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CHMY 491.03: Environmental Chemistry

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CHMY 491/541 – Introduction to Environmental Chemistry Syllabus Spring Semester 2022

Instructor: Dr. Lu Hu, Chem Bldg 304, Lu.hu@mso.umt.edu

Office hours: by appointment.

Text books: *No text is required for this course.* We will take material from:
Principles of Environmental Chemistry, James E. Girard, Jones and Bartlett, 2005;
Fundamentals of Environmental Chemistry, 3rd Ed., Stanley E. Manahan, CRC Press, 2009;
Environmental Chemistry, 8th Ed., Stanley E. Manahan, CRC press, 2005;
Environmental Chemistry, 5th Ed., Colin Baird and Michael Cann, 2012.
Introduction to Atmospheric Chemistry, Daniel J. Jacob, 2002.

We will also use information from published papers, and will give you the citations and post the manuscripts to Moodle when we do.

Learning Outcomes: Environmental Chemistry is a vast and broad topic that includes the chemistries of land, water and air, and the interaction of chemicals with plants and animals (including humans) in the environment. A one semester course cannot cover all of the topics in any real detail. Instead, this course will give an overview of important chemistries of the earth, water and air. The course will present natural chemical processes in the environment and use specific examples of anthropogenic impacts on the chemistry of the environment. The purpose of this course is to 1) establish an understanding and appreciation of environmental chemical processes and their complexities, 2) develop a working knowledge of the chemistry involved in specific environmental challenges, 3) develop a familiarity with commonly used measurement techniques and information available for the study of environmental chemistry, and 4) provide a familiarity with current research in environmental chemistry. Having completed this course, the student should be able to read the literature describing studies of environmental chemistry and should be better prepared for more in-depth studies of specific environmental chemistries (e.g. atmospheric or aquatic chemistry).

Topics included: Chemical principles and reactions in natural systems: Fate of chemical contaminants in the environment; partitioning of contaminants between phases (air/water/soil); chemistry of atmospheric pollutants; computer modeling of equilibrium and kinetic processes; degradation and transformation of organic contaminants.

Background: Min prerequisites in chemistry (i.e., CHMY104, 14x, or 12x). It is assumed that students have an undergraduate level knowledge of general chemistry such as chemical names, structures and notations, chemical reactions and stoichiometry, and

chemical reactivity. Students should have a working knowledge of equilibrium chemistry, and acids and bases.

Course Organization: Approximately the first three fourths of the semester will be taught in the traditional lecture format. During this period, the fundamentals of various areas of environmental chemistry will be covered, along with examples of the chemistry of specific environmental issues. During this period there will be a written exam. The final few weeks of the semester will be used for invited lectures from local researchers conducting research in environmental chemistry. Students will write a ~ ten-page paper on a topic of current interest in environmental chemistry. This could take the form of a critical review of a current paper from the literature considering related published works. Or, it could take the form of a literature review of a topic of interest (recommended for graduate students in this class). There will be a comprehensive final exam covering the fundamentals and specifics of the research presentations.

Grading: Grades will be on the +/- scale (A,A-,B+, etc) with the following breakdown:

Midterm Exam	20%
Homework Questions and Problems	15%
Preparation and Participation in Discussions	15%
Final Exam	20%
Research Paper	30%

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Academic misconduct is subject to an academic penalty by the course instructor and/or disciplinary sanction by the University. Academic misconduct is defined as all forms of academic dishonesty. All of the academic policies found in the Student Conduct Code (http://life.umt.edu/vpsa/student_conduct.php) apply to this course.

Of particular relevance to this course, it is considered academic misconduct to represent another person's words, ideas, data, or materials as one's own. It is also considered academic misconduct to copy from another student's paper, consult unauthorized material, give information to another student or collaborate with one or more students during an examination or academic exercise without the instructor's permission.

Students with Disabilities

If you are a student with a disability and wish to discuss reasonable modifications for this course, contact me privately to discuss the specific modifications you wish to request. Please be advised I may request that you provide a letter from Disability Services for Students verifying your right to reasonable modifications. If you have not yet contacted Disability Services, located in Lommasson Center 154, please do so in order to verify your disability and to coordinate your reasonable modifications. For more information, visit the Disability Services website at <http://www.umt.edu/disability>.

Important Dates Important dates and deadlines regarding registration for the fall semester can be found at

<http://www.umt.edu/registrar/calendar.php>

Lecture Schedule (Tentative; subject to change):

Week 1: Introduction and overview, Relevant chemical concepts, Cycles

Part I: The Lithosphere

Week 2-3: Chemical composition of earth and soils

Weeks 3-4: Agriculture and mineral resource development

Part II: The Atmosphere

Week 5: Layers of the atmosphere and their chemical composition

Week 6: Photochemical smog and particulate matter

Week 7: Greenhouse gasses and climate change

Week 8: Ozone depletion and the ozone holes

Midterm Exam, TBD

Part III: The Hydrosphere

Week 9-10: Chemistry of Natural Waters: pH and Redox Chemistry

Week 11-12: Water pollution: Nutrients, Acid rain, Acid mine Drainage.

Week 13: Water Treatment and management of water resources

Part IV: Special Topics TBA

3-5 Invited seminars on various environmental topics

Final Exam: TBD

Term paper deadlines

February 15: outline discussed and approved

March 15: first draft

April. 1: review due

April 25: paper due