



Module Title ENVIRONMENTAL CHEMISTRY

Credits 10

Co-Ordinator Maria Romero-Gonzalez

Semester Autumn

Unit Description

Unit Aims

1. To develop understanding of the chemical and physical characteristics of engineered and natural environments and how these impact the reactivity and behaviour of pollutants at a global scale.
2. To develop skills on critical analysis of the literature using examples from global environmental problems, communication and management of information to be presented to a wider non-technical audience.

Syllabus Biogeochemical Cycles and Environmental Pollution

Acid-Base equilibria and Alkalinity

Heterogeneous equilibria

Metals behaviour in Natural Waters

Adsorption of Organic and Inorganic Pollutants

Redox Reactions

Chemical Kinetics in Natural Waters

Phase Interactions

Atmospheric Chemistry

Interactions at the geosphere

Learning Hours

Learning Hours of the Unit		
Activity	Remarks	Hours
Lectures	Lectures	20
Problem Solving / Example Classes	Lectures	6
Tutorials	Meetings	4
Indepentant Study(including Prep	Private Study	50

for Assessment)		
Coursework	Private Study	20

Total Hours 100

#### Teaching Methods

Lectures and group discussion will enable the student to understand fundamental concepts and develop knowledge in the area. In class examples, provide an opportunity to build up conceptualisation of physical - chemical processes step by step. Individual reading is used to build up knowledge and develop critical analysis skills.

#### H&S / Risk Management

This module provides awareness on pollution and contamination at global scale that is related to health of ecosystems and human health. The likelihood of pollution/migration events occurring is quantified through physical-chemical processes, this provides an indication of risk of pollution in the environment.

#### Learning Outcomes

1.

To obtain a comprehensive understanding of the dominant classes of pollutants and their associated environmental hazards

2.

To understand and critically evaluate the classes of physical and chemical transformations that pollutants and contaminants can undergo in the environment.

3.

To apply concepts and quantitative models based on Chemical Thermodynamics to predict the extent of chemical transformation of pollutants in aqueous environments

4.

To apply concepts and quantitative models based on Chemical Kinetics to predict the rates of transformation of pollutants in the environment.

#### Assessment Methods

The assessment consists of an Individual report (40%) of a literature review on a topic related to the pollution of an environmental compartment by a specific compound. This includes a critical review of the literature, causes and consequences of the pollution and impact at a global or local scale. Specific knowledge on quantification of pollutants transformation is evaluated via written invigilated examination (60%).

#### Assessment Philosophy

The individual report provides an opportunity to the student to develop understanding of the subject area and development of critical thinking and evaluation of current research literature. The written individual and in class feedback contributes to strengthen the student abilities to evaluate published literature. The written exam assess the mathematical and analytical skills of the student, ability to apply models to quantify pollution in the environment.

#### Module Assessment

Type of Assessment				
Assessment Type	Learning Outcomes	Week	Day	Percentage
Individual Coursework, this includes lab reports, designs etc	(LO1,LO2)	Autumn Week 10	Friday	40
Written Exam Invigilated	(LO2,LO3,LO4)	Autumn Week 13	Exam Period	60

# Formative Assessment and Feedback

Feedback is provided through examples that students complete in class, this allows the student to identify areas for improvement. Small group or one to one meetings are provided to help students in the development of reading, writing and assessment of literature, essential skills for the evaluation of published research work.

## Recommended Reading

### Book 1 - Recommended

- Title: **Environmental chemistry**
- Author: **Stanley E. Manahan**
- Edition: 9th ed.
- Publisher: Boca Raton, Fla. : CRC ; London : Taylor & Francis distributor, 2009
- Identifier: ISBN 9781420059205 (hbk.);ISBN 1420059203 (hbk.)
- Format: xxix, 753 p. : ill. ; 26 cm.
- Notes: Previous ed.: 2005.
- Subjects: **Environmental chemistry**; **Industrial ecology**
- Further Information: Stanley E. Manahan.
- Record Id: 21199505080001441

