UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Aquatic Chemistry

2627-3-E3201Q087

Aims

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Study of the processes that regulate the chemical composition of a water body.

The student acquires knowledge of the chemical parameters useful for assessing water quality.

Knowledge and understanding
At the end of the course the student knows:
The main chemical reactions in the water: the hydrolysis reactions, the ox-red reactions, the precipitation reactions of the salts applied to closed and open systems.

Water purification processes.

Applied knowledge and understanding

At the end of the course the student is able to:
Calculate the chemical composition of a water as a function of pH in an open and closed system
Calculate the total alkalinity of a water
Calculate the electronic activity of a water

Autonomy of judgment

At the end of the course the student is able to:
Identify the main chemical species of water in open and closed systems
Identify water purification processes.

Communication skills

Exposing, in a clear and concise manner, the main chemical reactions in the water compartment.

Learning skills

Apply the acquired knowledge of water chemistry to the different types of water. Understanding the topics of environmental chemistry in past and present scientific literature.

Contents

The overall aim of the AQUATIC CHEMISTRY course is to provide an understanding of equilibria in aqueous solution. Applications for the water quality characterization and water treatments.

Detailed program

pH and buffer intensity, CO?,HCO??, CO?²? equilibria in natural waters;

Acidity and alkalinity of water:

Metal ions speciation;

Redox reactions, redox conditions in aqueous solution;

redox potentials; standard redox potentials and Nerst equation; water composition as a function of the redox potential;

Solubility product; common ion effect; solubility of metal hydroxides; solubility of carbonates; solubility-pH diagrams; the control of alkalinity and metal ion concentration;

Water quality characterization; chemical processes in water treatments.

Prerequisites

Fundamentals of general and organic chemistry.

Teaching form

Lessons, 5 credit, esercitations 1 credits, 50 hours

The course includes:

- 20 two-hour lectures, in person, with delivered didactics both (5 credits) by presenting slides and topics
- 5 two-hour practical classes, in person, with interactive teaching both (1 credits) for solving problems.

The teaching method develops the topics through a historical time.

Textbook and teaching resource

Teaching material can be available on the e-learning platform.

Suggested reading:W. Stumm, J. J. Morgan Aquatic Chemistry, Wiley, 1996

Semester

Second semester

Assessment method

Oral examination

Mark range 18-30/30

The exam consists in the assessment of the knowledge acquired by the student in the field of water chemistry, with particular attention to logC-pH charts, alkalinity, salt dissolution and Ox-Red reactions.

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:
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Sustainable Development Goals

CLEAN WATER AND SANITATION