



湖北工业大学
HUBEI UNIVERSITY OF TECHNOLOGY

Course Title	Chemical Principles Laboratory I
Course Code	CHEM 1311
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 1111 General Chemistry I CHEM 1112 General Chemistry II

Course Description:

This laboratory course develops practical skills in experimental chemistry through investigations of thermodynamic, equilibrium, electrochemical, kinetic, and solution-phase chemical systems. Emphasis is placed on laboratory safety, quantitative measurement, instrumental methods, data interpretation, scientific communication, and critical evaluation of experimental uncertainty. Students conduct experiments using modern analytical techniques including spectroscopy, pH measurement, conductivity analysis, electrochemical methods, and computer-assisted molecular modeling. The laboratory experiences provide preparation for upper-level laboratory work in chemistry, engineering, and life sciences.

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:

- Apply safe laboratory practices and proper chemical handling procedures;
- Collect, record, and evaluate quantitative experimental data;
- Use modern laboratory instrumentation for chemical measurements;
- Interpret thermodynamic, equilibrium, electrochemical, and kinetic phenomena through experimentation;
- Apply spectroscopic methods to quantitative chemical analysis;
- Prepare and evaluate buffer systems and electrolyte solutions;
- Utilize computational tools to investigate molecular structure and bonding;
- Analyze experimental uncertainty and sources of error;
- Communicate scientific findings through laboratory reports and presentations.

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:

Microsoft Excel / R for statistical data distribution and graphics creation.

Molecular visualization/modeling software (IQmol or equivalent)

Course Requirements:**Laboratory Preparation Exercises (15%)**

Before entering each lab session, students are required to review the specific experimental procedure and finish a pre-lab exercise. These exercises ensure readiness for laboratory work and encourage active engagement with experimental objectives.

Laboratory Notebook and Data Records (15%)

Students maintain a professional laboratory notebook documenting procedures, observations, calculations, and preliminary interpretations.

Laboratory Reports (30%)

Four formal reports are submitted throughout the semester. Reports require students to analyze experimental results, apply relevant chemical principles, discuss uncertainty and limitations, and present conclusions.

Instrumental Analysis Project (15%)

Students complete a short investigation utilizing spectroscopic, conductivity, or electrochemical measurements. The project emphasizes experimental design, calibration methods, and quantitative interpretation of instrumental data.

Practical Laboratory Examination (25%)

Near the end of the semester, students demonstrate competency in laboratory techniques, instrumentation, data collection, and safe chemical handling through a supervised practical assessment.

Assessments: Activity	Percent Contribution
Laboratory Preparation Exercises	15%
Laboratory Notebook & Data Records	15%
Laboratory Reports (4 reports)	30%
Instrumental Analysis Project	15%
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 1311 Schedule			
Session	Laboratory Operations	Lab Manual	Assignments
01	Laboratory Safety, Documentation, and Data Analysis	Safety Guidelines; Data Documentation; Laboratory Techniques	Pre-lab (1)
02	Experimental Thermochemistry: Calorimetry and Enthalpy Changes	<i>Beran</i> Exp.23 Calorimetry	Pre-lab (2)
03	Hess's Law and Enthalpy of Reaction Determination	<i>Beran</i> Exp.23 (extended analysis)	Pre-lab (3)
04	Spectrophotometric Measurements and Calibration Methods	<i>Beran</i> Exp.36 Spectrophotometric Metal Ion Analysis	Pre-lab (4)
05	Chemical Equilibrium and Equilibrium Constant Determination	<i>Beran</i> Exp.16 Equilibrium Constant	Pre-lab (5); Lab notebook check
06	Molecular Structure and Computational Chemistry Applications	Dry Lab 3 Atomic and Molecular Structure	Pre-lab (6) Lab report (1)

07	Le Châtelier's Principle and Dynamic Equilibrium	<i>Beran</i> Exp.17 Buffers and Le Châtelier's Principle	Pre-lab (7)
08	Thermodynamics of Dissolution and Temperature Dependence of Solubility	<i>Beran</i> Exp.24 Thermodynamics of Dissolution of Borax	Pre-lab (8)
09	Conductivity of Electrolyte Solutions and Ionic Behavior	<i>Beran</i> Exp.30 (supporting electrochemical concepts) + instructor materials	Pre-lab (9) Lab report (2)
10	Buffer Systems and Buffer Capacity	<i>Beran</i> Exp.17; Exp.19 Potentiometric Analyses	Pre-lab (10) Lab notebook check
11	Electrochemical Cells and Electrode Potentials	<i>Beran</i> Exp.30 Galvanic Cells, Nernst Equation	Pre-lab (11) Lab report (3)
12	Concentration Effects and Electrochemical Equilibria	<i>Beran</i> Exp.30	Pre-lab (12)
13	Spectroscopic Monitoring of Chemical Reactions and Kinetics	<i>Beran</i> Exp.14 Factors Affecting Reaction Rates; Exp.15 Rate Law and Activation Energy	Pre-lab (13); Instrumental Data Analysis Project Due
14	Determination of Reaction Order, Rate Constants, and Half-Life	<i>Beran</i> Exp.15	Lab report (4)
15	Practical Laboratory Examination		
16	Integration of Experimental Results and Lab Portfolio Presentation	Comprehensive Review	Lab notebook Submission

Laboratory Requirements and Safety Policies

Students are expected to:

- Attend all laboratory sessions punctually.
- Wear approved laboratory coats, safety goggles, and appropriate footwear.
- Follow chemical hygiene and waste-disposal procedures.
- Complete all required safety training before laboratory participation.
- Maintain accurate laboratory notebooks throughout the semester.
- Report accidents, spills, or equipment malfunctions immediately.
- Adhere to institutional regulations concerning academic integrity and laboratory conduct.

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

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.