

Sul Ross State University
Syllabus for CHEM 1311 (Spring 2019)

Class: General Chemistry II
Instructor: Dr. Yanfeng Yue
Room: WSB 307; Office: WSB 217
Time: MWF 10:00-10:50 am
Office Hours: MTWRF 11:00am-12:00 pm
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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.

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
6. The converting between mass and number of moles
7. Basic chemical reactions in Biology (coordination chemistry, chiral molecules e.g. amino acids/peptides)
8. Inorganic reactions related to Geology (metal ions and oxidation, color transformations)

Core Objectives (CO):

1. **Interests of Chemistry** – Inspire and keep the students' interests of chemistry.
2. **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.
3. **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.
4. **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.
5. **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.
6. **Career Goals** – Students will be trained in a broad set of skills in many disciplines that are ideal for pursuing jobs in industry or academics in graduate schools.

Lecture sessions are designed to fulfill PLO 1, CO – 1, 2, 3, 4, and 5. Lab sessions are designed to fulfill PLO 3, CO 1-6.

Text: General Chemistry by Raymond Chang (5th Edition or newer); Lab Manual: Freshman Chemistry by Rangra and Houston.

The following chapters will be covered:

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

Chapter 2: Atoms, Molecules, and Ions (SLO2)

Chapter 3: Stoichiometry (SLO 1)

Chapter 4: Reactions in Aqueous Solutions (SLO 2)

Chapter 5: The Ideal Gas Equation (SLO 5)

Chapter 7: The Electronic Structure of Atoms (SLO 2)

Chapter 8: The Periodic Table (SLO 2)

Chapter 9 and 10: Chemical Bonding (SLO 3)

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 15%

Each Midterm Exam (15%): $15\% \times 3$

Final Exam: 40%

Course Calendar

Lecture 1 (Jan 23): Discussion on Syllabus. **Chapter 6:** Importance of chemical energy, types of energy, energy changes in chemical reactions

Lecture 2 (Jan 25): First law of thermodynamics

Lecture 3 (Jan 28): Enthalpy of chemical reactions and calorimetry

Lecture 4 (Jan 30): Chapter 12: Kinetic Molecular Theory of liquids and solids Phase diagrams

Lecture 5 (Feb 1): Types of intermolecular forces, properties of liquids

Lecture 6 (Feb 4): Crystal structure and bonding in solids

Lecture 7 (Feb 6): liquid-vapor equilibrium, and liquid-solid equilibrium (*Homework Chapter 6 due*)

Lecture 8 (Feb 8): Chapter 13: types of solutions, concentration units

Lecture 9 (Feb 11): Factors affecting solubility,

Lecture 10 (Feb 13): Colligative properties (*Homework Chapter 12 due*)

Lecture 11 (Feb 15): Review of Chapter 6 & 12

Lecture 12 (Feb 18): Exam I: Chapters 6, 12

Lecture 13 (Feb 20): Chapter 14: Terminologies related to rate laws

Lecture 14 (Feb 22): First and second order reactions and experimental determinations of rate laws

Lecture 15 (Feb 25): Activation energy and temperature dependence of rate constants, elementary reactions

Lecture 16 (Feb 27): Catalysis (*Homework Chapter 13 due*)

Lecture 17 (March 1): Chapter 15: The concepts of chemical equilibrium, equilibrium constants

Lecture 18 (March 4): Reaction quotients, calculation of equilibrium concentrations

Lecture 19 (March 6): Factors affecting chemical equilibrium (*Homework Chapter 14 due*)

Lecture 20 (March 8): Review of Chapter 13 & 14

March 11-15: Spring break - no class

Lecture 21 (March 18): Exam II: Chapter 13 & 14

Lecture 22 (March 20): Chapter 16: Concepts of acids and bases, acid-base properties of water, pH, strength of acids and bases

Lecture 23 (March 22): Ionization constants of weak acids and bases, percent ionization

Lecture 24 (March 25): Ionization constants of conjugate acids-bases, acid-base properties of salts

Lecture 25 (March 27): Lewis acids and bases (*Homework chapter 15 due*)

Lecture 26 (March 29): Chapter 17: Concept of buffer solution, preparing buffer with a specific pH

Lecture 27 (April 1): Strong acid-strong base titrations, weak acid-strong base titrations

Lecture 28 (April 3): acid-base indicators, solubility product, molar solubility

Lecture 29 (April 5): Predicting precipitation reactions, common ion effect and solubility

Lecture 30 (April 8): complex ion equilibria and solubility (*Homework Chapter 16 due*)

Lecture 31 (April 10): Review of Chapter 15 & 16
Lecture 32 (April 12): Exam III: Chapter 15 & 16 (April 12: Last day to Drop)
Lecture 33 (April 15): Chapter 18: Spontaneous processes and entropy
Lecture 34 (April 17): Second law of thermodynamics
Lecture 35 (April 19): Gibbs free energy and chemical equilibrium (*Homework Chapter 17 due*)
Lecture 36 (April 22): Chapter 19: Redox reactions and balancing redox equations
Lecture 37 (April 24): Galvanic cells and standard reduction potentials
Lecture 38 (April 26): Electromotive force (emf)
Lecture 39 (April 29): Nernst equation
Lecture 40 (May 1): Concepts of batteries, corrosion, and electrolysis (*Homework Chapter 18 due*)
Lecture 41 (May 3): Review of Chapter 17 (*Homework Chapter 19 due*)
Lecture 42 (May 6): Exam Review
Final Exam (May 10th): Time: 10:15 am – 12:15pm, Room 307

Homework: There will be problems assigned for each chapter. **NO LATE HOMEWORK WILL BE ACCEPTED.**

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. Two midterm exams or final examination missing WILL RESULT IN FAILING THE COURSE.**

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

If not informed Dr. Yanfeng Yue in advance, NO credit for any club activity. The bonus for any club activity is < 2% of the original grade.

Calculator: A scientific calculator is required for this course. **Cell phones ARE NOT** permitted for use in exams and should be turned off on the class.

If any student is pregnant and also selected General Chemistry Labs, please inform the Instructor and related TA.

Students with Special Needs: *Sul Ross State University is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartz, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8203. E-mail: mschwartz@sulross.edu.*

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 after hours (not recommended), but must be hand written and scanned (either with a scanner or a smart phone) and emailed to Dr. Yue at: yanfeng.yue@sulross.edu. Homework electronically completed in Microsoft Word or other similar programs will NOT be accepted.