



American University of Beirut
Faculty of Arts and Sciences
Department of Chemistry



**Chem 202: Introduction to
 Environmental Chemistry (3 cr)**
Course Syllabus
AY 2013-2014
Spring 2014

LECTURER

Dr. Antoine Ghauch Room 430 Chem. Ext. 3990

ag23@aub.edu.lb

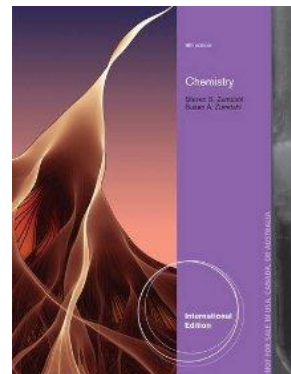
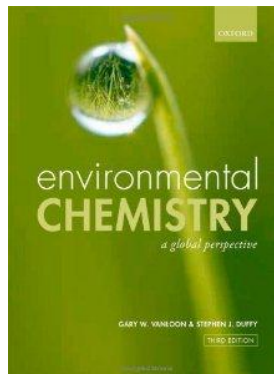
Office hours: TR 12:45-2:15 p.m. or by appointment

CLASS SCHEDULE

<i>Section</i>	<i>CRN</i>	<i>Main Lecture and Recitations</i>
2	22722	9:30-10:45, Bechtel 344 Dr. Ghauch

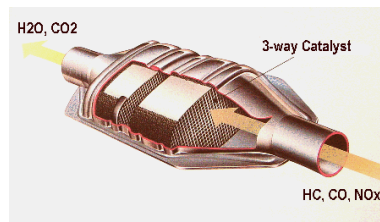
TEXTBOOKS AND RESOURCES

- Gary W. vanLoon and Stephen J. Duffy, *Environmental Chemistry: A Global Perspective*, 2nd/3rd Edition, Oxford University Press, 2005/2010
- Steven S. Zumdahl, Susan A. Zumdahl, *Chemistry*, 8th (2010) or 9th (2014) Edition, Houghton Mifflin Company.



COURSE DESCRIPTION

Chem202 is an introductory course to the fundamentals of physical, inorganic, and organic chemistry with applications to environmental problems: (i) air pollution with emphasis on ozone formation/destruction and (ii) water pollution with emphasis on pollutants (e.g. heavy metals) and waste water treatment. This course surveys reaction kinetics and pathways, rate laws, catalysis, free



radical reactions in the gas phase and temperature effect. Chem202 treated also equilibrium constants and solutions electro-neutrality, acid-base speciation as well as metal-ligand coordination, gas solubility and redox reactions.

Course Outline: The Big Picture! (Tentative)

Textbook	Chapter in text	Chapters	Sections	Assigned Exercises (8 th Edition)
Introduction	-	Syllabus / Green Chemistry	Syllabus	
VanLoon & Duffy	1	Environmental Chemistry: a Global Perspective	1.1-1.2.3	-
Zumdahl	12	Chemical Kinetics	12.1-12.8	23, 29, 51, 57, 61, 81, SE 5 p.544
VanLoon & Duffy	2	The Earth's Atmosphere	2.1, 2.2.4	S.E. 2.6, Pb 1, 2, 3, 4, 11, 13, 16
VanLoon & Duffy	3	Stratospheric Chemistry - Ozone	3.1 – 3.4	Pb. 4, 5, 7, 8, 9
VanLoon & Duffy	4	Tropospheric Chemistry - Smog	4.1 – 4.2.5, 4.3.4	Ex. 1, 3, 4, 9, 11
Q1		EXAM 1	All Above	
VanLoon & Duffy	5	Tropospheric Chemistry - Precipitation	5.1 - 5.7	6, 8, 9
VanLoon & Duffy	8	The Chemistry of Global Climate	8.1-8.3.7	Ex. 1, 2, 4, 13
Zumdahl	14	Acids and Bases	14.1 – 14.8	37, 49, 55, 85, 101, 137
Zumdahl	15	Applications of Aqueous Equilibria	15.6, 15.8	23, 39, 53, 55, 61
Q2		EXAM 2	All Above	
VanLoon & Duffy	10	Distribution of Species in Aquatic Systems	10.1	-
VanLoon & Duffy	11	Gases in Water	11.1, 11.2	Ex. 1, 3, 6, 11
VanLoon & Duffy	13	Metals in the Hydrosphere	13.1, 13.2, 13.3, 13.5	TBA
VanLoon & Duffy	16	Water Pollution and Waste-Water Treatment Chemistry	16.1 – 16.3	Ex. 2, 7
F		Final Exam	TBA	

LAST DAY FOR WITHDRAWAL FROM CHEM202 IS FRIDAY APRIL 4, 2014

ON LINE LEARNING CENTER

Student resources are available on:

<http://www.oup.com/uk/best.textbooks/chemistry/vanloon/>

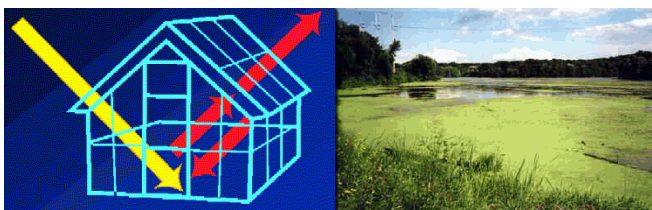
<http://www.college.hmco.com/pic/zumdahl7e>



EXAMINATIONS AND GRADING SCHEME

Exam I, *Thursday, February 27, 2014 @ 5:00 pm* Room: TBA
Exam II, *Thursday, April 3, 2014 @ 5:00 pm* Room: TBA
Final Exam, as shall be scheduled by the Registrar's Office in May 2014.

