



## ENV-110 Environmental Chemistry

### Course Syllabus-Spring 2022

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**Class Times:** 12:45 - 14:00 pm, Tuesday and Thursday **Prerequisite:** no

**Mid Term Exams:** In Class, March **Final Exam:** In Class, May

**Research Project:** To be done in pairs, with detailed assignment to follow, presentations in April.

**Texts:** Environmental Chemistry, 5th edition, by Colin Baird and Michael Cann, (W.H. Freeman and Co, New York, 2012)

### Course Description

#### ECh-100 Environmental Chemistry

In this course students will use the fundamental principles of chemistry to gain an understanding of the source, fate, and reactivity of compounds in natural and polluted environments. Emphasis will be placed on the environmental implications of energy utilization and on the chemistry of the atmosphere, hydrosphere, and lithosphere. Environmental issues that will be discussed include climate change, air pollution, stratospheric ozone depletion, pollution and treatment of water sources, and the utilization of insecticides and herbicides.

### Course Goals

The overall goal of this course is to gain an understanding of the fundamental chemical processes that are central to a range of important environmental problems and to utilize this knowledge in making critical evaluations of these problems. Specific goals include gaining:

- An understanding of the chemistry of the stratospheric ozone layer and of the important ozone depletion processes.
- An understanding of the chemistry of important tropospheric processes, including photochemical smog and acid precipitation.
- An understanding of the basic physics of the greenhouse effect, the sources and sinks of the family of greenhouse gases, and the implication for climate change.
- An understanding of the nature, reactivity, and environmental fates of toxic organic chemicals.
- An understanding of the chemistry of natural waters and of their pollution and purification.
- The ability to research an important environmental chemistry problem and prepare a formal presentation and white paper on that problem.

### Research Project

There will be one major research assignment during the course of the term. This assignment will be carried out with a partner and will culminate in a 20 minutes formal presentation to the class and a short written white paper to be distributed at the presentation. There will be several graded intermediate milestone deliverables during the term. *A detailed description of this assignment will be given out during the second week of the course.*

The presentation and paper will be expected to provide a clear, effective, and convincing presentation of your ideas in addition to an accurate and effective presentation of the relevant scientific concepts. This

assignment will be graded for all the usual aspects of presentation as well as for quality of research and effective communication.

During the early phases of this assignment, annotated bibliographies, complete outlines, brief proposals, and rough drafts will be turned in electronically for comment and discussion.

**All late deliverables will be subject to a grade penalty.**

## Class Participation and Homework Problems

**Class Participation.** Significant class time will be spent in discussion, active learning, in-class problem solving, occasional in-class quizzes, and student presentation. Students will be assigned grades based on their participation in these class activities as well as follow-up questions to be done after class. The greatest part of this grade by far will come from completing the active learning activities in class. *If you are missing from class, you cannot make up the participation grade.*

**Homeworks.** There will be several graded individual homework problem assignments given during the term. They may take the form of short answers, quantitative exercises, or general problem solving. Generally, these will be individual efforts, but ones that permit consultation with your partner. The detail and extent of grading will vary from week to week, depending on the time available. *In most cases, the homeworks will only be turned in electronically.*

**Back-up Copies.** You are responsible for maintaining back-up copies of all assignments, computer programs, etc. If an assignment should be lost or misplaced during the submission or grading process, it is your responsibility to provide a copy of that assignment upon request.

Always maintain current backup copies of all of your work. Computer crashes do not qualify as “emergencies” in this class.

## Midterm and Final Exams

The midterm examinations will each cover approximately 1/2 of the course material. The final exam will review the entire course as well as more intensively cover the last 1/2 of the course material. Because scientific knowledge is cumulative, the tests and examinations will always have a cumulative nature to them. The tests and exams will be mixtures of quantitative chemical problems, short answer questions and short essay questions. Very few multiple choice questions will be used; there will be no True/False questions. Most exam and test questions will be graded primarily for scientific content and your understanding of the concepts involved.

