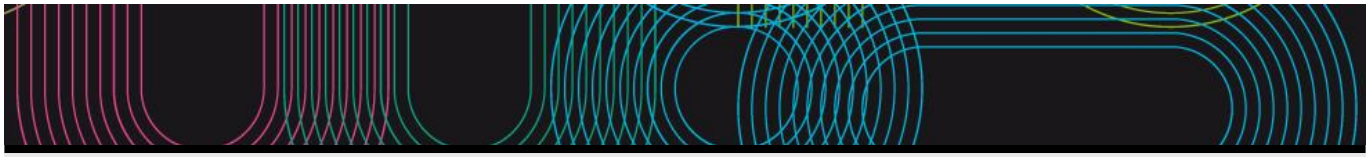

(*)Facultade de Química

Presentation

The studies of Chemistry have a large tradition at the University of Vigo, where it has been taught during more than 30 years. The stablisment of the Universitary System of Galicia in the 90s and the current process of implantation of the European Space of Higher Education (EEES) modified the offer of degrees, but no the pioneering spirit of the chemists in research of in the quest for a better service to the society.

Degrees given in the Faculty

Degree in Chemistry

- Masters And Doctorates:
  - Industry and Chemical Research and Industrial Chemistry
  - Theoretical chemistry and Computational Modelling
- Master:
  - Science and Technology of Conservation of Fishing Products

Web page

Information about the Faculty of Chemistry:

http://quimica.uvigo.es

(*)Grao en Química

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V11G200V01101	Biology: Biology	1st	6
V11G200V01102	Physics: Physics I	1st	6
V11G200V01103	Chemistry, physics and biology: Integrated laboratory 1	1st	6
V11G200V01104	Mathematics: Mathematics 1	1st	6
V11G200V01105	Chemistry: Chemistry 1	1st	6
V11G200V01201	Physics: Physics 2	2nd	6

V11G200V01202	Chemistry, physics and geology: Integrated laboratory 2	2nd	6
V11G200V01203	Mathematics: Mathematics 2	2nd	6
V11G200V01204	Chemistry: Chemistry 2	2nd	6
V11G200V01205	Geology: Geology	2nd	6

IDENTIFYING DATA				
Biology: Biology				
Subject	Biology: Biology			
Code	V11G200V01101			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department	Biochemistry, Genetics and Immunology			
Coordinator	Arenas Busto, Miguel			
Lecturers	Arenas Busto, Miguel			
E-mail	marenas@uvigo.es			
Web	http://http://darwin.uvigo.es/			
General description	The matter of Biology has like aim the preparation of the studens to comprise and explain better the living beings, as they are constituted and as they work, as they study , as they contrast the hypotheses and the experimental facts to elaborate the biological theories.			

Competencies	
Code	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C15	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories in: chemistry of biological molecules and their processes
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
D7	Apply theoretical knowledge in practice
D8	Teamwork
D9	Work independently
D12	Plan and manage time properly
D13	Make decisions
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		
Understand the cell like fundamental unit of the be alive.	A5	C15	D1 D3 D4 D7 D9 D12 D14
New			
New			
Understand the properties and organisation of the distinct *cellular organelles.	A5	C15	D1 D3 D4 D7 D9 D12 D14
Know the cellular structure in **procariotas and *eukaryotic.	A5	C15	D1 D3 D4 D7 D9 D12 D14

Relate the cellular structures with the metabolism.	A5	C15	D1 D3 D4 D7 D9 D12 D14
Understand the distinct metabolic *roads of the distinct organic molecules.	A5	C15	D1 D3 D4 D7 D9 D12 D14
Describe the hereditary material and know the principles of the central dogma.	A5	C15	D1 D3 D4 D7 D8 D12 D13 D14 D15
Define the process of mutation and his implication in the evolutionary processes.	A5	C15	D1 D3 D4 D7 D9 D12 D14
Know the technicians of DNA **recombinante.	A5	C15	D1 D3 D4 D7 D8 D9 D12 D13 D14 D15
Comprise the importance of the immune *system.	A5	C15	D1 D3 D4 D7 D8 D12 D13 D14 D15

Contents	
Topic	
1. The cell.	Size, form and cellular function. Cell classification. Cell Theory. Procaryotic cell and eukaryotic cell.
2. Biomembranes and systems of cellular transport.	Cell membrane: functions, biochemical composition, physic-chemical properties. Synthesis of the cellular membrane. System of transport through the biological membranes: bombs, protein transporters and channels.
3. The core and the chromosomes. The cellular organelles.	Cell nucleous: structure, composition and functions. Structure and functions of the nucleolus. Structures and functions of chromatin and chromosomes. Structure, composition and functions of: matrix extracellular, cytoskeleton and centrioles, endoplasmatic reticulum, apparatus of Golgi, endosomes and lisosomes, mitochondria, peroxisomes and cloroplasts.

4. Cellular division and cellular cycle.	Definition and characteristics of mitosis. Differences between somatics and germinal cells. Phases of the cellular cycle. Biological meaning ofmitosis. Concept of the apoptosis, cellular proliferation and cancer. Concept and differences between asexual and sexual reproduction. Definition and characteristic of meisosis. Phases of meiosis. Origin of the genetic variability of the meiosis. Differences between mitosis and meiosis.
5. General design of the metabolism: catabolism and anabolism.	Concept of: enzyme, energetic metabolism, metabolic route, catabolism, anabolism. The equivalent of ATP. Extraction of the chemical energy of the organic compounds: glucides, lipids and proteins.
6. Photosynthesis.	Nature of the light. Photosynthetic pigments. Stages of the photosynthesis: luminous phase and dark phase (cycle of Calvin). The problem of the photorespiration: plants C4 and plants CAM.
7. DNA, structure and function.	Composition, structure of the DNA. Function of the DNA. Replication of the DNA. Initiation the technicians of the recombinant DNA.
8. RNA and the expression of the genetic message.	Composition and structure of the RNA. mRNA, tRNA and rRNA. Other types cellular RNAs and its functions. Review of the concepts of transcription and translation. Language of the genic information.
9. Mutation and evolution.	Genic mutations: concept and types. Molecular consequences of the genic mutations. Structural chromosomal mutations. Numerical chromosomal mutations. Origin and consequences of the mutations. Relation of the mutations and cancer. Evolutionary theories. Arguments in favour of wool evolution.
10. The immune system.	Concept of immune system. Components of the immune system. Mechanism of the innate defence of the immune system. Antibodies and interferon. Types of immune response. Alterations of the immune system. Importance of the vaccines.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	48	74
Seminars	13	26	39
Problem solving	0	17	17
Supervised work	2	13	15
Short answer tests	1	4	5

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

Methodologies

	Description
Lecturing	In these classes the professor will explain and will develop the concepts and basic aspects of the subject in clear form to facilitate their understanding. The contents of each subject will be exposed in the platform TEMA with sufficient time so that the students can consult them. It is recommended that the student work on this material, consulting besides the bibliography recommended.

