UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Environmental Chemistry

2627-2-F5402Q036

Aims

Aims:

The overall aim of the Environmental Chemistry I course is to provide an understanding of the role of chemical compounds and pollutants on soil, water and atmosphere segments and their effects on humans and environment.

Knowledge and understanding

At the end of the course the student knows:

• The main chemical reactions for anthropogenic compounds present in the water compartment, the hydrolysis reactions;

• The main reactions of atmospheric compounds, the radical reactions;

• The chemistry of soil processes for organic contaminants and metals;

• The persistence of anthropogenic and natural compounds in environmental compartments

Applying knowledge and understanding

At the end of the course the student is able to:

• Calculate the life and half-life time of the compounds in the environmental compartments and predict their reactivity;

• Determine which anthropogenic compounds can be persistent, bioaccumulative and toxic

Making judgements

At the end of the course the student is able to:

• Identify which chemical compounds can impact on different environmental and human sectors;

• Identify the strategies for the control of pollutants in the various environmental sectors;

• Identify the processes for water purification.

Communication skills

Exposing, in a clear and concise manner, the main chemical reactions in the different environmental sectors.

Learning skills

Apply the acquired knowledge of environmental chemistry to anthropogenic compounds. Understanding the topics of environmental chemistry in past and present scientific literature.

Contents

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Detailed program

The atmosphere. Photochemistry, Photochemical smog.

Water. The earth’s water cycle, chemistry in bodies of water with anthropogenic influences.

Soil. Biogeochemical processes, metals, organic contaminants.

Effects of anthropogenic pollutants on atmosphere, water, soil.

Basic principles of pollutant, general decomposition pathways, hydrocarbon PAHs, PCBs, pesticides, heavy metals.

Air quality control. Processes for the preparation of drinking water. Principles of waste water treatment.

Prerequisites

Elements of inorganic, organic and analytical chemistry provided in the basic courses of the degree

Teaching form

Lessons, 6 credit, 48 hours

The course includes:
24 two-hour lectures, in person, with delivered didactics (6 credits) by presenting slides.
The teaching method develops the topics through a historical time history. The course explains the reasons for the synthesis of the different compounds and the progress of knowledge on chemical reactivity and the determination of the main metabolites.

Textbook and teaching resource

Jorge G. Ibanez et al, Environmental Chemistry – Fundamentals, Springer.

Stanley E. Manahan, Environmental Chemistry, Lewis

C.Baird et al., Chimica Ambientale, Zanichelli

R.P. Schwarzenbach et al. Environmental Organic Chemistry, Wiley

Semester

First semester

Assessment method

Examination type:

Oral examination

Mark range:

18-30/30

The exam consists in the assessment of the knowledge acquired by the student in the field of environmental chemistry, with particular attention to the reactivity of the volatile organic compounds in the atmosphere, the reactivity of pesticides in water and persistent organic compounds.

In the oral examination, the student will be assessed on the basis of the following criteria: 1) knowledge and understanding; 2) connection of the different concepts; 3) reasoning autonomy.

Assessment Descriptors:

Grade < 18
Knowledge and understanding:
The student identifies only some of the characteristics of the concepts and recognizes only a few relevant elements of a phenomenon, in an insufficient manner.
Ability to connect different concepts:
Connections among concepts are fragmented and insufficiently supported by theoretical knowledge, lacking a coherent logical structure.

Independent reasoning:
The student shows no autonomy in reconstructing their own learning process and professional development.

Grade 18–22
Knowledge and understanding:
The student recognizes and explains a sufficient number of conceptual features. Theoretical references are present, although not always rigorous.
Ability to connect different concepts:
Connections among concepts are adequate, but explanations are only partial, despite the presence of a logical structure. The student develops a basic argument with minimal organization and some inaccuracies.
Independent reasoning:
The student demonstrates only a basic level of autonomy in reconstructing their learning process and professional development.

Grade 23–27
Knowledge and understanding:
The student recognizes and explains a high number of conceptual features. Theoretical references are present and well organized, demonstrating good command of the subject-specific language and a solid logical and argumentative structure.
Ability to connect different concepts:
Connections among concepts are good, supported by complete explanations and a sound logical structure. The student develops an argument that highlights meaningful relationships among the various stages of development.
Independent reasoning:
The student demonstrates good autonomy in reconstructing their professional learning pathway and good critical reflection skills.

Grade 28–30
Knowledge and understanding:
The student demonstrates full mastery of the conceptual features. Theoretical references are well organized, and the student shows excellent command of the subject-specific language.
Ability to connect different concepts:
Conceptual connections are excellent and supported by comprehensive explanations. The student develops an argument that highlights meaningful relationships among the various stages of development and demonstrates an excellent logical and argumentative structure.
Independent reasoning:
The student demonstrates excellent autonomy in reconstructing their professional learning pathway and advanced self-reflection skills.

Office hours

The professor. Ezio Giovanni Bolzacchini receives the students by appointment by email:
ezio.bolzacchini@unimib.it

Sustainable Development Goals

QUALITY EDUCATION | RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION