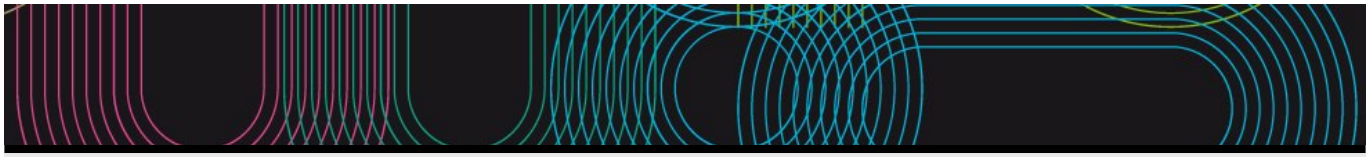

IDENTIFYING DATA				
Physical Chemistry II: Surfaces and Colloids				
Subject	Physical Chemistry II: Surfaces and Colloids			
Code	V11G201V01208			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Flores Rodríguez, Jesús Ramón			
Lecturers	Fernández Nóvoa, Alejandro Flores Rodríguez, Jesús Ramón Pastoriza Santos, Isabel Peña Gallego, María de los Ángeles Pérez Juste, Jorge			
E-mail	flores@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 the utmost 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.			

Competencies	
Code	
A2	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	Autonomous learning ability
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

Learning outcomes	
Expected results from this subject	Training and Learning Results

To know the general mechanisms of transport processes, its equations and applications.	A2	B1 B2 B4	C16 C27 C28	D1
To understand the origin of ionic conductivity and its chemical applications.	A2	B1 B2 B4	C16 C27 C28	D1
To know the structure of the interfaces and the magnitudes that characterise it.	A2	B1 B2 B4	C16	
To explain the principles which govern the adsorption phenomena and to know various adsorption isotherms.	A2	B1 B2 B4	C16 C27 C28	D1
To explain the nature and structure of polymers and macromolecules.	A2 A3	B1 B2 B4	C16	
To explain the causes of the stability of colloidal systems and their control.	A2 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	A2 A3	B1 B2 B4	C16 C27 C28	D1

Contents

Topic	
I. TRANSPORT PHENOMENA.	1. Fundamentals of the Kinetic Theory of Gases. 2. Non-electrical Transport Phenomena Diffusion coefficient. Effusión. Thermal conductivity. Viscosity. 3. The effect of interparticle forces. 4. Molecular motion and the structure of liquids. Liquid cristals. 5. Electrical 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. Capilarity. Vapour pressure. 3. Experimental determination of the surface tension. 4. Temperature dependence of the surface tension. 5. Adhesion and cohesion. 6. Interfaces with more than one component: the Gibbs law. Monolayers 7. Detergency. 8. Nucleation.
III. ADSORPTION ON SOLIDS	1. Introduction. 2. Clusters and nanoparticles. 3. Description of the structure of solid surfaces. Porosity. Electrical properties. 4. Experimental determination of the superficial structure and composition. 5. Adsorption: general aspects. 6. Experimental study. 7. Physisorption. The B.E.T. isotherm. 8. Chemisorption: Isotherms. 9. Superficial diffusion and desorption. 10. Superficial chemical bond. Restructuring of the surface. 11. The electrified interface. Double layer models and electrocapillarity. 12. Electrokinetic phenomena.

IV. POLYMERS AND MACROMOLECULES	1. General aspects. 2. Polymerization. Degree of polymerization. 3. Distributions of molecular mass. 4. Structure. Conformations. Conformational variables. 5. Structural models. The random coil model. The effect of chain rigidity. 6. Experimental characterization. 7. Fractionation. 8. The nature of the solid state and the physico-chemical properties.
V. COLLOIDS	1. Classification. 2. Stability and generation: general aspects. 3. Experimental characterization. 4. Liophobic dispersions : the D.L.V.O. theory. 5. Flocculation and Coagulation. 6. Synthesis of nanoparticles. 7. Stability of emulsions. Foams. Microemulsiones. Micelles. 8. The Langmuir-Blodgett method. Applications to the generation of nanomaterials. 9. Self-assembly and supramolecular chemistry
LAB	Experiments related to the contents. Transport phenomena, including ionic conductivity. Surface phenomena. Adsorption on solid surfaces. Macromolecules and colloids.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24	38.4	62.4
Problem solving	12	20.4	32.4
Laboratory practical	28	25.2	53.2
Objective questions exam	2	0	2

*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 TEMA (Faitic) 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. Students may, voluntarily as well, present a written resolution to an exercise and debate it with the teacher in tutoring hours.
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).

