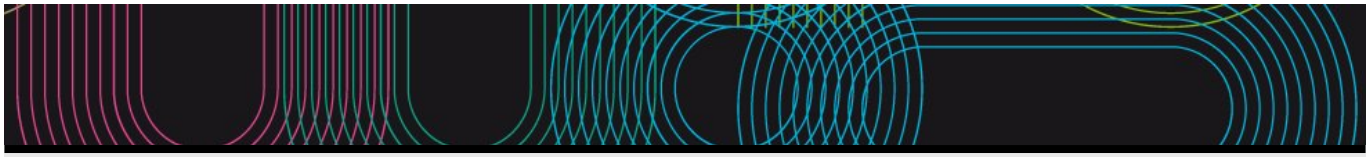

IDENTIFYING DATA				
Chemistry: Chemistry 2				
Subject	Chemistry: Chemistry 2			
Code	V10G061V01110			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Prieto Jiménez, Inmaculada			
Lecturers	Fernández Nóvoa, Alejandro Mandado Alonso, Marcos Prieto Jiménez, Inmaculada			
E-mail	iprieto@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The subject "Chemistry II" corresponds to first year of Chemistry in the degree of Marine Sciences at the University of Vigo. It aims to introduce students to the thermodynamic vision of Chemistry. For this, a review of principles will be carried out with the rigorous definition and meaning of the state functions such as those of Gibbs and Helmholtz, in addition to the chemical potential. From them we will define the equilibrium conditions and apply them to the study of phases and chemical processes. We will also consider how Thermodynamics approaches the study of ideal and real solutions and colligative properties. The teaching is divided into three parts. The first will present the theoretical part of the subject and some examples or theoretical applications of it. The second will consist of seminars for the resolution of exercises stimulating the participation/performance on the part of the students. The third part corresponds to the laboratory practices, where real applications (experimental sessions) of what has been studied in the other two parts will be dealt with and that will help the students assimilate the dynamics of work in a Chemistry laboratory. Subject of the English Friendly program: International students may request from the faculty: a) materials and bibliographical references to follow the subject in English, b) attend tutorials in English, c) tests and assessments in English.			

Training and Learning Results	
Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C6	Acquire the fundamentals and terminology of chemical processes.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject	Training and Learning Results			
Knowledge and employment of basic concepts of thermodynamics. Knowledge of the processes of transfer of heat and the processes of mixture in marine means.	A1	B4	C6	D1 D2
Knowledge and understanding of the phase equilibrium and the phase changes.		B4		D1 D2

Knowledge of the model of ideal solutions and colligative properties. Apply the colligative properties to the water of the sea.	A5	B4	C6	D2
Knowledge of the properties of the real and electrolyte solutions. Knowledge and application of the concept of activity. Knowledge of the description of the sea water as an aqueous electrolyte solution and analysis of related properties.	A5	B4	C6	D1 D2
Application of the concept of chemical equilibrium to real and electrolyte solutions. Knowledge of the influence of the characteristics of sea water in chemical reactions in that medium.	A5	B4	C6	D1 D2

Contents

Topic	
1. Principles of thermodynamics	The internal energy and the first principle. Enthalpy. Heat capacities. Ideal gases and first principle. Entropy and second principle. Calculation of entropy differences. Entropy, reversibility and irreversibility.
2. Thermodynamic functions	Gibbs and Helmholtz functions. Gibbs equations. Calculation of changes in state functions. Partial molar magnitudes. Chemical potential.
3. Phase equilibrium in one-component system	Phase equilibrium conditions. The phase rule. Phase diagram of water. The equations of Clapeyron and Clausius-Clapeyron.
4. Thermodynamics of ideal solutions	Chemical potential of an ideal gas. Ideal solutions. Vapor pressure. Ideal diluted solutions. Colligative properties: their influence on sea water. Osmotic pressure.
5. Thermodynamics of real solutions and electrolyte solutions	Deviations from Raoult's Law. Activity and activity coefficient. Determination of activities and activity coefficients. Chemical potential in electrolyte solutions and their activity coefficient. Debye-Hückel's theory. Thermodynamics of solvation of ions. Sea water as an electrolyte solution. Quantitative treatment of polyelectrolyte solutions.
Thermodynamics of chemical equilibrium	Chemical equilibrium and degree of progress of a reaction. Variation of the equilibrium constant with temperature. Chemical equilibrium in real solutions. Chemical equilibrium in electrolyte solutions. Effect of ionic strength on equilibrium.
Laboratory practices	Practices related to the following topics will be carried out: Enthalpy of dissolution. Method of solubility: enthalpy. Hot. Heat capacity. Effect of ionic strength on solubility. Chemical balance. Solubility product. Balance constant. Activity. Coefficient of activity. Ionic strength and its effect on the equilibrium constant. Dissolution and neutralization heat. Calorimetric method. Enthalpy, heat, heat of reaction, thermal capacity. Integral and differential heat. Ebulloscopic increase. Raoult's Law. Chemical potential. Enthalpy of vaporization. Study of the liquid-vapor equilibrium of mixtures of two liquids. Rule of the phases. Liquid-vapor balance. Phase diagram. Raoult's Law. Chemical potential. Coefficient of activity

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	35	58
Seminars	14	35	49
Laboratory practical	15	5	20
Essay questions exam	0	2	2
Essay questions exam	3	6	9
Problem and/or exercise solving	0	12	12

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

Methodologies

	Description
Lecturing	Theoretical classes taught through a presentation (available to students in the Moovi platform). In these classes will be introduced the basic contents, with emphasis in more important and difficult topics. Numerical problems will be also solved. The bulletins of problems will be available in the Moovi platform.
Seminars	Destined to the resolution of numerical problems and debate of the questions and exercises. The necessary material will be available in the Moovi platform. In addition, the students will solve proposed exercises and questions, according to the guidelines established by professors in the classes or seminars of the subject
Laboratory practical	Application of techniques of laboratory in practical problems related with the subject. The material will be available in the Moovi platform.

