



IDENTIFYING DATA

Physical chemistry III

Subject	Physical chemistry III			
Code	V11G200V01603			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Mandatory	3rd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Losada Barreiro, Sonia			
Lecturers	Losada Barreiro, Sonia Mariño López, Andrea Mosquera Castro, Ricardo Antonio Tojo Suárez, María Concepción			
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General description	The subject provides training in applications of Physical Chemistry of great importance, like Chemical Kinetics, including Catalysis, surface phenomena, Macromolecules and Colloids as well as some foundations of Electrochemistry.			

Competencies

Code	
C7	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: kinetics of change, including catalysis and reaction mechanisms
C14	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: relationship between macroscopic properties and properties of individual atoms and molecules, including macromolecules
C19	Apply knowledge and understanding to solve basic problems of quantitative and qualitative nature
C20	Evaluate, interpret and synthesize data and chemical information
C21	Recognize and implement good scientific practices for measurement and experimentation
C22	Process and perform computational calculations with chemical information and chemical data
C23	Present oral and written scientific material and scientific arguments to a specialized audience
C26	Perform common laboratory procedures and use instrumentation in synthetic and analytical work
C27	Monitor, by observation and measurement of physical and chemical properties, events or changes, and document and record them in a consistent and reliable way
C28	Interpret data derived from laboratory observations and measurements in terms of their significance and relate them to the appropriate theory
C29	Demonstrate skills for numerical calculations and interpretation of experimental data, with special emphasis on precision and accuracy
D1	Communicate orally and in writing in at least one of the official languages of the University
D3	Learn independently
D4	Search and manage information from different sources
D5	Use information and communication technologies and manage basic computer tools
D6	Use mathematics, including error analysis, estimates of orders of magnitude, correct use of units and data representations
D7	Apply theoretical knowledge in practice
D8	Teamwork
D9	Work independently
D14	Analyze and synthesize information and draw conclusions
D15	Evaluate critically and constructively the environment and oneself

Learning outcomes

Expected results from this subject	Training and Learning Results	
Describe the general mechanism of the process of transport and for the transport of distinct physical properties. Comprise the origin of the ionic conductivity. Know, apply this knowledge to the determination of thermodynamic parameters like constants of balance, coefficients of activity or others like molar conductivities limit.	C7	D1
	C14	D3
	C19	D4
	C23	D9
Define with precision, all the basic concepts in kinetic chemistry and, know the distinct methods of analysis of data to obtain rate equations.	C7	D1
	C19	D3
	C23	D4
		D9
Describe the foundation of the distinct experimental methods available for the kinetic study of the chemical reactions.	C20	D1
	C27	D3
	C28	D4
		D9
Be able to carry out the analysis of kinetic data, including the ones of complex reactions and relate the same with the mechanisms of reaction.	C7	D1
	C19	D3
	C27	D4
		D7 D9
Explain the fundamental hypotheses of the distinct theories on the chemical change, as well as the results and the limitations of each one of them (Theory of Collisions and Theory of the State of Transition) and know, apply them like tool in the analysis of kinetic results.	C7	D1
	C14	D3
	C19	D4
		D9
Describe the distinct types of catalysis, explain the mechanism of the catalized reactions and apply it to concrete cases. Know kinetic treatment to the distinct types of catalysis.	C7	D1
	C19	D3
		D4
		D9
Know the basic structure of the electrical interface and its application to the study of the stability of the colloids and of the processes in the electrical interfaces.	C7	D1
	C14	D3
	C19	D4
		D9
Explain the principles that govern the phenomena of adsorption on solid surfaces and distinguish the types. Comprise the origin of the distinct isotherms of adsorption and know apply them to concrete problems.	C14	D1
	C19	D3
		D4
		D9
Explain the nature and structure of the macromolecules in solution and the most representative models for their description.	C14	D1
	C19	D3
		D4
		D9
Describe with clarity the nature and the distinct types of colloidal systems. Comprise the basic appearances of the thermodynamic treatment of the macromolecular solutions.	C14	D1
	C19	D3
		D4
		D9
Describe the foundation of the experimental methods more important for the determination of the structure of macromolecules and colloidal systems.	C14	D1
	C27	D3
		D4
		D9
Describe the structure and explain the causes of the stability of the colloidal systems as well as recognise their chemical importance.	C14	D1
	C19	D3
		D4
		D9
Know the basic appearances of the structure of the electrical interface, the origin of the distinct types of sobrepotential and its application.	C7	D1
	C14	D3
	C19	D4
		D9
Apply the distinct basic methods in the field of the kinetics for the determination, between others, of rate equations and activation energies. Determine experimentally properties associated to the phenomena of transport and surface and the structure of the macromolecules and colloidal systems.	C19	D1
	C20	D4
	C21	D5
	C22	D6
	C26	D7
	C27	D8
	C28	D9
	C29	D14 D15