### Book 2 - Recommended

- Title: **Introduction to water resources and environmental issues**
- Author: **Karrie Lynn Pennington**
- Other Contributors: **Thomas V Cech**
- Content: Machine generated contents note: Preface; 1. Perspectives on water and **environmental** issues; 2. The water environment of early civilizations; 3. The hydrologic cycle; 4. Water quality; 5. Watershed basics; 6. Groundwater; 7. Lakes and ponds; 8. Rivers and streams; 9. Wetlands; 10. Dams and reservoirs; 11. Drinking water and wastewater treatment; 12. Water allocation law; 13. Roles of federal, regional, state, and local water management; 14. Water conflicts, solutions, and our future; References; Index.  
 "How much water does the world need to support growing human populations? What factors influence water quality, droughts, floods, and waterborne diseases? What are the potential effects of climate change on the world's water resources? These questions and more are discussed in this thorough **introduction to** the complex world of water resources. The strength of the book is its coverage of the fundamentals of the science of water, aquatic ecology, geomorphology and hydrology, supplemented by internet resources and examples from water resource issues in the news to engage the student. The book begins with a short history of human use and influence on water, followed by chapters on the geomorphology, hydrology, **chemistry**, and biology of lakes, rivers, and wetlands. Major disease issues, worldwide water quality and quantity problems, and potential solutions are addressed. Water laws, water allocation, and the conflicts involved are discussed using US and international examples. Students in departments of environmental studies, life science, Earth science, and engineering will benefit from this broad survey of these crucial issues"--Provided by publisher.  
 "The book begins with a short history of human use of and influence on water. The basics of water **chemistry** and the hydrologic cycle are discussed in detail, with chapters on the geomorphology, hydrology, **chemistry**, and biology of lakes, rivers, and wetlands. Major disease issues, worldwide

water quality and quantity problems, and potential solutions are also addressed"--Provided by publisher.

- Publisher: Cambridge : Cambridge University Press, c2010
- Identifier: ISBN 9780521869881 (cased);ISBN 0521869889 (cased)
- Format: x, 457 p. : ill. ; 26 cm.
- Subjects: [Water](#); [Hydrologic cycle](#); [Water conservation](#)
- Further Information: Karrie Lynn Pennington, Thomas V. Cech.
- Record Id: 21172157490001441

#### Book 3 - Recommended

- Title: [An Introduction to environmental chemistry](#)
- Other Contributors: [J. E Andrews \(Julian E.\)](#)
- Publisher: Oxford : Blackwell Science, 1996
- Identifier: ISBN 0632038543;ISBN 9780632038541
- Format: xviii,209p,[2]p of plates : ill.(some col.) ; 24 cm.
- Notes: Includes index.
- Subjects: [Environmental chemistry](#); [Environmental chemistry](#); [Environmental geochemistry](#); [Biology](#)
- Further Information: J.E. Andrews ... [et al.].
- Record Id: 21200813360001441

#### Book 4 - Recommended

- Title: [Introduction to natural water chemistry](#)
- Author: [Gordon K. Pagenkopf](#)
- Related Titles: Series: [Environmental science and technology series](#) ; v. 3
- Publisher: New York : M. Dekker, c1978
- Identifier: ISBN 0824767063;ISBN 9780824767068
- Subjects: [Water chemistry](#)
- Further Information: Gordon K. Pagenkopf.
- Record Id: 21170875720001441

#### Book 5 - Recommended

- Title: [Aquatic chemistry : chemical equilibria and rates in natural waters](#)

- Author: [Werner Stumm 1924-](#)
- Other Contributors: [James J Morgan \(James John\), 1932-](#)
- Edition: 3rd ed.
- Related Titles: Series: Environmental science and technology A Wiley-Interscience publication
- Publisher: New York ; Chichester : Wiley, c1996
- Identifier: ISBN 0471511846;ISBN 0471511854 (pbk.);ISBN 9780471511847;ISBN 9780471511854
- Format: xvi,1022p : ill. ; 25 cm.
- Notes: Previous ed.: c1981.
- Subjects: [Water chemistry](#); [Water chemistry](#); [Hydrology Chemical reactions](#)
- Further Information: Werner Stumm, James J. Morgan.
- Record Id: 21181584150001441

#### Book 6 - Recommended

- Title: [Principles and applications of aquatic chemistry](#)
- Author: [Francois MM. Morel](#)
- Other Contributors: [Janet G Hering](#)
- Edition: Rev. ed.
- Publisher: New York ; Chichester : Wiley, c1993
- Identifier: ISBN 0471548960;ISBN 9780471548966
- Format: xv, 588p ; 25 cm.
- Notes: Previous ed. published as "Principles of [aquatic chemistry](#)", 1983.
- Subjects: [Water chemistry](#); [Chemical equilibrium](#); [Hydrology](#); [Hydrology Chemical reactions](#)
- Further Information: François M.M. Morel, Janet G. Hering.
- Record Id: 21174810720001441