Seminars	These classes will be oriented to: a) Explanation of all type of doubts of the previously explained concepts. b) The students will perform pictures and schemes of the subjects analysed in the theoretical classes with the aim to adquire an overview of the subject, what will facilitate its understanding. c) In this section students will work on some contents of Biology, that by experience of the teacher are of a more difficult understanding and that therefore require a greater didactic support. d) When needed, these classes will also be used to perform tutored works and exercises.
Problem solving	Each student will have to perform a series of exercises for each part of the subject to strengthen the study and understanding. These bulletins of exercises will be considered for the evaluation.
Supervised work	To develop the competition *CT8, the students will realise two works in group. The works will be related with the fields of the biotechnology, molecular biology, genetics and immunology and will be proposed by the professor. Part of the information could be provided by the professor.

Personalized attention

Methodologies	Description
Supervised work	Presenting and solving questions, exercises and problems related with the subject. Each student will ask the teaching staff the clarifications that estimate opportune to comprise better the subject and develop successfully the tasks. These queries will be attended in schedule of tutorias.
Seminars	Presenting and solving questions, exercises and problems related with the subject. Each student will ask the teaching staff the clarifications that estimate opportune to comprise better the subject and develop successfully the tasks. These queries will be attended in schedule of tutorias.
Problem solving	Presenting and solving questions, exercises and problems related with the subject. Each student will ask the teaching staff the clarifications that estimate opportune to comprise better the subject and develop successfully the tasks. These queries will be attended in schedule of tutorias.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	The resolution by the students of a series of problems and / or exercises as academic follow-up of the student will be assessed. The final grade of these exercises will be 20% of the final grade.	20	A5	C15	D1 D3 D7 D9 D12 D13 D14 D15
Supervised work	The structuring and organization of the contents, the complexity of the work, the oral presentation and the sources consulted will be evaluated. These works will be exposed in the seminar sessions to the rest of the classmates. The final grade of these works will be 10% of the final grade.	10	A5	C15	D1 D3 D4 D7 D8 D9 D12 D13 D14 D15
Short answer tests	There will be a mid-course (20%) test and another test at the end of the course (final with the whole subject, 50%) on the subject explained in the lectures and seminars. It will consist mainly of short answer questions, although it could include some long answer questions. Said tests will represent 70% (20%, 50%) of the final grade.	70	A5	C15	D1 D3 D4 D7 D9 D12 D13 D14 D15

Other comments on the Evaluation

The student who takes the final evaluation test will be considered as presented.
The final grade of the subject will be given by the weighted average of the three sections of the evaluation.In this way, to pass the subject, said weighted average must be equal to or higher than 5.0.

In the second call, the evaluation will be carried out as follows: 1. The score reached by the student during the course in the

supervised works and seminars will be conserved (30% of the final grade).None of these sections is recoverable. 2. An analogous test will be carried out at the end of the semester.This test will be equivalent to 70% of the final grade.

Sources of information

Basic Bibliography

John Kimball, **http://biology-pages.info/**,

Bruce Alberts, Dennis Bray, Karel Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Robert, **Introducción a la Biología Celular**, Tercera Edición, 2011,

Peter J Rusell, **iGenetics. A molecular approach**, Third Edition, 2010,

Leonardo Fainboin, Jorge Geffner, **Introducción a la Inmunologia Humana**, Sexta Edición, 2011,

James D. Watson, **Biología Molecular del gen**, Séptima edición, 2016,

Christopher Mathews, K. E. van Holde, **Bioquímica**, Segunda edición,

Complementary Bibliography

Helmut Plattner, Joachim Hentschal, **Biología Celular**, Cuarta Edición, 2014,

Recommendations

Subjects that continue the syllabus

Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103

Subjects that are recommended to be taken simultaneously

Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103
Chemistry: Chemistry 1/V11G200V01105

Other comments

It is recommended to have done the matter Biology of the 2º course of Bachillerato, either in the modality of Sciences of the Health as in the one of Sciences (double option).

IDENTIFYING DATA				
Physics: Physics I				
Subject	Physics: Physics I			
Code	V11G200V01102			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department	Applied Physics			
Coordinator	Pérez Iglesias, María Teresa			
Lecturers	Pérez Iglesias, María Teresa			
E-mail	tpigles@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	General Physics is the general scientific analysis of nature, with the goal of understanding how the universe behaves. It is fundamentally an experimental science. The theories that are developed are tested with observations. From such a wide definition, different perspectives or application levels can be adopted, from microscopic phenomena to macroscopic ones. Physics is thus the basis of innumerable scientific and technological applications. In particular for the student of Chemistry, it is a fundamental tool to understand theories and methods belonging to that of domain of science.			

Competencies	
Code	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C23	Present oral and written scientific material and scientific arguments to a specialized audience
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
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
D12	Plan and manage time properly
D13	Make decisions
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		
Calculate the values of different kinematic magnitudes of a mechanical system when it starts from initial different conditions.	A5	C23	D1 D3 D6 D8 D9 D14
Describe the framework of classical mechanics and calculate for a mechanical system the values of its different magnitudes.	A5	C23	D1 D3 D4 D6 D8 D9 D12 D13 D14 D15
Explain the importance of the conservation theorems and apply some of them.	A5	C23	D1 D3 D4 D6 D7 D14

