

Chemistry 201: Chemical Principles

Fall 2017 Course Syllabus

- **Instructors:** Digambara Patra
- **Office:** Chemistry Building (D. Patra)
Room 414 – Phone 3985
- **Email:** dp03@aub.edu.lb (D. Patra)
- **Classes:**

Section	CRN	Time and Location	Recitation	Instructor
1	10584	9:00 MW CHSC Auditorium	9:00 F Chem 001	Ms. Sadak
2	10585		12:30 R Chem 001	Prof. Patra
3	10586		8:00 T Phys 329	Ms. Sadak
4	10587		1:00 F Chem 001	Ms. Sadak
5	10588		8:00 R Phys 317	Ms. Mrad
6	10589	10:00 MW SLH	9:00 W Phys 217	Ms. Sadak
7	10590		8:00 F SLH	Ms. Mrad
8	10591		11:00 F Phys 327	Ms. Sadak
9	10592		2:00 F Chem 101	Prof. Patra

- **Office hours:** (Prof. Patra) MW 11:00 a.m. to 12:30 p.m.

- **Resources available to the students:**

- **Textbook:** S. S. Zumdahl and D. J. DeCoste, **Chemical Principles**, 8th (International) Edition, Brooks/Cole, Cengage Learning, 2015.
+ **Solutions manual:** copies available on the reserve shelf in the Science Library.
- **Lectures and hand-outs:** will all be posted on **MOODLE**.
- **Solutions:** answers at the end of each chapter + detailed solutions in the Solutions Manual.

- **Grading:** Two 60-minutes quizzes: (better grade 30%, lower grade: 20%)
Final exam: 50%

- **Quiz dates:**

Quiz 1: Thursday, Oct 12, 2017; 6:15 pm - 500 Nicely and SLH

Quiz 2: Wednesday Nov 15, 2017; 6:15 pm in 500 Nicely and SLH

Final exam: will be scheduled by the Registrar's Office

Last day for withdrawal: Friday, Nov 24, 2017

Last day of classes: Thursday, Dec 7, 2017

- **Learning outcomes:**

Chem. 201 is a course intended to unify the **General Chemistry** background of incoming University students at the sophomore level, majoring in the Natural Sciences (Chemistry, Biology, Physics, Geology...), preparing for the Medical School, or providing the Chemistry background for Engineering. It should provide the student with a solid background in basic chemical principles, with two major objectives ahead:

1. Achieving a deep assimilation of chemical concepts, along with an ability to manipulate them and apply them in real life, while stressing the problem solving strategy.

2. Developing calculational skills in quantitative chemical problems, and acquiring a thinking methodology that should enable the student to approach **any** type of problem related to the studied material.

The following is a set of outcomes that should adhere to the student's mind after completion of the course:

- Learn the foundations of atomic structure and the origins of its discovery. Learn and assimilate the concepts and some mathematical aspects of **Quantum Mechanics**, which led to the modern conception of atoms and molecules. Understand the concepts of wave function, quantization, atomic orbitals, electronic configuration, spin, periodicity...
- Learn how to work out the distribution of valence electrons in molecules. Master the skill of drawing **Lewis structures**, and subsequently predicting the geometrical shapes of molecules using the **VSEPR** model and the theory of hybridization.
- Understand the three principal states of matter: know the characteristics and properties of each state, its behavior **at the molecular level**, with a notable emphasis on the gas phase. Then know the basis of the transitions between phases, depending on the change in conditions of temperature and pressure. Understand and know how to interpret a **phase diagram**.
- In the study of liquids, extrapolate to the properties of solutions, both qualitatively and quantitatively. Learn the **Ideal Solution theory**, and its application to the prediction of the **colligative properties**.
- Survey the laws of **Thermodynamics**, with a focus on the Second Law and its implications on the understanding of natural phenomena and spontaneity. Digest the concepts of entropy and free energy. Learn the relation between free energy and **Chemical Equilibrium**.
- Review the basics of ionic equilibria in aqueous solutions. Then develop calculational techniques for the treatment of typical acid-base problems. Master the computation of acid-base titration curves, and achieve a thorough understanding of all changes in the various titration stages.

CHEMICAL PRINCIPLES (8th Edition, International Edition)

Zumdahl and DeCoste

CONTENTS

Subject	Section in Zumdahl	Assigned problems
I. ATOMIC STRUCTURE AND BONDING		
Light and spectroscopy	12.1-12.2	12.21-12.37
Atomic Spectrum of Hydrogen	12.3	12.38 – 12.51 12.52-12.54
Bohr model	12.4	12.63- 12.74,
Quantum mechanical model	12.5, 12.7-12.9	12.75-12.81;
Atomic orbitals, quantum numbers	(exclude 12.6)	12.86-12.98
Electron spin and the Pauli principle	12.10- 12.11,12.14	
Periodic table and the Aufbau principle	12.13	
Electronegativity	13.1-13.3	13.16-13.24
Ionic and covalent bonding	13.6	13.63-13.81
Ionic character	13.9	13.82-13.91
Lewis structures	13.10	13.93-13.111
Exceptions to the octet rule	13.12	
Resonance	13.11	
Molecular geometry: VSEPR theory	13.13	
Hybridization	14.1	14.21-14.33

