Seoul Campus 02450 서울특별시 동대문구 이문로 107 tel 02.2173.2093 fax 02.960.7898
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Global Campus 17035 경기도 용인시 처인구 모현면 외대로 81 tel 031.330.4114 fax 031.333.1708
81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

Hankuk University of Foreign Studies

2023 Summer Session

CHEM 101 Introduction to Chemistry with Lab

Course Outline

Class Hours: 10:00-12:00 (Monday through Friday)

Course Code: CHEM 101

Instructor: Young Charles Jang, Ph.D.

Home Institution: Georgia Institute of Technology (Georgia Tech)

Office Hours: By Appointment

Email: young.jang@gatech.edu

Credit: 4

Class Hours: This course will have 72 class hours, including 40 lecture hours, 10 lecturer office hours, 10-hour TA discussion sessions, 2-hour review sessions, 10-hour lab classes.

Course Description

This is an active-learning class that introduces students to general chemistry fundamental laws and theories of chemical reactions. Topics include atomic structure; bonding theory; stoichiometry; properties of solids, liquids and gases; chemical thermodynamics; electrochemistry; and kinetics. This course will foster the development of critical scientific skills including hypothesis testing, experimental design, data analysis and interpretation, and scientific communication. Class time will consist of a variety of team-based activities designed to discuss, clarify, and apply new ideas by answering questions, drawing diagrams, analyzing primary literature, and explaining medical phenomenon in the context of chemical and biochemical principles.

Course Objectives

- Identify steps in the scientific method.

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- Apply concepts of measurement and significant figures to laboratory practices and chemical problems.
- Correlate position on the periodic table to properties of elements and bonds.
- Calculate amounts of chemical species using information from chemical formulas and chemical equations.
- Correlate information from balanced chemical equations to the microscopic scale.
- Explain atomic structure using the quantum mechanical model of the atom.
- Explain periodic trends using theories of electronic structure.
- Interpret thermochemical equations and data and evaluate energies of systems.
- Summarize the behaviors of gases and explain them using the kinetic-molecular theory.
- Correlate the molecular level process that occur during heating, cooling, and phase changes to the amount of energy removed or added to a system during each process.
- Interpret equilibrium data regarding gaseous and aqueous reactions.
- Compare/contrast the concepts of the three theories of acids and bases and apply them to inorganic and biological systems.
- Integrate the concepts of equilibrium, Gibbs free energy, and cell potential
- Use reaction mechanisms to infer the kinetics of a chemical reaction.
- Compare/contrast the relationships between rate and concentration, concentration and time, and rate and time. Apply these principles to kinetic data.
- Apply chemical concepts to everyday life.

Required Textbooks

CHEM 101 is taught on the flipped classroom model, meaning that you will need to complete your assigned readings before each lecture. **CHEM 101** will be taught without a textbook. All course readings and videos are available on the course website (TBD) or will be handed out before lectures. We will also use an online textbook found at **OpenStax Chemistry** (open source e-book): https://openstax.org/details/books/chemistry

Homework

Homework assignments will be made available each week in Learning Catalytics and are always due on Sundays at midnight. Homeworks close on Sunday at midnight, with few exceptions, and will not be reopened for credit, but you can review closed sessions for study purposes. In the week of Midterm and Final Exam, all homeworks for that module will be reopened for practice, not for credit. We will drop the lowest Homework from your participation grade.

Exams (Mid-term and Final)

This course has a midterm exam and final exam. The midterm exams will be held as "closed-book," and will be made up of multiple-choice questions based on topics, materials, and discussions presented in class, assigned readings, and homeworks.

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Grading & Evaluation

Your final grade will depend on the following combination of grades:

1) Mid-term exam 35%
2) Final exam - 35%
3) Homeworks 15%
4) Team based project 15%

Grading System (1 ~ 100)

A+ : 96 - 100	A : 91 - 95
B+ : 86 - 90	B : 81 - 85
C+ : 76 - 80	C : 71 - 75
D+ : 66 - 70	D : 60 - 65
F : 0 - 59	
Pa : Pass	Fa : Fail

Honor Code

All students are expected to abide by the Academic Honor Code. Plagiarism is the unattributed use of the words of ideas of others; plagiarism on any assignment, including laboratory reports are strictly prohibited. If you have any questions regarding your assignments and plagiarism, we encourage you to come consult with me before you submit the assignment.

Course Schedule:

Week 1:
Lecture 1: Course Introduction
The way science works
What is chemistry? Some fundamental concepts
The importance of chemical principles

Lecture 2: Chemistry: Methods and Measurements
Matter and Measurement
The modern metric system
Measuring energy
Density
Unit Conversions

Lab 1: Scientific Methods

Week 2:
Lecture 3: Atom, Molecules, and Ions (Chapter 2)
The modern view of Atomic structures

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Molecules and Molecular Compounds
Ions and Ionic Compounds

Lecture 4: Composition of substances and solutions (Chapter 3)
Formula Mass and Mole Concept
Determining Empirical and Molecular Formulas
Molarity
Other units of solution concentration

Lecture 5: Stoichiometry of Chemical Reactions (Chapter 4)
Writing and balancing chemical equations
Classifying chemical reactions
Reaction stoichiometry
Reaction yields
Quantitative chemical analysis

Lab 2: TBD

Week 3:
Review Session
MIDTERM (7/31)
Lecture 6: Thermochemistry (Chapter 5)
Energy Basics
Calorimetry
Enthalpy

Lecture 7: Electronic Structure and Periodic Properties of Elements (Chapter 6)
Electromagnetic Energy
The Bohr Model
Development of Quantum Theory
Electronic Structure of Atoms (Electron Configurations)
Periodic Variations in Element Properties

Lecture 8: Chemical Bonding and Molecular Geometry (Chapter 7)
Ionic Bonding
Covalent Bonding
Lewis Symbols and Structures
Formal Charges and Resonance
Strengths of Ionic and Covalent Bonds
Molecular Structure and Polarity
Lab 3: pH – Acid and Base

Week 4:
Lecture 9: Acids and Bases and Oxidation-Reduction

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pH scales
Chemical and biological buffers
Acid-base titrations
Balancing oxidation/reduction equations

Lecture 10: Organic Chemistry
Electrolytes
Hydrocarbons
Alcohols, Phenols, and Ethers
Aldehydes and Ketones
Lab 4: TBD

Week 5:
Lecture 11: Biological Chemistry
Proteins
Enzymes
Metabolism

Lecture 12: Modern Concepts in Biochemistry
Review Session
FINAL EXAM
Final Exam Q&A – Course Wrap-up