CHEM 220L – Analytical Chemistry Lab

Tuesdays, Fall 2025

INSTRUCTOR: *Dr. Shannon Stitzel (she/hers)*

Office: *Science Complex 3301C*

Office Phone: *410-704-2948*

Email (best way to contact me)*: sstitzel@towson.edu*

I make every effort to reply to emails promptly (typically within one business day). Emails received after 5:00 PM on Friday can anticipate a reply by the following Monday.

Student Hours*:*

Wednesday 12:30-1:30 PM
Friday 10:30-11:30 AM
Other times by appointment

Internet Communication:

Many important files and other useful information will be posted on Blackboard. You are encouraged to check Blackboard after each class meeting. Additional information will be communicated to you via your university email account. You are advised to check this email account frequently for important updates regarding this course.

LAB TIME AND LOCATION:

Tuesday from 12:30 PM – 4:20 PM SC 5339

Lab Fees

A course fee of $80 is charged in this course. Lab fees help to pay for chemicals, glassware, plasticware, pipettes, and other supplies, as well as maintenance and repairs to instruments (e.g., balances, HPLC, UV-Vis, and FAAS).

COURSE DESCRIPTION:

In this course we will examine the theory and practice of quantitative chemical analysis. You will learn how professional chemists determine the composition of solutions and materials in both simple and complex samples. Topics include: (1) statistical analysis and effective communication of scientific data, (2) equilibria in aqueous solutions (including activity effects, polyprotic acids/bases, buffers, and titrations), (3) chromatographic separations, (4) electrochemistry, and (5) spectrophotometry.

REQUIRED MATERIALS

Items denoted with an asterisk (*) must be brought to each lab session.

- *Textbook: Quantitative Chemical Analysis, 10th edition, by Daniel C. Harris,*
  (This textbook is also required for CHEM 310, so I advise against renting this book if you plan to enroll in CHEM 310 in the future.)
- *Scientific or graphing calculator*
- *Safety goggles (safety glasses are not acceptable)**
- *Proper laboratory attire (see laboratory guidelines below)**
- *Bound composition book (used as a lab notebook)**
- *Printed copy of the CHEM 220 lab manual (will be available on Blackboard)**
- *Black, fine-point permanent marker (e.g., a Sharpie)**

COURSE PREREQUISITES

Grade of "C" or better in General Chemistry II lecture (CHEM 132) and laboratory (CHEM 132L) or equivalent credit. CHEM 220L assumes you have a working knowledge of several key concepts from general chemistry, including concentrations, unit conversions, stoichiometry, and chemical equilibria involving strong/weak acid-base reactions. These concepts will not be formally reviewed in CHEM 220L. You are responsible for ensuring mastery of this material by the first week of this course.

COURSE OBJECTIVES

After completing this course, you should be able to:

- *Apply the analytical process to solve quantitative chemical problems in the laboratory*
- *Perform safe, precise, and accurate analytical laboratory procedures*
- *Analyze quantitative data sets using appropriate statistical techniques and error propagation*
- *Prepare professional-quality figures and tables from experimental data sets*
- *Calculate the concentrations of chemical species under equilibrium conditions in aqueous solutions*
- *Explain the main principles of calibration, chromatography, and spectrophotometry*

ATTENDANCE POLICY

This course is designed as an experiential learning environment and therefore ***attendance is required every week****. Students with unavoidable absences must contact the instructor* ***via email*** *within 24 hours of missing lab to make arrangements regarding a missed laboratory session. Failure to communicate clearly and in a timely manner with your instructor may result in a point reduction for missed assignments, including up to a score of zero.*

You must be on time for every lab session. *Each day begins with a mandatory pre-lab lecture which includes important information on how to work safely and efficiently in the laboratory space. Please demonstrate professionalism and respect for your classmates and instructor by arriving at class on time. If an unavoidable circumstance requires you to arrive late or leave early, please inform the instructor (ideally in advance) via email.*

POLICY CONCERNING ELECTRONIC DEVICES

Except when explicitly authorized by the instructor, the ***use of electronic devices*** *(including, but not limited to, cell phones, laptops, tablets, and computerized watches/wristbands)* ***during pre-lab or lab is prohibited****. Cell phones must be in silent mode. Students violating this policy will be asked to leave and grade reductions may be imposed.*

