



湖北工业大学
HUBEI UNIVERSITY OF TECHNOLOGY

Course Title	Chemical Principles Laboratory II
Course Code	CHEM 1312
Semester	Winter 2027
Course Length	4 Weeks, 60 Contact Hours
Credits	4
Instructor	Wang Jing
Office	Technology Building A405, Department of Chemistry, College of Science
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Prerequisite	CHEM 1112 General Chemistry II CHEM 1311 Chemical Principles Laboratory I

Course Description:

Chemical Principles Laboratory II expands upon foundational laboratory skills acquired in Chemical Principles Laboratory I through experiments involving solution behavior, phase equilibria, synthesis, separation science, quantitative analysis, and instrumental characterization. Students investigate physical and chemical properties of liquids and solutions, perform organic and inorganic syntheses, apply chromatographic and spectroscopic techniques, and conduct quantitative determinations using gravimetric, volumetric, and instrumental methods. Emphasis is placed on experimental design, data interpretation, analytical accuracy, scientific communication, and safe laboratory practice.

Delivery Mode: In-Person, Face-to-Face Instruction

Course Goals:

Students who successfully complete this course will demonstrate competency in the following general education core goals:

- **Critical thinking skills** – Students will engage in creative and/or innovative thinking, and/or inquiry, analysis, evaluation, synthesis of information, organizing concepts, and constructing solutions.
- **Communication skills** – Students will demonstrate effective written, oral, and visual communication.
- **Teamwork** – Students will demonstrate the ability to work effectively with others to support a shared purpose or goal and consider different points of view.
- **Social responsibility** – Students will demonstrate intercultural competency and civic knowledge by engaging effectively in local, regional, national, and global communities.

Student Learning Outcomes:

Upon completion of this course, students will be able to:

- Investigate solution behavior and intermolecular interactions experimentally;
- Apply liquid-liquid extraction techniques for chemical separations;
- Evaluate vapor pressure and phase-equilibrium relationships;
- Conduct organic and inorganic synthesis procedures safely and effectively;
- Utilize chromatographic techniques for reaction monitoring and purity assessment;
- Perform quantitative analyses using gravimetric and redox methods;
- Apply spectrophotometric and fluorescence methods for chemical determination;
- Construct and interpret calibration curves;
- Assess product purity and experimental uncertainty.

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:**Primary Text:**

J. A. Beran, Mark Lassiter. *Laboratory Manual for Principles of General Chemistry*, 11th Edition. Wiley.

Optional References:

Nivaldo J. Tro. *Chemistry: Structure and Properties*, 3rd Edition. Pearson.

Brown, LeMay, Bursten et al. *Chemistry: The Central Science*, 15th Edition. Pearson.

Software:

Spreadsheet software (Excel or equivalent)

Course Requirements:**Pre-Laboratory Assignments**

Prior to each laboratory sessions, students complete short assignments addressing theoretical principles, safety considerations, reaction mechanisms, and analytical methods relevant to upcoming experiments.

Laboratory Notebook and Experimental Records

Students maintain a laboratory record documenting procedures, observations, calculations, instrumental measurements, and preliminary interpretations.

Technical Laboratory Reports

Four formal reports are submitted following major experimental units. Reports require comprehensive treatment of methodology, quantitative calculations, uncertainty analysis, graphical interpretation, and scientific discussion of results.

Quantitative Analysis Project

Students complete a quantitative investigation employing gravimetric, volumetric, or spectrophotometric methods to determine the composition or concentration of an unknown sample.

Practical Laboratory Examination

Students demonstrate competency in laboratory techniques, solution preparation, instrument operation, safety procedures, and data interpretation during a supervised practical assessment.

Assessments: Activity	Percent Contribution
Pre-Laboratory Assignments	15%
Laboratory Notebook & Experimental Records	20%
Technical Laboratory Reports (4)	30%
Quantitative Analysis Project	10%
Practical Laboratory Examination	25%

Grading:

Final grades will be based on the sum of all possible course points as noted above.

Grade	Percentage of available points
A	94-100
A-	90-93
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D	64-69
D-	60-63
F	0-59

Course Schedule:

The schedule of activities is subject to change at the reasonable discretion of the instructor. Minor changes will be announced in class, major ones provided in writing.