Describe and calculate the kinematic and dynamic magnitudes of a system that undergoes a simple harmonic motion.	A5	C23	D3 D6 D7
Enunciate the postulates and principles of thermodynamics.	A5	C23	D1 D3 D4 D12 D13 D14
Explain the concept of thermodynamic system and its description using the corresponding variables and thermodynamic potentials.	A5	C23	D1 D3 D4 D12 D13 D14
Define the different temperature scales. Convert temperature values from one scale to another.	A5	C23	D1 D3 D6 D7 D12 D13 D14 D15
Calculate the work carried out by a thermodynamic system and the heat exchanged with the environment, as well as the variation of internal energy, enthalpy and entropy in quasiestatic processes.	A5	C23	D1 D3 D4 D6 D12 D13 D14
Distinguish between reversible and irreversible processes from the behaviour of the entropy variation.	A5	C23	D1 D3 D4 D6 D12 D13 D14

Contents	
Topic	
1. DESCRIPTION OF THE PHYSICAL REALITY	Introduction - Physical magnitudes and units - Dimensional analysis Errors.
2. KINEMATICS OF THE POINT AND RIGID BODY	Material point - Vector position, velocity and acceleration - Tangent and normal components of the acceleration - Study of some movements: rectilinear and plane - Rigid body.
3. PRINCIPLES OF THE DYNAMICS	Concept of force - Newton Laws - Newton´s theory of gravitation.
4. DYNAMICS OF THE PARTICLE	Equations of motion - Momentum and angular momentum - Radial Forces: Conservation of the angular momentum - Work and power - Kinetic Energy - Conservation of the mechanical energy - Non conservative forces. The conservation of energy. - Energy diagrams.
5. OSCILLATING MOTION	Simple harmonic Motion: Kinematics, Dynamics and Energy.
6. DYNAMICS OF SYSTEMS OF PARTICLES	Internal and external forces - Equation of motion for the center of mass - Work of external and internal forces Collisions.
7. THE RIGID BODY	Rigid Body: Rotational motion: Moment of inertia, angular momentum, Kinetic Energy.
8. FLUIDS	Pressure and density. Pressure in a fluid at rest. Measurement of pressure Surface Tension Capillarity. Jurin´s Law Tate´s Law.
9. INTRODUCTION TO THE THERMODYNAMICS. THERMOMETRY	Macroscopic and microscopic description - Thermal equilibrium - Zero´th law of Thermodynamics. Temperature Measure of temperature. Thermometers - Ideal Gas. Ideal gas temperature scale.
10. HEAT AND WORK	Thermodynamic Equilibrium. Equations of state. Quasiestatic Processes - Thermodynamic work - Heat capacity and specific heat. Latent heat.
11. THE FIRST LAW OF THERMODYNAMICS	The First Law of Thermodynamics - Internal Energy, enthalpy and heat capacities of the ideal gases. Mayer´s Law -Adiabatic changes of an ideal gas.

12. THE SECOND LAW OF THERMODYNAMICS	Introduction - Second Law: Clausius and Kelvin-Planck Statements - Cycle of Carnot. Theorem of Carnot- Thermodynamic Scale of Temperatures - Inequality of Clausius- Entropy.

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	26	28.6	54.6
Lecturing	26	28.6	54.6
Presentation	0	15	15
Short answer tests	1.5	4.5	6
Problem solving	4.5	15.3	19.8

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

Methodologies

	Description
Seminars	a) Exercises and problems will be solved, by the students or the teacher. Problems sheets will be available with sufficient anticipation. b) Doubts and difficult concepts will be discussed and clarified by group tutoring. c) Diverse tasks that students have to carry out will be programmed. d) Diverse tasks that students have to carry out will be tested.
Lecturing	The student can find information on lectures at the web platform Thema. a) In each topic the specific objectives will be analyzed. Its need and the possible applications will be indicated. b) The way to get objectives will be indicated. Emphasis will be made on those aspects that are more problematic and difficult. Different examples will be solved. c) In necessary case, it would be proposed some bibliographic references.
Presentation	The students will work in group. They will solve and they will debate problems, questions, summaries of readings, etc. that they will present or will explain to their classmates.

Personalized attention

Methodologies	Description
Presentation	Guided activities could need personalized attention. Voluntary Tutorials allows the clarification of doubts on an individual basis.
Seminars	The activities that will carry out in Seminars could need personalized attention. Voluntary Tutorials allows the clarification of doubts on an individual basis.

Assessment

	Description	Qualification	Training and Learning Results		
Seminars	Solving problems and other assignments that have been carried out in seminars.	25	A5	C23	D1 D3 D4 D6 D7 D8 D9 D12 D13 D14 D15
Presentation	The students will work in group and will solve and/ or will debate problems, questions etc.	10		C23	D1 D4 D8 D12
Short answer tests	Three tests written: a) The mínimum mark to pass each exam will be 5 out of 10. b) The third test will be done with the first term final exam. c) The marks of the two first tests will be maintained until the extraordinary exam (june). d) In first term final exam each student will have the opportunity to repeat the test he/ she has failed or those where he/she wishes to improve the mark previously obtained.	15	A5	C23	D3 D6 D7 D9 D13

Problem solving	Three tests written: a) The mínimum mark to pass each exam will be 5 out of 10. b) The third test will be done with the first term final exam. c) The marks of the two first tests will be maintained until the extraordinary exam (june). d) In first term final exam each student will have the opportunity to repeat the test he/ she has failed or those where he/she wishes to improve the mark previously obtained.	50	A5	C23	D3 D6 D7 D9 D13

Other comments on the Evaluation

Extraordinary exam (june) assessment: a) Written test to recover the written tests that were failed in the first term final exam. The criteria of evaluation in the second call will be the same as in the first term final exam assessment.

Sources of information

Basic Bibliography

Complementary Bibliography

Tipler P.A.; Mosca G., **Física para la ciencia y la tecnología (2 volumes)**, 2010,

Gettys E., **Física para ingeniería y ciencias**, 2005,

Serway R.A., **Física**, 2009,

José Mª de Juana, **Física General (2 tomos)**, 2003,

Young; Freedman, **Física universitaria I**, 2013,

Recommendations

Subjects that continue the syllabus

Physics: Physics 2/V11G200V01201
Chemistry, physics and geology: Integrated laboratory 2/V11G200V01202
Physics 3/V11G200V01301

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103

Other comments

It is recommended that students had studied Physics and Mathematics in 2nd level of high school.

In particular students should be familiar with:

- Vector algebra.
- Matrix algebra.
- Polynomial algebra.
- Graphic representation of polynomial, trigonometrical, logarithmic and exponential functions.
- Differential and integral calculus.