CLASSROOM DIVERSITY AND INCLUSION

The students, faculty, and staff at Towson University represent a diverse and vibrant community of learners and scholars. As a community, we value the unique contributions of each individual and promote active participation in all aspects of the learning process by each community member. Your instructor supports Towson University's goal of fostering a diverse and inclusive educational setting. Your instructor strives to create a classroom environment built upon the principles of mutual respect and support. Toward this end, all participants in this course are expected to demonstrate respect for all other members of the class. If you feel these expectations are not being met, please speak with your instructor or the designated diversity liaison, Dr. Cindy Zeller (czeller@towson.edu). For further information regarding the diversity and inclusion policies of Towson University, please see Towson University's Office of Inclusion and Equity, the Fisher College of Science and Mathematics Diversity Action Plan, and the Chemistry Department Diversity Action Plan.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

If you may need an accommodation due to a disability, please contact me privately as soon as possible to discuss your specific needs. A memo from Accessibility & Disability Services (ADS) authorizing your accommodations will be needed; it is your responsibility to present this paperwork in a timely fashion and to follow-up regarding accommodations that require instructor participation (e.g., testing accommodations). If you think accommodations might be appropriate for you, please contact ADS (Phone: 410-704-2638 or https://www.towson.edu/accessibility-disability-services/).

ACADEMIC INTEGRITY

The reputation of Towson University and the intrinsic value of your academic degree hinge on the personal integrity of each member of the TU community. Your instructor assumes a proactive role in preventing and reporting academic integrity violations; and students in this course are expected to do the same. Examples of academic integrity violations include, but are not limited to, all forms of cheating (including use of cell phones and similar devices during exams), plagiarism, unauthorized collaborations, alteration of graded assignments, forgery, falsification of data, lying, facilitating academic dishonesty, and unfair competition. You are encouraged to review the entire Student Academic Integrity Policy.

Unless explicitly authorized by the instructor, you may not reference, review, or otherwise rely on assignments (including, but not limited to, problem sets and lab reports) authored by others, including assignments authored by students who were enrolled in CHEM 220 in a previous semester.

For some activities in this course, collaboration with your colleagues is encouraged. Examples are provided below to clarify what levels of collaboration are acceptable.

Acceptable Collaboration Activities:

- *Working in groups to determine what key concepts or general strategies may be relevant to a post-lab question. Then, each member of the group works alone when preparing their responses to the assignment.*
- *Answering a colleague's question similar to how the instructor would answer the question (i.e., helping your colleague to understand the concepts without giving away the answers).*
- *Working in groups on ungraded practice problems.*

Unacceptable Collaboration Activities:

- *Viewing another student's final version of an assignment.*
- *Asking a colleague questions similar to, "Is this the final answer you arrived at?"*
- *Seeking (or providing) answers to assignments or exams.*
- *Using spreadsheets that you did not develop.*
- *Submitting work that does not reflect your individual understanding.*

All academic integrity violations will be penalized (up to and including a grade of "F" for the course for each student involved). Letters detailing the specifics of any academic integrity violations will be entered into the academic file of each student involved in such conduct, which may result in additional sanctions (e.g., suspension or expulsion from the university). If you have questions regarding how best to avoid academic integrity violations, please consult with your instructor.

AI POLICY

The use of all Artificial Intelligence (AI) tools is restricted to support learning rather than replace individual effort. Students may only use AI tools for enhancing understanding of course materials e.g. generating additional practice problems. AI is not permitted for completing graded assignments, exams, quizzes, or any assessments intended to evaluate individual knowledge, skills, or critical thinking.

All submissions must represent the student's own work and understanding. Any use of AI tools in permitted contexts must be fully disclosed, including a brief explanation of how they were used. Misuse of AI, including uncredited or unauthorized AI-generated content, will be considered academic misconduct and may result in penalties up to and including a zero for the assignment, or a failing grade for the course.

LABORATORY SCHEDULE

Procedures and guidelines for each experiment are provided in the lab manual, which is posted on Blackboard. In the table below, dates of lab work for each experiment are shaded in green. Due dates are shown in bold font and are shaded in orange.

