

Sul Ross State University
Syllabus for General Chemistry I: CHEM 1311:01 (Spring 2021)

Class: General Chemistry I
Room: WSB 101
Time: TR 11:00am -12:15pm

Instructor: Dr. David Leaver
Office: WSB 318
Virtual Office Hours:
M-R 2:00-4:30pm (Phone or Zoom)
Zoom (appointments only)
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OBJECTIVES

Student Learning Objectives (SLO):

A student graduating with the *chemistry major* is expected to demonstrate that (s)he is able to 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 to identify appropriate references for their paper.
4. Students will be become proficient at orally presenting scientific topics including the use of visual aids.

General Chemistry I Learning Objectives:

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

1. The basic concepts and terms used in chemistry
2. The electronic structures of atoms and the periodic table
3. The basic concepts of chemical bonding
4. Chemical reactions in aqueous solutions
5. The ideal gas equation

Core Objectives (CO):

1. **Critical Thinking Skills** – Students will gain/improve their critical thinking ability by solving real life chemistry problems through inquiry, analysis, and evaluation of available information. Students will be tested on their critical thinking ability in exams and through lab experiments.
2. **Communication Skills** – Students will have the opportunity of improving communication skills through oral discussion and writing reports (i.e. observation, explanation, and conclusion, etc.) on the experiments done in the lab sessions.
3. **Empirical and Quantitative Skills** – Students will use the mathematical skills needed to manipulate and analyze numerical data obtained through experimentation in order to form conclusions.

4. **Teamwork** – Students will use team-spirit and consider different points of view to work effectively while conducting experiments as a team working toward a shared purpose or goal.

TEXES® Core Subjects EC-6 (Texas Education Agency (TEA)), Science competencies covered in General Chemistry I (CHEM 1311):

Competency 002 (History and Nature of Science): The teacher understands the history and nature of science, the process and role of scientific inquiry and the role of inquiry in science instruction.

- A. Understand, plan, design and implement instruction that provides opportunities for all students to engage in nonexperimental- and experimental-inquiry investigations
- B. Focus inquiry-based instruction on questions and issues relevant to students and use strategies to assist students with generating, refining and focusing scientific questions and hypotheses.
- C. Understand and instruct students in the safe and proper use of a variety of grade-appropriate tools, equipment, resources, technology and techniques to access, gather, store, retrieve, organize and analyze data.
- D. Know how to guide students in making systematic observations and measurements and posing questions to guide investigations.
- E. Know how to promote the use of critical-thinking skills, logical reasoning and scientific problem solving to reach conclusions based on evidence.
- F. Know how to teach students to develop, analyze and evaluate different explanations for a given scientific result, including that repeated investigations may increase reliability.
- G. Know how to teach students to demonstrate an understanding of potential sources of error in inquiry-based investigation.
- H. Know how to teach students to demonstrate an understanding of how to communicate and defend the results of an inquiry-based investigation.
- I. Understand principles of scientific ethics.
- K. Understand the historical development of science (e.g., cell theory, plate tectonics, laws of motion, universal gravity) and technology and the contributions that diverse cultures and individuals of both genders have made to scientific and technological knowledge.

Competency 003 (Impact of Science): The teacher understands how science impacts the daily lives of students and interacts with and influences personal and societal decisions.

- A. Understand that decisions about the use of science are based on factors such as ethical standards, economics and personal and societal needs.
- B. Apply scientific principles to analyze the advantages of, disadvantages of or alternatives to a given decision or course of action.
- E. Identify and understand the types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources.
- F. Understand the role science and scientists can play in helping resolve personal, societal and global challenges.

Competency 004 (Concepts and Processes): The teacher knows and understands the unifying concepts and processes that are common to all sciences.

- A. Understand how a unifying, explanatory framework across the science disciplines is provided by the concepts and processes of systems, order and organization; evidence, models and explanation; change, constancy and measurements; and form and function.
- B. Demonstrate an understanding of how patterns in observations and data can be used to make explanations and predictions.
- C. Analyze interactions and interrelationships between systems and subsystems.
- D. Apply unifying concepts to explore similarities in a variety of natural phenomena.
- F. Understand how change and constancy occur in systems.
- G. Understand the complementary nature of form and function in a given system.
- H. Understand how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

Competency 005 (Students as Learners and Science Instruction): The teacher has theoretical and practical knowledge about teaching science and about how students learn science.

- D. Understand common misconceptions in science and have effective ways to address those misconceptions.

- H. Understand how to sequence learning activities in a way that enables students to build on their prior knowledge and that challenges them to expand their understanding of science.

