CHEM 220 – Analytical Chemistry (CRN 1209)
University of San Diego, Fall 2023

Lecture -Thursday 9:15 am – 10:35 am in ST130
Lab - Wednesday 1:25 pm-5:25 pm in ST494
Instructor: Dr. Eleanor Gillette, Office: SCST 375 Phone: x4247 Email: egillette@sandiego.edu
Office Hours: 11:00 am – 12:00 pm Monday, Wednesday and Thursday, 3 – 5 pm Tuesday or by appointment
(please my check my schedule on Blackboard and email me with a few possible times to meet!)

Description and Overview of the Course:

Welcome! Analytical Chemistry is the science of chemical measurement. It addresses questions such as, "How do you know how much phosphoric acid is in that Coke?" and "Is there a better way to measure lead in drinking water?" Most of chemistry and much of science rests on our ability to get answers to questions like these. Analytical chemistry itself rests on a foundation of statistics, standards and strategies that allow us to determine the quality of our results.

General Course Goals
Upon completion of this course, you will be able to:
- summarize and interpret lab results using statistical functions,
- work skillfully in any type of laboratory,
- evaluate the quality of a measurement,
- use the scientific method, and
- communicate the results of your work in person and in writing.

Specific Course Outcomes
Upon completion of this course, you will be able to:
- select and use glassware properly,
- attach an error term to any measurementand laboratory result,
- apply statistics to assess the precisionand accuracy of a measured value,
- keep a complete and useful writtenrecord of all your lab work,
- perform accurate and complex titrations
- quantitatively predict the behavior ofsolutions affected by competitive equilibria,
- make standards for chemical analysis
- build and fully utilize calibration curves
- make buffer solutions at target pH values
- design and execute a sampling plan for a target analyte,
- develop and optimize a measurement method
- make quantitative measurements using the techniques of spectroscopy chromatography, electrochemistry and kinetics
- automate repetitive tasks/calculations

Required Materials:

- **Textbook**: Custom LibreText Edition of *Analytical Chemistry 2.1* by David Harvey. The text is available for free and links to the material are embedded in BlackBoard. You can also print the text, or purchase printed versions of the text, if you prefer that text format.
    - Supplemental readings will also be provided in BlackBoard.
- **Calculator** capable of scientific notation, exponential and logarithmic calculations, and standard deviations
- **A laptop or tablet device is required**
- **Electronic Lab Notebook (ELN)** – We will set up your notebook on the first day of lab. It requires that you bring a laptop or tabletto class in order to have access to the website where your electronic notebook is stored. https://mynotebook.labarchives.com/
- **Personal protective Equipment:**
    - **Safety glasses** (must have *side shields* at minimum, available from chemistry club)
    - **Lab Coat (**Available from the Torero bookstore)

Course Format and Explanation of Assignments:

Lecture: The lectures (Thursday, 9:15 am – 10:35 am) are classroom sessions organized around the practical work of data analysis. We will focus on problem-solving practice, group activities and calculations. **It is essential that you do any assigned reading and watch the prelab lecture videos before you come to class.** Come to class on time, prepared and ready to participate. This course material quickly builds on knowledge from previous classes, so it is important to keep up. The lecture portion of the course will be assessed by the following mechanisms:

Quizzes: Three thirty-minute, closed note written quizzes will be given in lecture, focused on the information provided in the reading, pre-lecture videos and lectures. Quizzes will be a mix of quick response (multiple choice, true/false, etc.) and short answer questions. Dates for each quiz are provided in the schedule posted in Blackboard.

Class Assignments/Group Work /Participation Points: Coming to class prepared is important; you must watch pre-lecture videos and come to class prepared. Attendance, preparation and participation in class activities will be noted. One missed lecture/activity or video will be excused with no penalty, however, please speak to me if you will need to miss more than one lecture.

Laboratory Experiments The labactivities include not only making chemical measurements, but also data analysis, error evaluation, and report writing. You will be expected to prepare and maintain a good laboratory notebook during lab, and to work safely and efficiently with your classmates in the laboratory setting. Additionally, there will be a number of "short reports" or calculation summaries, as well as three more detailed analysis reports. Finally, you will have a final projects which will involve the design of experiments and reporting of results.

