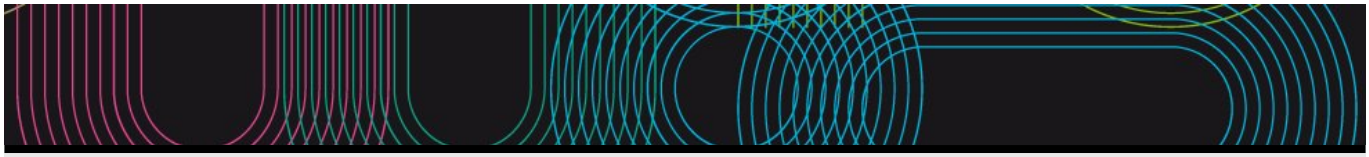

IDENTIFYING DATA				
Physical Chemistry II: Surfaces and Colloids				
Subject	Physical Chemistry II: Surfaces and Colloids			
Code	V11G201V01208			
Study programme	Grado en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Hervés Beloso, Juan Pablo			
Lecturers	Fernández Nóvoa, Alejandro González Cabaleiro, Lara Hervés Beloso, Juan Pablo López Fernández, Iago Otero Martínez, Clara Polavarapu , Lakshminarayana			
E-mail	jherves@uvigo.es			
Web	http://https://faitic.uvigo.es/index.php/es/			
General description	In the present subject we intend to develop the fundamentals of Chemical Thermodynamics which have been introduced in previous subjects in order to apply them to systems of particular chemical interest, such as macromolecules and colloids, as well as to the adsorption processes. For accomplishing these purposes, Transport Phenomena are studied first, using some basic elements of Kinetic Theory which will be analyzed more deeply in the subject 'Química Física V: Cinética Química' of the third year. It is then possible to study the origin of ionic conductivity and discuss its chemical applications extensively. By using the thermodynamic treatment of the interface, the stability of colloidal systems can be analyzed and the adsorption processes studied. The experimental methods for the study of the structure and composition of interfaces are presented and used as far as possible in lab experiments. Such methods include those based on surface tension measurements and also those related to adsorption on solid surfaces. The experimental methods needed for the study of macromolecules and colloids are also studied. : English Friendly subject: 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
B1	Ability for auronomous learning
B2	Organization and planning capacity
B4	Ability for analysis and synthesis
C16	Know the relationship between macroscopic properties and properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids, crystals and other materials
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	Training and Learning Results			
To know the general mechanisms of transport processes, its equations and applications.	A1	B1 B2 B4	C16 C27 C28	D1
To understand the origin of ionic conductivity and its chemical applications.	A1	B1 B2 B4	C16 C27 C28	D1
To know the structure of the interfaces and the magnitudes that characterise it.	A1	B1 B2 B4	C16	
To explain the principles which govern the adsorption phenomena and to know various adsorption isotherms.	A1	B1 B2 B4	C16 C27 C28	D1
To explain the nature and structure of polymers and macromolecules.	A1 A3	B1 B2 B4	C16	
To explain the causes of the stability of colloidal systems and their control.	A1 A3	B1 B2 B4	C16 C27 C28	D1
To describe the fundamentals of the experimental techniques used in the determination of the structure of macromolecules and colloidal systems	A1 A3	B1 B2 B4	C16 C27 C28	D1

Contents	
Topic	
I. TRANSPORT PHENOMENA.	1. Fundamental results of the kinetic theory of gases. 2. Non-electric transport phenomena: Diffusion. Thermal conductivity. Viscosity. 3. Electric transport phenomena. ionic conductivity. Ionic mobility. Applications of conductivity measurements.
II. SURFACE PHENOMENA and SURFACE TENSION	1. Interfaces. 2. Thermodynamic treatment: surface tension. curved interfaces. Kelvin equation 3. Capillarity and contact angle. 4. Interfaces with more than one component: Gibbs Law. 5. Monolayers. Detergency.
III. ADSORPTION ON SOLIDS	1. Description of the structure of solid surfaces. 2. Adsorption: general aspects. 3. Physisorption and Chemisorption. 4. Adsorption isotherms. 5. Electrified interface. Double layer models.
V. COLLOIDS	1. Classification of colloidal systems. 2. Synthesis of colloids. 3. Colloidal stability. 4. DLVO theory. 5. Association colloids: micelles, vesicles and microemulsions
IV. POLYMERS AND MACROMOLECULES	1. Structure of macromolecules. 2. Structural models. Conformations. 3. Distribution of molecular masses. 4. Characterization of macromolecules. 5. Polymerization. Degree of polymerization.
LABORATORY LESSONS	Laboratory practices related to the contents of the theory classes: - Transport phenomena: ionic conductivity. - Surface phenomena: Surface tension Measurements. - Adsorption on solid surfaces. - Synthesis and characterization of macromolecules and colloids.