IDENTIFYING DATA

Chemistry, physics and biology: Integrated laboratory 1

Subject	Chemistry, physics and biology: Integrated laboratory 1			
Code	V11G200V01103			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department	Biochemistry, Genetics and Immunology Applied Physics Analytical and Food Chemistry Inorganic Chemistry Organic Chemistry			
Coordinator	Lavilla Beltrán, María Isela			
Lecturers	Alonso Gómez, José Lorenzo Calle González, Inmaculada de la Lavilla Beltrán, María Isela Magadán Mompo, Susana Rodríguez Arguelles, María Carmen Salgueiriño Maceira, Verónica			
E-mail	isela@uvigo.es			
Web				
General description	"Machine translation into english of the original teaching guide" In this matter pretends that students initiate and learn the criteria and indispensable manipulations to work in a chemical laboratory ia correct way, safe and respectful with the enviroment. Student will learn to use glass materials, instrumentation and basic operations, reaching skills that will allow them to work in specialized laboratories. There will be a focus on the observation and preparation of a laboratory notebook as well as in the realisation of a final report of the work carried out.			

Competencies

Code	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C25	Handle chemicals safely, considering their physical and chemical properties, including the evaluation of any specific risks associated with its use
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
D12	Plan and manage time properly
D13	Make decisions
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

Interpret the results of the work of laboratory and relate them with the appropriate theories.	A5	C28	D7 D9 D12 D14
Handle properly the common material in the chemical laboratory.	A5		D7 D9
Calibrate the experimental teams and use patterns when it was necessary.	A5	C28	D7 D9 D12 D13
Determine some properties of the chemicals: melting-point, boiling-point, *viscosidad, density, superficial tension, specific heat.	A5	C27	D6
Prepare dissolutions.	A5	C25	D7 D9 D12
Separate the components of mixes, so much *homogéneas like heterogeneous.	A5	C25	D7 D9 D12
*Predecir And check how a balance alters by addition or elimination of reagents, changes of volume, pressure or temperature.		C25 C27	D7 D9
Realise the necessary mathematical operations to quantify the processes carried out in the laboratory.	A5	C29	D3 D6 D7 D9 D12
Look for information on the properties (physical, chemical, dangerousness, etc.) of the chemicals.	A5		D4 D5 D9 D12
Apply the norms of security and hygiene in the chemical laboratory	A5	C25	D7 D9 D13 D15
Delete the waste generated in the laboratory of suitable form.	A5	C25	D7 D13 D15
Handle solids and liquids of safe way to temperature acclimatise in the atmosphere of the laboratory.	A5	C25	D7 D9 D15
Interpret the data derived of the measures realised in the laboratory.		C29	D3 D8 D9 D14
Elaborate a fascicle of laboratory that register of systematic way all the events and changes observed in the development of the work of laboratory.	A5	C27	D1 D4 D9 D12
Handle the techniques and the scientific instrumentation-technical of the inmunochemistry	A5		D7 D8 D9 D12 D15
Separate, isolate, identify and quantify the distinct *biomoléculas.	A5	C25	D14
Realise an assessment of the risks associated to the use of chemicals.		C25	D7 D9 D15

Contents
Topic
1) Norms of hygiene and security in the laboratory (1 session).
2) basic Concepts of the calculation of errors in the measures: I handle of the calibrate and analysis of distribution of populations (1 session).
3) Recognition and utilisation of the basic material of laboratory. Design of a fascicle of laboratory (1 session).

4) Determination of densities of liquids and solid (1 session).
5) Preparation of dissolutions (2 sessions): to) From a solid solute (exact and approximate concentration). *b) From a liquid solute (*Ej.: *HCl, *H2SO4, etc.). *c) Prepare dissolutions diluted of the ready previously.
6) Measure of the superficial tension (1 session).
7) Measure of the *viscosidad (1 session).
8) Establishment of a chemical equation: stoichiometry (1 session).
9) Separation of the components of a mix by means of sublimation and leak (1 session).
10) Reactions of precipitation (1 session).
11) Heat of reaction. (1 session).
12) Isolation of organic compounds: liquid extraction-liquid. (1 session).
13) Purification of liquids: distillation (1 session).
14) Purification of solids: crystallisation. Measure of melting-points. (1 session).
15) Study of the chemical balance. Principle of Him *Chatelier (1 session): to) Effect of the temperature. *b) Effect of the concentration.
16) Specific heat of liquids and solid (1 session).
17) Determination semi-quantitative by the technical of Dot-Blot of the presence of a protein in a proteins mixture inmobilized in a membrane of nitrocelulosa (1 session).
18) Determination semi-quantitative of the presence of an antigen in a proteins mixture by the method of Ouchterlony of double difusión in agarose gel (1 session).
19) Extraction and quantification of DNA (1 session).
20) ELISA *sandwich, technical *inmunoenzimática stop the specific and quantitative detection of *antíxenos and antibodies in solid phase (2 sessions).
21) *Volumetrías acid-base (2 sessions): it) Assessment of hydroxyde of sodium with hydrogen *ftalato of *potasio. *b) Assessment of sour *clorhídrico with hydroxyde of sodium prepared in (it).
22) *Volumetrías *redox (1 session): it) Assessment of *oxalato of sodium with *permanganato of *potasio.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practices	70	40	110
Lecturing	5	0	5
Short answer tests	2	8	10
Laboratory practice	3	7	10
Practices report	0	15	15

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

Methodologies

	Description

Laboratory practices	They Will realize experiments of laboratory, of individual form, in sessions of 3 hours #each. The student will have of the scripts of practices and questionnaires related as well as of material of support, in the platform *Tem@, so as to that can have a previous knowledge of the same that allow him prepare the experiments to realize. During the development of the practices the student will elaborate a fascicle of laboratory in the that will owe to note all the relative observations to the experiment realized. In any cases, will owe also elaborate a report of practices and/or questionnaire to petition of the professor that require it.
Lecturing	To the start of each session of laboratory, the professor will do an exhibition of the contents to develop by the students.

Personalized attention

Methodologies	Description
Laboratory practices	Each student will ask to the professor the explanations that estimate timely for a better understanding of the matter and to develop successfully the tasks that were him proposed. These queries will do in *horado of *tutorías.
Tests	**Description**
Practices report	Each student will ask to the professor the explanations that estimate timely for a better understanding of the matter and to develop successfully the tasks that were him proposed. These queries will do in *horado of *tutorías.