**Classroom Rules.** These basic rules, in addition to the requirements of the AUCA rules, apply to the instructor and all students at all times in the classroom. If you cannot observe them at any time, you are expected to leave the classroom:

- No use of computers for web surfing, e-mail, or any other activities not directly related to class.
- No headphones, blue tooth earphones, etc in the classroom.
- No cell-phone calls, rings, musical interludes, etc., during class.
- All views are to be heard and engaged respectfully. As scholars, we are expected to analyze subject matter critically and express reasonable positions that are based on logic and fact rather than on emotion.

**In no case are *ad hominem* arguments permitted in ECh-100.**

**Attendance: Class & Exams.** Any excuse for missing an exam *other than illness or family emergency* must be cleared with me at least one week ahead of time. If you cannot attend class on an exam day because of illness or emergency, you are expected **before class** to contact me by phone, leave a voice mail message, leave a message for me with the Interdisciplinary Arts and Science office, or leave



me an e-mail message. Failure to notify me in one of these ways may result in you not receiving consideration for a make-up examination.

Regular class attendance is expected, although roll calls will not be generally taken. If you are not present to participate in class activity, that will, of course, profoundly affect your grade on that collaborative assignment. *Collaborative problem solving is a goal of this course.* Missed in class work (for whatever reason) *cannot* be made up.

**Late Assignments.** Most course assignments have due dates, which provide a framework that assures mastery of certain concepts before moving on to other more complex ones. These dates also allow me to determine how well you achieve mastery of certain concepts in an allocated amount of time. They also provide assurance of equity and fairness to all class members. Assignments with due dates will not be accepted late, *unless otherwise noted in the assignment instructions or at the Catalyst Drop Box.* . If you are out of town on an assignment due date, it is your responsibility to arrange for internet access and submit the assignment electronically or to submit it before you leave. Some of the assignments allow late submission for a short period with a significant penalty.

### **Academic Honesty**

The highest standards of academic honesty will be expected in this class. Cheating and plagiarism in any of their forms are unacceptable. At the least, a grade of zero will be assigned to any work that is the product of cheating or plagiarism. Work that is assigned to you alone is to be accomplished by you alone. When formal collaboration on assignments is permitted that fact will be made explicit. Assume that all assignments are to be individual work unless I indicate otherwise.

**Collaboration:** Some assignments (homework's) are individual, while others may be formal collaborations with your partner. Discussion of problems with fellow students is ok, provided you do not provide detailed outlines of solutions or give specific answers to problems. *You may look to the other students for hints and suggestions about how to approach the problem, not for solutions to it.* You may always discuss any problem with me. You are expected to subscribe to the highest standards of honesty. Failure to do this constitutes plagiarism. Plagiarism includes copying assignments in part or in total, using solutions from other students, solution sets, other textbooks, etc. without crediting these sources by name. Plagiarism will not be tolerated in this class, any more than it would be in the "real world". Any student guilty of plagiarism will be subject to disciplinary action. In the "real world", you are responsible for the security of your intellectual properties. In our case, you are responsible for the security of your problem solutions (either on public hard disk, or on printed copies) and copies of your homework assignments.

Work turned in for this course may be subject to electronic checking for plagiarism.

### **Grades**

The final grade will be determined numerically by averaging your scores with the following weights:

**Midterm Exams 20%**

**Final Exam 30%**

**Homework, Presentation, Paper 30%**

**Active Participation, Class Attendance 20%**



Most grades given during the course of the term will be based on a 100-point scale. The **official decimal class grades** (0.0 - 4.0) will be determined from a weighted average of your individual grades. A weighted average of 96 will be assigned a decimal grade of 4.0, and a weighted average of 55 will be assigned a decimal grade of 0.7. Intermediate grades will be determined by a linear relationship between these two limits. This scale represents a *minimum* decimal grade.

