CHEM 304
SPRING 2012
COURSE OUTLINE

Schedule: 1:00 – 1:50 MWF, Phillips 104.

Instructor: Dr. Jim Phillips, P451, 36-5399, phillija@uwec.edu.
Office hours: **12-2 T & Th**: or drop in (**?**), or **make appointment via e-mail**.

Text: Baird, C. *Environmental Chemistry*, 4nd Ed., Freeman, 2009. (rental)
(There will be additional readings as well, i.e. handouts, web links, etc.)

Web Sites: http://www.chem.uwec.edu/Chem304_S12 (HW keys, links, handouts etc.)

http://bcs.whfreeman.com/envchem4/ (the textbook site…)

Additional Stuff: I will have a small collection of secondary texts & reference materials, and a binder with hard copies of HW keys (and Quiz/exam answer keys) in **P426.**

Goals for 304:
- CHEM 304 addresses UWEC Learning Goals: **1** (*understanding of human cultures and natural world*), **2** (*critical and creative thinking*), **3** (*communication skills*), and **4** (*individual and social responsibility*).
- Illustrate the role that chemistry plays in understanding natural processes and human impacts on them. *Chemistry is nature – nature is chemistry!*
- *Synergy*: Introduce "chemistry" students to "environmental science" – and sharpen the "chemical mojo" of the environmental science students.
- Make connections between your "academic" knowledge and current issues in the "real world" – e.g. explore the science/society/policy interface.

Integration:
- We will have a few visitors from other departments who will give guest lectures, thereby providing some additional perspective on the issues we deal with.

Grades: Based on a percentage of points earned on the assignments listed below (possibly curved to a small extent).

2 Exams	(2 x 80 points)	= 160 points
5 Quizzes	(5 x 20 points)	= 100 points
Carbon footprint/inventory		= 20 points
Short writing assignments	(~3 x 10 points)	= ~30 points
Final Project		= 80 points
Tentative Total		**~ 390 points**

Attendance will be taken daily, and I will subtract one point from your grade for each unexcused absence.

Quizzes: 20 minutes of class time, tentatively scheduled for weeks: 3, 5, 7, 11, 13/14

Hour Exams: will be given during class time, tentatively: **F 3/16** and **W 5/9**

Homework: Assigned about once per 1.5 weeks (there are 10). Not designed collected or graded, but you must do them promptly, and get help if necessary. Questions are often thorough, and you will do most of your learning by grinding through these. Answer keys (often annotated) will be posted on the web page and in the binder (in P426).

Other assignments: You will do a personal carbon footprint inventory, and write a few short reflection papers on guest lectures and/or other connecting activities (a FORUM lecture) that may arise.

Final Projects: You will be doing a final project, which count equal to one exam in your overall grade. This assignment is still being designed and is subject to input from YOU. In the past, I have focused final projects on "energy", and have also left the topics wide open. My thought for this semester is "communicating science", which would involve a written piece and/or a video or a recording. In a week or so we will devote some class time to talking about what YOU would like to do for this. This will be due at the beginning of finals week.

Topical Outline/ Approximate Timeline:

0. Chemical Stability & its Role in Environmental Chemistry

I. Chemistry of the Earth's Atmosphere

A. Fundamentals (Chapter 1: 3 lectures, weeks 1 & 2)
- Physical structure of the atmosphere
- Chemical composition: Major components, Traces species, Free radicals

B. Stratospheric Chemistry I: Oxygen Chemistry & The Ozone Layer (Chapter 1: 4 lectures, weeks 2 & 3)
- Essential Concepts and observations
- The Chapman cycle: "Oxygen only chemistry"
- Fundamentals of Photochemistry & Chemical Kinetics

C. Stratospheric Chemistry II: Catalytic Ozone Depletion (Chapters 1 & 2: 6 lectures, weeks 4 - 6)
- Catalyst "Families": Sources, Sinks, & Reservoirs
- Some chemical case studies
- Observations and assessments
- Polar ozone depletion: The ozone hole
- Control Policy: The *Montreal Protocol*

D. Tropospheric Chemistry: Air Pollution and Acid Rain (Chapters 3 & 5 & Appendix:4 lectures, weeks 6 - 7)
- Essential features of Tropospheric Chemistry
- Urban Air pollution aka "Smog"
- Acid precipitation
- Control Policy: The *Clean Air Act*

——————————— Exam 1 cut off ———————————————————

D. Global Climate Change (Chapter 6 & 7, IPCC AR4 Report (2007): 6 lectures, weeks 8 - 10)
- The Earth's Radiation Balance
- Absorption of Infrared Radiation & "Greenhouse Gases"
- Combustion chemistry and the global carbon cycle
- Other Factors: Solar, Albedo (land use and aerosols)
- Temperature histories
- Final Assessment: A discussion of the **2007 IPCC WGI AR4 Report**.

> We will have some guest lectures in or around this point.

II. Chemistry of the Earth's Hydrosphere (i.e. water) (Chapter 13: ~5 lectures, weeks 12-14)

- Overview: water cycle, ground vs. surface water, etc.
- Solubility of gases and minerals
- Oxidation/Reduction Processes (pE)
- Acid Base Chemistry (pH)
- Rationalizing Chemical composition of aquatic various environments, e.g. lakes
- Pollution and Impacts: 3 Short Case Studies
- Effects of low pH (acid rain) on aquatic ecosystems
- Carbonate equilibria: buffering capacity, distribution of species

III. Toxic Compounds ("Highlights" of Chapters 10-12, & 15: ~ 3 lectures: week 14 & 15)
-Toxicity
- Organics: pesticides, PCB's.
- persistence and bioaccumulation
- Metals: Hg, Pb, As, Cd
- discussion of targeted reading – excerpt from Silent Spring ???