

**SUL ROSS STATE UNIVERSITY**  
**Syllabus for General Chemistry II (CRN:21621)**  
**CHEM 1312 (Spring 2024)**

General Chemistry II: Lecture (3 credits)  
Room: WSB 307  
Time: T/Th: 12:30-1:45 pm  
Date: Jan. 17 to May 8

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

**Learning Objectives and Expected Outcomes for General Chemistry II**

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

1. **The intermolecular forces** (Hydrogen bonds, Ion-Ion interaction, Ion-neutral molecules interactions, and London forces) **between molecules**. These interactions determine boiling points (B.P.) and melting points (M.P.) for substances.
2. **Physical properties of solutions**: There are many types of solutions. (liquid solution in which the solvent is a liquid and the solute is a solid or a liquid) Molecules that possess similar types of intermolecular forces readily mix. Solubility is a quantitative measure of the amount of a solute dissolved in a solvent at a specific temperature. Temperature generally influences the solubility of a substance. Pressure can affect the solubility of a gas in a liquid. Finally, as physical properties of solutions, colligative properties are considered. The presence of a solute affects the vapor pressure, boiling point, and freezing point of a solvent.
3. **The basic concepts of chemical kinetics and equilibrium**: the rates (speed) of a reaction measure how fast a reactant is consumed or how fast a product is formed. The rate is expressed as a ratio of the change in concentration to elapsed time. The rate is not constant but varies continuously as concentrations change,  $\Delta[ ]$ , over some

time,  $\Delta t$ . Experimental measurement of the rate leads to the rate law for the reaction, which expresses the rate in terms of the rate constant ( $k$ ) and the concentrations of the reactants.

4. **Chemical equilibrium** in acid-base reactions: Chemical equilibrium describes the state in the state in which the rates of forward and reverse reactions are equal and the concentrations of the reactants and products remain unchanged with time. This state of dynamic equilibrium is characterized by an equilibrium constant.

5. **Factors that affect chemical equilibrium:** Changes in concentration can affect the position of an equilibrium state, i.e., the relative amounts of reactants and products.

6. **The concepts of acid and bases by Bronsted and Lewis:** Strong acids and strong bases are assumed to ionize completely. Most weak acids and bases ionize to a small extent. The concentrations of the acid, conjugate base, and  $H^+$  ion at equilibrium can be calculated from the acid ionization constant which corresponds to the equilibrium constant for the reaction.

7. **Buffer solutions, Acid-Base titrations, and Solubility Equilibria:** A buffer solution contains a weak acid and a salt derived from the acid. To maintain a relatively constant pH, the acid and base components of the buffer solution react with added acid or base. The characteristics of an acid-base titration depend on the strength of the acid and base involved. Different indicators are used to determine the endpoint of a titration. Another application of the equilibrium concept is the solubility equilibria of sparingly soluble salts, which are expressed as the solubility product. The solubility of such a substance can be affected by the presence of a common cation or anion.

8. **Laws of thermodynamics:** The 1<sup>st</sup> law of thermodynamics is based on the law of conservation of energy. The 2<sup>nd</sup> law states that for a spontaneous process, the change in the entropy of the universe must be positive. Gibbs' free energy helps us to determine the spontaneity of a reaction by focusing only on the system. The Gibbs free energy is made up of two terms: a change in enthalpy and a change in the entropy times temperature.

9. **Equations representing redox reactions** can be balanced using the half-reaction method. These reactions involve the transfer of electrons from a reducing agent to an oxidizing agent. Using separate compartments, such a reaction can be used to generate electrons in an arrangement called a galvanic cell.

10. **Organic molecules, hydrocarbons, and functional groups:** Organic compounds contain primarily C (carbon) and H (hydrogen) atoms, plus N (nitrogen), O (oxygen), S (sulfur), and other elements. The hydrocarbons -the alkanes (containing only single bonds), the alkenes (containing carbon-carbon double bonds), the alkynes (containing carbon-carbon triple bonds), and the aromatic hydrocarbons (containing the benzene ring). **The functional groups**, which are groups of atoms, are largely responsible for the chemical behavior of the compounds.