<table>
<tr><th rowspan="2">Week of</th><th colspan="7">Experiment</th><th>Lab Notebook</th></tr>
<tr><th>#1
Excel</th><th>#2
Labware</th><th>#3
Calibration</th><th>#4
Iron</th><th>#5
Buffer</th><th>#6
Caffeine</th><th>#7
Titration</th><th></th></tr>
<tr><td>Aug 26</td><td>Lab work</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sept 2</td><td>Worksheet</td><td rowspan="2">Lab work
1st Notecard due by end of period</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sept 9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sept 16</td><td></td><td></td><td>Lab work</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sept 23</td><td></td><td></td><td>Notecard and Worksheet</td><td rowspan="3">Lab work</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sept 30</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Inspection #1</td></tr>
<tr><td>Oct 7</td><td></td><td></td><td></td><td>Lab work</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Oct 14</td><td colspan="5">Asynchronous Lab Week due to Fall Break</td><td>Proposal
Due as assigned (see schedule</td><td></td><td></td></tr>
<tr><td>Oct 21</td><td></td><td></td><td></td><td>Worksheet</td><td></td><td rowspan="3"></td><td></td><td></td></tr>
<tr><td>Oct 28</td><td></td><td></td><td></td><td></td><td>Notecard</td><td rowspan="3">Lab work</td><td></td></tr>
<tr><td>Nov 4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Nov 11</td><td></td><td></td><td></td><td></td><td></td><td>Data Analysis</td><td></td><td></td></tr>
<tr><td>Nov 18</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Part A due by end of period</td><td></td></tr>
<tr><td>Nov 25</td><td colspan="7">Thanksgiving Break</td></tr>
<tr><td>Dec 2</td><td colspan="7">Check out</td><td>Inspection #2</td></tr>
<tr><td>Dec 8</td><td colspan="5">No Lab/ last day of classes</td><td>Worksheet</td><td>Notecard</td><td></td></tr>
<tr><td>Dec 9</td><td colspan="7">Final Exam 12:30 – 2:30PM</td><td></td></tr>
</table>

LAB EVALUATION AND GRADING

Lab assignments are outlined in the table below, along with their due dates and their contribution to the overall lab grade.

Experiment	Assessment	Due Date [a]	Contribution to Lab Grade
Lab Safety	On-line quiz through Blackboard	Sunday August 31st by 11:59PM	Required for Lab Entry
	Lab Quizzes	Variable	7%
#1 (Excel)	Worksheet	Sept 3rd by 12:30PM	3%
#2 (Labware)	Notecard [b]	Sept 9th (during lab)	6%
#3 (Calibration)	Notecard [b] worksheet	Sept 23rd by 12:30PM	6% 6%
	1st Notebook Inspection	Sept 30th (during lab)	not graded
#4 (Iron)	Worksheet	Oct 21st by 12:30PM	15%
#5 (Buffer)	Notecard	Oct 28th by 12:30PM	6%
#6 (Caffeine)	Experimental Plan Data Analysis Worksheet	Sunday Oct. 19th by 11:59PM Nov 11th by 12:30PM Dec 8th by 1PM (last day of classes)	3% 8% 8%
#7 (Titration)	Worksheet Notecard [b]	Nov 18th (during lab) Dec 8th by 1PM (last day of classes)	4% 8%
	2nd Notebook Inspection	Dec 2 (during lab)	8%
	Final exam	Dec 9th 12:30 – 2:30PM	12%

[a] Unless otherwise indicated, assignments are due by the beginning of your pre-lab session for the week indicated. Assignments up to 24 hours late will be penalized 15% of the total points possible. Assignments more than 24 hours late will not be graded.

[b] May be repeated for a better grade; restrictions apply (see lab manual for details)

Laboratory Notebook

You will keep a notebook in which you will record the experimental details of your lab work. This notebook is expected to be current to the minute. Recording data on scraps of paper is not permitted; the instructor reserves the right to confiscate such pieces of paper.

The lab manual has questions embedded within each experiment. You are required to answer these questions in your notebook on (or before) the day that the experiment is performed.

Your notebook will be inspected twice during the semester (see schedule above). The first inspection is ungraded and is an opportunity for you to receive feedback to improve your record keeping. The second inspection of the notebook will be for a grade. The following items are considered when notebooks are graded:

- *Is the table of contents complete and current?*
- *Is the notebook well organized and easy to navigate?*
- *Does the notebook adhere to the guidelines provided in the lab manual? In particular:*
  - *Do all pages include a page number and a date?*
  - *Are appropriate units included for all numerical values?*
  - *Do all values < 1 include a leading zero (e.g., 0.2453 g is formatted properly; .2453 g is not formatted properly)*

- *Are corrections made appropriately using single lines?*

- *Are responses included to all questions posed in the lab manual?*
- *Are all observations and raw data from each experiment present?*
- *Are all calibration curves present (e.g., printed and taped onto a page with your initials and the date)?*

Post-Lab Assignments

The results of your laboratory work will be submitted in one of two formats, described below. All materials submitted for a grade must be prepared individually and reflect your individual understanding.

