Experimental Chemistry II, CH 461 and CH 461H

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

Exp	CH 461 & CH 461H Learning Outcome
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.

Exp	CH 461 & CH 461H Learning Outcome (cont'd)
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.