Fall 2019 -- CH 461 & CH 461H
EXPERIMENTAL CHEMISTRY II

Course Instructor:

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Textbook: Harris, "Quantitative Chemical Analysis" 7th/ 8th/or 9 th editions (also used in CH 421 and 422).

Course Content -- Laboratory Experiments**:**

1. Chemical Instrumentation
    A. Electronic Instrumentation
    B. Optical Instrumentation
2. Determination of Riboflavin: A Comparison of Techniques
    A. Molecular Absorption Spectrophotometry
    B. Molecular Fluorescence Spectrometry
    C. HPLC
3. Enzyme Kinetics
4. ICP Atomic Emission and Flame Absorption Spectrometry
5. Coulometric Titration
6. Special Project

Grading

Lab Reports (weighted roughly according to time required for experiment)	80%
Lab Quizzes	10%
Instructors' evaluation of lab technique, safety practices, preparation, etc. etc.	10%

Course Outcomes: A student who completes CH 461 or CH 461H successfully should be able to**:**

Exp	Objective
1A	Calculate voltage, current, or resistance in simple circuits with Ohm's law.
1A	Design a voltage divider and calculate output voltage.
1A	Describe internal resistance; calculate effective internal resistance from load resistance and output voltage.
1A	State basic principles of op-amps and use them to calculate currents and voltages for various op-amp circuits: voltage amplifier, voltage follower, low pass filter, integrator.
1A	Calculate voltage, current, charge, or capacitance in simple circuits with capacitors.
1B	Explain characteristics of light sources, monochromators and photodetectors.
1B	Determine experimentally characteristics of light sources, monochromators and photodetectors.
1B	Explain quantitatively and determine experimentally the effect of slit width in a monochromator on the light throughput and wavelength resolution.
1B	Explain quantitatively and determine experimentally how the magnitude of signal fluctuations (noise) depends on the time constant or cutoff frequency of the signal processing electronics.
2A	Use Beers Law to relate A, a, ε, b, and c.
2A	Calculate concentration from experimental measurements of Er, Es, Ed, %T and A.
2A	Sketch a block diagram of a single-beam and a double-beam spectrophotometer and describe how each processes Er, Ed, Es to obtain %T and A.
2A	Determine detection limit in absorption spectrophotometry.
2B	Describe the physical basis of molecular fluorescence and the components of spectrofluorometers.
2B	Describe the components of the signal in fluorescence spectrometry (Ef, Ed, Esc, Ed) and determine their values experimentally.
2B	Determine a spectrofluorometric calibration curve and use it to determine the concentration of an unknown.
2B	Determine detection limit in fluorescence spectrophotometry.
2C	Describe the components of a high performance liquid chromatograph.

2C Predict change in retention with change in solvent composition in ion-pairing reverse phase HPLC.

2C Use HPLC to separate and determine the concentration of components of a solution.

3 Describe the Michaelis-Menten model of enzyme kinetics and the assumptions on which it is based.

3 Identify the three special cases of $[S]_0 << K_m$, $[S]_0 >> K_m$ and $[S]_0 = K_m$ in a plot of v_0 vs. $[S]_0$ and associate Km and v_{max} with the data on the plot.

3 Use an Eadie-Hofstee plot to determine the parameters K_m and v_{max}.

3 Use initial rates with $[S]_0 << K_m$ to determine the concentration of a substrate in a sample.

3 Use initial rates with $[S]_0 >> K_m$ to determine the specific activity of an enzyme.

4 Describe basic physical principles of atomic emission and atomic absorption.

4 Describe basic components of an inductively coupled plasma atomic emission spectrometer (ICP-AES) and a flame atomic absorption spectrophotometer (AAS).

4 Use ICP-AES and AAS to determine concentrations of elements in various samples.

4 Select and use appropriate methods of sample preparation (dry ashing, microwave digestion, acid dissolution) to prepare samples for atomic spectrometry.

5 Determine charge passed from current and time; relate charge passed to number of moles titrant generated with Faraday's law.

5 Describe the configuration of a coulometric cell including the reactions at both electrodes.

5 Perform a coulometric titration with spectrometric endpoint detection and determine concentration of an analyte.

6 Formulate a complete procedure for chemical analysis, including method selection, sampling, preparation of sample for analysis, preparation of standards, incorporation of quality assurance measures, and analysis of data.