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practices	The professor will realize a tracking, through questionnaires and/or of the fascicle elaborated, of the experimental work realized pole student in the sessions of laboratory. Since it is a subject of experimental type, is mandatory the assistance to the sessions of laboratory. The foul of assistance, still being justified, *penalizará the note (pole that always that it was possible, and treating of fouls justified, recommends to recover the practice in another group). If the number of absences is upper to 6 will suppose to suspend the subject.	40	A5	C25 C27 C28 C29	D1 D3 D4 D5 D6 D7 D8 D9 D12 D13 D14 D15
Short answer tests	Once finished all the practical sessions, will realise a proof written (of brief answer) relative to concrete appearances of the operations realised in the laboratory. The date of the proof will publish with previously.	20		C28 C29	D1 D3 D6
Laboratory practice	It will realise a practical proof (a session of laboratory) that will allow to evaluate the competitions and skills purchased by the student. Said proof will be realised of independent form for each group of practices. This proof will carry out the day established in the official calendar of evaluations.	30	A5	C25 C27 C28 C29	D1 D3 D6 D7 D9 D12 D13 D14 D15
Practices report	By request of the professor, the student will elaborate reports of practices that reflect the work developed in the laboratory.	10	A5	C28 C29	D1 D4 D5 D6 D14

Other comments on the Evaluation

To The assistance to more of two sessions of laboratory involves that the student already is being evaluated, pole that, his qualification in the proceedings will not be able to be no presented.

It IS necessary to obtain a minimum note of 4 on 10 in each of the *apartados of the evaluation for power do average; in the *apartado "reports" will be necessary, *asimesmo, obtain a minimum note of 4 on 10 inform us of the subjects of #each of the areas that evaluate them; all the previous *aplicaráse also the second announcement. In the case of not surpassing the subject, the qualification in the proceedings will be the note pondered of the practical proof of laboratory.

In the second announcement to evaluation *levaráse to cape of the following way:

*Conservaráse The punctuation achieved pole student during it study in the *apartado "practical of laboratory" (40%), no recoverable.

In the case of not having obtained the minimum note demanded in any of the remaining *apartados *poderánse recover the following:

1) "Proof of short answer" (20%); the date of the *examen will be the one who fix the official calendar.

2) "practical Proof" (30%); the date of the *examen will be the one who fix the official calendar.

3) "Reports of practical" (10%); *entregaránse in advance the official date of the *examen *dacordo *cas indications of the teaching staff.

The final qualification will be the sum of the notes of all the *apartados always that they surpass the minima demanded. Of not being the case, the qualification that will figure in the proceedings will be the note pondered of the practical proof (dictate sense will not be able to be inferior it of the first announcement).

Sources of information

Basic Bibliography

M.A. Martinez Grau, A.G. Csasky, **Técnicas Experimentales en Síntesis Orgánica**, 2ª Ed., Síntesis, 2012

J. Guiteras, R. Rubio, G. Fonrodona, **Curso experimental en Química Analítica**, Síntesis, 2003

C.K. Mathews, K.E. Van Holde, D.R. Appling, S.J. Anthony-Cahill, **Bioquímica**, 4ª Ed., Pearson Educación, 2013

J. R. Taylor, **Introducción al análisis de errores: estudio de las incertidumbres en las mediciones físicas**, Reverté, 2014

A. de Carlos Villamarín, J.M. Faro Rivas, **Manual de técnicas experimentais en bioloxía molecular e celular**, Servizo de Publicacións da Universidade de Vigo, 2014

R. Chang, **Química**, 12ª Ed., McGraw-Hill Education, 2017

Complementary Bibliography

D.R. Palleros, **Experimental Organic Chemistry**, John Wiley, 2000

P.A.Tipler, G. Mosca, **Física para la Ciencia y la Tecnología (2 volúmenes)**, 6ª Ed., Reverté, 2010

I. Lefkovits, **Immunology methods manual: the comprehensive sourcebook of techniques**, Academic Press, 1997

D. Voet, J.G. Voet, **Bioquímica**, 3ª Ed., Editorial Médica Panamericana, 2006

R.H. Petrucci, W.S. Harwood, F.G. Herring, **Química General: principios y aplicaciones modernas**, 11ª Ed., Pearson Educación, 2017

Recommendations

Subjects that continue the syllabus

Chemistry, physics and geology: Integrated laboratory 2/V11G200V01202

Subjects that are recommended to be taken simultaneously

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry: Chemistry 1/V11G200V01105

IDENTIFYING DATA				
Mathematics: Mathematics 1				
Subject	Mathematics: Mathematics 1			
Code	V11G200V01104			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Galician			
Department	Mathematics			
Coordinator	Quinteiro Sandomingo, María del Carmen			
Lecturers	Quinteiro Sandomingo, María del Carmen			
E-mail	quinteir@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	"Machine translation into english of the original teaching guide" The matter collects contents, theoretical and practical of algebra linear and calculus (in a variable). The follow-up of the same will improve the capacity of compression and employment of the mathematical language. It will allow to the students purchase skills of calculation and initiate in the use of computer applications.			

Competencies	
Code	
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
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
D12	Plan and manage time properly
D13	Make decisions
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	
Operate with vectors, distances and angles.	C22 C29	D6 D7 D9
Formulate matrix models to tackle problems of distinct branches of the Science.	C22 C29	D5 D6 D9
Dominate the properties of the matrices and of his application for the approach and resolution of systems of linear equations.	C29	D7 D9
Resolve systems of linear equations using packages of symbolic and numerical calculation.	C22 C29	D5 D7
Operate properly with real numbers and complexes.	C22 C29	D6 D7
Realise calculations of limits, continuity, derivative and integrals of real functions of real variable and of partial derivatives of functions of several variables.	C22 C29	D7
Identify real problems that can be tackled by means of the differential calculation and integral and resolve them with these technicians.	C22 C29	D6 D7 D9 D14
Analyse and represent functions, knowing deduce properties of the same from his graphic.	C29	D7

Formulate and resolve problems of optimisation.		C29	D7 D9 D14
Calculate integrals of line of scalar and vectorial fields and know his connection with concepts of the Physics.		C29	D7
Handle some computer package of symbolic calculation to resolve problems of differential calculation and integral.		C22	D5 D7
Express of oral form and writing, mathematical concepts.	A4	C23	D1 D3 D4 D5 D8 D12 D13 D14 D15

