

SUL ROSS STATE UNIVERSITY
Syllabus for Analytical Chemistry I
(CHEM 2401: CRN:22090)
Spring 2026

Analytical Chemistry I: Lecture
Room: WSB 307
Time: T/TR 12:30 – 1:45 pm
Date: Jan. 14 to May 6, 2026

Instructor: Dr. Hong Young Chang
Office: WSB 219
Email: hxc19tv@sulross.edu
Office Hours: MTWRF 2:00-6:30 pm

OBJECTIVES:

Student Learning Objectives (SLO):

A student graduating with a *chemistry major* is expected to demonstrate that (s)he can do the following:

1. **Organic Chemistry**—Students will be able to draw organic molecular structures and explain organic reactions, stereochemistry, structural analysis and reactions in biological systems.

2. **Inorganic Chemistry**—The student will be able to demonstrate understanding of coordination chemistry, valence theory, elementary actions and advanced molecular theory.

3. **Analytical Chemistry**—The student will be able to demonstrate an understanding of theory of analytical chemistry and conduct analytical analysis, including data analysis and calibration, equilibrium chemistry, gravimetric analysis, titrimetric analysis, spectroscopic analysis, and electrochemical analysis.

4. Physical Chemistry—The student will be able to demonstrate an understanding of the application and theory of physical chemistry, including topics such as atomic structure, electrochemistry, surface chemistry, solid-state chemistry, and thermodynamics.

5. Research—The student will collect and analyze published chemical literature and undertake a chemistry research project.

BSc in Chemistry Marketable Skills

1. Students will become good at punctuality and time management.
2. Students will analyze &/or synthesize molecules and perform spectroscopic characterization and interpret their results scientifically.
3. Students will become proficient at writing scientific papers and identify appropriate references for their paper.
4. Students will become proficient at orally presenting scientific topics including the use of visual aids.

Course Description: Analytical Chemistry course is appropriate for students who are majoring in the natural sciences, science education, engineering, and pre-professional programs. This course assumes that an adequate degree of two collegiate level knowledge has been achieved from a two semester General Chemistry sequence since many of the concepts discussed in this class build directly upon the material learned in freshman level chemistry such as stoichiometry, equilibrium, acid– base reactions, and electrochemistry. This course will study in detail the analytical process including the techniques and methods used to isolate

and quantify specific analytes in samples of materials. Major topics that will be discussed in this course include sample preparation, equilibrium, titrations, electrochemistry, spectrophotometry, and separations. This course will focus on the quantitative procedures of measurement using chemical and instrumental methods in order to compare analysis to theoretical information obtained from equilibrium and stoichiometry using statistical methods.

Analytical Chemistry I Learning Objectives:

At the end of this course, a student should have a good understanding of:

1. Analytical process, chemical measurements, stoichiometry calculations for gravimetric analysis
2. Students learn about the calibrations for a variety of tools (analytical balance, Burets, Volumetric Glassware, Pipets, Syringes, etc.)
3. Types of experimental error, Gaussian distribution, standard deviations, confidence intervals, t-Tests, the method of least squares, which relates to statistics
4. Chemical equilibrium and equilibrium constant,
5. Complex formation, strengths of acids and bases, activity
6. The systematic treatment of equilibrium, principles of acid-base titrations, and EDTA titrations

The following chapters will be covered in analytical chemistry I

Chapter 0: The Analytical Process

Chapter 1: Chemical Measurements

Chapter 2: Tools of the Trade

Chapter 3: Experimental Error

Chapter 4: Statistics

Chapter 5: Quality Assurance and Calibration Methods

Chapter 6: Chemical Equilibrium

Chapter 7: Let the Titration Begin

Chapter 8: Activity and the Systematic Treatment of Equilibrium

Chapter 9: Monoprotic Acid-Base Equilibria

Chapter 10: Polyprotic Acid-Base Equilibria

Chapter 11: Acid-Base Titrations

Chapter 12: EDTA Titrations

Required Textbook:

“Quantitative Chemical Analysis” 9th Edition, Daniel C. Harris & Charles A. Lucy, 2016, Freeman, W. H. & Company, New York

The SRSU library has one copy of this textbook in the “Textbook Collection” section. Please ask the library front desk if you need help finding this textbook.

SRSU Library Services: The Sul Ross Library offers FREE resources and services to the entire SRSU community. *Access and borrow books, articles, and more by visiting the library’s website, library.sulross.edu.* Off-campus access requires your LoboID and password. Check out materials using your photo ID. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).

Calculator: a scientific calculator is required for this course.

Microsoft Excel software: is essentially required to visualize experimental data with drawing graphs.

ATTENDANCE PRERESQUITE: BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THE COURSE.

Cell phones **ARE NOT** permitted for use in exams and should be turned off during class time.

Homework: Twelve (12) homework (each homework is composed of 2 or 3 questions) will be assigned throughout the semester. All the homework will contribute 30 % of your final mark. Homework must be completed in PEN! You need to keep the due date.

EXAMINATIONS: There will be two in-course examinations and a final examination. **NO MAKEUP EXAMS WILL BE GIVEN.** The final is mandatory and will be comprehensive.

