Teaching Guide				
Identifying Data				2022/23
Subject (*)	Kinetic and Catalysis		Code	610G04026
Study programme	Grao en Nanociencia e Nanotecnoloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Third	Obligatory	6
Language	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Brandariz Lendoiro, Maria Isabel	E-mail	i.brandariz@udc.es	
Lecturers	Brandariz Lendoiro, Maria Isabel	E-mail	i.brandariz@udc.es	
Web	campusvirtual.udc.es			
General description	This chemical kinetics course is divided into three fundamental blocks: first, the basic concepts are studied (definitions, integration of the rate equations, etc.), to give way in a second place to the theories that deal with the rate of reaction from the point of view of from a theoretical point of view (theory of collisions, of the transition state and its applications), to finish studying in the last section the different types of catalysis.			

Study programme competences	
Code	Study programme competences
A1	CE1 - Comprender los conceptos, principios, teorías y hechos fundamentales relacionados con la Nanociencia y Nanotecnología.
A2	CE2 - Aplicar los conceptos, principios, teorías y hechos fundamentales relacionados con la Nanociencia y Nanotecnología a la resolución de problemas de naturaleza cuantitativa o cualitativa.
A3	CE3 - Reconocer y analizar problemas físicos, químicos, matemáticos, biológicos en el ámbito de la Nanociencia y Nanotecnología, así como plantear respuestas o trabajos adecuados para su resolución, incluyendo el uso de fuentes bibliográficas.
A7	CE7 - Interpretar los datos obtenidos mediante medidas experimentales y simulaciones, incluyendo el uso de herramientas informáticas, identificar su significado y relacionarlos con las teorías químicas, físicas o biológicas apropiadas.
B2	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio
B3	CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
B4	CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado
B5	CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía
B6	CG1 - Aprender a aprender
B7	CG2 - Resolver problemas de forma efectiva.
B8	CG3 - Aplicar un pensamiento crítico, lógico y creativo.
B9	CG4 - Trabajar de forma autónoma con iniciativa.
C1	CT1 - Expresarse correctamente, tanto de forma oral coma escrita, en las lenguas oficiales de la comunidad autónoma
C2	CT2 - Dominar la expresión y la comprensión de forma oral y escrita de un idioma extranjero
C7	CT7 - Desarrollar la capacidad de trabajar en equipos interdisciplinares o transdisciplinares, para ofrecer propuestas que contribuyan a un desarrollo sostenible ambiental, económico, político y social.
C8	CT8 - Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad

Learning outcomes

Learning outcomes	Study programme competences		
Know the fundamental concepts of kinetical chemical Know the theories that explain the speed of reaction and theie applications Comprise the origin of the catalytic phenomena	A1 A2 A3		
Comprise the chemical change and the factors that influence in the speed of the chemical reactions Be able to comprise kinetical data and relate them with the mechanisms of reaction.	A1 A2 A3 A7	B2 B3 B4 B5 B6 B7	
Be able to design, realize and interpret experiments cinéticos in the laboratory.	A2 A3 A7	B7 B8 B9	C1 C2 C7 C8

Contents	
Topic	Sub-topic
Basic concepts of chemical kinetics	Rate of chemical reactions Integration of rate equations Experimental techniques for measuring reaction rates Methods for determining reaction orders Rate of complex reactions (reversible, consecutive, etc) Derivation of the rate equation from the reaction mechanism, and vice versa
Kinetic Theories and their applications	Collision theory for gas phase reactions Potential energy surfaces Transition state theory Elementary reactions in solution Diffusion controlled reactions. Photochemical reactions Reactions with solids
Catalysis	Catalysis: definition and types Homogeneous catalysis Microheterogeneous catalysis
Lab experiments	Laboratory experiments for the monitoring of chemical reactions with different experimental methods and the determination of rate equations

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A2 A3 A7 B6 B7	28	50	78
Seminar	B2 B3 B4 B5 B6 B7 B8 B9	8	32	40
Laboratory practice	B2 B3 B4 B5 C1 C2 C7 C8	15	12	27
Multiple-choice questions	A1 A2 A3 A7 B6 B7 B8 B9 C1 C2 C7 C8	0.5	0	0.5
Mixed objective/subjective test	A1 A2 A3 A7 B6 B7 B8 B9 C1 C2 C7 C8	3.5	0	3.5

Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Guest lecture / keynote speech	The fundamental concepts and theories of the subject are explained
Seminar	Problems, questions and doubts related to the theoretical contents are solved.
Laboratory practice	It consists of two stages: Carrying out the assigned experiment in the laboratory Preparation of the internship report in which the results are described and the data obtained is analyzed.
Multiple-choice questions	Short test on fundamental concepts
Mixed objective/subjective test	It will consist of problems similar to those solved in the seminars and questions related to the theoretical content.

