UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: CHEMICAL ANALYSIS I
Code: 14309
Type: BASIC
ECTS credits: 6
Degree: 376 - UNDERGRADUATE DEGREE PROGRAMME IN PHARMACY
Academic year: 2023-24
Center: 14 - FACULTY OF PHARMACY
Group(s): 10
Year: 1
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site: https://www.uclm.es/es/albacete/farmacia/guias-docentes
Bilingual: N

Lecturer: **FERNANDO DE ANDRES SEGURA** - Group(s): **10**

Building/Office	Department	Phone number	Email	Office hours
Faculty of Pharmacy / 1st floor	Q. ANALÍTICA Y TGIA. ALIMENTOS	967599200/2200	Fernando.deAndres@uclm.es	To arrange with the teacher via email in order to organize a tutoring session tailored to the student's and teacher's schedule. It will be indicated in the Virtual Secretary.

Lecturer: **VIRGINIA RODRIGUEZ ROBLEDO** - Group(s): **10**

Building/Office	Department	Phone number	Email	Office hours
Faculty of Pharmacy / 1st floor	Q. ANALÍTICA Y TGIA. ALIMENTOS	967599200/8240	virginia.rrobledo@uclm.es	To arrange with the teacher via email in order to organize a tutoring session tailored to the student's and teacher's schedule. It will be indicated in the Virtual Secretary.

Lecturer: **MOHAMMED ZOUGAGH ZARIOUH** - Group(s): **10**

Building/Office	Department	Phone number	Email	Office hours
Faculty of Pharmacy / 1st floor	Q. ANALÍTICA Y TGIA. ALIMENTOS	926052675	Mohammed.Zougagh@uclm.es	To arrange with the teacher via email in order to organize a tutoring session tailored to the student's and teacher's schedule. It will be indicated in the Virtual Secretary.

2. Pre-Requisites

Although there are no prerequisites for this subject, it is recommended, in order to provide the student with certain guarantees of success, that they have previously taken General Chemistry and Introduction to Laboratory, and have a basic knowledge of Physics and Mathematics.

To achieve this, it is also recommended that students have completed the Physics and Chemistry course in high school and have knowledge in:

Chemical nomenclature and formulation.
Balancing chemical reactions.
Equilibria in solution.
Stoichiometric calculations.
Basic mathematical calculations (solving equations, logarithmic operations, systems of equations...).
Handling of a scientific calculator for performing calculations.

3. Justification in the curriculum, relation to other subjects and to the profession

JUSTIFICATION IN THE CURRICULUM:

Pharmacy, as a healthcare profession at the Graduate level, and according to Directive 2005/36/EC of the European Parliament and of the Council, dated September 7, 2005, is responsible for activities related to the production, preservation, and dispensation of medications, as well as collaboration in analytical, pharmacotherapeutic, and public health surveillance processes (Article 6.2b). To carry out these activities, it is necessary to have a broad understanding of the subject matter and acquire the competencies that the Analytical Chemistry I course aims to provide.

As described in the curriculum for the Bachelor's Degree in Pharmacy, the contents of the Analytical Chemistry I course, which falls within the Chemistry module, are mainly based on the study of analytical processes and their stages in the pharmaceutical field, sample collection and preparation, validation of analytical methods, and the development of the necessary knowledge for understanding classical methods of quantitative chemical analysis. Additionally, there is an introduction to analytical separations, although this aspect will be extensively covered in advanced courses, specifically in the Analytical Chemistry II course.

RELATIONSHIP WITH OTHER SUBJECTS OR FIELDS:

The Analytical Chemistry I course is taken in the second semester of the first year, serving as an essential foundation for the continuation of studies with the Analytical Chemistry II course, which is taught in the second year of the degree program.

Furthermore, in order for the Pharmacy graduate to become a competitive professional capable of facing the challenges of a clearly expanding sector that demands new experts, multidisciplinary training is of vital importance. Many pharmacists have contributed to scientific development in diverse fields such as botany, chemistry, biochemistry, bromatology, soil science, parasitology, microbiology, etc. Therefore, the interrelation and multidisciplinary nature of the various fundamental subjects described in the Pharmacy degree program are evident.

