

CHEM 899P – Special Topics: Environmental Chemistry for High School Teachers (online -- Summer 2013)

3 credit hours

Online Format

(June 3 – July 25, 2013)

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Required Textbook: *Chemistry of the Environment*, 3rd ed. (Spiro, Purvis-Roberts, & Stigliani)

ISBN 978-1-891389-70-2

Supplemental handouts and internet references will be provided by the instructor

Technical Requirements and Competencies. Course delivery will be made entirely through Blackboard. A broadband internet connection (DSL, cable, etc.) is recommended but the instructor will make every effort to keep the size of course documents down to accommodate those with dial-up internet connections. Course documents may be in Adobe PDF or Microsoft Office (Word, Excel, Powerpoint) formats. Links to downloadable free viewers will be provided. It is expected that you be able to download documents and open them in their appropriate programs. Exams will taken on Blackboard. Familiarity with standard online form functions – radio buttons, check boxes, fill-in blanks, etc. – is required.

Course Description: A study of the fate of chemicals in the air, water, and soil, and their impact on human health and the natural environment. Topics will include water pollution and water treatment, greenhouse gases and ozone-layer destruction, sources and management of hazardous wastes.

Course Learning Structure. Welcome to the world of environmental chemistry! Course content is divided between three modules:

Module 1 – Energy and its Impact on Environmental Chemistry
(Textbook chapters 7-10 plus supplemental internet references)

Module 2 – Chemistry of the Atmosphere
(Textbook chapters 3-6 plus supplemental internet references)

Module 3 – Water & Soil Chemistry
(Textbook chapters 13-15 plus supplemental internet references)

Within each module, the following types of assignments must be completed:

Readings – from the textbook, instructor-generated supplemental handouts, and internet resources. ***Recorded Powerpoint lectures will be provided via Blackboard Collaborate.***

Homework Problems – from end-of-chapter textbook problems

Discussion Board – You will be required to contribute at least one response to each instructor-initiated thread pertaining to questions or issues within each module. The instructor will initiate two threads per module. A qualifying response must demonstrate a thorough analysis of the issue or question at hand – in other words, something more thought out than “yes” or “no”. The instructor’s role in discussion activities will primarily be that of a moderator, as threads will typically address open-ended issues and questions. Specific questions about the understanding of course material should be e-mailed directly to the instructor.

Your grade will be based on the number of accumulated points as a percentage of the total possible number of points according to the distribution given below:

GRADING DISTRIBUTION

Exams (3)	45% (15% each)
Graded Homework (3)	21% (6% each)
Original Lesson Plan	25%
Discussion Board Responses (6)	9% (1.5% each)

Exams. Three examinations of 90- to 120-minute lengths will be delivered via Blackboard. These may consist of a variety of question formats (multiple choice, multiple answer, matching, short answer, essay, problem solving). Each exam will cover one module. There will be no cumulative “final” exam.

Homework. End-of-chapter homework problems are given in the following course outline and objectives. These must be turned in by specified deadlines.

Original Lesson Plan Assignment (deadline: Thursday, July 25, 5:00 p.m. CT). At the graduate level, one must develop the ability to create original instructional material from existing knowledge. As a term project, you are required to write an original 3-5 day lesson plan that introduces and/or reinforces one or more concepts from this course **as well as addresses an environmental concern of local or regional interest.** Your writeup should include a lesson plan summary in the format that you would turn in to your principal or department head, detailed outlines (with full explanations of any example problems) of any lectures, full descriptions and “teacher notes” for any demonstrations, and complete handouts for any lab experiments or field studies (include a background section, procedural instructions for students, additional notes for teachers, and information on chemical hazards, safety, and storage considerations), homework assignments, and quizzes. **A one-page topic proposal and plan outline must be turned in by July 11.** Within a week, the instructor will evaluate the outline and return it with suggestions for the full assignment. A grading rubric/scale will be provided separately on Blackboard.

Discussion Board Responses. See above for a description.

Grading Scale. The following weighted percentage point scale will be the initial starting point: A (93-100), A- (90-92.9), B+ (87-89.9), B (83-86.9), B- (80-82.9), C+ (77-79.9), C (73-76.9), C- (70-72.9), D+ (67-69.9), D (63-66.9), D- (60-62.9), F (below 60). ***This scale may be moved downward at the instructor’s discretion.*** After the 2nd and 3rd exams, grading scale adjustments and individual course grade estimates will be posted on Blackboard.