II. STATES OF MATTER		
Gases		
Measurements of gas pressure	5.1	5.21-5.25 5.26- 5.49
Gas laws	5.2-5.5	5.52-5.73
Kinetic Molecular Theory (KMT)	5.6	5.76-5.100
Transport properties: effusion and diffusion	5.7	
Real gases: intermolecular forces	5.10	
Liquids and Solids		
Intermolecular forces	16.1	16.13-16.25
The liquid state	16.2	16.33,
Structures and types of solids	16.3 16.4	16.38-16.40 16.44-16.52
Phase changes, phase diagrams	16.10-16.11	16.61,16.62 16.80-16.109
Solutions		17.13-17.23
Composition	17.1	11.25-17.28,
Energetics of mixing	17.2	17.33-17.41,
Solubility	17.3	17.42-17.57,
Ideal solution theory	17.4	17.58-17.75,
Colligative properties	17.5-7	17-76-17.92
III. THERMODYNAMICS		
First law		
Entropy and the second law	10.1,10.5	10.12
Effect of temperature on spontaneity	10.6	10.35-10.53, 10.54-10.91
Free energy	10.7	
Entropy, free energy and chemical reactions	10.8,10.9	
Effect of pressure	10.10	
ΔG and ΔG°		
Chemical equilibrium	10.11	
IV. IONIC EQUILIBRIA		

Review of acids, bases and pH pH of salts	7.1-7.6 (reading material) 7.8	7.18, 7.21-7.33 7.34-7.41, 7.43-7.68, 7.69- 7.81
Buffer solutions Titrations and pH curves Acid-base indicators	8.1-8.2, 8.4, 8.5, 8.6	8.16-8.21, 8.27-8.53, 8.54-8.65, 8.73, 8.79, 8.80, 8.84

- **General policy:**

- **Attendance:**

Students are expected to attend all lectures. Attendance will be taken in recitations occasionally. Students must attend the lectures in the section in which they are registered.

- **Absence from Exams:**

- Absence from quizzes and/or the final is not permitted. If a student is forced to miss a quiz for reasons beyond his/her control, he/she must present a written excuse. In case of sickness, the student must report to the AUB infirmary to validate his/her excuse (in writing or verbally by an infirmary physician).
 - In case the excuse is deemed valid, a new grading formula will be worked out by the course instructor. No make-up quizzes will be given.
 - If a student misses two quizzes, he/she must drop the course.
 - If a student misses the final exam, he/she will get a zero on that exam and his/her grade will be calculated accordingly. If a valid excuse is presented, a make-up exam is given only after the approval of the professor and the A&S **Student Academic Affairs Committee** (Dean's Office).

- **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, Ext. 3246; West Hall, 314.

- **Cheating:**
Cheating is strictly prohibited, and will be penalized in accordance with the regulations of the Faculty and the *Student Code of Conduct*.
- **Discipline and Quiet Policy:**
The attitude, conduct and behavior of the students in both general lectures and recitation sessions are extremely important. Talking and inter-student communication are forbidden. **Class disruption shall be reported to Student Disciplinary Affairs Committee for disciplinary action.**
- **Mobile phones:** must be strictly switched off during the class (and of course during exams). The use of mobile phones during the lecture (including texting) is considered a serious class disruption and disrespect. Any student using a mobile will automatically be sent out of the class.
- **Taking Exams:**
Periodic tables are provided during exams. Physical Constants and Tables of Data are given. The use of scientific calculators is ***indispensable***. Sharing calculators is not allowed under any circumstance.

UNIVERSITY POLICIES

Academic Integrity:

Please refer to AUB Student Code of Conduct: <http://www.aub.edu.lb/pnp/generaluniversitypolicies/Documents/StudentCodeConduct/StudentCodeConduct.pdf> , in particular section 1.1, which concerns academic misconduct including cheating, plagiarism, in-class disruption, and dishonesty. Please be aware that misconduct is vigorously prosecuted and that AUB has a zero tolerance policy. Course policy is that **credible evidence of cheating will result in course failure.**

Recommended Accessibility Statement to Acknowledge the Unique Learning Needs of Students with Disabilities:

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.

Non-Discrimination

AUB is committed to facilitating a campus free of all forms of discrimination including sex/gender-based harassment prohibited by Title IX. The University's non-discrimination policy applies to, and protects, all students, faculty, and staff. If you think you have experienced discrimination or harassment, including sexual misconduct, we encourage you to tell someone promptly. If you speak to a faculty or staff member about an issue such as harassment, sexual violence, or discrimination, the information will be kept as private as possible, however, faculty and designated staff are required to bring it to the attention of the University's Title IX Coordinator. Faculty can refer you to fully confidential resources, and you can find information and contacts at www.aub.edu.lb/titleix . To report an incident, contact the University's Title IX Coordinator Trudi Hodges at 01-350000 ext. 2514, or titleix@aub.edu.lb . An anonymous report may be submitted online via EthicsPoint at www.aub.ethicspoint.com