***Notecard**: A 3x5 index card containing raw data, results of statistical calculations, final results, and sample calculations. See the lab manual for the required format of each notecard. Blank notecards are available from the instructor. Notecards will be graded based on the accuracy and precision of your results. If you are not satisfied with your grade, you may repeat the experiment to obtain a new notecard grade (some restriction may apply; see lab manual for details).*

***Worksheet**: The guidelines for each worksheet will be distributed on Blackboard. Experiments associated with worksheets cannot be repeated.*

ADDITIONAL LABORATORY POLICIES

Required clothing: Long pants and closed-toe shoes. All skin must be completely covered from the neck down to the toes. Any student wearing tank tops, shorts, capri pants (including athleticwear), skirts, or shoes exposing any part of the foot or ankle will not be permitted to work in the laboratory.

Safety goggles: Approved safety goggles are sold by the TU Student Affiliates of the American Chemical Society (SAACS) and must be worn at all times in the laboratory. If you wish to defog your goggles, please step into the hallway before removing your goggles.

Nitrile gloves: Wearing nitrile gloves while handling concentrated acids and bases is strongly recommended. Please remove gloves promptly as soon as you are finished transferring the acid or base. Gloves should never be worn while touching faucets, door knobs, computers, or other common-use items. Gloves should also not be worn in the hallway.

Cleanliness: Cleanliness is a prerequisite for a safe and professional analytical laboratory. In addition to posing significant safety hazards, an unclean or cluttered laboratory workspace calls into question the quality of any data generated therein (if your lab bench is sloppy, how can others trust that your results aren't sloppy, too?). As such, students are required to keep their lab bench, assigned equipment (e.g., balances), and communal areas clean.

Food/Drinks: Eating, drinking, and chewing gum are prohibited in the laboratory. To further minimize exposure to chemicals, you should not place pens in your mouth and should avoid touching your face.

Be aware of your neighbors: You will be working in close proximity to your fellow students in this laboratory. Walk slowly and avoid turning around abruptly so as to minimize bumping into others. If you see your neighbor doing something in a dangerous or inappropriate manner, say something to this neighbor and/or alert your instructor.

Waste disposal: Many chemicals cannot be safely (or legally) disposed of down the drain. All chemicals must be disposed of as directed. If in doubt, please ask your instructor.

Accidents: Notify the instructor immediately in the event of any accident or injury (regardless of how minor it may seem).

Personal electronics: The use of cell phones, tablets, iPods, and other personal electronic devices is not permitted during laboratory (or pre-lab lecture). Some chemicals in the laboratory can harm these devices. Please turn all cell phones off (or place on silent mode) and keep cell phones stored at all times.

Punctuality: Important safety information is routinely discussed during pre-lab lectures; therefore, students arriving late to pre-lab may be prohibited from performing that week's lab work.

Additional tips:

- *Never work in the laboratory without the knowledge and consent of your instructor.*
- *"Do as you oughta, add concentrated acids (or bases) to water." Do not add water to concentrated acids (or to concentrated bases).*
- *If you do not know how to use a piece of equipment or an instrument, please ask the instructor before proceeding.*

The instructor reserves the right to reduce your laboratory grade for violations of syllabus policies including (but not limited to) failure to wear goggles at all times, improper waste disposal, failure to keep your lab bench and assigned equipment clean, unsafe behavior, unauthorized use of personal electronic devices, tardiness, and staying in lab past the specified end time without instructor approval.

RE-GRADE POLICY

If you believe a grading error has been made on an assignment, you must notify the instructor via email within 48 hours of receiving the grade. In your email, you must clearly explain your rationale for requesting that the assignment be re-graded. If a re-grade request is accepted, the instructor reserves the right to carefully re-grade the entire assignment.

POTENTIALLY USEFUL RESOURCES AT TU

- *Department of Chemistry and Forensic Science Homepage: http://www.towson.edu/chemistry/*
- *Natural Science Tutoring: https://www.towson.edu/tutoring-learning/course-support/tutoring/natural-science.html*
- *Tutoring & Learning Center: https://www.towson.edu/tutoring-learning/*
- *Academic Advising Center: https://www.towson.edu/academicadvising/*

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SYLLABUS SUBJECT TO CHANGE

Although your instructor makes every effort to adhere to the syllabus in its current form, all information, schedules, and policies outlined herein are subject to change. Any changes will be announced via email and/or via Blackboard.