Contents	
Topic	
Introduction to the real functions of real variable	The real numbers and the straight real. Operations with real numbers. Real functions of real variable. Command and rank. Graphic of a real function of real variable. Elementary functions.
Differential calculation in a variable	Limits and continuity of real functions of real variable. Derived of a function in a point. Calculation of derivatives. Consequences of the *derivación. Relative extremes. Graphic representation of real functions of real variable.
Integration of real functions of real variable.	Integral of Riemann. Fundamental theorem of the integral calculation. Calculation of primitive.
Real vectorial spaces	Operations with vectors in the plane and in the space. Scalar product. Angle formed by two vectors. Vectorial product in *R3. Mixed product. Vectorial spaces. *Subespacios. Bases.
Systems of linear equations	Matrices. *Determinantes. Basic operations with matrices and *determinantes. Discussion and resolution of systems of equations *lineares. Method of Gauss.
Scalar functions and vectorial functions	Scalar functions and vectorial functions. Partial derivatives of scalar functions. Vector gradient. Ways and integrals of line. Fields *conservativos.
Complex numbers	Complex numbers. Operations with complex numbers.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	30	50
Computer practices	6	3	9
Problem solving	26	39	65
Essay questions exam	3	22	25
Laboratory practice	0	1	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	The *profesorado will expose the theoretical foundations of the matter; it will present possible applications; it will formulate problems, questions and exercises; it will propose tasks and activities with orientations on the methods and technical to employ to carry out them.
Computer practices	Activities oriented to the learning and handle of computer programs of Mathematics, for the calculation and the graphic representation of functions and data.
Problem solving	In this activity, each student, well of individual way or in group, will have to resolve exercises and *probemas related with the matter. It will have to be able to formulate the mathematical model more convenient, apply the most appropriate technician to resolve each case and interpret and present, of oral way or written, the results.

Personalized attention	
Methodologies	**Description**

Problem solving	Each student will sue to the *profesorado the explanations that estimate timely for better comprise the matter and develop successfully the tasks that were him proposed. These queries will attend in the schedule of *tutorías.
Computer practices	Each student will sue to the *profesorado the explanations that estimate timely for better comprise the matter and develop successfully the tasks that were him proposed. These queries will attend in the schedule of *tutorías.

Assessment

	Description	Qualification	Training and Learning Results	
Problem solving	Each student will have to resolve a series of exercises or problems in the term of time and under the conditions established by the *profesorado. The works sued will be able to be of distinct types: presentation of a document written, exit to the *encerado, oral exhibition of any subject related with the matter,... These activities will allow to evaluate of way continued the learning of each student.	15	A4	C23 D1 C29 D3 D4 D6 D7 D8 D9 D12 D13 D14 D15
Essay questions exam	Final examination. Proof for the evaluation of the competitions purchased. It will realise when finishing the period *lectivo and will include questions and exercises to which the students and the students will answer organising and presenting, of extensive way, the knowledges that have on the matter.	80		C29 D1 D6 D7 D12
Laboratory practice	Proof to evaluate the skill in the handle and application of the computer resources learnt during the practices of laboratory. It will take place during the sessions of practices of computing	5		C22 D5 D6

Other comments on the Evaluation

To surpass the matter, the note obtained will have to be equal or upper
to 50% of the total punctuation.The students and the students that do not surpass the matter in January, and pretend to do it in the announcement of July, will have to repeat *obligatoriamente the final examination. The note obtained during the course in the others proofs
(Resolution of problems and/or exercises; practical Proofs, of execution of real tasks and/or mock) will keep for the announcement
of July.Any student that participate in one of the two proofs of long answer realised when finishing the period *lectivo (in January or, to be the case, in July) will not be able to, in no case,
obtain the qualification of NO PRESENTED.

Sources of information

Basic Bibliography

R. A. Adams, **Cálculo**, 6ª ed., Pearson, 2009

M. Besada, F. J. García, M. A. Mirás, C. Quinteiro, C. Vázquez, **Matemáticas á Boloñesa**, 1ª ed., Servizo de Publicacións da Universidade de Vigo, 2014

R. Larson, R. Hostetler, **Precálculo**, 8ª ed., Cengage Learning, 2012

J. Medina Moreno, **Álgebra lineal y cálculo para estudios de químicas con problemas resueltos**, 1ª ed., Paraninfo, 2015

G. Pota, **Mathematical Problems for Chemistry Students**, 1ª ed., Elsevier, 2006

J. Rogawski, **Cálculo: una variable**, 2ª ed., Editorial Reverté, 2012

E. Steiner, **The Chemistry Maths Book**, 1ª ed., Oxford University Press, 2008

Complementary Bibliography

Centro virtual de divulgación de las Matemáticas, **http://www.divulgamat.net/**,

Recommendations

Subjects that continue the syllabus

Mathematics: Mathematics 2/V11G200V01203
Numerical methods in chemistry/V11G200V01402

Subjects that are recommended to be taken simultaneously

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103

Other comments

It recommends have *cursado the matter of Mathematics of the last course of *Bachillerato.

IDENTIFYING DATA				
Chemistry: Chemistry 1				
Subject	Chemistry: Chemistry 1			
Code	V11G200V01105			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Galician			
Department	Physical Chemistry Inorganic Chemistry			
Coordinator	Tojo Suárez, María Concepción			
Lecturers	García Martínez, Emilia Mosquera Castro, Ricardo Antonio Tojo Suárez, María Concepción			
E-mail	ctojo@uvigo.es			
Web				
General description	Subject in the that impart contents of General Chemistry.			