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 20 % (Three Homework)

In-Course Questions or Midterm Exams: 60 %

Final Exam: 20%

Midterm Exam I: Thursday, February 13th

Midterm Exam II: Thursday, March 6th

Final Exam: Tuesday, April 29th, Class Time

Course Calendar

Lecture 1 (January 15): Discussion on Syllabus, Importance of Analytical Chemistry, Job of Analytical Chemistry

Lecture 2 (January 20): SI units; chemical concentrations, General steps of analytical chemistry, Preparing solutions, Stoichiometry calculations

Lecture 3 (January 22): Safe, Ethical handling of chemical waste; Lab notebook; Glassware, Basic analytical techniques

Lecture 4 (January 27): Significant figures; Types of error; Uncertainty (random error and systematic error), Propagation of uncertainty from random error/systematic error

Lecture 5 (January 29): Gaussian distribution; Standard deviation; Confidence intervals

Lecture 6 (February 3): Comparison of means with Student's t ; t tests with a spreadsheet; Grubbs test for an outlier.

Lecture 7 (February 5): The method of least squares; Calibration curves

(Homework 1 Due)

Lecture 8 (February 10): **Exam Revision on Chapters 0, 1 & 2**

Lecture 9 (February 12): Exam I (Chapters 0, 1 & 2)

Lecture 10 (February 17): Basics of Quality Assurance; Method validation

Lecture 11 (February 19): Standard addition; Internal standard

Lecture 12 (February 24): Thermodynamics; Equilibrium constants

Lecture 13 (February 26): Solubility product; Complex formation; Protic acid and base; pH; Strengths of acids and bases **(Homework 2 Due)**

Lecture 14 (March 3): Exam Revision on Chapters 3, 4 & 5

Lecture 15 (March 5): Exam II (Chapter 3, 4 & 5)

NO CLASS: SPRING BREAK (March 9 to March 15)

Lecture 16 (March 17): Titration; Titration calculations

Lecture 17 (March 19): Titration of mixture; Titration curves

Lecture 18 (March 24): End-point detection; ionic strength; Activity coefficient

Lecture 19 (March 26): pH revised; Systematic treatments of Equilibrium

Lecture 20 (March 31): Strong Acids and bases; Weak acids and bases; acid-base equilibrium

Lecture 21 (April 2): Buffers; Diprotic acids and bases; Diprotic buffers

Lecture 22 (April 7): Polyprotic acids and bases; Principal species; Fractional composition equations; isoelectric and iso-ionic pH

Lecture 23 (April 9): Titration weak base with strong acid; Titrations in diprotic systems

Lecture 24 (April 14): End point; Practice notes; Leveling effect; Titration curves

Lecture 27 (April 16): Metal-chelate complex; EDTA titration; Metal ion indicators

Lecture 28 (April 21): Activity coefficients; Dependence of solubility on pH

(Homework 3 Due)

Lecture 29 (April 23): **Final Exam Revision**

Lecture 30 (April 28): **Final Exam (Comprehensive)**

Libraries: The Bryan Wildenthal Memorial Library in Alpine offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu/. Off-campus access requires logging in with your LobolD and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or by phone (432-837-8123).

No matter where you are based, public libraries and many academic and special libraries welcome the public into their spaces for study. SRSU TexShare Cardholders can access additional services and resources at various libraries across

Texas. Learn more about the TexShare program by visiting library.sulross.edu/find-and-borrow/texshare/ or ask a librarian by emailing srsulibrary@sulross.edu.

New for Fall 2023: Mike Fernandez, SRSU Librarian, is based in Eagle Pass (Building D-129) to offer specialized library services to students, faculty, and staff. Utilize free services such as Interlibrary Loan (ILL) and Scant to get materials delivered to you at home or via email.

Academic Integrity: Students in this class are expected to demonstrate scholarly behavior and academic honesty in the use of intellectual property. Students should submit work that is their own and avoid the temptation to engage in behaviors that violate academic integrity, such as turning in work as original that was used in whole or part for another course and/or professor; turning in another person's work as one's own; copying from professional works or internet sites without citation; collaborating on a course assignment, examination, or quiz when collaboration is forbidden. Students should also avoid using open AI sources *unless permission is expressly given* for an assignment or course. Violations of academic integrity can result in failing assignments, failing a class, and/or more serious university consequences. These behaviors also erode the value of college degrees and higher education overall.

Counseling: Sul Ross has partnered with Timely Care where all SR students will have access to nine free counseling sessions. You can learn more about this 24/7/356 support by visiting [Timely care/SRSU](https://www.timelycare.org/). The SR Counseling and Accessibility Services office will continue to offer in-person counseling in Ferguson Hall room 112 (Alpine campus), and telehealth Zoom sessions for remote students and RGC students.

Classroom Climate of Respect: Importantly, this class will foster free expression,

critical investigation, and the open discussion of ideas. This means that all of us must help create and sustain an atmosphere of tolerance, civility, and respect for the viewpoints of others. Similarly, we must all learn how to probe, oppose, and disagree without resorting to tactics of intimidation, harassment, or personal attack. No one is entitled to harass, belittle, or discriminate against another based on race, religion, ethnicity, age, gender, national origin, or sexual preference. Still, we will not be silenced by the difficulty of fruitfully discussing politically sensitive issues.

Distance Education Statement: Students enrolled in distance education courses have equal access to the university's academic support services, library resources, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should submit online assignments through Blackboard or SRSU email, which require secure login information to verify students' identities and to protect students' information. The procedures for filing a student complaint are included in the student handbook. Students enrolled in distance education courses at SRSU are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook.

SRSU Disability Services: ADA (Americans with Disabilities Act): Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Students seeking accessibility/accommodations services must contact Rebecca Greathouse Wren, LPC-S, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a message and we'll get back to you as soon as we can during working hours), or email

rebecca.wren@sulross.edu. Their office is located on the first floor of Ferguson Hall (Room 112), and our mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas, 79832.

Scholastic Dishonesty:

*Students who violate the University rules on scholastic dishonesty are subject to penalties, including the possibility of an **F** in the course and/or dismissal from the University.*