



IDENTIFYING DATA

Physical Chemistry V: Chemical Kinetics

Subject	Physical Chemistry V: Chemical Kinetics			
Code	V11G201V01308			
Study programme	Grado en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Bravo Díaz, Carlos Daniel			
Lecturers	Bravo Díaz, Carlos Daniel Cepero Rodríguez, Elizabeth Giráldez Martínez, Jesús Losada Barreiro, Sonia			
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Web				
General description	International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
A1	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Ability for autonomous learning
B4	Ability for analysis and synthesis
C12	Know the kinetics of chemical change, including catalysis and reaction mechanisms
C27	Demonstrate the ability to observe, monitor and measure chemical processes, by systematically and reliably recording them and presenting reports of the work done
C28	Interpret data derived from laboratory observations and measurements in terms of their meaning and relate them to the appropriate theory
D1	Ability to solve problems

Expected results from this subject

Expected results from this subject	Training and Learning Results
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Define with precision, all the basic concepts in Chemical Kinetics, and know the different methods of data analysis to obtain speed equations.	A1	B1	C12	D1
Be able to carry out the analysis of kinetic data, including those of complex reactions and relate them to the reaction mechanisms.	A3	B4	C27	
Explain the fundamental hypotheses of the different theories on chemical change, as well as the results and limitations of each of them (Collision Theory and Transition State Theory and know how to apply them as a tool in the analysis of kinetic results).	A5		C28	
Describe the different types of catalysis, explain the mechanism of catalyzed reactions, and apply it to specific cases. Know how to particularize said kinetic-formal treatment to the different types of catalysis.				
Describe the basis of the different experimental techniques available for the study kinetics of chemical reactions.				

Contents

Topic	
Statistical thermodynamics	Introduction to the Statistical Thermodynamics. Configurations. Function of molecular partition. Canonical community. Thermodynamic functions. Constants of balance.
Kinetic theory of the gases	Foundations of the kinetic theory of the gases. Collisions and surfaces. Effusion.
Kinetic formal.	Rates of chemical reactions and rate equations. Orders of reactions, half-lives, elementary steps, molecularity. Analysis of kinetic data. Kinetic analysis of some complex reactions. Mechanisms. Effects of temperature.
Experimental methods in Kinetic Chemical	Transformation of the rate equations. Conventional techniques for slow reactions. Relaxation methods to study fast reactions.
Theoretical interpretation of the speed of reaction.	Collision theory for bimolecular reactions. Transition state theory.
*Catalysis	Catalysis. Homogeneous, acid-base, enzymatic, and heterogeneous catalysis.
Kinetic *electrochemical	Electrode-solution interface. Steps of an electrochemical process. Galvanic cells. Overpotentials. Butler-Volmer and Tafel equations. Corrosion. Experimental techniques.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24	0	24
Seminars	12	60	72
Laboratory practical	14	11	25
Objective questions exam	2	16	18
Essay questions exam	0	3	3
Problem and/or exercise solving	0	6	6
Essay questions exam	0	3	3

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Exposition delivered before an audience or class, especially for instruction or to set forth some subject of the course. The students have to develop the ideas and topics delivered after lectures.
Seminars	meeting for giving and discussing information, and that will mostly be employed to solve previously proposed problems and/or exercises to complement lectures theoretical classes
Laboratory practical	Practical activities developed in laboratories related to topics of the course

Personalized assistance

Methodologies	Description
Seminars	Resolution of doubts on the proportionate explanations in classes. These queries will be able to attend also by telematic means (email, videoconference, forums of *FaiTIC, ...), previous application through an email.
Lecturing	Resolution of doubts on the proportionate explanations in classes. During all the educational period the students will be able to consult all type of doubts related with the matter. These queries will be able to attend by telematic means (email, videoconference, forums of *FaiTIC, ...), previous application through an email.

Laboratory practical In the schedule of *Tutorías of the professor will resolve of form *individualizada and more personal those doubts of the students that can arise along the course during the realisation of the practices of laboratory or the preparation of the corresponding reports. These queries also will be able to attend by telematic means (email, videoconference, forums of *FaiTIC, ...), previous application through an email.

Tests	Description
Problem and/or exercise solving	In the schedule of *Tutorías of the professor will resolve of form *individualizada and more personal those doubts of the students that can arise along the course during the realisation of the practices of laboratory or the preparation of the corresponding reports. These queries also will be able to attend by telematic means (email, videoconference, forums of *FaiTIC, ...), previous application through an email.
Essay questions exam	The examination will make , in the time that stipulate , on the contents of the subject and will be able to *contenter theoretical questions like practices (problems).

Assessment					
	Description	Qualification	Training and Learning Results		
Seminars	Examination / short proof	15	A1 A5	C12 C28	D1
Laboratory practical	It marks here, together with the effort and the attitude, the *destrezas and the competitions developed pole student during the realization of the distinct practices. Also it will value the quality of the summary of #each of the practices as well as it of the memory that will have to deliver to it finalize all they (memory of practical). The delivery of the summaries to it finalize each practical, the memory of practices, and the assistance the sessions of practices is MANDATORY and, therefore, is not possible to approve the subject in the case of not to have realized *alguna of them.	15	A1 A3 A5	C12 C27 C28	D1
Essay questions exam	Examination of theory - questions/*cuestions developmental	35	A1 A5	C12 C28	D1
Essay questions exam	*Examen Practical - development of exercises that can be numerical the theorists	35	A1 A5	C12 C28	D1

Other comments on the Evaluation

- On the date indicated for the exams there will be two tests, one theoretical (35%) and another practical (practical exercises, 35%).

- In the second and subsequent exams, the teacher may opt for this scheme or another set, corresponding to a score of 70% of the overall grade.

Attendance at practices, and the delivery of the corresponding reports (summary of each practice and memory of which indicated) is MANDATORY. An unjustified fault will mean a direct failure in the subject and have to do them again the following year. More than three (3) justified absences will mean the suspense of the subject and that they have to be done again in the following course.

Attendance at master classes and seminars is highly recommended.

The score of the laboratory part will have to be equal to or greater than 5.0 (scale 0-10). The minimum grade REQUIRED in each of the development exams will be 3.8 (on a scale 0-10) so that it can be averaged with the scores of the other sections. There is no minimum grade in the control exams / short tests. The overall average score must be equal to or greater than 5.0 (scale 0-10).

Sources of information

Basic Bibliography

I. N. Levine, **Química Física,**

P. W. Atkins, J. De Paula, **Physical Chemistry,** 10,

Complementary Bibliography

T. Engel, P. J. Reid, **Physical Chemistry,**

K. J. Laidler, **Chemical Kinetics,**

S. Senent, **Química Física II, 3ª Ed.,**

M. E. Robson, **Chemical Kinetics,**

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 2/V11G201V01107

Mathematics: Mathematics 2/V11G201V01108

Physical chemistry I: Chemical thermodynamics/V11G201V01203

Physical Chemistry II: Surfaces and Colloids/V11G201V01208

Physical Chemistry III: Quantum Chemistry/V11G201V01303
