

## CHEM\*3360/ TOX\*3360 Environmental Chemistry and Toxicology Winter 2009

**Instructor:** Dr. Nick Westwood, MacN 124, x53807, [westwood@uoguelph.ca](mailto:westwood@uoguelph.ca)

**Lectures:** Monday/Wednesday/Friday 9:30 - 10:20 am (MacKinnon 121)

**Course Description:** The chemistry of the natural environment; the influence of pollutants upon the environment, including methods of introduction of pollutants to and removal of pollutants from the environment. Credit weighting = 0.50.

**Prerequisite(s):** CHEM\*1050

**Restriction(s):** Students with standing in CHEM\*1310 should not take this course.

**Required Text:** Environmental Chemistry, 2nd Ed., 1994 by Nigel J. Bunce, available at the UofG Bookstore. You may optionally purchase the Answer Guide to the problems. Copies of both books are on reserve at the library.

**Lecture Notes:** I will use overheads in class. Copies will be made available on-line.

### **Evaluation:**

Test 1 (in-class, 50 min) 20%

Test 2 (in-class, 50 min) 20%

One take-home assignment 20%

Test 3 (final exam, 120 min) 40%

**Note:** A grade of zero will be assigned for any missed Test except for valid medical or compassionate reasons (documentation must be provided in person). In the case of a missed in-class Test, if a valid excuse is received, the grade on the missed in-class Test will be estimated from the student's performance on those questions on the final Test which are related to material covered by the missed Test. There will be no make-up Tests. Standard university policy hold for a missed Test 3 (final exam.).

**Assignment:** The assignment will be further explained with a handout at the appropriate time. A late assignment will be accepted but there will be time-dependent penalties.

**Problems:** Numerical problems will be assigned week by week. Most will be from the textbook. If material is added to the course, relevant problems will be provided. It is highly recommended that you do the assigned problems at the appropriate time as part of your understanding of the course material and as a study strategy for the tests. Working the problems in small groups is encouraged.

**COURSE OUTLINE** (approximate book sections in parentheses)

- Week 1** (Jan 5-9) Introduction: review of thermodynamic and kinetic concepts, etc.; the atmosphere; environmental cycles and residence times (1.1-1.2)
- Week 2** (Jan 12-16) Solar energy/ photochemistry. Temperature profile of the atmosphere. Greenhouse gases and climate change; Kyoto (1.3-1.5)
- Week 3** (Jan 19-23) Ozone balance in the stratosphere, chlorofluorocarbons (2.1-2.3)  
Montreal protocol; CFCs/replacement compounds (2.4-2.8)
- Week 4** (Jan 26-30) Pollution in the troposphere; formation/reactions of the hydroxyl radical; NO<sub>x</sub> cycle; photochemical smog (3.1-3.5)
- Week 5** (Feb 2) **TEST 1**  
(Feb 4-6) Secondary pollutants; air toxics; particulate matter in the lower atmosphere (3.6-3.9)  
Indoor air quality: occupational hygiene (4.1). Indoor air quality; radioisotopes in the environment (4.2)
- Week 6** (Feb 9-13) Dissolved gases in natural water; Henry's law (5.1)  
Dissolved solids in natural water: alkalinity and hardness; water softening, water use in irrigation (5.2)
- FEB. 16-20** **READING WEEK**
- Week 7** (Feb 23-27) Acid rain: nitrogen and sulfur oxides in the atmosphere (6.1-6.5)  
Acid rain: biological effects and abatement methods (6.6-6.8)
- Week 8** (Mar 2) **TEST 2**  
(Mar 4-6) Drinking water: chlorination (7.1-7.3)  
Alternatives to chlorination; Sewage treatment (7.4-7.8, 8.1)
- Week 9** (Mar 9-13) Treatment of other wastes; chlorine and its compounds (8.2-8.6, 9.1-9.4)
- Week 10** (Mar 16-20) PCBs and dioxins: chemistry and sources, toxicity (9.5-9.7)  
PCBs and dioxins: toxicology, toxic equivalency factors, Phase I/ Phase II metabolism (9.5-9.7)
- Week 11** (Mar 23-27) Endocrine disrupting compounds; pollution in the pulp and paper industry  
Metals in the environment; mercury and lead (10.1-10.3)
- Week 12** (M30-Ap3) Arsenic in the environment; acid mine drainage (10.4-10.5)  
Catch-up and Review

**April 9 TEST 3 (Final Exam): 120 min., whole course, emphasis on later material.**

**Disclaimer:** The precise sequence, timing and content of the above outline is at the discretion of the Prof. The above is the best zeroth-order approximation.