The following chapters will be covered in General Chemistry II:

**Chapter 6:** Energy Relationships in Chemical Reactions

**Chapter 11:** Introduction to Organic Chemistry

**Chapter 12:** Intermolecular Forces and Liquids and Solids

**Chapter 13:** Physical Properties of Solutions

**Chapter 14:** Chemical Kinetics

**Chapter 15:** Chemical Equilibrium

**Chapter 16:** Acids and Bases

**Chapter 17:** Acid-Base Equilibria and Solubility Equilibria

**Chapter 18:** Thermodynamics

**Chapter 19:** Redox Reactions

**Text Book:**

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

**Reference Book:**

“OpenStax Chemistry 2e” <https://openstax.org/details/books/chemistry-2e> by Paul Flowers, Klaus Theopold, Richard Langley, etc.

“Introductory Chemistry Concepts and Critical Thinking” by Charles H. Corwin

The SRSU library has one copy of the textbook General Chemistry in the “Textbook Collection” section. Please ask the library front desk if you need help finding this textbook. For the “OpenStax Chemistry 2e”, you can free-download the book file as a PDF. Among the two books described above, you can choose one.

**Calculator:** A scientific calculator is required for this course.

**Web Availability:** This course will be taught face-to-face. However, you need to do your homework *on the “Blackboard” of SRSU*. In addition, Homework & Assignments, and Announcements, will be uploaded on the blackboard or by email.

## **Homework & Assignments:**

Homework will be assigned after learning one chapter. *The homework will be solved in the SRSU Blackboard (multiple choice homework). You may try to solve the problem sets several times to attain your highest score. You need to keep the due date for each chapter. The due date for each chapter will be noted on the Blackboard.*

## **Examinations:**

There will be *three midterm* examinations and *a final* examination. The final is mandatory and comprehensive. All exams will be taken face-to-face.

**NO MAKE-UP EXAMS WILL BE GIVEN.**

NOTE: All exams MUST be completed **face-to-face with your pen!!**

**ATTENDANCE PREREQUISITE: BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THIS COURSE.**

## **Percentage Breakdown of Marks:**

Homework: 20% (Blackboard multiple-choice homework)

Each Midterm Exam (20 % for each exam): 60%

Final Exam: 20%

**Midterm Exam I:** Thursday, February 15<sup>th</sup> (it covers chapters 6, 11, & 12)

**Midterm Exam II:** Thursday, March 28<sup>th</sup> (it covers chapters 13, 14, & 15)

**Midterm Exam III:** Tuesday, April 23<sup>rd</sup> (it covers chapters 16, 17, & 18)

**Final Exam:** Wednesday, May 8<sup>th</sup> from 10:15 am -12:15 am as face-to-face in WSB 307 (it covers all chapters you have learned)

**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.

**Examinations:** There will be *three midterm* examinations and *a final* examination. The final is mandatory and comprehensive. *The final exam will be taken in the face-to-face style.*

**NO MAKE-UP EXAMS WILL BE GIVEN.**

**NOTE: all exams MUST be completed in pen as the face-to-face style!**

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

## CHEM1312 Course Calendar

\* This course calendar could be changeable. Before one week, your professor will let you know the changes.

Date	Lecture #	Chapter #	Topics	Due work
Jan.18	Lecture1	Ch 6	Discussion on Syllabus. Importance of chemical energy, types of energy, energy changes in chemical reactions	
Jan.23	Lecture2		The first law of thermodynamics, enthalpy of chemical reactions, and calorimetry.	
Jan.25	Lecture3		Hess's law and standard enthalpy of formation and reaction. Discussion on selective questions and problems on Chapter 6	
Jan.30	Lecture4	Ch 11	Classification of organic compounds and aliphatic/aromatic hydrocarbons and nomenclature on hydrocarbons and their structures in Chapter 11. Chemistry of the functional groups and Chirality-hardness of molecules.	<b>Ch6 HW Due</b>
Feb.1	Lecture5		Discussion on selective questions and problems in Chapter 11.	
Feb.6	Lecture6	Ch 12	Types of intermolecular forces, properties of liquids, liquid-vapor equilibrium, liquid-solid equilibrium, and solid-vapor equilibrium.	<b>Ch11 HW due</b>
Feb.8	Lecture7		Liquid-solid equilibrium, phase change & phase diagrams.	
Feb.13	Lecture8		Discussion on selective questions and problems in Chapter 12 & <b>Exam I revision</b>	
Feb.15	Lecture9	Test	<b>Exam I Day (It covers Ch6, Ch11, &amp; Ch12)</b>	<b>Ch12 HW due</b>
Feb.20	Lecture10	Ch 13	Factors affecting solubility, Types of solutions, Concentration units	
Feb.22	Lecture11		Colligative Properties and Discussion on selective questions and problems on Chapter 13	