The goals of each experiment may vary, but many experiments are designed to help you organize information, find patterns, and construct hypotheses. Data analysis and evaluation are integral parts of each experiment – in fact, it is often impossible to know if you have taken enough data before doing at least some preliminary analysis. For that reason, some experiments will require pre-lab calculations that are graded. It is also important not to put your brain on "idle" during lab! Plan to stay in lab the full 4

hours each week so that you can maximize "face time" with your lab partners and instructor and minimize the work you must finish later. When you finish data collection, work on data analysis or writing**.**
Labs will consist of one or more of the following:

Prelab: Before each lab, you will be asked to do some preparatory work. Typically, this involves reading some introductory material, doing some preparatory calculations, and preparing your lab notebook. Each prelab should contain at least a brief goal/purpose statement for the experiment, alist of needed reagents and equipment, a preliminary procedure and any prelab calculations necessaryfor the experiment. Late prelabs are worth up 50% but will not be accepted once the lab starts. You must have your prelab complete before you will be allowed to do the experiment. **Your pre-lab assignment must be submitted in your ELN (electronic lab notebook) by 5 pm the Tuesday before your lab**. Late prelabs are worth up 50% but will not be accepted once the lab starts. You must have your prelab complete before you will be allowed to do the experiment.

Data and Observations section: All laboratory work is to be recorded in an online electronic lab notebook. Record everything that you do **AND why you do it.** All experimental procedures, data and observations *must* be kept within your notebook. The more you write, the better off you will be. As you make updates the lab notebook time stamps every entry you make. You will record all data and observation in lab and submit these for credit at the end of the lab period. No late submissions are allowed.

Calculation Summaries: For every lab, a calculation summary in Jupyter will be submitted. All calculations must be submitted in this format, though the ELN. Details for how to work with Python in Jupyter notebooks will be provided in our first laboratory meeting. These calculation summaries will usually be due the Sunday after the lab meeting in which the data was collected. If these assignments are submitted on time, they will be reviewed and graded BEFORE the post-lab report for the module is due, to allow you to review and correct calculations before you write your lab report. A late penalty of 10 % per day will also be assessed on these summaries, and late summaries may not be graded as promptly.

Post-Lab Reports: Laboratories in the class are grouped by module. At the end of each module, you will review all of your calculations and write a short report providing details, context and interpretation of the results of those laboratories in the context of some real-world scenario. Details will be provided for each report, and due dates in the schedule on Blackboard.

General Course Policies:
Attendance Policy: If you are feeling seriously ill, please do NOT come to class or to lab. If you are going to miss a lecture or lab due to illness, please email me before the start of the session, so that I can make arrangements for accommodation. We will address the situation on a case-by-case basis, but flexibility will be provided to the best of my ability. However, please recognize that this is primarily a laboratory class, and that there is no remote experience which can fully replicate the hands-on experience of being present in the laboratory. Priority will be given to finding ways to make up missed lab experiences in person whenever possible. If you must miss more than two consecutive class meetings, due to illness or mandatory quarantine, a note from student health will be required. Accommodations will also be made for NCAA travel and other official university events but please inform me of any events as far in advance as possible.

Office hours: Because this is a hands-on class with a lot of calculations, it is usually easiest for me to see your work and help you if you can come to my office hours in person. If you need to attend by Zoom, please just let me know and I will share a Zoom link with you. Outside of office hours, I am available by appointment, in person or by Zoom; please email me to request an appointment. Additionally, don't hesitate to e-mail me with questions, but please allow up to 24 hours for a response.

Academic Integrity: USD's Academic Integrity Policy states: "The University of San Diego is an academic institution, an instrument of learning. As such, the university is predicated on the principles of scholastic honesty. It is an academic community all of whose members are expected to abide by ethical standards both in their conduct and in their exercise of responsibility toward other members of the community." It is your responsibility to be familiar with the academic integrity policy, and to hold yourself and your classmates to the standards established there. **Any academic integrity violation is a serious matter and will be dealt with according to the USD Academic Integrity policy**.
It is considered a violation of the Academic Integrity Policy to possess or otherwise use course materials(i.e., lab reports, homework, exams or **Python code**) from previous semesters, or to use copies of code written entirely by someone else (this includes code written by generative AI!).

Disability Accommodations: Students with any sort of learning disability who require accommodations for this class are encouraged to contact Disability and Learning Difference Resource Center in Serra 300 (disabilityservices@sandiego.edu) within the first three weeks of the semester.

IMPORTANT NOTES:
- Allow up to 7-10 days for the return of assignments.
- Coming late to class is disruptive. Please be on time. Attendance will be monitored.
- You are expected to maintain a respectful attitude toward *everyone* in the class.
- Parts of the course are subject to change, to meet the needs of the students.

Grading System:
Grades: Your grade in this course be weighted according to the table below. Tentative score cut-offs are also provided, but the instructor reserves the right to make small adjustments to cut offs as needed. **Plus and minus grades** will be assigned within 3 % of the cutoff.

Assignment:	% of Total Grade
Quizzes	25 %
Class Participation	5 %
Prelabs	10 %
Data and Obs Pages	10 %
Calculation Summaries	25 %
Post-Lab Reports	25 %

Tentative Grade Cut-Offs*

A = 90% - 100%

B = 78% - 89%

C = 65 % - 77%

D = 52% - 64%

F < 52%