Assessment

	Description	Qualification	Training and Learning Results			
Problem solving	The resolution of one or more exercises by the student and their presentation will be rated. Tests will be rated as well. In both cases on a voluntary basis. The weight in the mark lies between 0-10%.	10 (max)	A2	B1 B2 B4	C16	D1
Laboratory practical	Laboratory practices are compulsory. They will be rated by the assessment of their experimental development (13%) as well as by that of a written report of each experiment. Such reports have to be elaborated by every student individually, contain tables, figures and the calculations needed for obtaining of the results, as well as an analysis of those results, in relation to the experimental procedure and the theoretical foundations. They must be given to the teacher in charge of the corresponding laboratory group according to the dealine (7%)	20	A2 A3	B1 B2 B4	C16 C27 C28	D1
Objective questions exam	Short exam. It will take place by the middle of the quarter approximately. It consists of 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 depends on the other assessment sections lying between: 0-28%. Long exam. It is compulsory and takes place at the end of the quarter. The students who have not passed the short test will have to answer all the proposed exercises. Those who have passed it can still take on the corresponding exercises of the long exam, on a voluntary basis, for improving their mark. Its weight, which depends on the other sections of the assessment, lies between 45.5%-80%. The combined mark of the exams has to be at least 4.0 on the 10-point scale for passing the subject.	70-80	A2		C16 C28	D1

Other comments on the Evaluation

In the July call students will have to take a long test, which can represent up to 80% of the score, corresponding the rest to that of the Laboratory. The marks of the other sections (Problem solving and short test) may be kept if they lead to a higher average.
The combined score of the exams has to be at least 4.0 on the 10-point scale for the student to pass the subject.
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

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

Horta Zubiaga, A., **Macromoléculas**, UNED, 2004

Llorente Uceta, M. A.; Horta Zubiaga, A., **Técnicas de Caracterización de Polímeros**, UNED, 1993

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

Recommendations

Subjects that are recommended to be taken simultaneously

Structural Determination/V11G201V01206

Analytical Chemistry II: Optical Methods of Analysis/V11G201V01207
Inorganic chemistry II/V11G201V01209

Subjects that it is recommended to have taken before

Physics: Physics I/V11G201V01102
Physics: Physics 2/V11G201V01107
Geology: Geology/V11G201V01106
Chemistry: Chemistry Lab II/V11G201V01110
Chemistry: Chemistry 2/V11G201V01109
Biochemistry/V11G201V01201
Physical chemistry I: Chemical thermodynamics/V11G201V01203
Organic chemistry I/V11G201V01205

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.

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 (or with a wide *antelación) by the students and the *profesorado through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===

Methodologies:

Lecturing.
In the so-called "modalidad mixta" the Faculty of Chemistry will set up shifts for the assistance of students to the lectures. Those lectures will be broadcasted, whenever possible in a synchronous way, by means of the computer tools provided by the "Campus Remoto" or others, for those students who cannot otherwise attend the lecture.
In the "modalidad no presencial" the lectures must be followed telematically. The teacher will try to answer short questions by means of the utilities of the computer tools.

Problem solving.
In the "modalidad mixta", the students attending the seminar will still be able to present, on a voluntary basis, the resolution of an exercise. In the "modalidad no presencial" the teacher will solve the exercises telematically. Tests and questions will be made available for the students to solve; they should be presented for instance by the use of the TEMA platform (Faitic).

Laboratory practices.
Students should be able to perform in the lab, at least, the operations and measures which are indispensable for obtaining the needed data. The analysis and treatment of those data for obtaining the results of the experiment may be done at home, eventually with telematic assistance by the teacher (by e-mail, videoconference, TEMA tools) in the way which happens to be more agile.
Under the "modadlidad no presencial" the lab will be substituted by a sort of "supervised work". Additional information will be provided to the students in the form of videos and tutorials, concerning the experimental procedures. Students will be given too, sets of typical data of the measurements so they can draw up the figures and perform the calculations needed to obatin the results of the experiment. They, on an individual basis, will produce a report, written somehow in the way of a "supervised work" report, containing however all elements of a lab report. The teacher may too set up questionnaires about the additional information given to the students. Those questionnaires will be taken and the reports presented by the TEMA platform.

* Tutorships
Tutoring will be carried out preferably in a telematic way under the "modalidad mixta", and necesarily that way under the "modalidad no presencial".

* Modifications of the contents list
No changes.

* Additional bibliography to facilitate the self-learning
It will provided in due time. It will consist basically of videos, tutorials, and e-books, as well as any type of relevant information which can be provided by the TEMA platform or be accessed by the Internet (the corresponding links will be given).

=== ADAPTATION OF THE EVALUATION ===

Problem solving.
Under the "modalidad mixta" the assessment will be done as usual, as far as possible. Perhaps, the tests may be done telematically rather than in the classroom.
In the "modalidad no presencial" it will consist of tests to be carried out telematically.

Laboratory practices.
Under the "modalidad mixta" they will be qualified as usual.
In the "modalidad no presencial" only the written report and the questionnaires will be rated.

Exams.
Short exam.
In the "modalidad mixta" some exercises will be proposed to be presented telematically if they cannot be taken in the classroom. Under the "modalidad no presencial" they must be done telematically.
Long Exam. In the "modalidad mixta" a long written exam will be performed, if necessary by setting up time shifts. If that is not possible, and always under the "modalidad no presencial", it will be substituted by exercises to be presented telematically by the student using the TEMA platform and also by study works about particular topics of the subject,.