Feb.27	Lecture12	Ch 14	Understanding of terminologies related to rate laws. Zero, first & second-order reactions, Experimental rate laws, activation energy, and temperature dependence of rate constant	<b>Ch13 HW due</b>
Feb.29	Lecture13		Elementary reactions, reaction mechanisms, and catalysis. Experimental determination of rate laws. Discussion on selective questions and problems in Chapter 14	
Mar. 5	Lecture14	Ch 15	Understanding the concepts of chemical equilibrium	<b>Ch14 HW due</b>
Mar. 7	Lecture15		Equilibrium constants, Reaction quotients, Calculation of equilibrium concentrations, and factors affecting chemical equilibrium. Discussion on selective questions and problems in Chapter 15	
Mar.19	Lecture16	Ch 16	Understanding of concepts of acids and bases, acid-base properties of water, pH, strength of acids and bases, ionization constants of weak and bases, and percent ionization	<b>Ch15 HW due</b>
Mar.21	Lecture17		Ionization constants of conjugate acids-bases, determination of pH for weak acids and bases using ICE tables, acid-base properties of salts, Lewis's acids and bases	
Mar.26	Lecture18	Review & Test	<b>Exam II revision</b>	
Mar.28	Lecture19		<b>Exam II (It covers Ch13, 14, &amp; 15)</b>	
Apr.2	Lecture20	Ch 17	Discussion on selective questions and problems in Chapter 16. Common ion effect in chemical equilibrium, Henderson-Hasselbalch equation.	
Apr.4	Lecture21		Strong acid-strong base titrations, weak acid-strong base titrations, acid-base indicators	<b>Ch16 HW due</b>



Apr.9	Lecture22		Solubility product, molar solubility, predicting precipitation reactions, common ion effect, and pH on solubility	
Apr.11	Lecture23	Ch 18	Discussion on selective questions and problems in Chapter 17, spontaneous processes and entropy, and microstates related to entropy.	
Apr.16	Lecture24		The second law of thermodynamics, entropy changes in systems and surroundings, and the third law of thermodynamics	<b>Ch17 HW due</b>
Apr.18	Lecture25		Gibbs free energy chemical equilibrium, and discussion on selective questions and problems in Chapter 18 <b>Exam III revision</b>	
Apr.23	Lecture26	Test	<b>Exam III (It covers Ch16, 17, &amp;18)</b>	<b>Ch18 HW due</b>
Apr.25	Lecture27	Ch 19	Redox reactions, balancing redox equations, spontaneous Galvanic cells, and standard reductions	
Apr.30	Lecture28	Review & Test	<b>Final exam revision</b>	
May.8	Lecture29		<b>Wednesday, May 8th, 10:15 AM to 12:15 PM, WSB307</b>	

SLO, CO, Marketable Skills, ADA, Libraries, Counselling, etc. are also described in the next pages.

## **Student Learning Outcomes (SLO) by SACSCOC:**

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 an 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 the 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 become proficient at orally presenting scientific topics including the use of visual aids.

### **The SLOs as Core Curriculum Courses:**

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. In addition, students will have opportunities for simple self-assessments on critical thinking.
2. Communication Skills – Students will have the opportunity to improve communication skills through oral discussion and writing reports (i.e., observation, explanation, conclusion, etc.) on the experiments done in the lab sessions. In addition, students will have opportunities for simple self-assessments on communication skills.
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.

## **SRSU Disability Services: ADA (Americans with Disabilities Act):**

Sul Ross State University (SRSU) is committed to equal access in compliance with the 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 Mrs. Mary Schwartze Grisham, LPC, SRSU's Accessibility Services Director at 432-837-8203 or email [mschwartze@sulross.edu](mailto:mschwartze@sulross.edu). Our office is located on the first floor of Ferguson Hall, room 112, and our mailing address is P.O. Box C122, Sul Ross State University, Alpine, Texas, 79832.

## **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/](http://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](mailto: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 general 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/](http://library.sulross.edu/find-and-borrow/texshare/) or ask a librarian by emailing [srsulibrary@sulross.edu](mailto: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.

### **Counselling:**

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](#). 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 on the basis of 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:**

Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires a secure login. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies about academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website. Directions for filing a student complaint are located in the student handbook.