Competency 007 (Forces and Motion): The teacher understands forces and motion and their relationships.

- A. Demonstrate an understanding of the properties of universal forces (e.g., gravitational, electrical, magnetic).

Competency 008 (Physical and Chemical Properties): The teacher understands the physical and chemical properties of and changes in matter.

- E. Distinguish between elements, compounds, mixtures and solutions and describe their properties.

Competency 015 (Structure and Function of Earth Systems): The teacher understands the structure and function of Earth systems.

- A. Understand the structure of Earth and analyze constructive and destructive processes (including plate tectonics, weathering and erosion) that produce geologic change, including how these processes have affected Earth history.
- B. Understand the form and function of surface water and groundwater.
- C. Apply knowledge of the composition and structure of the atmosphere and its properties.
- D. Apply knowledge of how human activity and natural processes, both gradual and catastrophic, can alter Earth systems.

Competency 016 (Cycles in Earth Systems): The teacher understands cycles in Earth systems.

- D. Apply knowledge of how human and natural processes affect Earth systems.
- E. Understand and describe the properties and uses of Earth materials (e.g., rocks, soils, water, atmospheric gases).

Competency 017 (Energy in Weather and Climate): The teacher understands the role of energy in weather and climate.

- A. Understand the elements of weather (e.g., humidity, wind speed and direction, air pressure, temperature) and the tools used for measurement
- B. Compare and contrast weather and climate.

REQUIRED RESOURCES AND TEXTS:

You **must** wear a suitable mask/face covering while on campus (including lectures & laboratories). You will be asked to leave the classroom if you come to class without a suitable mask/face covering.

<https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html>

Assigned seating: please pick a seat in the classroom and you will be required to sit in the same seat for every class you attend in person.

Disinfection of Classroom Surfaces: Each person should disinfect their space at the beginning and end of every class meeting. The university has provided disinfectant wipes in the classroom. When you enter the classroom, please take a wipe and use it to clean your space before settling in. Please wipe down your space before you leave the classroom.

Orderly Dismissal: When class is over, Dr. Leaver will dismiss students row by row. Please wipe down your desk/leave when Dr. Leaver dismisses your row.

Food & Drinks: There will be no eating or drinking in the classroom. If you need to take a sip of your drink during class time, you may leave the room to do so.

If you have tested positive for COVID-19 (or have been exposed to someone who has tested positive for COVID-19), please self-report: <https://srinfo.sulross.edu/covid-19/self-report/>. In order to self-report you will need to be signed in with your SRSU credentials (yellow “log in” button on the bottom left hand side of the above website).

Required Text: “*General Chemistry: The Essential Concepts 7th Edition*” by Raymond Chang and Kenneth A. Goldsby, McGraw-Hill, New York, United States of America, 2014. (Older editions such as the 5th or 6th editions are ok to use).

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.

Suggested reading: “*Chemistry 2e*” by Paul Flowers, Klaus Theopold, Richard Langley and William R. Robinson, OpenStax, Rice University, Houston, Texas, United States of America, 2019. <https://openstax.org/details/books/chemistry-2e>

Calculator: A scientific calculator is required for this course.

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

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).

The following chapters will be covered (according to "General Chemistry: The Essential Concepts 7th Edition"):

Chapter 1: Basic Concepts: Classification of Matter; Physical and Chemical Properties of Matter; Measurement; Handling Numbers; Dimensional Analysis in Solving Problems

Chapter 2: Atoms, Molecules, and Ions

Chapter 3: Stoichiometry

Chapter 4: Reactions in Aqueous Solutions

Chapter 5: The Ideal Gas Equation

Chapter 7: The Electronic Structure of Atoms

Chapter 8: The Periodic Table

Chapters 9 and 10: Chemical Bonding

Homework: There will be problems assigned for each chapter. **NO LATE HOMEWORK WILL BE ACCEPTED.** Homeworks must be completed in **PEN!**

Examinations: There will be *three midterm* examinations and *a final* examination. The final is mandatory and will be comprehensive. **NO MAKE-UP EXAMS WILL BE GIVEN.**

ATTENDANCE PRERESQUITE: BEING ABSENT FROM MORE THAN 6 LECTURES WILL RESULT IN FAILING THE COURSE.