Competencies	
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
C1	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: Major aspects of chemical terminology, nomenclature, units and unit conversions.
C2	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: types of chemical reactions and its main characteristics
C19	Apply knowledge and understanding to solve basic problems of quantitative and qualitative nature
D1	Communicate orally and in writing in at least one of the official languages of the University
D3	Learn independently
D6	Use mathematics, including error analysis, estimates of orders of magnitude, correct use of units and data representations
D7	Apply theoretical knowledge in practice
D9	Work independently
D12	Plan and manage time properly
D13	Make decisions
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		
Use mol, empirical and molecular formula. Name binary compounds.	A1	C1 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Describe the general structure of the atom and the main models. Use the periodic table.	A1	C1 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15

Explain the covalent bond and Lewis structures. Predict the bond polarity. Name and formulate poliatomic ions. Describe the properties of ionic compounds.	A1	C1 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Use the RPECV model. Determine the orbitals hybridization in one central atom and the corresponding molecular geometry. Identify sigma and pi bonds. Predict the polarity of molecules. Describe the different types of intermolecular interactions and used them to explain the melting and boiling points.	A1	C1 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Adjust simple chemical equations and do stoichiometric calculations. Recognize types of general reactions. Explain neutralization reactions and oxidation-reduction reactions.	A1	C2 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Explain the properties of gases. Calculate the quantities of gas reactants and products that take part in chemical reactions. Describe the ideal gases model and compare it with real gases.	A1	C1 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Explain the properties of liquids, and the phase transitions that take place between solids, liquid and gases. Perform calculations on the basis of simple unitary cells and the dimensions of atoms and ions. Explain the metallic bonding and interprete the properties of metals, semiconductors and insulating materials.	A1	C1 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Describe the different forms of energy. Recognise and use the thermodynamic language. Apply the Hess law. Calculate the variations of the different thermodynamic functions in a chemical reaction.	A1	C1 C2 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Describe the properties of a system in chemical equilibrium. Calculate the equilibrium constant and the concentrations of reactants and products in system in chemical equilibrium. Use the Le Chatelier principle.	A1	C1 C2 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15

Explain the properties of water. Predict the solubility. Describe the role of water in the acid-base reactions. Identify the conjugate base and the conjugate acid. Calculate the pH. Identify the oxidizing and reducing agents in a redox reaction and balance redox reactions.	A1	C1 C2 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15
Define the main concepts of Chemical Kinetics. Determine the rate laws and the rate constants. Calculate the activation energy and the frequency factor. Explain the catalytic action.	A1	C1 C2 C19	D1 D3 D6 D7 D9 D12 D13 D14 D15

Contents	
Topic	
Subject 1. Nature of Chemistry	The matter and its properties. Classification of the matter. Atoms and elements. Concept of mol. Chemical compounds. Formulation. Classification. Molecular mass and mol of a compound. Determination of empirical and molecular formula.
Subject 2. Chemical reactions	Classification. Chemical equations. Stoichiometric calculations. Limiting reactant. Yield.
Subject 3. Gases	Properties of gases. The atmosphere. Ideal gases law. Density and molar mass of gases. Partial pressures. Real gases.
Subject 4. Thermochemistry and the spontaneity of a chemical processes.	Thermochemistry and the spontaneity of chemical processes. Units of energy. Transfer of energy and phase transition. Thermochemical equations. Hess´s law. Entropy and second law of thermodynamics. Gibbs energy.
Subject 5. Chemical equilibrium	Equilibrium constant: determination and meaning. Calculation of equilibrium concentrations. Le Chatelier's principle. Gibbs energy and equilibrium constant.
Subject 6. Water and chemistry of solutions	Water as a solvent. How substances are solved. Temperature and solubility. Solubility equilibrium. Concept of Brönsted acid-base. Water autoionization. Ionization constants. Acid-base reactions. Hydrolysis. Buffer solutions. Redox reactions. Balance of redox reactions.
Subject 7. Condensed phases	Liquid state. Order in liquids. Solid state. Melting point. Boiling point. Phase equilibria. Phase diagram.
Subject 8. Chemical kinetics	Reaction rate. Effect of concentration. Rate lawand order of reaction. Mechanisms of reaction. Catalysis. Thermodynamic and kinetic stability.
Subject 9. The atom	Subatomic particles. Nuclear atom. Chemical elements. Isotopes. Electronic structure of atoms. Electronic configuration. Periodic table. Periodic properties.
Subject 10. Chemical bonding	Simple covalent bonds and Lewis structures. Multiple covalent bond. Lewis structures and resonance. Polarity of a bond and electronegativity. Coordinated covalent bonds. Ions and ionic compounds.
Subject 11. Molecular structure	Prediction of molecular forms: RPECV. Hybridization. Molecular polarity. Condensed phases formation. Intermolecular interactions.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	26	52
Seminars	26	26	52
Problem solving	0	19	19
Essay questions exam	4	14	18
Short answer tests	2	7	9
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Lecturing	In this kind of sessions the general aspects of the program will be introduced in an structured way. The basics and the more important or difficult to understand aspects will be emphasized. The required material to study the next week will be available through the Tem@ platform. In this case, students are advised to study previously the available material and to consult the recommended bibliography to complete the information. In this way the explanations of the program contents will result in a better academic progress.
Seminars	Two classes a week will be devoted to students solve some of the problems or proposed exercises related with the subject. Some of these exercises or any other proposed by the teacher can be ordered to be qualified. As well as the correct exercises resolution, the suitable use of the language and handle mathematics (including error analysis, correct estimate of magnitude orders, use of units and ways of data presentation) will be valued.
Problem solving	The list of problems must be solved by students, with the help, if necessary, of the teacher during seminars or tutorial timetable. These list of problems can be requested in the established date if teacher ask for them. As well as the correct exercises resolution, the suitable use of the language and handle mathematics (including error analysis, correct estimate of magnitude orders, use of units and ways of data presentation) will be valued.

Personalized attention

Methodologies	Description
Problem solving	The students can consult all type of questions about the subject during the tutorial timetable.
Seminars	The students can consult all type of questions about the subject during the tutorial timetable.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	The attendance (mandatory) to seminars, the involvement of students and the resolution by students of a serie of problems and/or exercises can be valued to monitor the student progress.	25	A1	C1 C2 C19	D1 D6 D7 D13 D14 D15
Essay questions exam	Exams to evaluate the competences that students have acquired. After the lessons and trainning sessions finish, an exam will take place. A minimum score of 4 out of 10 in this exam is needed to take into account the rest of marks in the evaluation.	45	A1	C1 C2 C19	D1 D3 D6 D7 D9 D12 D13 D14
Short answer tests	Students must pass two tests of the contents explained in the magistral sessions and seminars.	30	A1	C1 C2 C19	D1 D3 D6 D7 D9 D12 D13 D14

Other comments on the Evaluation

The final mark in Chemistry I may be the highest mark between the final exam mark and the weighted averaged mark (which is obtained including continuous evaluation).

