

Course Title: Chemistry of Environment

Course Code: CH-332

Credit Hours: 3-0

Pre-requisite: Nil

Course Objectives

1. The health issues are becoming environment-related with the progress in technological advancement. Ozone depletion, the "green house effect," heavy metal poisoning and acid rain are only a few issues that have come to the public attention.
2. It has become increasingly important for the science students not only to be aware of environmental and health issues, but also to be well trained about causes and remedies of these problems. CH-230, Environmental Chemistry will provide a broader overview of important environmental issues. It will also give students the most reliable and recent scientific information available, so that they may draw independent conclusions about these issues and can apply the chemistry principles in environment related subjects.

Contents

3. Introduction to Atmosphere. The air around us, atmospheric temperature and pressure profile. Composition, Structure and Transport in the Atmosphere. a. Air Composition and its Units. b. Pressure Structure (Barometric Law for gases at equilibrium), Scale Height for actual atmosphere
4. Stratospheric Chemistry. The Ozone Layer; the ozone hole, ozone protection, biological consequences of ozone depletion. (Chapman Cycle , Ozone-Destroying Catalytic Cycles , Sources of Radicals, Propagation, Common cycles , Less common cycles compete , Rate-limiting step, Termination, Coupling radical families). The story of CFCs and their replacements, ODP, Effectiveness of Initiation and Termination: Cl versus other halogens, Thermodynamics and kinetics of HX formation. Photolysis of HOX and XONO₂, Night & Day/Summer & Winter, Observations of the Ozone Hole, [O₃] vs time and altitude, the polar vortex and competing hypotheses, Polar Stratospheric Cloud (PSC) formation.
5. The Chemistry of Ground-level Air Pollution. Temperature inversion and photochemical smog, particulate matter in the atmosphere, Industrial pollutants, radioactivity, atmospheric aerosols, Acid rain; major sources, mechanism, control measures and effects on buildings and vegetation, Global warming; major green house gases, mechanism, control measures and global impact.
6. Water Pollution. The Chemistry of Natural Waters. Water Pollutants. Sources of water pollution industrial sources and agricultural sources, heavy metals contamination of water, Eutrophication, detergents and phosphates in water, water quality criteria, Water purification; primary, secondary and advanced treatment. Removal of Phosphorus and nitrogen compounds from water. Organic matter in water and its decomposition.
7. Soil Pollution. Soil and mineral resources, general principles of metal extraction, Heavy metals contamination of soil, toxicity of heavy metals, bio-accumulation of heavy metals, Organic matter in soil, Macro and micro-nutrients in soil, ion-exchange in soil, soil pH and nutrients availability.
8. Green Revolution. Toxic Heavy Metals, Pest control, pesticides, toxicity of pesticides, integrated pests management. Energy Production and Environment. liquid and gaseous fuel, hydrogen economy. Renewable Energy. nuclear energy, solar energy, geothermal and tidal energy.
9. Textbooks
 - a. [Jac]. D. J. Jacob, "Introduction to Environmental Chemistry , Princeton University Press, 1999.

- b. [Man] S. E. Manahan, "ENVIRONMENTAL SCIENCE, TECHNOLOGY, AND CHEMISTRY" *Environmental Chemistry*, Taylor & Francis Inc. CRC Press LLC, 2009.
- c. Recommended Books:
- d. Collin Baird, Environmental Chemistry, W. H. Freeman and company, New York, 1995.
- e. Peter O. Neill, Environmental Chemistry, Chapman and Hall, London, 1993.
- f. Derek M. Elsom, Atmospheric Pollution, Blackwell Publishers, Oxford, 1992.

10. Course Outcomes

- a. On successful completion of the course the student will be able to:
- b. Demonstrate knowledge of chemical principles of various fundamental environmental phenomena and processes in air land and water.
- c. Apply the basic concepts of Chemistry (e.g chemical thermodynamics, kinetics, and photochemistry) to analyze chemical processes involved in different environmental issues.
- d. Critically discuss local and global environmental issues based on scientific principles.