CHEM 1312 Schedule			
Session	Laboratory Operations	Lab Manual (<i>Beran</i>)	Assignments
01	Laboratory Safety, Advanced Glassware Handling, & Microscale Techniques	Safety and Guidelines; Data Documentation	Pre-Lab 01; Safety Quiz
02	Intermolecular Forces in Liquid Mixtures: Volumetric Deviations and Liquid-Liquid Extraction	Experiment 1: Basic Laboratory Operations	Pre-Lab 02
03	Thermodynamics of Phase Transitions: Temperature Dependence of Vapor Pressure and ΔH_{vap} Calculations	Appendix C: Vapor Pressure of Water	Pre-Lab 03
04	Ideal vs. Real Solutions: Collative Profiling and Vapor Pressure Deviations from Raoult's Law	Experiment 11: Molar Mass of a Volatile Liquid	Pre-Lab 04; Lab Notebook 01-03
05	Organic Synthesis Module I: Acetylation of Salicylic Acid to Form Acetylsalicylic Acid (Aspirin)	Experiment 34: Aspirin Synthesis and Analysis (Part A)	Pre-Lab 05; Lab Report 01 (Vapor Pressure)
06	Organic Synthesis Module II: Monitoring Reaction Progress via Thin-Layer/Paper Chromatography	Experiment 35: Paper Chromatography	Pre-Lab 06; Lab Notebook 04-05

07	Purity Characterization: Capillary Melting Point Analysis and Fe^{3+} Coordination Complex Testing	Experiment 34: Aspirin Synthesis and Analysis (Part B)	Pre-Lab 07
08	Quantitative Analytical Assays: Constructing Beer-Lambert Plots for Acetylsalicylic Acid Quantitation	Experiment 36: Spectrophotometric Metal Ion Analysis (Colorimetric adaptation)	Pre-Lab 08; Lab Notebook 06 & 07
09	Inorganic Synthesis Module I: Preparation and Crystallization of a Coordination Iron Salt	Experiment 33: Transition Metal Complexes (Synthesis Setup)	Pre-Lab 09; Lab Report 02 (Aspirin Spectroscopy)
10	Inorganic Synthesis Module II: Analytical Isolation via Classical Gravimetric Determination	Experiment 3: Water Analysis: Solids / Experiment 4: Hydrated Salts	Pre-Lab 10; Lab Notebook 08 & 09
11	Inorganic Synthesis Module III: Characterizing Empirical Formulas via Volumetric Redox Titrations	Experiment 25: Oxidation-Reduction Reactions / Exp 9: Volumetric Analysis	Pre-Lab 11
12	Optical Spectroscopy: Qualitative and Geometric Matrix Evaluation of Food Dye Component Systems	Experiment 36: Spectrophotometric Metal Ion Analysis (Multi-component scan)	Pre-Lab 12; Lab Notebook 10 & 11
13	Advanced Spectroscopy I: Serial Dilution Matrixing and Calibration of Chlorophyll Standards	Experiment 36: Spectrophotometric Analysis (Instrumental Baseline Calibration)	Pre-Lab 13; Lab Report 03 (Dye Matrix)
14	Advanced Spectroscopy II: Solid-Liquid Isolation and Fluorometric Analysis of Natural Spinach Plant Extracts	Experiment 1: Extraction Protocols / Institutional Instrumental Supplement	Pre-Lab 14; Lab Report 04 (Chlorophyll Assay)
15	Individual Chemical Practical Examination		Lab Notebook Submission

Laboratory Requirements and Safety Policies

Students must:

- Wear approved laboratory coats, safety goggles, and suitable footwear at all times.
- Follow established procedures for handling acids, bases, organic solvents, oxidizing agents, and metal-containing compounds.
- Dispose of chemical waste according to laboratory regulations.
- Maintain accurate laboratory records during all experimental sessions.
- Complete required safety training before participation.
- Report all accidents, spills, or equipment malfunctions immediately.

Failure to comply with laboratory safety requirements may result in removal from the laboratory sessions.

Accommodation Statement:

Academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow.

Academic Integrity Statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in coursework may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or outside the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Other Items:**Attendance and Expectations**

All students are required to attend every class, except in cases of illness, serious family concerns, or other major problems. We expect that students will arrive on time, be prepared to listen and participate as appropriate, and stay for the duration of a meeting rather than drift in or out casually. In short, we anticipate that students will show professors and fellow students maximum consideration by minimizing the disturbances that cause interruptions in the learning process. This means that punctuality is a must, that cellular phones be turned off, and that courtesy is the guiding principle in all exchanges among students and faculty. You will be responsible for the materials and ideas presented in the lecture.

Assignment Due Dates

All written assignments must be turned in at the time specified. Late assignments will not be accepted unless prior information has been obtained from the instructor. If you believe you have extenuating circumstances, please contact the instructor as soon as possible.

Make-Up Work

The instructor will not provide students with class information or make-up assignments/quizzes/exams missed due to an unexcused absence. Absences will be excused and assignments/quizzes/exams may be made up only with written documentation of an authorized absence. Every effort should be made to avoid scheduling appointments during class. An excused student is responsible for

requesting any missed information from the instructor and setting up any necessary appointments outside of class.

Access, Special Needs and Disabilities

Please notify the instructor at the start of the semester if you have any documented disabilities, a medical issue, or any special circumstances that require attention, and the school will be happy to assist.