last day to drop a course to receive a “W”.** |
| 3/17 | Experiment 17.5 Qualitative Tests for Aldehydes and Ketones. Q 5,8. Due 3/24 |
| 3/22 | Experiment 18.1 The aldolcondensation: synthesis of dibenzalacetone. Q 2(a,b),3. Due 3/29 |
| 3/24 and 3/29 | Ferrocene synthesis. Hand-out. No Q. Due 4/7 |
| 4/5 and 4/7 | Experiment 19.3 The coupling of diazonium compounds, azo dye formation. Bring a T-shirt to dye. Q1. Due 4/14 |
| 4/12 and 4/14 | Experiment 20.1 Oxidation of 2-methylnaphthalene. **Formal Report III to be written on this experiment. Due 4/28** |
| **4/18 and 4/22** | **Spring Recess. No labs** |
| 4/26 and 4/28 | Experiment 21.2 Qualitative tests for carbohydrates. New Q1. Due 5/5 |
| 5/3 | Experiment 23.1 Preparation and properties of a soap. Q1(a,d),2(a,b),3(a,b). Due 5/10 |
| 5/5 | Experiment 23.2. Qualitative determination of un-saturation in lipids. Q1,2. Due 5/12 |
| 5/10 and 5/12 | Experiment 22.2 Qualitative tests for amino acids and proteins. Q 1,3(a,b,d,e,g),4 Due 5/12 before you leave today!!!! |

**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 un-saturation 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