



University of International Business and Economics International Summer School

CHE 110 Introduction to Chemistry (with Lab)

Term: September 20th – December 10th, 2021

Instructor: Guirong Wang

Home Institution: Beijing University of Chemical Technology

Email: wanggr@mail.buct.edu.cn

Class Hours: 2 days per week, 120 minutes each teaching day (2,400 minutes in total)

Office Hours: TBD

Discussion Session: TBD

Total Contact Hours: 64 contact hours (45 minutes each)

Credit: 4 units

Course Description:

This course is designed to introduce students to the fundamental principles of chemistry. We will begin with the atomic and molecular nature of matter and its changes, unit conversions, the periodic table and nomenclature. We will discuss the mole concept, stoichiometry, oxidation-reduction and precipitation reactions, and solution chemistry. We will finish the semester discussing quantum chemistry and examine the atomic theory, modes of bonding, periodicity, Lewis structures, VSEPR theory, intermolecular forces and the gas laws.

Course Goals:

- i) To develop an understanding of the atomic and molecular nature of matter and of the chemical reactions that describe their transformations.
- ii) To develop quantitative and critical thinking skills necessary to solve chemical problems using the concepts of balanced chemical reactions, stoichiometry, and solution chemistry.
- iii) To gain an understanding of the periodic table as an organizing concept of chemical properties.
- iv) To use the principles of the VSEPR to gain an understanding for the relationship between molecular structures, geometry and use these to discuss bond polarity, solubility, types of intermolecular forces.

Course Material:

- *Chemistry: A Molecular Approach, 4th ed.* by Nivaldo J. Tro, ISBN: 97 8-0134112831
- Non-programmable Scientific Calculator

Homework Assignments:

Mandatory graded Assignments will be assigned associated with your textbook. These assignments will help you to assess your understanding of the material and identify areas of difficulty and allow you to work at your own pace to achieve mastery the material.

Either assignment or quiz, have specified due dates and will be graded. It is your responsibility to complete the assignments by the set deadlines. Assignments count for 25% of each student's final numerical grade.

Laboratory:

Laboratory is an integral part of the course. For more information on the Laboratory, please visit the lab syllabus.

Academic Honesty:

The relationship between students and faculty is based upon trust and the continued maintenance of this trust is necessary for education to be successful. Students need to trust faculty to make appropriate judgments about the content and structure of the course. Faculty members need to trust that the work turned in by students represents their own effort. Violation of this trust undermines the educational process. As a result, there is no tolerance for breach of academic integrity such as cheating, plagiarizing, or inappropriate sharing of laboratories or quizzes.

Anyone caught cheating or plagiarizing will receive an F in the course.

Cheating can include sharing answers, as well as stealing answers. Plagiarism means copying words from someone's work, even if you "change the sentence a bit." If you share your laboratory report you are as guilty as the person copying it. If you do use material from an appropriate source, make sure you reference it properly in your reports. If you have any questions about the proper way to reference sources, please ask.

Grade Calculations:

Regular class attendance and completion of chapter readings are necessary to succeed in this course. Your final course grade will be calculated as follows:

Discussion Attendance and Participation	10%
Assignments	20%
Quizzes (4)	20%
Cumulative Final Exam	30%
Laboratory	20%

Grading Scale:

Assignments and examinations will be graded according to the following grade scale:

A	90-100	C+	72-74
A-	85-89	C	68-71
B+	82-84	C-	64-67
B	78-81	D	60-63
B-	75-77	F	below 60

