
COURSE: ANALYTICAL CHEMISTRY I

ACADEMIC YEAR: 2016-2017

TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characterizing, Affine, Free choice, Other) Basic

TEACHER: Dr. Rosanna Ciriello

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website:

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Language: **ITALIAN**

ECTS: **6**
(6 of lessons)n. of hours: **48** of lessonsCampus: **Potenza**
Dept./School: **Science**
Program: **CHEMISTRY (L27)**Semester: **II**
(expected dates of
course beginning and
end: 06/03/2017,
15/06/2017)

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course is the first teaching within the scientific field CHIM/01, and therefore is aimed to examine the fundamentals of Analytical Chemistry. The main objective of the course is to provide students with the foundation for understanding the theoretical principles of analytical chemistry, learn the methodological approaches of basic analytical techniques and the correct formulation of the results.

Learning Outcomes:

- Activity versus concentration and systematic treatments of equilibrium
- Experimental errors and their evaluation
- Principles of volumetric and gravimetric analyses: basic-acid, precipitation and dissolution, complex and redox reactions
- Theory and classification of volumetric and gravimetric titrations

Main skills acquired:

- Individualization of the sources of error in analytical determinations;
 - Representation of experimental results with the relative uncertainty; application of the statistical tests to assess the accuracy and precision of an analytical method;
 - Formulation of the equations necessary to solve a system at equilibrium; representation of the titration curves of the treated systems and evaluation of the conditions and errors of titration;
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PRE-REQUIREMENTS

The contents of the course of "General and Inorganic Chemistry" are a prerequisite for the understanding of the topics treated in "Analytical Chemistry I". The basic knowledge of inorganic chemistry are required and in particular:

- measure units and IUPAC nomenclature of the main inorganic compounds;
- the mole concept, stoichiometry principles and chemical reaction balancing;
- types of solutions, concentration units and preparation of liquid solutions;
- equilibrium constants and their meaning, Le Chatelier's Principle;
- atom electron configurations and periodic table;
- the chemical bond.

It is also advisable to know how to calculate partial derivatives of a function in order to properly apply the formulas related to the propagation of errors.

SYLLABUS**EVALUATION OF ANALYTICAL DATA**

Systematic errors. Measurement errors and their propagation. Random errors and Normal distribution. Significance test: Q, F, t essays.

BASICS OF QUALITATIVE AND QUANTITATIVE ANALYSIS

Qualitative analysis and periodic tables of elements. Unities and concentrations. Systematic treatment of chemical equilibria in aqueous solutions. Ionic Strength. Activity and activity coefficients.

GRAVIMETRIC ANALYSIS

Solubility, solubility constants and factors affecting solubility. The process of precipitation in water. Colloids.

VOLUMETRIC ANALYSIS

Standard solutions, titrations with chemical indicators and associated relative errors.

- *Argentometry* Mohr, Volhard and Fajans methods. Construction of titrations curves for silver halides
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precipitates

- *Acid base*: An overview of acid-base equilibria in water. Definition of pH. Dissociation constants and distribution functions. Henderson-Hasselbach equation and buffer systems. Acid-base titrations.
- *Complexometry* Global and consecutive formation constants of Complexes. Chelate complexes and use in analytical chemistry. Amphoteric hydroxides. Titrations with EDTA and metallochromic indicators.
- *Redox* Redox reaction and equilibrium constants. Nernst equation. Standard and Formal Redox potential, redox reagents and their applications. Redox titrations. Indicators and self-indicators.

NUMERICAL EXERCISES

TEACHING METHODS

Theoretical lessons, Numerical exercises

EVALUATION METHODS

The laboratory activities require the preparation of reports to be discussed during the oral examination which will be delivered to the teacher a week before the examination date.

One oral examination comprising the two courses 'Analytical Chemistry I' and 'Laboratory of Analytical Chemistry I'.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- ARANEO, "CHIMICA ANALITICA QUALITATIVA", AMBROSIANA (MI)
- D.C. HARRIS, "CHIMICA ANALITICA QUANTITATIVA", 2^a EDIZIONE, ZANICHELLI, BOLOGNA
- J.N. BUTLER, "EQUILIBRI IONICI: ELEMENTI PER UNA TRATTAZIONE MATEMATICA", SOCIETÀ EDITRICE UNIVERSO, ROMA
- E. DESIMONI, "CHIMICA ANALITICA Equilibri ionici e fondamenti di analisi chimica quantitativa", CLUEB, BOLOGNA
- SKOOG, WEST, HOLLER, "FONDAMENTI DI CHIMICA ANALITICA" EDISES, NAPOLI
- Lecture notes provided by the teacher

INTERACTION WITH STUDENTS

At the beginning of the course the teacher informs the students about the objectives, the program and the verification methods. Simultaneously collects the list of students, together with name and e-mail. Since the frequency of the course is compulsory, the teacher will collect the signatures of the students at lectures. At the end of each topic among those listed above, the teacher will provide students with an electronic copy of all the lessons projected in the classroom.

The office hours are as follows:

Monday: from 10 am to 11 am at the office 2DA302;

Tuesday: from 10 am to 11 am at the office 2DA302;

Wednesday: from 10 am to 11 am at the office 2DA302.

The teacher is available to meet at all times students by appointment agreed through its own institutional e-mail address (rosanna.ciriello@unibas.it).

EXAMINATION SESSIONS (FORECAST)¹

2/02/2017, 15/03/2017, 31/05/2017, 29/06/2017, 20/07/2017, 26/10/2017, 20/12/2017

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

¹ Subject to possible changes: check the web site of the Teacher or the Department/School for updates.