If I judge it to be warranted, I will give higher grades than those indicated by this scale. Based on past experience, the class GPA will likely fall in the range 2.7-3.2 (a “B” average).

The following table represents the conversion of standard letter grades to the decimal grade scale and the conversion to the 100-point scale used in this class:

Percentage Score	Grade
95-100	A
89-94	A-
83-88	B+
77-82	B
71-76	B-
60-70	C+
54-59	C
48-53	C-
42-47	D+
36-41	D
30-35	D-
< 30	F

### Library Materials:

Many useful reference materials are to be found in the AUCA’s library on the AUCA’s campus. Library materials are recommended for reading as homework assignments (for calculations).

- 1) The metric system (mass, distance, volume); Significant digits and calculated results; Exponential numbers, etc. (*D. E. Goldberg, Fundamentals of Chemistry, 3d Edition, 2001*)
- 2) Atoms and Atomic Masses and Electronic Configuration of the Atom (*D. E. Goldberg, Fundamentals of Chemistry, 3d Edition, 2001*)
- 3) *Chemical Bonding, Nomenclature and Formula Calculations* (*D. E. Goldberg, Fundamentals of Chemistry, 3d Edition, 2001*)
- 4) *Solution, Acids and Bases*, (*Ch. G. Gebelein, Chemistry and Our World, 1997*)
- 5) *The Chemistry of Global Warming* (*A. T. Schwartz et al., Chemistry in context, 2d Edition, Applying Chemistry to Society, 1997*)

### Use of E-Mail

You will be required to use e-mail as part of this course. Since our personal contact hours are quite limited, this will be a major avenue for communication. In addition, I will use the class email list and web page as means of broadcasting information to the class. It is assumed that class members are reading their e-mail on a daily basis. You may, of course, read our e-mail anywhere of your choosing, but it is required that you will have an active account of the form [name@auca.kg](mailto:name@auca.kg). or at **list your own personal one** that you check or forward daily.



## TENTATIVE CLASS SCHEDULE (SUBJECT TO CHANGE)

Week DATE READING TOPICS

- (1) Course introduction; Baird, Intro to atmospheric chemistry and Environmental Chemistry.
- (2) History of the Atom
- (3) Three Phases of Matter
- (4) The Octet Rule
- (5) Chemical reaction
- (6) Chemical reaction types
- (7) Acid and Bases

### *March: Midterm Examination*

- (8) Baird, Organic chemistry and pesticides
- (9) Baird Chemistry of natural waters
- (10) Baird, Pollution and Purification of water
- (11) Baird, Heavy Metals; Waste and Soils

Research Project Presentations

### *May: Final Examination*

No	Themes, laboratory classes.	Reagents, equipment and the work description.
1	Fundamentals of Chemistry	Lecture (questions and answers)
2	Safety instructions	Instructing
3	Periodic Table of Elements DI Mendeleev	Lecture (performance targets for chemical elements)
4	pH, acids, salts, bases	Indicators, NaOH solution, HCl solution, NaCl, potentiometers
5	Preparation and determination of the concentration of the solution	Areometers, Spectrophotometer, KMnO <sub>4</sub> solutions
6	Qualitative reaction cations and anions	Portable laboratory
7	Solving problems (calculation of concentration: mol%, the chemical reaction.)	Tasks
8	<b>Monitoring, water sampling in the river Alamedin.</b>	<b>Visual assessment of the state of the river, assessment of ecosystem Alamedin river. (Portable</b>



		<b>Laboratory)</b>
9	Determination of chlorides, sulfates, nitrates, phosphates, etc. in water	<b>portable laboratory</b>
10	<b>Soil sampling to determine the human impact.</b>	<b>Drying, screening, preparation of soil extract (drying cabinet, screen, portable laboratory)</b>
11	<b>Analysis of soil extracts</b>	<b>portable laboratory</b>
12	<b>tasks</b>	<b>Physical and chemical processes in the atmosphere, hydrosphere and soils.</b>