SYLLABUS[1]

CHEM 2123 – ORGANIC CHEMISTRY LABORATORY I
Fall 2016

Dr. Sergio Cortes SLC 3.509 972-883-6801 scortes@utdallas.edu Hours: TBA

PREREQUISITES: General Chemistry II or equivalent.
COREQUISITES: Organic Chemistry I

DESCRIPTION: Introduction to basic experimental technique and information sources. Major topics include safety, record keeping, written communication, information sources, physical separations, determination of physical constants, purification and characterization techniques, and simple organic reactions. Correlation with the organic lecture is adequate, but practical factors prevent full overlap.

LEARNING OBJECTIVES AND OUTCOMES

- Describe and utilize safety protocols associated with basic organic chemistry laboratory operations.
- Know how to keep experiment records, produce reports, interpret data, and draw conclusions.
- Prepare, purify, and characterize simple organic compounds.
- Know how to work and communicate effectively in small groups and teams.

TEXTBOOK: Pavia, Lampman, Kriz, and Engel. *A Microscale Approach to Organic Laboratory Techniques.* **5th ed**. Thomson Brooks/Cole, 2013. Please refer to the publisher's website for ISBN and price information. Access to the OWL Lab Skills is NOT required.

> ***NOTE**: Previous editions of the textbook will not do for this course. You are NOT required to bring the textbook to class, so you can share a copy with other students if necessary.*

SUPPLIES: The combination padlock is required for check-in during the first lab meeting (see calendar on next page). The rest of the items are required for the second lab meeting and thereafter.

- **COMBINATION PADLOCK** (Only one per group). Can be obtained from the bookstore, or from area retail outlets such as the off-campus bookstore, Tom Thumb, Target, Staples, and Home Depot.
- **APPROVED SAFETY GLASSES**:
  - **Must have the Z87 code engraved on them**.
  - **The spectacle type is recommended over the goggle type**. Spectacles look like regular glasses. They are comfortable and can be worn over prescription glasses. They can also be made to prescription at certain retail outlets.
- **HARDBOUND NOTEBOOK** with duplicate sheets (carbon copies) for prelabs.
- **GLOVES**: Although disposable gloves are available in the lab, they are not chemical resistant and can tear easily. Having your own gloves is recommended. Dishwashing gloves are adequate for this lab.
- **PROPER ATTIRE**: Students working in chemistry labs are required to dress properly. This means covered torso, long pants, and closed shoes. Items that leave large portions of skin exposed to the action of organic solvents, chemicals, and broken glass are unacceptable. These include sleeveless garments, tank tops, shorts, sandals, ballet flats, Capri pants, etc.
- **ITEMS OF PERSONAL USE** (one set per group is adequate): Towel, sponge pack for cleaning, tweezers, marker or pen, and masking tape for labeling.

[1] *The descriptions and timelines presented in this syllabus are subject to change.*

CLASS SCHEDULE – Org. Lab I – Fall 2016

NOTE: There are no labs the first week of class. All organic lab operations begin on the second week.

DATE	TOPIC / EXPERIMENT
Aug. 29 – Sept. 3	• Introduction to Organic Lab Procedures & Safety Protocols • Weekly Quiz Preparation • MSDS assignment • Check-in
Sept. 6 – 12	Exp. 10: Extraction of active ingredient from analgesic drug **MSDS assignment due**
Sept. 13 – 19	Exp. 3 A: Crystallization of Acetanilide **NOTE: Acetanilide is substituted for sulfanilamide in this exp. Refer to the class notes for details**.
Sept. 20 – 26	Exp. 4 A,B: Extraction & distribution coefficient
Sept. 27 – Oct. 3	Exp. 6 A,B: Thin layer chromatography (TLC)
Oct. 4 – 10	Exp. 17 A - C: Isolation of pigments from spinach **Please bring a small package of fresh spinach for your group**
Oct. 11 – 17	Exp. 14 A: Synthesis of isopentyl acetate (banana oil)
Oct. 18 – 24	Infrared Spectroscopy **Dry lab: No prelab required. Read the class notes & description below**.
Oct. 25 – 31	Exp. 66: An oxidation puzzle
Nov. 1 – 7	Exp. 23 A,C: Sn1 and Sn2 reactions
Nov. 8 – 14	Bromination of stilbene (Not in textbook - Posted in eLearning) **Glassware & drawer cleanup in preparation for check-out**
Nov. 15 – 19, & 28	Final Exam & Check-out

DETAILED DESCRIPTIONS, READINGS, & ASSIGNMENTS

INTRODUCTORY MEETING

1. Organic Lab Operations & Safety

ASSIGNED READINGS:

- *Syllabus & Introductory Items* folder in eLearning – **Please read the items in this folder carefully**.
- Technique 1 in the textbook (Laboratory safety): p. 576-591
- *Safety Manual,* available at the *UTD Chemistry Safety Page*.