RELATIONSHIP WITH THE PROFESSION:

As a result of their multidisciplinary training encompassing scientific, technical, and health sciences areas, Pharmacy graduates are qualified to practice the profession in pharmacies, the pharmaceutical industry, hospital and non-hospital specializations, healthcare analysis laboratories, healthcare management, and educational and research activities. The subject of Analytical Chemistry provides professionals with a solid knowledge base in classical and instrumental analytical chemistry, validation of analytical methods in the pharmaceutical field, as well as chemical analysis using separation techniques coupled with various detection techniques such as mass spectrometry, enabling the

identification and confirmation of a wide range of compounds of pharmaceutical interest.

Please note that the materials prepared by the instructor and made available to students on the Virtual Campus platform are the property of the instructor. Taking these materials out of that context and making them available to individuals outside of that platform without the instructor's consent will be considered a violation of copyright. Additionally, it is prohibited to record classes and various activities without the express consent of the instructor.

Engaging in different tests with unauthorized aid or materials will be considered fraud. In accordance with Article 8 of the Student Evaluation Regulations, a test in which fraud is detected will be considered invalid and will be graded as a fail (0), including any detected acts of plagiarism as fraudulent. All of this is without prejudice to the disciplinary procedure that may be initiated against the student, in accordance with the offenses and sanctions stipulated in the current disciplinary regulations.

4. Degree competences achieved in this course

Course competences

Code	Description
B01	Proficiency in a second foreign language at level B1 of the Common European Framework of Reference for Languages.
B02	Knowledge of Information and Communication Technologies (ICT).
B03	A correct oral and written communication
B04	Ethical commitment and professional deontology.
B05	Ability to develop those learning skills necessary to undertake further studies.
EQ01	Identify, design, prepare, analyse and produce active principles, drugs and other materials and products of sanitary interest.
EQ02	Adequately choose the techniques and methodologies for the evaluation, design and application of chemical reagents, laboratory methodologies and analytical techniques.
EQ03	Complete standard laboratory processes including the employment of scientific equipment related to synthesis and analysis.
EQ04	Evaluate risks/hazards associated to the use of chemical substances and lab processes.
EQ06	Know and understand the characteristics of chemical reactions in solution, the different states of matter and the principles of thermodynamics and their application to pharmaceutical sciences.
EQ09	Know origin, nature, design, production, analysis and drugs quality control and sanitary products.
EQ10	Know principles and procedures for the analytical determination of compounds: analytical techniques applied to water, food and environment analysis.
EQ11	Know and apply the main structural determination techniques, including spectroscopy.
G01	Identify, design, obtain, analyze, control and produce drugs and medicines, as well as other products and raw materials of sanitary interest for human or veterinary use.
G02	Evaluate the therapeutic and toxic effects of substances with pharmacological activity.
G03	Know how to apply the scientific method and acquire skills in the handling of legislation, sources of information, bibliography, elaboration of protocols and other aspects considered necessary for the design and critical evaluation of preclinical and clinical trials.
G04	Design, prepare, supply and dispense medicines and other products of health interest.
G05	Provide therapeutic advice in pharmacotherapy and dietotherapy, as well as in the nutritional and food field in the establishments where they provide services.
G06	Promote the rational use of medicines and medical devices, as well as to acquire basic knowledge in clinical management, health economics and the efficient use of health resources.
G07	Identify, evaluate and assess problems related to drugs and medicines, as well as participate in pharmacovigilance activities.
G08	Conducting clinical and social pharmacy activities, following the pharmaceutical care cycle.
G09	Intervene in health promotion and disease prevention activities at the individual, family and community levels, with an integral and multi-professional vision of the health-disease process.
G10	Design, apply and evaluate clinical reagents, methods and analytical techniques, knowing the basic principles of clinical analysis and the characteristics and contents of laboratory diagnostic reports.
G11	Evaluate the toxicological effects of substances and design and apply appropriate tests and trials.
G12	Develop hygienic-sanitary analyses, especially those related to food and environment.
G13	Develop communication and information skills, both oral and written, to deal with patients and users of the centre where they carry out their professional activity. Promote the capacity to work and collaborate with multidisciplinary teams and those related to other health professionals.
G14	Know the ethical and deontological principles according to the legislative, regulatory and administrative provisions governing professional practice, understanding the ethical implications of health in a changing social context.
G15	Recognise own limitations and the need to maintain and update professional competence, with particular emphasis on self-learning of new knowledge based on scientific evidence.
T01	Critical thinking skills based on the application of the scientific method
T02	Ability to manage quality scientific information, bibliography, specialized databases and resources accessible through the Internet.
T03	Handling of basic and specific software for the treatment of information and experimental results.
T04	Motivation for quality, safety at work and awareness of environmental issues, with knowledge of the internationally recognised systems for the correct management of these aspects.
T05	Organizational, planning and implementation skills.
T06	Ability to address human resources decision-making and management.
T07	Ability to work as a team and, where appropriate, exercise leadership functions, encouraging entrepreneurship.
T08	Develop interpersonal skills and the ability to function in an international and multicultural context.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Application of the gained knowledge on solution reactions for the qualitative analysis of substances of pharmaceutical interest.