Tentative Schedule

Week 1	Topics	Textbook readings
	Overview <ul style="list-style-type: none"> Scientific Method Classification of Matter 	1-5
	Overview <ul style="list-style-type: none"> Physical and Chemical Changes and Properties Units of Measurements 	9-13
Week 2		
	Atoms and Elements <ul style="list-style-type: none"> Basic Principles of Atomic Theory and Structure. Subatomic Particles 	53-55
	Atoms and Elements <ul style="list-style-type: none"> Atomic Mass The Mole Concept 	65-69
Week 3		
	Holiday	
Week 4		
	Molecules, Compounds, and Chemical Equations <ul style="list-style-type: none"> Chemical Bonds Ionic Compounds 	87-90
	Molecules, Compounds, and Chemical Equations <ul style="list-style-type: none"> Molecular Compounds – Nomenclature Formula Mass, Mole Concept of Compounds 	101,107
Week 5		

	Molecules, Compounds, and Chemical Equations Writing and Balancing Equations	107,119
	Molecules, Compounds, and Chemical Equations Mole Concept and stoichiometry calculations	141
Week 6		
	Chemical Quantities and Aqueous Reactions Properties of Solutions	
	Chemical Quantities and Aqueous Reactions Solubility of Ionic Compounds and Precipitation Reactions	158-162
Week 7		
	Chemical Quantities and Aqueous Reactions <ul style="list-style-type: none"> • Acid-Base and Gas-Evolution Reactions • Oxidation-Reduction Reactions • Combustion Reactions 	167-175
Week 8		
	Gases <ul style="list-style-type: none"> • Ideal Gas Law • Kinetic Molecular Theory 	208, 224
Week 9		
	Quantum Theory	297-308
	Periodic Properties of the Elements Electron Configuration – Pauli Exclusion Principle, Aufbau Principle, Hund’s Rule	339-347
Week 10		
	Periodic Properties of the Elements Periodic Trends – Size of Atoms, Ionic Radii, Ionization Energy, Electron Affinity	352-356
	Chemical Bonding I Ionic, Covalent and Metallic Bonds	384-394
Week 11		

	Chemical Bonding I Electronegativity and Bond Polarity	396-399
	Chemical Bonding II <ul style="list-style-type: none"> VSEPR Theory – Molecular Geometry Valence Bond Theory – Hybridization 	428-437
Week 12		
	Intermolecular Forces <ul style="list-style-type: none"> Dispersion, Dipole-Dipole, Ion-Dipole Forces, and Hydrogen Bonding States of Matter and Physical Properties 	486-489
	Review & FINAL EXAM	

Laboratory Syllabus

Course Goals:

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

- Demonstrate the ability to work safely and effectively in the laboratory.
- Competently perform a broad variety of analytical and synthetic procedures and critically evaluate the results.
- Perform basic laboratory skills and understand common laboratory practices, procedures, and equipment, including safety issues.
- Explain, analyze and interpret the data obtained from each experiment.
- Demonstrate adequate skills in technical writing.

Tentative Lab Schedule:

Date	Topic
	Laboratory Safety and check-in Experiment #1 Measurements and Density
	Experiment #2 Isolating the Components of a Three-Component Mixture
	Experiment #3 Determining the Water Content of an Ionic Hydrate
	Experiment #4 Studying Chemical Reactions and Writing Chemical Equations
	Experiment #5 Acid-Base Titration

	Experiment #6 Gas Laws
	Experiment #7 Molecular Models (Dry Lab)
	Experiment #8 Spectrophotometric Analysis of Permanganate Solutions

Each module will contain a Lab Activity document where you will find the instructions and procedures for that module's labs. These activity documents are designed to act as a study guide for the module test.

Each Lab Activity Document has the following:

- Purpose
- Learning Objectives
- Assignment Submission Checklist (Experimental Photographs, Formal Lab Reports, Graphs, Lab Assessment, etc.)
- Lab Activity Number
 - Introduction
 - Procedure
 - Analysis and Questions

You will only be submitting what is in the Assignment Submission Checklist Area. You aren't going to submit the handouts or analysis and questions section. Your instructor will have those answers if you are stuck and need clarification.

All reports/handouts will need to be submitted in a word document and uploaded as an attachment. Please make sure you title your file with your last name and the title of the lab. Your name should also be included on the actual document itself.