Exam 1	30%
Exam 2	30%
Final Exam	40%



COURSE OBJECTIVES

The main objectives of this course are to:

- Provide students a basic knowledge in environmental sciences with emphasis on chemistry and its role in maintaining or breaking the natural equilibrium existing between the atmosphere, the lithosphere and the hydrosphere through global cycles (e.g. Carbon, Hydrogen, Nitrogen).
- Introduce students to the global warming problem (cause and effect) and let them thinking about how to sustain a clean environment that will not have adverse effects on humans and other living species and organisms at the surface of the earth.
- Teach students how to prevent pollution by minimizing the use of chemicals and by respecting regulations and policies developed by environmental specialist.
- Motivate students to participate in solving relevant environmental problems encountered in their everyday life.
- Encourage students to participate in improving quality of life by endorsing international policies regarding environmental issues so as to avoid future natural disasters e.g. (floods, global warming, soil erosion, etc).

LEARNING OUTCOMES

At the end of this course, students will be able to:

1. Enumerate and understand the twelve principles of green chemistry.
2. Analyze any environmental problem given the adequate parameters describing the situation.
3. Distinguish between the different layers of the atmosphere and describe their content in terms of gaseous species.
4. Differentiate between the good ozone formed in the stratosphere and the bad ozone formed in the troposphere.

5. Explain the different cycles of the main nutrients happening between the lithosphere, atmosphere and hydrosphere.
6. Understand all chemical reactions happening at different layers of the atmosphere.
7. Explain the formation of acid rain through chemical equations and determine the pH of rain using equilibrium constants.
8. Understand Lake Acidification and its relation to food toxicity.
9. Enumerate water pollutants as well as atmospheric pollutants.
10. Use the appropriate units for aqueous and gaseous species dissolved in water or in air.
11. Understand reaction kinetics and the role of catalysts (activation energy).
12. Understand air pollution mechanisms especially smog and aerosols formation, global warming (GW) and ozone depletion potential (ODP).
13. Describe ozone depletion and how to relate this phenomenon to anthropogenic activities.
14. Define a CFC compound and determine its number from its chemical formula and vice-versa.
15. Explain the formation of Polar Stratospheric Clouds and associated chemical reactions.
16. Recognize water pollution indices (eutrophication, BOD, TOC).
17. Write and balance chemical equations including acid-base, precipitation, complexation and redox reactions.

GUIDELINES

Course Expectation:

- There are no solving sessions however, some exercises and problems will be assigned during lectures.
- Students are expected to study daily, to solve problems to test how well they have grasped the material and consequently, to come prepared to class.

Attendance:

- Students are expected to attend 75% of the classes and participate in class discussion.
- Attendance will be taken at random intervals.
- Poor attendance may result in withdrawal from the class or failure in the course.

Missing Exams:

- Absence from quizzes and/or the final exam is not allowed unless under hindering circumstances (see below). No make-up quizzes will be given.
- In case of absence for reasons beyond control, a valid excuse (**AUB Infirmary or AUB MC**) should be submitted to the Prof. as soon as possible. In that case the grade distribution will become **40%** for the other exam and **60%** for the final.
- If two quizzes are missed, the student will be asked to withdraw from the course.

- In case of absence from the final examination with a valid reason, a student is entitled to a make-up final upon consent of the Instructor and the Arts and Sciences Dean's office.

Academic Integrity and Student's Responsibility:

- Cheating is a violation of the University's academic regulations and is subject to disciplinary action.
- Cheating on exams will result in a grade of *zero* for that exam.
- During lectures students are expected to be quiet and well behaved. Students deemed to be disruptive will be asked to leave.
- Frequent observed misconduct in the classroom subjects the student to disciplinary action.
- Students are held responsible for all announcements in class and on Moodle, whether they are present or absent for that day.

Have a Great Semester! 😊 Updated: January 28, 2014 (V1.2014)

NB: this course is prerequisite for civil and environmental engineering courses and required for mechanical engineering students.

- ✓ CIVE 649 Microbial Ecology and Molecular Biology for Engineers
- ✓ CIVE 651 Environmental Chemistry and Microbiology
- ✓ MECH 701: Principles of Combustion
- ✓ MECH 702: Pollutant Formation and Control in Combustion
- ✓ MECH 703: Combustion Modeling
- ✓ CHEM 203 Introductory Chemical Techniques
- ✓ CHEM 205: Introductory Chemistry Laboratory