To understand the validation strategies of analytical methodologies.

To understand the basis of the quality assurance program and of good laboratory practices with application in the pharmaceutical industry, as well as to learn about the control on raw materials, excipients, intermediary and final products.

To understand the physicochemical principles in which the different techniques of instrumental analysis are based.

Ability to apply the general system of the analytical process to solve simple practical issues with application in different fields.

Capacity to estimate the analytical results reliability together with a deep understanding of the statistical criteria applied for their evaluation, especially those related to accuracy and precision.
Good environmental practices for the management of chemical substances and residues.
Ability to select the ideal instrumental technique for the analytical and structural study of substances of pharmaceutical interest.
To identify and to understand the importance of each stage of the analytical process.
Capacity to elaborate reports on the analytical results obtained, also understandable for no experts in the field.
Self-learning: organization capacity, ability to analyze and to manage the information.
To learn the different automatic systems of analysis developed to obtain better productivity in a pharmaceutical lab.
To differentiate the sense of chemical reactions, their extension and influence on concurrent equilibria. To interpret titration curves.
Teamwork: critical and self-critical ability.

Additional outcomes

To learn the correct use of the language for an adequate oral and written communication.
The student will be capable of undertaking advanced subjects within the area of Chemistry.
Acquisition of the capacity to assimilate new principles and knowledge, as well as critical reasoning based on the evidences and the scientific method.
To apply the acquired knowledge on the fundamental principles of classical analytical methods and techniques to the drugs and pharmaceutical analysis, as well as for the analysis of potentially toxic substances or of health interest.

6. Units / Contents

Unit 1: PART I. INTRODUCTION AND GENERAL ASPECTS OF CHEMICAL ANALYSIS. Unit 1: Introduction to Chemical Analysis.
Unit 2: The analytical process.
Unit 3: Preliminary operations of the analytical process.
Unit 4: Measurement, transduction of the analytical signal, and evaluation and expression of analytical results.
Unit 5: PART II. VOLUMETRIC AND GRAVIMETRIC ANALYSIS. Unit 5: Introduction to volumetric techniques and gravimetric methods.
Unit 5.1 Introduction to precipitate equilibria.
Unit 5.2 Gravimetric methods.
Unit 5.3 Introduction to volumetric techniques.
Unit 6: Acid-base equilibria and titrations.
Unit 6.1 Acid-base equilibria.
Unit 6.2 Acid-base titrations.
Unit 7: Complex formation equilibria and titrations.
Unit 7.1 Complex formation equilibria.
Unit 7.2 Complex formation titrations.
Unit 8: Oxidation-reduction equilibria and titrations.
Unit 8.1 Oxidation-reduction equilibria.
Unit 8.2 Oxidation-reduction titrations.
Unit 9: PART III. LABORATORY PRACTICES.
Unit 9.1 Preparation of solutions and necessary reagents for conducting the laboratory practices.
Unit 9.2 Gravimetric determination of Nickel with dimethylglyoxime.
Unit 9.3 Titration of a strong base (NaOH) against a primary standard acid. Titration of hydrochloric acid (HCl) using a pre-contrasted sodium hydroxide (NaOH) solution.
Unit 9.4 Determination of the content of acetylsalicylic acid in an analgesic.
Unit 9.5 Titration of a potassium permanganate ($KMnO_4$) solution using sodium oxalate ($Na_2C_2O_4$).
Unit 9.6 Determination of hydrogen peroxide in a commercial sample (H_2O_2).
Unit 9.7 Liquid-Liquid Extraction of Amaranth and Erythrosine in commercial samples (pomegranate juice and liquid candies). Comparison between single-stage and multiple-stage or stepwise extraction.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ06 EQ09 EQ10 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06	1.44	36	Y	N	The availability of teaching resources will be accessible on the Moodle platform before the start of each activity. In addition, students will have access to complementary bibliographic and audiovisual materials (books, review articles, videos, etc.) at the university library on the Albacete campus. The active participation of students through cooperative work, both in and outside the classroom, as well as in the preparation and defense of assignments, case studies, problem-solving, workshops, and seminars, which will be actively resolved throughout the course, will be taken into account in the final assessment of the subject.
							Practical teaching will be conducted in small groups within the periods established in the academic calendar, which do not overlap with other instructional activities. They will

Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ06 EQ09 EQ10 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06	0.8	20	Y	Y	take place in laboratories equipped with the necessary resources to achieve the proposed objectives. The student will not be able to pass the subject unless they obtain a PASS grade in the practical module (PASS = grade equal to or greater than 4.0). The laboratory component of the Analytical Chemistry I course will consist of supervised practices closely related to the theoretical contents of the subject.
Study and Exam Preparation [OFF-SITE]	Self-study	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ06 EQ09 EQ10 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	3.6	90	N	-	Individual work that the student will dedicate to studying and learning the contents of the subject. The student can request personal tutoring on the subject matter by scheduling an appointment in advance with the corresponding professor.
Formative Assessment [ON-SITE]	Assessment tests	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ06 EQ09 EQ10 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.16	4	Y	Y	Specific dates have been reserved in the academic calendar for evaluation tests that do not overlap with other instructional activities.
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Laboratory sessions	20.00%	20.00%	Application in the laboratory of the knowledge previously acquired in the theoretical module. The skill acquired in handling chemical substances, as well as laboratory equipment, the student's attitude, and the proper preparation of the laboratory notebook, will be evaluated. Additionally, a practical exam will be conducted. The overall grade for the practical module will account for 20% of the final grade for the subject. Once a PASS grade (equal to or greater than 4.0) is obtained in the practical module, the grade will be valid for the following two academic years, as long as the practical module grade is equal to or higher than 5.0. Attendance to laboratory practical classes is mandatory to pass the module in the regular exam session. To pass the subject, the student must have obtained a PASS grade (equal to or higher than 4.0 out of 10) in the Practical Content Module. In case of non-attendance to practical sessions, absence from any session without proper justification, or failure to achieve a PASS grade in the module, the student will have to make up for this activity by completing a test (written, oral, or experimental) along with the submission of a lab report that includes the content of the missed sessions. The location where practical sessions will take place and the necessary materials, among other details, will be provided on the Moodle platform prior to the start of the practical lessons.
Assessment of active participation	10.00%	10.00%	The professor will request students, through the virtual campus or via email (if necessary), during the first three weeks of the second semester, to complete a maximum of two individual theoretical assignments (topic development and/or practical cases). The active participation of students will also be evaluated, both in lectures and in tutorials and daily activities. Group and individual tutorials will be conducted to monitor the students' learning progress, covering theoretical content and the resolution of seminars and/or problems related to the subject. The students' autonomous work in developing the assigned task(s) throughout the course will be positively valued, as well as oral presentations and/or cooperative work, if applicable. Model exercises will be solved on the board to help students

