

Sul Ross State University
Syllabus for CHEM 2402 (Spring 2017)

Class: Inorganic Chemistry I
Instructor: Dr. Yanfeng Yue
Room: WSB 307; Office: WSB 217
Time: Monday, Wednesday, Friday 10:00-10:50 am
Office Hours: Monday to Friday 11:00-12:00 am
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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.

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: Inorganic Chemistry by Catherine E. Housecroft (4th Edition). The following chapters will be covered:

Chapter 1: Basic Concepts: atoms (SLO 1)

Chapter 2: Basic Concepts: Molecules (SLO2)

Chapter 3: Introduction to molecular symmetry (SLO 1)

Chapter 4: experimental techniques (SLO 2)

Chapter 5: Bonding in polyatomic molecules (SLO 5)

Chapter 6: Structures and energetic of metallic and ionic solids (SLO 2)

Chapter 7: Acids, bases and ions in aqueous solution (SLO 2)

Chapter 8: Reduction and oxidation (SLO 3)

Chapter 9: Non-aqueous media (SLO 3)

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

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. 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. PERCENTAGE BREAKDOWN OF MARKS:

Homework: 15%

Each Midterm Exam (15%): $15\% \times 2$

Lab: 15%

Final Exam: 40%

Final Exam (from Chapter 1 to chapter 9) (May 5): 10:15 a.m. - 12:15 p.m.

Course Calendar

- Lecture 1 (Jan 18):** Discussion on Syllabus, importance of chemistry
- Lecture 2 (Jan 20): Chapter 1.** Fundamental particles, wave mechanics
- Lecture 2 (Jan 23):** Atomic orbitals
- Lecture 3 (Jan 25):** Many-electron atoms, the periodic table
- Lecture 4 (Jan 27):** The Aufbau Principle, Ionization energy and electron affinity
- Lecture 5 (Jan 30): Chapter 2.** Bonding model (**Homework 1 due**)
- Lecture 6 (Feb 1):** Molecule orbital theory
- Lecture 7 (Feb 3):** Octet rule, electronegativity values
- Lecture 8 (Feb 6):** Dipole moments, VSEPR model
- Lecture 9 (Feb 8):** Molecular shape (**Homework 2 due**)
- Lecture 10 (Feb 10): Chapter 3.** Symmetry operations and symmetry elements
- Lecture 11 (Feb 13):** Point group, character table, vibrational spectroscopy
- Lecture 12 (Feb 15):** Chiral molecules (**Homework 3 due**)
- Lecture 13 (Feb 17):** Exam Revision Chapters 1, 2, and 3
- Lecture 14 (Feb 20): Exam I, Chapters 1, 2 & 3**
- Lecture 15 (Feb 22): Chapter 4.** Separation and purification techniques, elemental analysis
- Lecture 15 (Feb 24):** Mass Spectroscopy, Thermogravimetry
- Lecture 16 (Feb 27):** Infrared and Raman Spectroscopy
- Lecture 17 (March 1):** Electronic spectroscopy and NMR
- Lecture 18 (March 3):** Electron paramagnetic resonance and Mossbauer Spectroscopy (**Homework 4 due**)
- Lecture 19 (March 6): Chapter 5.** Valence bond theory
- Lecture 20 (March 8):** Molecular orbital theory
- Lecture 21 (March 10):** Applications of Molecular orbital theory (**Homework 5 due**)
- Spring break March 13-17**
- Lecture 22 (March 20):** Revision on Chapters 4 and 5
- Lecture 23 (March 22): Chapter 6.** Packing sphere, metallic radii, alloys
- Lecture 24 (March 24):** Bonding in metals, semiconductor
- Lecture 25 (March 27):** Sizes of ions, ionic lattice
- Lecture 26 (March 29):** lattice energy
- Lecture 27 (March 31):** Defect in solid state lattices (**Homework 6 Due**)
- Lecture 28 (April 3) Chapter 7.** Properties of water, aqueous solutions
- Lecture 29 (April 5):** Acids and bases
- Lecture 30 (April 7):** Common-ion effect, Dissociation, Amphoteric oxides and hydroxides
- Lecture 31 (April 10):** Coordination complexes (**Homework 7 due**)
- Lecture 32 (April 12):** Exam Revision on Chapters 6, 7
- Lecture 33 (April 14): Exam II, Chapters 4, 5, 6, 7**
- Lecture 34 (April 17): Chapter 8.** Oxidation and reduction
- Lecture 35 (April 19):** Potential diagram
- Lecture 36 (April 21):** Frost-Ebsworth diagrams
- Lecture 37 (April 24):** The relationship between Standard reduction potentials and other quantities
- Lecture 38 (April 26): Chapter 9.** Relative permittivity, acids and bases in water
- Lecture 39 (April 28):** Liquid sulfur dioxide, ammonia, and HF
- Lecture 40 (May 1):** Superacids, Ionic liquids and supercritical fluids

Lecture 41 (May 3): Final Exam Review

May 4, Thursday Dead Day

Final Exam (May 5): 10:15 a.m. - 12:15 p.m.

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.