Personalized attention	
Methodologies	**Description**
Seminar Laboratory practice	Attendance at tutorials is recommended to resolve any questions that may arise both in solving problems, as well as for the preparation of the laboratory practice or for questions related to the master classes.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Mixed objective/subjective test	A1 A2 A3 A7 B6 B7 B8 B9 C1 C2 C7 C8	Written test to answer theoretical questions and solve exercises related to the contents of the lectures, seminars and practices.	80
Laboratory practice	B2 B3 B4 B5 C1 C2 C7 C8	In the evaluation of this activity, the laboratory work and the Results Report are taken into account.	10
Multiple-choice questions	A1 A2 A3 A7 B6 B7 B8 B9 C1 C2 C7 C8	Multiple choice test	10

Assessment comments
-Attendance to the practices and the delivery of the Report, are essential requirements to pass the subject -To pass the subject, it will be necessary to obtain a grade of no less than 4.5 out of 10 in the mixed test and to achieve, adding the grades of all the activities, a minimum grade of 5.0. -If the minimum grade in the final mixed test has not been reached, the subject will appear as failed, even if the average of the grades obtained in the different methodologies is higher than 5 (out of a maximum of 10), in which case the final grade awarded will be from 4.5. -The registration qualification is granted preferably at the first opportunity. -In the second opportunity, the mixed test will be repeated and the qualification of the other activities will be maintained. -The qualification of not presented will be granted to those who do not appear for the mixed test.-Students with recognition of part-time dedication and academic waiver of attendance exemption who cannot attend the seminars, may be assigned different works/problems throughout the course to be exposed during tutoring hours.

Sources of information	
Basic	- P. W. Atkins, J. de Paula (2008). Química Física, 8ª Ed. . Panamericana - Laidler K. J. (1994). Chemical Kinetics . Harper and Row, New York. - Bockris, J.O.M., Reddy, A K.N. (1998). Modern Electrochemistry 1. Ionics. 2nd ed.. Plenum Press, New York - Espenson J. H. (1995). Chemical kinetics and reaction mechanisms 2ª ed.. McGraw-Hill, New York. - P. W. Atkins, J. de Paula (2010). Physical Chemistry, 9th Ed. . Oxford University Press
Complementary	- P. L. Brezonik (1994). Chemical Kinetics and Process Dynamic in Aquatic Systems.. Lewis Publishers - R. A. Jackson (2004). Mechanism in Organic Reactions.. Royal Society of Chemistry (RSC) - P. Sanz Pedredo (1992). Físicoquímica para Farmacia y Biología.. Masson-Salvat Medicina - LEVINE I. N. (2004). Fisicoquímica 5ª ed.. McGraw-Hill, Madrid - KORITA, J, DVORAK, J., KAVAN, L. (1987). Principles of Electrochemistry. 2nd ed.. Wiley, Chichester - S. R. Logan (2000). Fundamentos de Cinética Química. Addison Wesley - BOCKRIS, J.O.M., REDDY, A.K.N., GAMBOA-ADELCO, M.E. (2000). Modern Electrochemistry 2A. Fundamentals of Electrodics.. Kluwer Academic/Plenum Press: New York - BERRY R. S., RICE S. A., ROSS J. (2000). Physical Chemistry. 2ª ed.. Oxford University Press, New York - J. BERTRAN-RUSCA, J. NUÑEZ-DELGADO Eds , (2002). Química Física, vol. II. Ariel Ciencia

Recommendations
Subjects that it is recommended to have taken before
Chemistry: Equilibrium and Change/610G04008
Subjects that are recommended to be taken simultaneously
Supramolecular Chemistry/610G04027
Subjects that continue the syllabus
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.