			understand the concepts acquired in the theory classes. The active participation of students in seminars will be evaluated. Students who have not received a score for "participation with achievement in class" will have the opportunity to improve their grade by presenting one or several activities developed during the course (workshop, written assignment, oral presentation, etc.), as defined by the professor and described on the virtual campus during the first three weeks of the second semester.
Final test	70.00%	70.00%	The student can pass the subject through continuous assessment during the course. To do so, they must take two final exams that will include theoretical concepts as well as problem-solving, seminars, or practical cases. 70% of the final grade for the subject will be distributed in these two mandatory recoverable final exams, with each exam accounting for 35% of the total subject grade. The final grade will be calculated as the average ((Exam1 + Exam2)/2) of the two exams. To pass the subject, the student must achieve a sufficient average grade in the final exams, resulting in a score of 5.0 or higher after considering the remaining grades (laboratory practices - 20% - + participation with achievement - 10% -).
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The professor will assume that all students are opting for the continuous assessment modality (in-person) unless otherwise informed (non-continuous modality) via an email addressed to the responsible professor of the subject, and provided they have not participated in evaluative activities during the instructional period that collectively account for at least 50% of the total evaluation of the subject. If a student has reached that 50% threshold of evaluative activities or if, in any case, the instructional period has ended, they will be considered under continuous assessment without the possibility of changing the assessment modality.

The subject will be passed when a weighted final grade of at least 5.0 out of 10 is achieved, with a minimum grade of 4.0 in the practical block.

THEORETICAL BLOCK EVALUATION (70% of the final grade): It will consist of two mandatory final exams (continuous assessment), recoverable in subsequent exam sessions (if continuous assessment is not passed). The final exams will each carry a weight of 50% in the evaluation of the theoretical block.

PRACTICAL BLOCK EVALUATION (20% of the final grade): ATTENDANCE to laboratory practical sessions is MANDATORY to pass the subject in the regular exam session, and the practical sessions will NOT be recoverable (except for duly justified situations). It will be evaluated through the submission of a laboratory notebook, attitude and performance in the laboratory, compliance with safety regulations and waste management, and a final exam at the end of the practical sessions. To pass the practical module in the regular exam session, the student must attend all practical sessions and obtain a grade of at least 4.0 out of 10 in the arithmetic average of the notebook grade, the performance in the practical sessions, and the final exam. This grade will be valid for the following two academic years if the practical module grade is equal to or higher than 5.0.

PARTICIPATION EVALUATION (10% of the final grade): It will be carried out through the development and submission of various activities that the professor will indicate at the beginning of the course and propose on the virtual campus (Moodle platform) and in the classroom during the first three weeks of the second semester. These activities are NOT mandatory and can be recovered.

Non-continuous evaluation:

As specified in the previous section, the professor will assume that all students are opting for the continuous assessment modality (in-person) unless otherwise informed (non-continuous, blended modality) via an email addressed to the responsible professor of the subject, and provided they have not participated in evaluative activities during the instructional period that collectively account for at least 50% of the total evaluation of the subject. If a student has reached that 50% threshold of evaluative activities or if, in any case, the instructional period has ended, they will be considered under continuous assessment without the possibility of changing the assessment modality. The subject will be passed when a minimum of 5.0 points out of 10 are obtained in the overall grade, and having obtained a PASS (equal to or higher than 4.0 points) in the practical block.

THEORETICAL BLOCK EVALUATION (70% of the final grade): It will consist of ONE mandatory and recoverable final exam.

PRACTICAL BLOCK EVALUATION (20% of the final grade): ATTENDANCE to laboratory practical sessions is MANDATORY to pass the subject in the regular exam session, and the practical sessions will NOT be recoverable (except for duly justified situations).

PARTICIPATION EVALUATION (10% of the final grade): It will only apply to students who have not achieved a score in the part of activities developed in the continuous assessment. To obtain a score in activities, the student will be proposed to complete specific activities that will be indicated by the professor through the virtual campus and via email (if necessary). These activities are NOT mandatory and can be recovered (see the section on Specifics of the extraordinary exam session).

Specifications for the resit/retake exam:

The subject will be passed when a minimum of 5.0 points out of 10 are obtained in the overall grade, calculated using the following equation: THEORETICAL block grade x (0.7) + PRACTICAL block grade x (0.2) + PARTICIPATION grade with achievement x (0.1).