ASSIGNMENT (due next period): Download an MSDS for a chemical of your choice, print it, highlight any information that seems important, and turn it in (max.: 5 pages). This is your first report (100 pts).

2. Overview of Prelabs and Lab Reports

ASSIGNED READINGS: Guide to Prelabs and Post-labs (posted in *eLearning*)

3. Check-in Procedure – Students will form groups of two. **Each group must provide a combination padlock**. No drawers can be assigned without combination padlocks.

For all experiments you are strongly encouraged not only to do the assigned readings, but also to bring the class notes to the lab. They contain useful tips and possible modifications to the experimental procedure.

EXP # 10: ISOLATION OF ACTIVE INGREDIENT FROM ANALGESIC. Solid-liquid extraction, vacuum filtration, melting point determination.

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 79-82
- Technique 8 (Filtration): p. 652 - 655
- Technique 9 (Melting point theory): p. 660 – 663
- Suggested study questions from the textbook: # 1-5 on p. 82

NOTE: The suggested study questions might appear in the post-lab. Giving these questions some thought will enable better understanding of the experiment and will make it easier to answer the post-lab questions.

EXP # 3A: CRYSTALLIZATION.

Note: Acetanilide is substituted for sulfanilamide in this exp. See the class notes for details.

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 22 – 26.
- Technique 10 (Solubility): p. 669 - 677
- Technique 11 (Crystallization): p. 678 - 686
- Suggested study questions from the textbook: # 1 on p. 33

NOTE: The "Pre-Lab Calculations" section of some experiments in the textbook (such as exp. 3A, p. 24) is not required for your prelab.

EXP # 4 A & B: EXTRACTION. Liquid-liquid extraction, miscibility & solubility, distribution coefficient.

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 34 - 38
- Technique 12 (Extraction): p. 700 - 715

EXP # 6 A & B: THIN LAYER CHROMATOGRAPHY (TLC). Theory and practice of chromatography.

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 47 - 50
- Technique 20 (Thin-Layer Chromatography):
  - p. 810 – 811 (sections 20.1 & 20.2)
  - p. 814 - 820 (sections 20.4 & 20.9)
- Suggested study questions from the textbook: problems # 1 – 5 on p. 822 - 823

EXP # 17 A – C: ISOLATION OF PIGMENTS FROM SPINACH. Combined use of column chromatography and TLC to isolate and identify natural products. **Please bring a small package of fresh spinach for your group.**

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 144 - 150
- Technique 19 (Column Chromatography):
  - p. 790 – 799 (sections 19.1 – 19.6)
  - p. 802 – 803 (sections 19.8 – 19.9)
  - p. 804 – 806 (sections 19.11 – 19.13)
- Technique 20 (Thin-Layer Chromatography): p. 820 – 822 (section 20.10)
- Suggested study questions from the textbook: # 1, 3, 4 on p. 150; and # 3, 5 on p. 809

EXP # 14A: CHEMICAL SYNTHESIS: PREPARATION OF ISOPENTYL ACETATE. Esterification, reflux, simple distillation, boiling point determination, driving equilibrium reactions.

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 109 - 117
- Technique 7 (Reaction Methods): p. 631 – 634 (sections 7.2 & 7.3)
- Technique 13 (Physical Constants of Liquids): p. 727 – 729
- Technique 14 (Simple Distillation): p. 738 – 743 (no "internal monitoring of temperature.")
- Suggested study questions from the textbook: # 3-7 on p. 116 - 117

INFRARED SPECTROSCOPY. Introduction to instrumental methods of structure determination through infrared spectroscopy.

ASSIGNED READINGS & EXERCISES:

- Class notes (PowerPoint presentation) posted in eLearning.
- Technique 25 (Infrared Spectroscopy): p. 875 – 895.
- Students will work on an exercise during class time, due at the end of the class period (100 pts.).

EXP # 66: AN OXIDATION PUZZLE. Oxidation of alcohols. Use of infrared spectroscopy for product characterization.