Personalized assistance

Methodologies	Description
Lecturing	Sessions in which professors solve the doubts and queries related to the subject, and with the activities carried out during the course. Students may attend personalized tutorials to resolve doubts. To optimize time, it is convenient to agree with professors on the date and time of the tutorial in advance.
Seminars	Ídem
Laboratory practical	Ídem
Tests	**Description**
Essay questions exam	Ídem
Problem and/or exercise solving	Ídem
Essay questions exam	Ídem

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	In this section could be valued: - The work carried out by the students in the laboratory. - The report on the laboratory experiments carried out by the students. - Test about the work developed. Attendance at laboratory experiments is required. To overcome the subject the student should reach at least 50% of the maximum possible score for this activity.	15		B4		D2
Essay questions exam	Written exam in which the level of theoretical knowledge and problem solving skills will be checked. It will be made in the middle of the semester. See "Other comments on the evaluation"	30	A1 A5	B4	C6	D1 D2
Essay questions exam	Written exam in which the level of theoretical knowledge and problem solving skills will be checked. It will be made in the date determined by the Faculty. See "Other comments on the evaluation"	30	A1 A5	B4	C6	D1 D2
Problem and/or exercise solving	The resolution of problems and questions proposed in the classroom and/or on the Moovi platform will be valued	25	A1		C6	D1 D2

Other comments on the Evaluation

The participation of students in any of the assessment activities of the subject will involve the assignment of a grade. Regarding this point, attendance at the laboratory sessions (two or more), realization of 20% of the exercises proposed by the professor and the realization of written tests will be considered.

The final grade of the subject will be the weighted addition of the marks for all the sections, provided that the minimum score required in each of them is reached.
The students who only carry out the laboratory practices will receive the qualification resulting from the application of the percentage corresponding to this section.The qualification corresponding to the written tests will be the average of the grade obtained in both and, to pass the subject, a score equal to or greater than 4 points out of 10 must be achieved. In case of obtaining a grade of less than 4 points out of 10, the grade that will be obtained will be the weighted grade of the written tests.

Evaluation in extraordinary call

In the July call, the previous percentages will be respected, maintaining the qualifications obtained in the laboratory practices and in the resolution of exercises and questions.
In this call, students will be able to recover the qualification corresponding to the written tests (60%) by taking a global test. To pass the subject, you must achieve a score equal to or greater than 4 points out of 10 in this test.The final grade of the subject will be the weighted addition of the marks for all the sections, as long as the required score are reached. If this is not the case, the final mark for the subject will be the weighted grade of the global test.

Global evaluation

Students who wish to opt for the global evaluation (EG) must request it within the period and in the manner established by the Faculty. This information will be available to students before the start of the academic period.To pass the subject, it is necessary to carry out the practices and also achieve at least 50% of the maximum possible score for this activity.The students who opt for the EG will take a test in which all the content of the subject will be assesed. This test will constitute

85% of the final grade for the subject, both in the ordinary and extraordinary calls. To pass the subject, it is necessary to obtain a grade equal to or greater than 5.0 points out of 10 in this test.

Other considerations
The assessment test schedule can be found at: http://mar.uvigo.es/alumnado/examenes/

IMPORTANT: Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of professor proposed work. This fraudulent behavior will be sanctioned with the firmness and rigor established by current regulations.

Sources of information

Basic Bibliography

Levine, **Fisicoquímica**, McGraw-Hill. 5ª Ed. (2004),

Atkins, **Química Física**, 8ª Ed. , Ed. Omega (2008),

Levine, **Problemas de Fisicoquímica**, 6ª Ed. McGraw-Hill (2014),

Complementary Bibliography

J. Pellicer, J. A. Manzanares, **100 Problemas de Termodinámica**, Síntesis (1996),

Laidler, Meiser, Sanctuary, **Physical Chemistry**, Edition, Houghton Mifflin (2002),

Klotz, Rosenberg, **Chemical Thermodynamics: Basic Theory And Methods**, 6th Ed., John Wiley (2000),

Rock, **Termodinamica Quimica**, Vicens-Vives (1989),

Rodríguez Renuncio, Ruiz Sánchez, Urieta Navarro, **Problemas resueltos de termodinámica química**, Síntesis. (2000),

W. Stumm, J. J. Morgan, **Aquatic Chemistry (Chemical equilibria and rates in Natural Waters)**, 3ª Ed. John Willey & Sons (1995).,

D. Eisenberg e D. Crothers, **Physical Chemistry with Applications to the Life Sciencies**, Benjamin/Cummings Publishing Company.(1979),

J. Wright e A. Colling, **Sea-water: its composition, properties and behaviour**, Oceanography, vol.2. The Open University. Pergamon Press.(1991),

Recommendations

Subjects that continue the syllabus

Chemical oceanography I/V10G061V01204
Chemical oceanography II/V10G061V01209

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematics II/V10G061V01109

Subjects that it is recommended to have taken before

Physics: Physics I/V10G061V01102
Mathematics: Mathematics I/V10G061V01104
Chemistry: Chemistry I/V10G061V01105