Planning	Class hours	Hours outside the classroom	Total hours
Lecturing	24	42	66
Problem solving	12	22	34
Laboratory practical	28	20	48

Objective questions exam	1	0	1
Objective questions exam	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

	Description
Lecturing	Discussion of the fundamental aspects of each topic and description of those to be addressed in the seminars. Discussion of the specific issues raised by students. The student will be provided with the study material necessary to follow the lessons through the Moovi platform.
Problem solving	Resolution of numerical problems and theoretical questions as well as test-type exercises. Numerical and theoretical problems will be solved by the teacher with the participation of the students. The results will be analyzed and interpreted. On a voluntary basis, the student may solve some of these exercises in the seminar, with the assistance of the teacher and the participation of the rest of the students.
Laboratory practical	Every student is expected to perform a well balanced set of experiments which exemplifies and develops the fundamental topics. In principle, we expect the experiments to be carried out by couples of students for agility, but they may also be done individually, depending on the circumstances. Scripts describing every experiment, references to bibliographic material and instructions for the use of the devices if needed, as well as others related to laboratory safety, will be made available. The student must draw up the fugures and make the necessary calculations to obtain the final results, as well as analyze and discuss them.

Personalized assistance

Methodologies	Description
Lecturing	The student may raise specific questions in the lectures and more extensive ones in the teacher's tutoring schedule
Problem solving	The solution to the proposed exercises will be discussed with students in connection with the development of the theoretical foundations. The additional questions students may raise will be answered during the teacher's tutoring schedule.
Laboratory practical	The problems or doubts the students might have regarding the theoretical foundation of the experiments, their development and the key aspects of the calculations needed to obtain the result will be discussed during the practical sessions. Additional issues will be addressed in tutoring hours.
Tests	**Description**
Objective questions exam	Any doubts regarding the exams, in particular those related to their scope and configuration, shall be clarified. In the case of the short test, the solutions to the exercises will be briefly presented and discussed in the following seminar. During tutoring hours, the answers provided by the student will be discussed with him/her at his/her request; the time deadlines will be respected in the case of the exam (long-duration test).
Objective questions exam	

Assessment

	Description	Qualification	Training and Learning Results			
Problem solving	The resolution by the student of the proposed exercises and their presentation will be valued. Test-type questionnaires will also be carried out. In both cases voluntarily. The weight in the score is between the limits 0-15%	15	A1	B1 B2 B4	C16	D1
Laboratory practical	Laboratory leasons are compulsory. Its experimental development is valued as well as the presentation of a practice report. This must contain tables, graphs and the necessary calculations to obtain the results, as well as an analysis of the same, in relation to the experimental procedure and the theoretical theories used. The weight in the score is between the limits 0-15%)	15	A1 A3	B1 B2 B4	C16 C27 C28	D1
Objective questions exam	First short exam. It will take place in the middle of the semester approximately. It will consist of solving questions and problems. If its mark reaches or surpasses 5 on the 10-point scale the corresponding topics can be considered as passed. Its weight, depending on the other sections of the evaluation, will be 35%.	35	A1		C16 C28	D1

Objective questions exam	Second short exam. It will take place at the end of the semester. It will consist of solving questions and problems. Its weight, depending on the other sections of the evaluation, will be 35%.	35	A1	C16 C28	D1

Other comments on the Evaluation

To pass the subject it is necessary to pass the laboratory practices.
The qualification of each exam (and the average of them) must be at least 4.0 out of 10 so that an average can be made with the other sections.
Presenting any exercise, performing any practice or test makes it impossible for the qualification to be 'non qualified'.

Sources of information

Basic Bibliography

Atkins, P.W.; de Paula, J., **Atkin's Physical Chemistry**, 10th ed., Oxford University Press, 2014

Levine, I. N, **Physical Chemistry**, 6th ed., McGraw-Hill, 2009

Complementary Bibliography

Bertrán-Rusca, J; Núñez-Delgado, J, **Química Física (Vol II)**, 1º edición, Ariel Ciencia, 2002

Adamson, A. W.; Gast, A. P, **Physical Chemistry of Surfaces**, 6th ed, Physical Chemistry of Surfaces, 1997

Everett, D. H. F.R.S, **Basic Principles of Colloid Science**, RSC Paperbacks, 1988

Recommendations

Subjects that it is recommended to have taken before

Chemistry: Chemistry 2/V11G201V01109
Physical chemistry I: Chemical thermodynamics/V11G201V01203

Other comments

Some contents will be developped and complemented in subjetcs taught in the third and fourth year. For instance "Química Física V: Cinética Química" (3rd year), "Química de Materiales" (4th year) and, the optional subjects "Nanoquímica" and "Materia Condensada" of the 4th year.