THEORETICAL BLOCK EVALUATION (70% of the final grade): It will consist of ONE mandatory and non-recoverable final exam.

PRACTICAL MODULE EVALUATION (20% of the final grade): The practical module will be evaluated as follows:

OPTION 1: Those students who did NOT pass the practical module in the regular evaluation but attended all practical sessions will take a practical knowledge test (oral or written) in the extraordinary exam session. The specific modality (oral or written) will be communicated to the student through the virtual campus and via email (personally) with sufficient time for the student to be properly informed.

OPTION 2: Those students who did NOT pass the practical module in the regular exam session due to MISSING some practical sessions will be evaluated through a test that will require them to demonstrate their acquired competencies in the subject through a written, oral, or experimental test, along with the submission of a report including the work developed in the test. To pass the practical module, they must obtain an overall grade of at least 4.0 points out of 10.

This grade will be valid for the following two academic years if the practical module grade is equal to or higher than 5.0 and if the student expresses their wish to maintain the grade.

The date and time of the practical module recovery test (OPTION 1 and OPTION 2) will be communicated to the student in advance through the virtual campus and via email (if necessary).

PARTICIPATION EVALUATION (10% of the final grade): The grade obtained in the regular exam session will be maintained. However, for students who did not participate in the module during the regular exam session, they can recover it by completing and submitting activities that will be assigned by the professor with sufficient time for their completion, through the virtual campus or via email (if necessary).

Specifications for the second resit / retake exam:

Only students who meet the requirements stated in the Student Evaluation Regulations of the University of Castilla-La Mancha will be eligible for this exam session, and they will be evaluated according to the criteria applied in the extraordinary exam session.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	36
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Formative Assessment [PRESENCIAL][Assessment tests]	4

Global activity

Activities	**hours**
Formative Assessment [PRESENCIAL][Assessment tests]	4
Class Attendance (theory) [PRESENCIAL][Lectures]	36
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
M. Valcárcel	Principios de Química Analítica	Springer-Verlag Ibérica	Barcelona	84-07-00500-1	1999	
D.C. Harris	Análisis Químico Cuantitativo 3ª ed., (6ª ed. orig.)	Reverté, D.L.	Barcelona	978-84-291-7225-6	2016	
Burriel Martí, F., Lucena Conde, F., Arribas Jiméno, S. y Hernández Méndez, J.	Química Analítica Cualitativa	Paraninfo, S.A	Madrid	9788497321402	2008	
C. Cámara, P. Fernández, A. Martín-Esteban, C. Pérez-Conde y M. Vidal	Toma y tratamiento de muestra	Síntesis	Madrid	8477389624	2002	
Douglas A. Skoog, Donald M. West, F. James Holler y Stanley R. Crouch	Fundamentos de química analítica	Cengage Learning	Mexico DF	978-607-519-377-9	2015	
J. Ruiz Soriano	Problemas de laboratorio químico y farmacéutico (2a Ed.)	Elsevier	Amsterdam	978-84-8086-339-1	2009	
J.A. López Cancio	Problemas resueltos de Química Analítica	Thomson-Paraninfo	Madrid	978-84-9732-348-2	2015	
M. Silva, J. Barbosa	Equilibrios iónicos y sus aplicaciones analíticas	Editorial Síntesis	Madrid	978-84-9756-025-2	2008	
Miller, J.N., Miller, J.C.	Estadística y quimiometría para química analítica	Pearson Educación		978-84-205-3514-2	2008	
Gary D. Christian	Química Analítica (6ª Edición)	Mc Graw Hill	Mexico DF	978-970-10-7234-9	2009	
R. Cela, R.A. Lorenzo, M.C. Casais	Técnicas de separación en Química Analítica.	Síntesis	Madrid	84-9756-028-0	2010	
R. Compañó y A. Ríos	Garantía de la calidad en los laboratorios analíticos	Síntesis, D. L.	Madrid	84-9756-024-8	2002	
Yañez-Sedeño Orive, Paloma; Pingarrón Carrazón, José Manuel; de Villena Rueda, Francisco Javier Manuel.	Problemas resueltos de Química Analítica	Síntesis	Madrid	84-9756-071-X	2008	