



Universidad de Jaén
FACULTY OF EXPERIMENTAL SCIENCES

Analytical chemistry

2024-2025
Grado en Química



GRATIS



Acceso Mayores 40

Guías docentes UJA

Horarios de tutorías

Llamamientos PEvAU

Movilidad (Coordinador)

P.O.D.

Solicitud bilingüismo

Syllabus 2024-25 - 10312001 - Analytical Chemistry (Química analítica)

Caption

- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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DEGREE:

Grado en Químicas

FACULTY:

FACULTY OF EXPERIMENTAL SCIENCES

ACADEMIC YEAR:

2024-25

COURSE:

Analytical Chemistry

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Analytical Chemistry

CODE: 10312001

ACADEMIC YEAR: 2024-25

LANGUAGE: English

LEVEL: 1

ECTS CREDITS: 6.0

YEAR: 2

SEMESTER: PC

2. LECTURER BASIC INFORMATION

NAME: AYORA CAÑADA, MARÍA JOSÉ

DEPARTMENT: U127 - QUÍMICA FÍSICA Y ANALÍTICA

FIELD OF STUDY: 750 - QUÍMICA ANALÍTICA

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LANGUAGE: English

LEVEL: 1

NAME: DOMÍNGUEZ VIDAL, ANA

DEPARTMENT: U127 - QUÍMICA FÍSICA Y ANALÍTICA

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LANGUAGE: English

LEVEL: 1

NAME: ROCIO BAUTISTA, PRISCILLA

DEPARTMENT: U127 - QUÍMICA FÍSICA Y ANALÍTICA

FIELD OF STUDY: 750 - QUÍMICA ANALÍTICA

OFFICE NO.: B3 - 114

E-MAIL: procio@ujaen.es

P: 953212532

WEBSITE: -

ORCID: -

LANGUAGE: English

LEVEL: 1

3. CONTENT DESCRIPTION

LESSON 1. Introduction to Analytical Chemistry

Analytical Chemistry: concept, object and purpose. Types of analysis and classification of methods of chemical analysis. The language of analytical chemistry: fundamental concepts. The analytical problem. Steps in the analytical process.

LESSON 2. Sampling

Introduction and sample types. Representativeness of the sample. Sampling plan design. General strategies for sampling. Methods and equipment for sampling fluids, gases and solids. Storage and preservation of samples.

LESSON 3. Sample Preparation

Preliminary operations or sample pretreatment. Sample preparation: general considerations. *Sample treatment for determination of inorganic analytes*. Sample dissolution. Mineralization of organic matrices.

Sample treatment for determination of organic analytes. Solid-liquid extraction. Liquid-liquid extraction. Solid-phase extraction.

LESSON 4. Qualitative and Quantitative Aspects of Analytical Measurements

The analytical signal. *Qualitative aspects.* Identification based on chemical reactions. Identification based on instrumental techniques. Standards in qualitative analysis. *Quantitative aspects.* Types of quantification methodologies. Methods with and without analytical standards. Analytical standards and reference materials. Analytical calibration versus instrumental calibration.

LESSON 5. Evaluation of analytical results

Errors in quantitative analytical results: concept and types. Statistic treatment and confidence intervals. Hypothesis tests for outliers rejection. Uncertainty.

LESSON 6. Gravimetric Methods of Analysis

Gravimetric Analysis: An Overview. Classification of gravimetric methods. Stoichiometric calculations in gravimetric analysis. Errors. General operations in gravimetric analysis. Precipitation based gravimetry. Other gravimetric methods.

LESSON 7. Principles of Volumetric Analysis

Volumetric Analysis: an overview. Requirements of a reaction for use in volumetric analysis. Classification of volumetric methods. Titration Curves. End point and equivalence point. Endpoint indicators. Indicator error. Volumetric material: use and calibration. Primary standards and standardized solutions.

LESSON 8. Neutralization titrations

Neutralization curves: a) strong acid with strong base and vice versa, b) weak base with strong acid c) weak acid with strong base, d) polyprotic acids e) mixtures of acids and bases. Acid-base indicators. Transition interval and selection of appropriate indicator. Preparing standardized solutions of acids and bases: secondary standards. Errors in neutralization titrations. Examples of application.

LESSON 9. Oxidation-reduction titrations

Titration curves: characteristics. Redox indicators: types and selection. Previous treatments of oxidation or reduction. Titrations with permanganate: preparation of standard solutions, standard substances, applications. Titrations with dichromate: preparation of standard solutions, indicators, applications. Iodometry and iodimetry: standard preparation, standard substances, indicators, sources of error, applications.

