

Sul Ross State University
Syllabus for CHEM 4406 (Fall 2018)

Class: Physical Chemistry I

Room: WSB 305

Time: TR 11:00-12:15

Office Phone: (432) 837-8217

Email: yanfeng.yue@sulross.edu

Instructor: Dr. Yanfeng Yue

Office: WSB 217

Office Hours: MWF 11:00-12:00

TR 8:00-9:30

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, you should have a good understanding of:

- A. Basic concepts of intermolecular forces
- B. Physical properties of solutions
- C. Basic concepts of chemical kinetics and equilibrium
- D. Concepts of acid and bases
- E. Laws of thermodynamics
- F. Redox reactions

Core Objectives (CO):

- A. **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
- B. **Communication Skills** – Students will have the opportunity to improve their communication skills through oral discussion and writing reports (i.e. observation, explanation, and conclusion etc.) on the experiments done in the lab sessions.

- C. **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
- D. **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

Lecture sessions are designed to fulfill PLO 1, CO -A, B & C, and lab sessions are designed to fulfill PLO 3, CO A-D.

Textbook: “*Physical Chemistry*” by Peter Atkins, Julio de Paula and James Keeler 11th Edition

The following chapters will be covered:

Focus 1: The properties of gases (SLO E)

Focus 2: The first law (SLO A)

Focus 3: The second and third laws (SLO B)

Focus 4: Physical transformation of pure substances (SLO C)

Focus 5: Simple mixtures (SLO C)

Focus 6: Chemical equilibrium (SLO D)

Focus 7: Quantum theory (SLO D)

Focus 8: Atomic structure and spectra (SLO E)

Focus 9: Molecular structure (SLO F)

Focus 10: Molecular symmetry (SLO F)

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

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

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

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 15%

Each Midterm Exam (15%): 30%

Lab: 15%

Final Exam: 40%

Course Calendar

Lecture 1 (August 28): Discussion on Syllabus. The perfect gases

Lecture 2 (August 30): The kinetic model

Lecture 3 (September 4): Real gases

Lecture 4 (September 6): Internal Energy

Lecture 5 (September 11): Enthalpy

Lecture 6 (September 13): Thermochemistry

Lecture 7 (September 18): State functions and exact differentials

Lecture 8 (September 20): Adiabatic changes

Lecture 9 (September 25): Entropy

Lecture 10 (September 27): Entropy changes accompanying specific process

Lecture 11 (October 2): The measurements of entropy

Lecture 12 (October 4): Concentrating on the system

Lecture 13 (October 9): Combing the first law and second laws

Lecture 14 (October 11): Phase diagram of pure substances

Lecture 15 (October 16): Thermodynamic aspects of phase transition

Lecture 16 (October 18): The thermodynamic description of mixtures

Lecture 17 (October 23): The properties of solution

Lecture 18 (October 25): Phase diagram of binary systems: liquids & solids

Lecture 19 (October 30): Phase diagrams of ternary system and activities

Lecture 20 (November 1): Students' presentation about Focus 6

Lecture 21 (November 6): Students' presentation about Focus 6

Lecture 22 (November 8): Wavefunctions, operators and observations

Lecture 23 (November 13): Translation motion, vibrational motion, and rotational motion

Lecture 24 (November 15): Hydrogen atoms, many-electron atoms

Last day to withdraw November 16, Friday

Lecture 25 (November 20): Atomic spectra

November 21-23: NO CLASS: THANKSGIVING HOLIDAY

Lecture 27 (November 27): Valence-bond theory, Molecular orbital theory

Lecture 28 (November 29): shape and symmetry, Group theory and Application of symmetry

Lecture 29 (December 4): Revision

Lecture 30 (December 6): Dead day

Final Exam (December 10, Monday): Time: 10:15 -12:15, Room 305

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 Schwartze, 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.*