Chemistry 200: Basic Chemistry and Applications
Course Syllabus: Spring 2017 – 2018

Course Instructors

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Meeting Times and Locations

General Lecture: Tuesday and Thursday: 8:00 – 9:50 am (SLH)

Recitations: Please check the time and place of your recitation

Resources Available to Students

The course will use handouts, internet resources and articles from the news and science journals. Electronic copies will be placed on Moodle.
Wikipedia is a great resource for all kind of information

What is Chemistry 200 about?

Chemistry is the study of matter and its transformation.

Chem 200 introduces some of the modern views of the nature of matter and the physical principles that control its transformation. This is done in the context of addressing contemporary problems and applications, such as global warming, alternative energy resources and the mechanism of human vision!
The level of the course is not elementary, and students are expected to put at least two hours of study on a daily basis.

Exam Dates and Locations

Test 1: TBA
Test 2: TBA

The exact date and place of the Final will be scheduled by the registrar
Please do not arrange for travel before you know the Date of the Final.
You may not ask for early final or an incomplete for travel reasons

☞ You will most likely have other exams on these dates. It is important then that you study daily so you don't get stressed or overwhelmed at the time of the tests.

☞ The exams will Probably be of the short question – short answer type

Some questions will require that you explain or interpret things in a concise way using key words. It is important that you practice to do this when you are studying. You should practice to make clear drawings of molecules, and to make clean clear labeled graphs. Part of the grade will go to the quality of your presentation.

Grading Scheme

Recitation attendance, recitation problem sets and class participation = 10 points
Two tests = 50 points: Test with lowest grade = 20 pts, Highest grade = 30 pts
Cumulative Final Exam = 40 points.

No make ups will be given in this course. You take a zero if you miss a test with no excuse.
If you miss one test with excuse, the final will count 55 pts and the test 35 pts.
You will take a failing grade if you miss the two tests, even if you have an excuse.

No incomplete will be allowed if you miss the final for travel purposes

It will always be to your advantage to take the two tests

Course Policies

AUB is not an online university.
In Chem 200 attendance is strictly required. In the recitation attendance will be taken every week. You lose 2 points for every recitation you miss without excuse. Because the course does not use a textbook, you can easily loose track of the course if you miss the lectures or recitations or if you don't study daily. If for any reason you suspect you may have to miss class, you should not take this course.
You are responsible for all announcements made in class, and for all the topics and material discussed in the lectures and recitations even if a topic is not mentioned in the course outline or the study guides. Lecture notes will be placed on Moodle before the lecture. You can print these and bring with you to the lecture. However, you are strongly encouraged to keep a notebook and to take notes in class.

Special Accommodation

AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314.

Course Learning Outcomes

After completing this course, the successful student should be able to:

1. Describe the quantum mechanical view of the electronic structure of atoms and molecules.
2. Distinguish between the ground state and excited states of atoms and molecules, and explain how they relate to light absorption and light emission.
3. Apply Molecular Orbital Theory to explain the driving force for covalent bond formation.
4. Apply Coulomb's Law to explain the driving force for ionic bond formation.
5. Predict the geometry of molecules of the main group elements.
6. Identify the major classes of functional groups in organic chemistry and biochemistry.
7. Identify the intermolecular forces and use them to explain various physical properties of matter such as melting temperatures and solubilities.
8. Discuss the importance of atmospheric photochemistry to life on earth, and the environmental problem of ozone destruction.
9. Discuss the problem of global warming, the evidence that it is caused by human emitted green house gases, and the efforts made to solve it.
10. Describe the molecular basis of examples of biochemical process, such as human vision, enzyme functions, or the chemistry of drugs.

Course outline

The course will be structured in three parts.
Detailed outlines and study guides will be distributed during the semester to specify in details what is expected from you.

PART 1: The Basics

Getting Started:

A quick survey of the chemical elements:
Those symbols and numbers in the periodic table of the elements

Atomic Mass and the Notion of the Mole Chemistry

The notion of the mole and its use to calculate the limiting reagent in chemical reactions
What does the mass of a particle mean?
The notion of the fundamental properties of matter, and what they are.

Introduction to the Notion of Structure in Chemistry. Part 1:
Ionic Compounds

Apply Coulomb's Law to determine Energy of interaction between spherical ions
Apply Coulomb's Law to predict the most favorable geometry of ionic molecules such as Na_2Cl_2 and Li_2S
Explain the origin of the large driving force of ionic compounds to make extended solids

The Obscure Spin

Response of electrons and protons to magnetic fields
Utilizing the spin property in NMR spectroscopy: Distinguishing between different structures of compounds having the same molecular formula.
The use of NRI as a diagnostic tool in Medicine.

Photons or Electromagnetic Radiation:

Analysis of the radiation emitted by the sun
Particle vs wave character of light
Wavelength and energy of the radiation

The Quantum Mechanical Model for the Electronic Structure of the Atom

Particle vs wave character of the electron
The notion of the bound atomic states: ground states vs excited states
Energy of the electrons in atoms
Position of the electrons in atoms: Atomic orbitals
Origin of the periodicity in the periodic table:
The Trends in the ionization energy and size of atoms

PART 2: Molecules Я US*: Bonding and Molecular Geometry*

Chemical Bonding in non ionic compounds
Dihydrogen:
The idea of the potential energy surface
The meaning of equilibrium geometry and molecular vibration

Molecular Orbital Theory
The dihydrogen molecule in details

Covalent Bonding
MO-Theory for dinitrogen and dioxygen:
The idea of Sigma and Pi MOs
The idea of molecular ground and excited state: Triplet vs Singlet O_2.

Evidence In Support of MO-Theory
Ionization energy on atomic oxygen and nitrogen against the ionization energy of molecular oxygen and nitrogen.

Chemical Forces: 1- Vander Waals Interactions
Comparing the temperature at which Helium, dihydrogen, and dinitrogen become liquids.

Lewis structure for simple covalent molecules

Geometry and Bonding of Ozone

➔ **Application 1**
Photochemistry in the Atmosphere.

Heteroatomic covalent bonds,
Polar Bonds vs Polar Molecules.

Molecular Geometry and Physical Properties
Lewis structure for polyatomic molecules
Using the Valence Shell Electron Pair Repulsion Model to Predict Molecular Geometry

PART 3: Organic Chemistry and Biochemistry

Organic Chemistry

Hydrocarbons: alkanes, alkenes and alkynes.
Hydrocarbons: Aromatic rings.

The notion of the Functional Group in Organic Chemistry

Alcohols, aldehydes, ketones and carboxylic acids.

The Molecules of Life
Amino acids and the idea of chirality.
The peptide bond, using aminoacids to make proteins.
The structure of proteins

Lipids and fats
The structure of Cell Membranes

Carbohydrates
Sugar and cellulose

Application 2:
The Chemistry of Drugs

Application 3:
The Mechanism of Human Vision

Part 4: The Search for Alternative Energy Resources

The need to generate energy in daily life.
The environmental problems from generating energy by burning oil or coal.
Global warming and its serious implications.

If time permits: Application 5: Photovoltaic Cells
(or how to generate electricity from sun light)