6 Carry out the chemical analysis and report results including uncertainty.

Experiment Number	Handouts, Lecture Notes	Harris Section	Harris pages, 8th Ed.
1A	Lab Info 1A		
1B	1B	19-19.4 20.1-20.4*	445-458 462-464
2A	2A	17	394-403
2B	2BC	17.6-17.7	404-413
2C	2BC	25.1-25.2*	596-628
3	3		
4	4	20	479-495
5	5	16.1; 16.3 15.7	362-366; 369-371 347; 351
6	6	0.2 - 0.3; Chap 5; Chap 8; Chap 27	6-12; 96-110; 412; 525; 584-586; 699 -715.

* Not the entire section

Fees

Course Fee (chemicals, lab disposables): $44.00
Lab manual with handouts: $28.00
Required goggles, $ 12.00
Optional: lab coat, $ 5.00

Safety Goggles

Approved Safety GOGGLES (model sold at OSU chemistry issue rooms) are **mandatory** for experiments which involve a possible chemical hazard and are to be worn at all times when working with or around chemicals and chemical solutions. These can be purchased from the issue room. Notify the course instructor if you wear contacts and turn in the request form.

Laboratory Notebooks

Everyone should have a bound laboratory notebook with provision for making a duplicate copy (can use one from previous integrated lab course). In the laboratory, make sure that you record all pertinent instrumental settings and keep all hardcopies and instrument traces. Much of your data will also be recorded on the "data sheets" provided with most experiments. All other data such as weighing data, details of solution preparation, or additional observations should be

recorded in your laboratory notebook. You will not be allowed to record data on scratch paper because it is unprofessional and it is easy to lose. Have an instructor check your daily work and initial the notebook before you leave lab for the day. When you turn in your report, include the duplicate copy of the appropriate pages in your laboratory notebook.

Due Dates For Lab Reports

All lab reports are due as indicated on the course schedule (usually, but not always, one week from the date of the scheduled completion of the lab). Reports are due at the **beginning of the lab or lecture period** on the date indicated. You may only work on your laboratory reports during the scheduled laboratory time if you are completely finished with the scheduled experiment for that day. You must do your own work on the report once the data has been collected in the lab as a team. Calibration curves that are constructed during the course of the actual laboratory work as a team may be shared but each individual team member must check the collective calibration curve for accuracy before submitting with their report.

Penalty For Late Lab Reports

Late lab reports are penalized **2% of the total possible laboratory points in the term for each day late**. Every student has three free "late days" for the whole term. Note that this is a stiff penalty and about 5 late days above the three free days is equivalent to 10% of the total laboratory points and will lower your grade a whole grade point.

Preparation Before The Laboratory

Before each laboratory, read and understand the experiment and pertinent handout sheets and lecture notes. The TA's will go around and ask each team questions about the lab procedure at the start of lab. If any member in your group is not prepared, the entire group will be required to stop work and read the lab manual before proceeding with the lab work. If solution preparation is required, work out the details and outline the procedure in your laboratory notebook before coming to class. This policy will almost insure that you will finish the laboratory in the allotted time and may help you to finish the experiment in much less than the allotted time. Part of your performance grade is based on the instructor's perception of your preparation.

Attendance

You are expected to attend all scheduled lectures and laboratory periods and be present at the scheduled starting time. **Un-excused absences or tardiness will lower your performance grade.** Please inform in advance a faculty member involved with the course of an expected legitimate absence or bring a doctor's excuse in the case of a sudden illness. Time conflicts with other courses must be discussed with the course instructor prior to the first meeting. Generally, time conflicts with other courses are not allowed.

Quizzes in the Laboratory

During the term, four or more lab quizzes will be posted on the course web page by 5 pm the day before the quiz is due. The quiz is due at the beginning of the lab or lecture on the date indicated in the course schedule. These quizzes are designed to test your understanding of the material in the lectures and the laboratory manual.

Statement Regarding Students with Disabilities:

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations.
While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Student Conduct Expectations link:

http://studentlife.oregonstate.edu/code

Reach Out for Success:

University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it's important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with
wellness and academic success at oregonstate.edu/ReachOut. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255).