

Jimma University
College of Natural Sciences
Department of Chemistry



Continuing and Distance Education Programme
Module for
Environmental Chemistry & Toxicology (Chem 455)

Prepared by: Menberu Yitbarek (MSc)

Higemengist Astatkie (MSc)

Edited by: Yinebeb Tariku (MSc)

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Jimma, Ethiopia

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Prepared by: Menberu Yitbarek (MSc) and Higemengist Astatkie (MSc)

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1 Title page

8 pages: including Copy right, Module overview, Table of contents and self study time

264 Module main body pages: including Chapter summaries and Self test exercises

Editor: Yinebeb Tariku (MSc)

Jimma University

P.O.Box 378

Jimma, Ethiopia

Tel: office: +251471111252/+251471120286

Writers' E-Mail: 1. menbekly@yahoo.com
2. hige_merawi@yahoo.com

Editor's E-Mail: yinebeb_tariku@yahoo.com

General Overview of the module

This module starts with Introduction to Environmental Chemistry. In addition to providing updated material in the rapidly developing area of environmental chemistry, this module emphasizes several major concepts that are proving essential to the practice of environmental chemistry at the beginning of the new millennium. These include the concept of the anthrosphere as a distinct sphere of the environment and the practice of industrial ecology, sometimes known as “Green Chemistry” as it applies to chemical science.

The first chapter of the module starts with Introduction to Environmental Chemistry. This module is about Environmental Chemistry. It also discuss further about the properties of chemicals in the environment, environmental transformation and degradation and matter and cycles of matter. To understand that topic, it is important to have some appreciation of environmental science as a whole.

Environmental science in its broadest sense is the science of the complex interactions that occur among the terrestrial, atmospheric, aquatic, living, and anthropological environments. It includes all the disciplines, such as chemistry, biology, ecology, sociology, & government that affect or describe these interactions. For our purpose, environmental science is defined as the study of the earth, air, water, and the living environments, and the effects of technology there on.

The second chapter deals with fundamentals of aquatic chemistry. It deals with definition of some basic terms, sources and uses of water: The hydrologic cycle, the unique properties of water, characteristics of bodies of water, chemical phenomena in water bodies, gases in water (O_2 , CO_2), water acidity and CO_2 in water, alkalinity in water, calcium in water, complexation reaction in water, redox reaction in water, water quality, water quality parameters (physical, chemical and biological), water quality requirements, nature and types of water pollutants, types of pollutants, classes of pollutants.

The third chapter discusses atmospheric chemistry. It deals with definition of some basic terms, introduction to atmospheric chemistry, importance and physical characteristics of the atmosphere, atmospheric chemical reactions such as: (photochemical reactions, reactions in Troposphere, reactions in Stratosphere, Ozone formation and depletion, reactions in Thermosphere), atmospheric pollution, nature and classification of air pollutants, particles in the atmosphere, Gaseous inorganic air pollutant, Gaseous organic air pollutants, the endangered global atmosphere(Photochemical smog, Green house and Global warming, the Nuclear winter and Acid rain).

The fourth chapter discusses with Soil Chemistry. It deals with soil and agriculture, nature and compositions of soil, nutrients in soil, reactions in soil and wastes and pollutants in soil which provide you the basic concept of soil Chemistry. Soil and agricultural practices are strongly tied with the environment.

The fifth chapter deals with Environmental Toxicity and Toxicology. It introduces and outlines the topic of toxicological chemistry and discusses the toxicological chemistry of various classes of chemical substances. It discuss further about organic and inorganic pollutants, agricultural and pharmaceutical contaminants, pesticides, PCB's (poly chlorinated biphenyl), Chlorofluro compounds, nitrogen and phosphorous compounds, toxic heavy metals like mercury, lead, arsenic and chromium and Organo-metallic compounds.

The sixth chapter deals with introduction to Green Chemistry. It tried to introduce the concepts of Green Chemistry and to give students a chance to think about the field of chemistry from a different perspective. **Green chemistry** is a pro-active approach to pollution prevention. It targets pollution at the design stage, before it even begins. Green Chemistry is designing chemical products and processes that reduce or eliminate the use and/or the generation of hazardous substances.

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Mode of delivery: Tutorial, group discussion, group and individual assignment.

Mode of assessment: Quizzes, assignments, tests, and final examination.

Mode of evaluation:

Assignment	30%
Final exam	<u>70%</u>
Total	100%

Self study time of the module

This module will require 242 hours

The following table is your study time table

Module Chapter	Study time (Hours)	Duration
Chapter 1: Introduction to Environmental Chemistry	25	Tikimit 1-25
Chapter 2: Aquatic Chemistry and Water Pollution	60	Hidar 1- Tahsas 15
Chapter 3: Atmospheric Chemistry and Air Pollution	70	Tahsas 20- Yekatit 15
Chapter 4: Soil Chemistry	25	Yekatit 20- Megabit 15
Chapter 5: Environmental Toxicity and Toxicology	50	Megabit 20- Miazia 30
Chapter 6: Introduction to Green Chemistry	12	Ginbot 5- Ginbot 17
Total	242	