DEADLINES. A table of deadlines for all assignments and exams is given on the last page of this syllabus. ***To keep the class flowing smoothly, these deadlines will be strictly adhered to.*** The following penalties will be applied to late work:

Up to 24 hours late	25% of possible points (or zero score for discussion board response)
Between 24-48 hours late	50% of possible points (or zero score for discussion board response)
Over 48 hours late	Zero score

(NOTE: These late times apply to business days only. Business days are defined as Monday-Friday except the following – May 27 (Memorial Day) and July 4 (Independence Day)

CHEM 899P Course Material, Assignments, and Objectives

Topic Area and Textbook Coverage	Broad Objectives	Assigned End-of-Chapter Homework Problems
MODULE 1 – ENERGY		
Chapter 7 (Energy Flows) <i>entire chapter</i>	<ul style="list-style-type: none"> • Understand natural energy flow cycles • Review necessary General Chemistry concepts and skills – significant figures, metric units, plot reading, exponential decay 	<ul style="list-style-type: none"> • 1
Chapter 8 (Fossil Fuels) <i>Sections 8.1-8.4a, 8.5-8.6b, 8.8ab, and Chapter 4, sections 4.7-4.7b</i>	<ul style="list-style-type: none"> • Understand combustion reactions and bond energy calculations that may be used to estimate energies released • Understand the roles of various fossil fuels in energy production and environmental hazards 	<ul style="list-style-type: none"> • 4, 5
Chapter 9 (Nuclear Energy) <i>Sections 9.1-9.7, 9.9-9.10a</i>	<ul style="list-style-type: none"> • Understand isotopes, nuclear decay products, and nuclear reactions pertaining to fission • Understand nuclear fusion reactions and how fusion reactors work 	<ul style="list-style-type: none"> • 1, 3, 4
Chapter 10 (Renewable Energy) <i>Sections 10.1-10.4, 10.6-10.6b</i>	<ul style="list-style-type: none"> • Be aware of the variety of renewable energy sources in development • Describe how photovoltaic energy is generated from a metallic bonding standpoint • Understand the chemistry of biomass energy production 	<ul style="list-style-type: none"> • 2, 7
MODULE 2 -- ATMOSPHERE		
Chapter 3 (Air Pollution) <i>Sections 3.1-3.7a</i>	<ul style="list-style-type: none"> • Understand the nature of atmospheric reactions leading to pollution • Understand measures taken to control emissions 	<ul style="list-style-type: none"> • 6, 12
Chapter 4 (Oxygen Chemistry) <i>Sections 4.1-4.6b, 4.7c</i>	<ul style="list-style-type: none"> • Understand fundamental kinetic and thermodynamic properties of atmospheric reactions • Understand common atmospheric reaction mechanisms 	<ul style="list-style-type: none"> • 3, 8 in #8, use $2 \text{NO} + \text{O}_2 = 2 \text{NO}_2$
Chapter 5 (Stratospheric Ozone) <i>All sections <u>except</u> 5.4a</i>	<ul style="list-style-type: none"> • Understand the different atmospheric regions and their gaseous contents • Understand common reactions ozone undergoes in the atmosphere • Understand ozone destruction mechanisms 	<ul style="list-style-type: none"> • 1abc, 10
Chapter 6 (Climate Change) <i>Sections 6.1-6.6, 6.9-6.10(stop at beginning of 6.10a)</i>	<ul style="list-style-type: none"> • Understand the Earth's heat balance cycle and the roles of radiation absorption, emission, and albedo • Understand the roles of aerosol particles and the sulfur cycle in climate • Understand the properties and chemistry of greenhouse gases 	<ul style="list-style-type: none"> • 8, 10, 13

MODULE 3 – WATER & SOIL		
<p>Chapter 13 (Water as Solvent)</p> <p><i>Sections 13.1-13.1a, 13.2-13.4</i></p>	<ul style="list-style-type: none"> • Understand liquid water structures and behavior at a molecular level • Understand fundamental acid-base chemistry pertinent to the environment 	<ul style="list-style-type: none"> • 4, 5, 8
<p>Chapter 14 (Water & the Lithosphere)</p> <p><i>Sections 14.1-14.2b, 14.3-14.5a, 14.5c-end of chapter</i></p>	<ul style="list-style-type: none"> • Understand pertinent solubility equilibria in the environment • Understand the structure and chemical behavior of clays • Understand the chemistry and effects of acid rain 	<ul style="list-style-type: none"> • 2, 5, 6
<p>Chapter 15 (Oxygen and Life)</p> <p><i>Sections 15.1-15.2, 15.4-15.6, 15.10-15.10e</i></p>	<ul style="list-style-type: none"> • Understand fundamental redox reactions and energy associated with oxygen in the environment • Understand biological oxygen demand (BOD) • Understand the effects of water composition on ecology 	<ul style="list-style-type: none"> • 5, 7, 9

CHEM 899P (Summer 2013) Deadline Summary

Date	Event
Tuesday, June 11	First Module 1 discussion board (DB) forum response due
Monday, June 17	Second Module 1 DB forum response due
<i>June 15-23</i>	<i>Exam #1 access window</i>
Thursday, June 27	First Module 2 DB forum response due
Monday, July 1	Second Module 2 DB forum response due
<i>July 3-10</i>	<i>Exam #2 access window</i>
Thursday, July 11	Original Lesson Plan proposal & outline due
Monday, July 15	First Module 3 DB forum response due
Thursday, July 18	Second Module 3 DB forum response due
<i>July 17-24</i>	<i>Exam #3 access window</i>
Thursday, July 25	Original Lesson Plan project due

Exam time windows begin at 8:00 a.m. CT on the first day and end at 11:00 p.m. CT on the last day. Other deadlines are at 5:00 p.m. CT unless otherwise noted.

NOTE: For each module, homework problem deadlines are when you access that exam. Allow 48 hours (counting business days only) for feedback.