ASSIGNED READINGS & EXERCISES:

- Experiment: Posted notes and p. 571 - 573
- Suggested study questions: # 2 on p. 895

EXP # 23 A & C: SYNTHESIS OF ALKYL HALIDES BY Sn1 AND Sn2 REACTIONS.

ASSIGNED READINGS & EXERCISES:

- Posted notes and p. 200 – 206
- Suggested study questions from the textbook (p. 208):
  - For *n*-Butyl bromide: questions 1, 3-5
  - For *t*-Pentyl chloride: questions 3, 5

BROMINATION OF STILBENE. Electrophilic addition reactions of alkenes. Stereospecific reactions. Identification of diastereomers.

- This experiment is not in the textbook. Refer to the class notes posted in eLearning.

CHECK-OUT. ALL students must be present for check-out. Anyone missing will continue to be responsible for the equipment in their drawer. No check-out is allowed prior to this date unless you drop the course.

GRADING POLICY

The final grade for this course is calculated as follows. All work graded on a 100 point scale.

- Prelabs (individual) 30%
- Post-labs (group) 30%
- Quizzes 20%
- Final exam 20%

INDIVIDUAL PRELABS are required to perform every experiment and are due prior to the beginning of the lab session. Please refer to the guidelines for writing prelabs posted in *eLearning*.

POST-LABS are a group effort and consist of a form to be filled out and turned in following completion of the experiment. The grade obtained applies to all members of the group. However, individual members can lose points for poor technique (see below).

LABORATORY TECHNIQUE & SAFETY AWARENESS. Students will be individually evaluated by the instructors on their technique and on safety awareness for each experiment. Points will be deducted from the post-lab for students who:

- show a lack of preparation or lack of knowledge of basic procedures and calculations
- disregard safety rules (for instance not wearing eye protection or proper attire in lab)
- do not carry their fair share of the group's work
- leave experiments unattended or leave the lab for long periods of time
- leave the lab for good before the group concludes the experiment (this earns a grade of zero for the experiment).
- any other types of unprofessional or unsafe behavior

INDIVIDUAL ASSIGNMENTS. These are individual write-ups intended to be completed outside the lab, and handed in during lab time at the beginning of the lab session. See class schedule for due dates.

QUIZZES. Quizzes are given during the prelab lecture period and are intended to ensure that students are prepared before they attempt to perform the experiment. Therefore, the following applies:

- Students arriving to class after the quiz has started, but before it ends, may take the quiz but will receive 5 point off the quiz grade.
- Students arriving after the quiz has ended may not take the quiz. They can still perform the experiment provided they produce the corresponding prelab.

FINAL EXAM. The questions in the final exam are based on the theory and technique of the experiments. Students arriving late to the final exam will receive 5 points off the exam grade.

LETTER GRADE ASSIGNMENT TABLE (based on final percent grade after round-off)

95 - 100 = **A**+	80 – 84 = **B**+	65 – 69 = **C**+	50 – 54 = **D**+
90 – 94 = **A**	75 – 79 = **B**	60 – 64 = **C**	45 – 49 = **D**
85 – 89 = **A**-	70 – 74 = **B**-	55 – 59 = **C**-	40 – 44 = **D**-

POLICY REGARDING MISSED WORK (experiments, prelabs, or quizzes)

1. Students who miss one experiment, **but who otherwise complete all the assigned work on schedule**, will drop the missed experiment. This also applies to missed prelabs and quizzes. The final exam cannot be dropped.

2. There are no makeup labs, quizzes, or exams unless allowed by university policy or state law (see exemptions below).

3. Students who request and are granted a makeup lab or a final exam makeup for reasons other than those listed below cannot drop any grades. All grades will count towards the final grade.

EXEMPTIONS GRANTED BY UNIVERSITY POLICY & STATE LAW

Students can request exemptions from certain rules (e.g. waiving an absence or making up an experiment) IF the reasons are covered by university policy or state law, AND IF they can be properly documented.

Examples of reasons covered under this policy are: **military duty, jury duty, major illness, medical procedures, and participation in university-sponsored events**.

Examples of reasons **NOT COVERED** under this policy are: **personal engagements such as travel and social events, common emergencies such as accidents and minor illness, and any reasons that cannot be properly documented**.

UTD SYLLABUS POLICIES AND PROCEDURES WEBPAGE – Use this link to access information regarding such matters as:

- Incomplete grades policy
- AccessAbility services
- Student conduct
- Grievance procedures
- Religious holy days
- Withdrawal from class
- Student resources (Peer tutoring, PLTL, SI, etc.)
- Sharing confidential information
- Campus carry