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 25%

Each Midterm Exam (16.67%): 50%

Final Exam: 25%

Midterm Exam I: Tuesday, February 16th

Midterm Exam II: Tuesday, March 23rd

Midterm Exam III: Tuesday, April 20th

Final Exam: Monday, May 3rd 10:15 am -12:15 pm

Course Calendar (Section 1)

Lecture 1 (January 12): Discussion on Syllabus, importance of chemistry (*online recording*)

Lecture 2 (January 14): Classifications of matter, overview of states and properties of matter, physical and chemical changes, units of measurements (length, volume, density, temperature etc.), and Scientific notation and significant figures (*online recording*)

Lecture 3 (January 19): Precision and accuracy, Revision on Chapter 1 (*online recording*)

Lecture 4 (January 21): Dalton's atomic theory, discoveries of subatomic particles (electron, proton, and neutron), Rutherford's atomic model, atomic number, mass number, and isotopes; (**Homework 1 due**) (*online recording*)

Lecture 5 (January 26): Molecules, compounds, ions, molecular formula and empirical formulas

Lecture 6 (January 28): Chemical nomenclature, naming of compounds, acids, bases, oxides, and oxoacids, Review on Chapter 2

Lecture 7 (February 2): Molecular mass, mole, molar mass, atomic mass, formula mass and their relations (**Homework 2 due**)

Lecture 8 (February 4): Chemical equations and balancing chemical equations, calculations of product/reactant amounts using balanced chemical equations, limiting reagents, and percent yields

Lecture 9 (February 9): Revision on Chapter 3, terminologies related to solutions, electrolytes, non-electrolytes, precipitation reactions (**Homework 3 due**)

Lecture 10 (February 11): Exam Revision

Lecture 11 (February 16): Exam I, Chapters 1, 2 & 3

Lecture 12 (February 18): Writing balanced ionic equations, acid-base reactions; oxidation numbers; oxidation-reduction reactions- types with examples; solution stoichiometry, concentration units, and gravimetric analysis

Lecture 13 (February 23): Revision on Chapter 4, physical properties of gases-relation between temperature, pressure, volume and amount of gases

Lecture 14 (February 25): Ideal gas law and its applications, gas stoichiometry- calculation of reactant/product amounts in gaseous reactions using ideal gas equation (**Homework 4 due**)

Lecture 15 (March 2): Kinetic theory of ideal gases, deviation of ideal gas, properties, modification of ideal gas law for real gases

Lecture 16 (March 4): Revision on Chapter 5, Properties of light, black-body radiation and photo-electric effect (**Homework 5 due**)

March 8-12th is Spring Break (No classes)

Lecture 17 (March 16): Atomic spectra and Bohr atomic theory De Broglie equation, dual nature of particles, Schrodinger wave, equation and orbital concept, electronic configuration-Aufbau principle, Hund's rule, paramagnetism

Lecture 18 (March 18): Exam Revision on Chapters 4 and 5

Lecture 19 (March 23): Exam II (Chapters 4 and 5)

Lecture 20 (March 25): Review on Chapter 7, Introductory discussion on periodic table (**Homework 6 Due**)

Lecture 21 (March 30): Classification of elements, and electronic configuration of ions, periodic variation of properties of elements, group properties of elements

Lecture 22 (April 1): Review on chapter 8; Basic concepts of chemical bonding, ionic bonds, lattice energy (**Homework 7 due**)

Lecture 23 (April 6): Calculation of lattice energy, covalent bonds, polar covalent bonds and polarity, Lewis structures of molecules,

Lecture 24 (April 8): Formal charge calculation, resonance structures and bond energy; revision on Chapter 9 (**Homework 8 due**)

Lecture 25 (April 13): Molecular geometry-Valence shell electron repulsion theory

Lecture 26 (April 15): Molecular orbital theories, Revision on Chapter 10, **Exam Revision**

Lecture 27 (April 20): Exam III (Chapters 7-9)

Lecture 28 (April 22) Final Exam Revision, Chapters 1-4 (Homework 9 due)

Lecture 29 (April 27): Final Exam Revision, Chapters 5, 7-10

Final Exam Monday (May 3): At 10:15am-12:15 pm (Comprehensive)

ADA Statement: *Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. Students with qualifying disabilities who seek accommodations must initiate a request for a meeting for accessibility services. Students seeking accessibility services must contact Rebecca Greathouse Wren, M.Ed., LPC-S, Counseling & Accessibility Services, Telephone: 432-837-8203, or E-mail: rebecca.wren@sulross.edu*
For more information see: <https://www.sulross.edu/page/1384/accessibility-services>

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. All assignments (including homework) need to be individually completed and not copied from another student's work. Electronic submission of homework is accepted but must be hand written and scanned (either with a scanner or a smart phone) and emailed to Dr. Leaver at: david.leaver@sulross.edu. [.pdf is the preferred format for electronically submitted homework.]*