

CHEMICAL PRINCIPLES OF ENVIRONMENTAL SCIENCE 11:375:202

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Text: Environmental Chemistry, 5th Edition (Baird, 2012), available at the Rutgers Bookstore

Pre-Requisite: General Chemistry 01:160:160 or 01:160:162

I. TOPICS

Earth's oxidizing atmosphere

Physical structure and chemical composition of the atmosphere

The greenhouse effect and gas concentration units

Reactions of oxygen in the stratosphere and chemical kinetics

Anthropogenic ozone depletion

Tropospheric chemistry

Photochemical smog

Sulfur oxidation in the atmosphere

Atmospheric particulates

Dissolved constituents in natural waters

Carbonate chemistry and the pH of natural waters

Acidification and recovery: acid mine drainage and acidified lakes

Suspended particles in natural waters

Redox potential of natural waters

Sources, speciation, and cycling of trace elements in the environment

Organic contaminants in the environment

II. COURSE GOALS

A. Develop your environmental chemistry vision and intuition (meets Program Goal 1. apply knowledge of mathematics, science, engineering to environmental problems)

1. help you see the world in terms of its *chemical constituents*
2. teach you to think across spatial scales (micro, macro, global)
3. help you understand chemical reactions and reaction mechanisms associated with natural and anthropogenic processes in the environment

B. Increase your science literacy through the development of the four skills of a scientist (meets Program Goals 1. apply knowledge of mathematics, science, engineering to environmental problems, 5 communicate technical information, and 7 address contemporary issues)

1. critical thinking: develop rigorous and constructive *skepticism* – most important trait of a scientist; most important trait to be learned by non-scientists
2. ability to formulate questions that lead to *important* and *testable* hypotheses
3. ability to quantify natural phenomena
4. broad vocabulary in the language of science

C. Prepare you for a wide range of career options (meets Program Goals 4. develop ability to function on multidisciplinary teams)

III. INSTRUCTIONAL ACTIVITIES TO ACHIEVE GOALS

Goals A and B

- applications of the chemical kinetics and thermodynamics of gas and aqueous phase reactions to past and current environmental problems are presented in course lectures and readings;
- students apply these concepts by completing individual problem sets outside of class and during in-class cooperative group exercises.

Goal C

- groups of 4 to 6 students work cooperatively to solve environmental chemistry problems during in-class group exercises;
- students are provided guidance on how to work effectively in groups prior to and during group exercises.

IV. ASSESSMENT ACTIVITIES

Goals A and B

- individual performance on take home problem sets (30% of assessment)
- performance on group exercises (30% of assessment)
- individual performance on three exams (40% of assessment)

Goal C

- evaluation of solutions to group exercises (100% of assessment)