Department of Chemistry and Geoscience

CHEM 253 Introduction to Environmental Chemistry

Course Outline - Fall 2002

A. General Information

Instructor: Neil Meanwell **Office**: F348B **Telephone**: 370-3448

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Office Hours: Monday, Wednesday and Friday, 11:30 am to 12:30 pm. Wednesday and Thursday, 12:30 to 1:30 pm.

Scheduled Lectures: Monday (F 300): 9:30 - 10:20 am, Wednesday (F 302): 1:30 - 2:20 pm and Friday (F302): 9:30 -10:20 am.

Scheduled Labs: Thursday: 2:30 - 5:20 pm (F 356)

B. Course Textbook

Environmental Chemistry, 7th Edition, (Lewis), Stanley E. Manahan (new and used copies are available in the Bookstore)

C. Lecture Material

1. Introduction (Chapters 1 and 2)

Environmental science, biosphere, hydrosphere, geosphere, lithosphere, atmosphere, energy and energy cycles, matter and matter cycles, humans and pollution, anthrosphere, technology and the anthrosphere, effects of the anthrosphere on Earth, anthrosphere and industrial ecology.

2. Properties of Water and the Composition of Natural Waters (Chapters 3 and 4)

Properties of water, chemical models of natural water systems, hydrologic cycle, solubilities of inorganic compounds, metal ions in water, solubility of gases in water, oxygen in water, alkalinity, carbon dioxide and carbonate species, acidity, calcium and other metals in water, metal complexes, other chemical species in water, redox reactions in water, electron activity and pE, pE values in natural waters, corrosion.

3. Pollution of Natural Waters (Chapter 7)

Water quality, Canadian drinking water standards, classes of water pollutants, pollutant trace elements, algal nutrients and eutrophication, inorganic pollutants such as nitrites, cyanide, and ammoniacal nitrogen, detergents, soaps and detergent builders, sewage, organic pollutants (biological oxygen demand, chemical oxygen demand and total organic carbon).

4. The Atmosphere and Atmospheric Chemistry (Chapter 9)

Description and importance of the atmosphere, physical characteristics, energy and mass transfer, basic chemical reactions in the atmosphere.

5. Particles in the Atmosphere (Chapter 10)

Physical behaviour of particles in the atmosphere, physical and chemical processes of particle formation, types of particles and their effects, Air Quality Index, PM index.

6. Gaseous Organic and Inorganic Pollution (Chapters 11, 12, 13 and 14)

Hydrocarbons, aldehydes and ketones, organohalides, organosulphides, organonitrogen compounds, carbon monoxide, sulphur dioxide, nitrogen oxides, fluorine, chlorine and their gaseous compounds, acid rain, ozone layer destruction, greenhouse effect, photochemical smog. Production and control of pollutant hydrocarbons from automobiles, reactions of organic compounds in the atmosphere, mechanisms of photochemical smog formation, effects of photochemical smog, sulphates and nitrates in photochemical smog.

7. Hazardous Waste (Chapter 19)

Definition, ignitability, corrosivity, reactivity, toxicity. Hazardous compounds and their classification, chemical classification of hazardous wastes. Pesticides, industrial hazardous waste, and municipal solid waste. Hazardous waste and the environment. Leachate and leachate tests on contaminated sites. Elimination of wastes, products of incomplete combustion (PICs).

8. Environmental Biochemistry and Chemical Toxicology (Chapters 22 and 23)

Pollution and the biosphere, toxic substances, toxicity equivalence factors (TEFs), metabolism of toxic substances, disturbance of enzyme action, effects of arsenic, lead, mercury, cyanide, nitrite, carbon monoxide, ozone, PAN, and pesticides. Mutagenesis, teratogenesis, and carcinogenesis.

9. Natural Resources and Energy (Chapter 18)

Natural resources-energy-environment triangle, metal and non-metal mineral sources, wood, energy problem, world energy resources, energy conversion processes, petroleum and natural gas, coal, nuclear fusion and fission power, alternative sources of energy including geothermal and solar. Energy from biomass. Where appropriate specific examples will relate to industrial activity in Western Canada, such as aluminum production, gas plants, sour gas, and kraft mills.

D. Assignments

Assignment questions will be distributed periodically to keep pace with the course material. The questions will be chosen from the questions given at the end of each chapter of the textbook.

Some additional questions will also be given. The assignments will not be taken in for marking. Solutions will be posted periodically outside my office.

E. Exams

You will be required to take the following exams:

Review Exam - Week 5 - 120 minutes duration. Written exam which covers topics in Chem 120 and Chem 121 which are essential for Chem 253. Scheduled for the lab period of Week 5.

Midterm Exam - Week 9 - 120 minutes duration. Written exam on the lecture material presented from Week 1 to Week 9 of the course. Scheduled for the lab period of Week 10.

Final Exam 180 minutes duration. Written exam on **all** the lecture material presented in the course. Scheduled for the week immediately following the end of the semester.

Note: If you have to miss an exam through illness you must inform me as soon as possible to allow me to make alternative arrangements.

F. Laboratory Work

You will be required to perform a laboratory experiment each week of the semester except the first and last weeks and the weeks when exams are scheduled.

G. Course Mark

Review test	15%
Midterm exam	20%
Final exam	35%
Laboratory work	30%

The Letter Grade

The following scale is used:

>95 A+	80-84 B+	65-69 C+	50-59 D	0-49 F
90-94 A	75-79 B	60-64 C		
85-89 A-	70-74 B-			