Contents

Topic

Phenomena of transport	Kinetic theory of gases. No-electrical transport phenomena. Electrical transport transport: conductivity
Surface phenomena	Surface tension. Structure of the solid surfaces. Adsorption on solid surfaces. Physisorption and chemisorption: models. The electrical interface.
Formal kinetics	Reaction rates and rate equations. Analysis of data. Kinetic analysis of complex reactions. Mechanisms. Influence of the temperature in the rate of reaction.
Experimental methods in chemical kinetics	Transformation of the rate equations. Conventional methods. Experimental methods for the study of fast reactions.
Theoretical interpretation of the rate of the reaction	Collision theory for bimolecular reactions. Transition-state theory.
Macromolecules	Structure of the macromolecules. Structural models. Characterization of macromolecules.
Colloids	Classification of colloidal systems. Synthesis and characterization of colloids. Stability of colloidal systems.
Catalysis	General catalysis mechanism. Homogeneous catalysis mechanism. Heterogeneous catalysis mechanism.
Electrode kinetics	Stages of an electrode process. Sobrepotential. Sobrepotential of transfer of load. Diffusion sobrepotential. Sobrepotential of reactions and crystallizations. Experimental methods.
Laboratory practical	Experiments of kinetic chemistry including catalysis, transport phenomena, electrochemistry, macromolecules and colloids.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	0	26
Seminars	13	65	78
Laboratory practical	45.5	32.5	78
Problem and/or exercise solving	1	5	6
Problem and/or exercise solving	1	5	6
Essay questions exam	3	15	18
Report of practices, practicum and external practices	0	6	6
Problem and/or exercise solving	0	7	7

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

Methodologies

	Description
Lecturing	Lesson in a classroom. Resolution of some exercises in the classroom.
Seminars	Approach, analysis and discussion of problems and questions of some complexity.
Laboratory practical	Realization under the supervision of Professor (but of autonomous way) of laboratory practises related with the subject.

Personalized assistance

Methodologies	Description
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 subject. These questions will be able to attend by telematic ways (email, videoconference, forums of FaiTIC, ...), previous application through an email.
Seminars	Resolution of doubts on the proportionate explanations in classes. These questions will be able to attend by telematic ways (email, videoconference, forums of FaiTIC, ...), previous application through an email.
Laboratory practical	Those questions of students that may arise during the realization of laboratory practices or the corresponding reports will be resolved individually in the teacher tutoring schedule. These questions will be able to attend by telematic ways (email, videoconference, forums of FaiTIC, ...), previous application through an email.
Tests	Description
Report of practices, practicum and external practices	Those questions of students that may arise during the realization of laboratory practices or the corresponding reports will be resolved individually in the teacher tutoring schedule. These questions will be able to attend by telematic ways (email, videoconference, forums of FaiTIC, ...), previous application through an email.

Problem and/or exercise solving Doubts and questions of problems and/or questions provided in classes. These questions will be able to attend by telematic ways (email, videoconference, forums of FaiTIC, ...), previous application through an email.