LESSON 10. Complex Formation titrations

Titration Curves. Endpoint indicators: choice of indicator. Titration error. Titration with monodentate ligands. Titration with polydentate ligands: complexometry with EDTA. Applications and examples.

LESSON 11. Precipitation titrations

Titration Curves: Factors influencing the endpoint. Detection of endpoints in titrations with silver: chemical indicators. Mohr method, Fajans method and Volhard method. Applications.

LESSON 12. Quality Assurance in analytical chemistry

Concept of traceability in analytical measurements. Validation of analytical processes: quality parameters. Quality assessment in the laboratory. Internal control activities. Inter-laboratory exercises.

Laboratory program:

Gravimetric
determination of nickel in an alloy
Neutralization Titration: use of acid-base indicators and
standardization of HCl
Determination of a mixture of alkalis
Determination of vitamin C in pharmaceutical preparations
Determination of water hardness by complexometry

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4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

Sessions in small groups (2 hour duration) comprise 5 practical sessions in the laboratory and 5 sessions of discussion and presentation of case studies and exercises.

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

5. ASSESSMENT METHODOLOGY

The attendance to laboratory sessions and seminars (small group sessions) is compulsory. The proposed homework only will be evaluated in case of attendance.

A minimum qualification of 4 points must be reached in the exam to consider the rest of the aspects for evaluation

Competences evaluated with each instrument:

Written Exam: B1, C3, Q1, Q2, Q3

Exercises and oral presentations: B1, B4, C3, Q2, Q3

Laboratory report: P2, Q3

Lecturer's notes and observations: B1, B4, Q1

6. BOOKLIST [\(Access the bibliography in the Library catalog\)](#)

MAIN BOOKLIST:

- Analytical chemistry. Edition: 5th ed. Author: Christian, Gary D.. Publisher: New York [etc.]: John Wiley & Sons, 1994 ([Library](#))
- Solving problems in analytical chemistry. Edition: -. Author: Brewer, Stephen. Publisher: New York: John Wiley & Sons, [1980] ([Library](#))

ADDITIONAL BOOKLIST:

- Principles of analytical chemistry : a textbook. Edition: -. Author: Valcárcel Cases, M.. Publisher: Berlin [etc.]: Springer, 2000 ([Library](#))

7. SUSTAINABLE DEVELOPMENT GOALS

Salud y bienestar

Educación de calidad

Agua limpia y saneamiento

Industria, innovación e infraestructura

Producción y consumo responsables

DETAILED INFORMATION

The contents of the program are aligned with Sustainable Development Goals: SDG3, SDG4, SDG6, SDG9 and SDG12.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

METHODOLOGY

AND ACTIVITIES

All

teaching activities -evaluation included- will be face-to-face to the extent that the situation allows.

Tutorization can be either face to face or through GSuite Meet videoconference

ASSESSMENT

METHODOLOGY:

Final

exam: 50%

Exercises,

study cases and oral presentations: 15%

Online

questionnaires: 15%

Laboratory

reports: 15%

Active

participation on different activities: 5%

9. VIRTUAL TEACHING SCENARIO

METHODOLOGY AND ACTIVITIES

Theoretical

lessons online (synchronous) through GSuite Meet (38 h)

Seminars

in small groups (10 h in 2 h sessions) through GSuite Meet

Laboratory

works are

substituted by virtual online activities. Online activities

include visualization

of videos showing similar experimental works and computer

simulations. Training in data treatment strategies will be achieved

using experimental data provided.

Tutorization

through GSuite Meet videoconference

Assessment methodology:

Final

exam: 50%

Exercises,

study cases and oral presentations: 15%

Online

questionnaires: 15%

Virtual

laboratory reports: 15%

Active

participation on different activities: 5%

DATA PROTECTION CLAUSE (on line exams)

Institution in charge of data processing: Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

Data Protection Delegate: dpo@ujaen.es

Purpose: In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

Legitimacy: compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

Addressees: service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

Storage periods: those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

Rights: you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection www.ctpdandalucia.es

CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

Person in charge: Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; www.ujaen.es

Data protection delegate (DPO): TELEFÓNICA, S.A.U. ; Email: dpo@ujaen.es

Procedure aim: To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

Period for record storage: Images will be kept during legal term according to regulations in force

Legitimacy: Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

Data recipients (transfers or assignments): Any person allowed to get access to every teaching modality

Rights: You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council www.ctpdandalucia.es

Campus Las Lagunillas s/n | 23071 - Jaén

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