Assessment				
	Description	Qualification	Training and Learning Results	
Seminars	Presentation and discussion of exercises prior to the seminar will be evaluated	4	C7 C14 C19 C23	D1 D6 D7 D14
Laboratory practical	It is scored here along with the effort and the attitude, the skills and the competences developed by the student during the accomplishment of the different practices. Attendance at practice sessions is mandatory and, therefore, it is not possible to pass the subject in case it has not taken place.	15	C19 C20 C21 C22 C23 C26 C27 C28 C29	
Problem and/or exercise solving	Evaluation of acquired knowledge up to date with a small exam (questions, problems)	18	C7 C14 C19 C23	D1 D7
Problem and/or exercise solving	Evaluation of acquired knowledge up to date with a small exam (questions, problems)	18	C7 C14 C19 C23	D1 D7
Essay questions exam	Final exam (long exam). Evaluation of the acquired knowledge: questions and problems	40	C7 C14 C19 C23 C28	D1 D7
Report of practices, practicum and external practices	The presentation and quality of the experimental data obtained in experiments will be evaluated. Reports will necessarily include some discussion on the reported data.	5	C14 C19 C20 C21 C22 C27 C28	

Other comments on the Evaluation

- The assistance to masterclasses, seminars and the realisation of the practices and the delivery of the corresponding reports is compulsory.

The notes of the seminars and practical of laboratory will keep for the second evaluation. Under special circumstances, students may be required to make a special work to improve the grades obtained.

The minimum note of the "official" (long) exam will be of 3.8 (in scale 0-10, 1.52 in scale 0-4) and of 3.0 (scale 0-10) in the short ones, so that the final grade will be an average (with the corresponding percentage) of the punctuations of all sections. To pass the topic, the global grade has to be, of course, equal to or higher than 5.0. There is not minimum punctuations in other sections, but presentation and discussion of exercises during the seminars is highly relevant and will be considered important.

Sources of information

Basic Bibliography

Complementary Bibliography

I.N. LEVINE, **Physical Chemistry**, 6^a,

P.W. ATKINS y J. DE PAULA, **Physical Chemistry**, 10^a,

T. ENGEL y P.J. REID, **Physical Chemistry**, 3^a,

K. J. LAIDLER, **Chemical Kinetics**, 3^a,

A. HORTA, **Macromoléculas (2 vols)**, 2ª,
S. SENENT, **Química Física II**, 3ª,
J. Bertrán y J. Núñez (coords.), **Química Física (2 vols)**, 1ª,

Recommendations

Subjects that are recommended to be taken simultaneously

Analytical chemistry 3/V11G200V01601
Inorganic chemistry II/V11G200V01604

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===

In front of the uncertain and unpredictable evolution of the sanitary alert caused by the COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance by the students and the teachers through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===

All the educational methodologies foreseen in the educational guide initial will be kept, with the exception that, if the classes could not give of face-to-face form, these would give through the classrooms of the Remote Campus of the University of Vigo.

If the practices of laboratory could not be developed of face-to-face form, the content of the practices will be explained through the classrooms of the Remote Campus of the University of Vigo and some experimental data will be provided to the students, so that with them can fill the corresponding report of practices of laboratory.

The personalized assistance will be able to carry out in different modalities: by email or through the dispatches of each professor in the Remote Campus of the University of Vigo previous application through an email.

=== ADAPTATION OF THE EVALUATION ===

In the case that the small and long exams could not carry out of face-to-face way, the evaluation of the subject keeps as indicated in the educational guide, with the same percentages of qualification, but with the difference that the small and long exams will carry through the Remote Campus being able to have like support the use of the platform of FaiTIC and without prejudice to other measures that can be adopted to guarantee the accessibility of the students to the exams.

The assessment of the contents of laboratory (20% on the total of the subject in the continuous evaluation) will remain covered by means of the correction of the reports delivered during the course.

For the second assessment, the qualifications of continuous evaluation obtained along the course will be kept.