Call on July:

The mark obtained during the course in the section Troubleshooting and/or exercises is mantained.

The exam includes the whole list of topics of the training course. A minimum score of 4,5 out of 10 in this exam is needed to pass the subject.

Sources of information

Basic Bibliography

Chang, R. y Goldsby, K.A., **Química**, 12, McGraw-Hill, 2017

Complementary Bibliography

Atkins, P y Jones, L, **Principios de Química. Los caminos del descubrimiento**, 5, Médica Panamericana, 2012

Petrucci, R.H., et al., **Química General: principios y aplicaciones modernas**, 11, Pearson Educación, 2017

Whitten, K.W. et al., **Química**, 10, Cengage Learning, 2015
López Cancio, J.A., **Problemas de Química. Cuestiones y ejercicios**, Prentice-Hall, 2000
Orozco Barrenetxea, C et al., **Problemas Resueltos de Química Aplicada**, Paraninfo, 2011

Recommendations

Subjects that continue the syllabus

Chemistry: Chemistry 2/V11G200V01204

Subjects that are recommended to be taken simultaneously

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103

IDENTIFYING DATA				
Physics: Physics 2				
Subject	Physics: Physics 2			
Code	V11G200V01201			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Galician			
Department	Applied Physics			
Coordinator	Salgueiriño Maceira, Verónica			
Lecturers	Salgueiriño Maceira, Verónica			
E-mail	vsalgue@uvigo.es			
Web	http://faitic.uvigo.es			
General description	"Machine translation into english of the original teaching guide" Physics, like scientific discipline, occupies, in general, of the description of the components of the matter and of his mutual interactions, developing theories that, in a formal and consistent way, have an agreement with the empirical knowledge of the reality. From a so wide definition, can adopt distinct perspectives or levels of application, from the microscopic phenomena (at atomic scale) to the macroscopic ones, that give place to his distinct branches. Physics, in this way, is basic precursor of countless scientific and technological applications and, in particular for the student of Chemistry, is indispensable like base and tool to understand developments and theories that will be treated specifically in other matters of the plan of studies of the degree.			

Competencies	
Code	
C23	Present oral and written scientific material and scientific arguments to a specialized audience
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
D12	Plan and manage time properly
D14	Analyze and synthesize information and draw conclusions

Learning outcomes		
Expected results from this subject		Training and Learning Results
2. Explain the utility of the electrostatic potential and calculate it for a distribution of particles loaded so much discreet like continuous.	C23	D1 D3 D4 D5 D6 D9 D12 D14
3. Calculate the polarisation and the dipolar moment in simple cases.	C23	D1 D3 D5 D6 D12 D14
4. Explain the electrostatic properties of a driver.	C23	D1 D3 D4 D5 D6 D7 D12 D14

5. Describe cualitatively from the atomic point of view the effect of an electrical field on a dielectric.	C23	D1 D3 D4 D5 D6 D12 D14
6. Determine the physical effects of the electrical current.	C23	D1 D3 D4 D5 D6 D7 D12 D14
7. Calculate the characteristics and type of path of loaded particles in an electrical or magnetic field.	C23	D1 D3 D5 D6 D8 D12 D14
8. Distinguish the materials by his behaviour in a magnetic field.	C23	D1 D3 D5 D6 D12 D14
9. Calculate the magnetisation and the magnetic moment in simple cases.	C23	D1 D3 D4 D5 D6 D12 D14
10. Explain the difference between conservatives and non conservative electrical fields.	C23	D1 D3 D5 D12 D14
11. Explain of qualitative form basic appearances of the interaction of the electromagnetic radiation with the matter.	C23	D1 D3 D5 D12 D14
12. Determine the limit of resolution of a network of diffraction.	C23	D1 D3 D4 D5 D6 D12 D14

Contents	
Topic	
Subject 1. ELECTROSTATIC FIELD	Introduction. Electrical load. Law of Coulomb. Electrical field. Continuous distribution of Load. Lines of Electrical Field. Scalar sources of Electrical Field. Law of Gauss. Electrical Potential energy. Electrical potential. Equipotential Surfaces. Electrical dipole. Capacity and Combination of Condensers.
Subject 2. CONTINUOUS CURRENT	Introduction. Electrical current and density of current. Law of Ohm. Resistance. Electromotive Strength. Law of Joule. Calorific Power loss. Circuits of continuous current:-Association of resistances, -Rules of Kirchhoff.

Subject 3. MAGNETIC FIELD	Introduction. Magnetic strength. Strength of Lorentz. Magnetic strength on a driver by which circulates current. Magnetic field of a load in movement. Magnetic field of an element of current. Law of *Biot-*Savart. Magnetic strength between two parallel drivers. Lines of magnetic field and magnetic flow. Law of Gauss. Law of *Ampère. Magnetic materials.
Subject 4. ELECTROMAGNETIC INDUCTION	Phenomena of electromagnetic induction: experiences of Faraday, magnetic flow, laws of Faraday and of *Lenz, experience of Henry. Applications: generators and electrical receptors, mutual induction and slef-induction. Magnetic energy.
Subject 5. WAVES	Introduction. Simple Harmonic movement. Superposition Of BUT. Swings cushioned. Swings forced. Resonance. Waves in material means. Equation of wave. Harmonic waves. Interference of waves. Superposition.
Subject 6. COMMON PROPERTIES To THE DIFFERENT WAVES.	Reflection and refraction. Superposition: Interference, pulses, stationary waves. Diffraction. Doppler Effect.
Subject 7. PHYSICAL OPTICS	Nature of the light: electromagnetic waves, luminous ray, speed of propagation. Wave phenomena: dispersion, interference, diffraction of *Fraunhofer: by a slit, by a pair of equal parallel slits, networks of diffraction. Polarisation. Optical activity.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24	43.2	67.2
Seminars	26	46.8	72.8
Short answer tests	2	0	2
Problem solving	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	In the TEMA platform, at disposal of the students, there will be information on the teaching sessions. a) the specific aims pursued in each subject will be analysed, indicating needs and possible applications. b) the way to reach the aims will be shown. Those aspects result more problematic or difficult will be treated in more detail and distinct examples will be solved. c) Diferent bibliographic references will be proposed.
Seminars	a) exercises and problems that will be previously at disposal of the students in the page web will be solved. b) Doubts and concepts of difficult understanding will be clarified. c) Problems of the bulletins that student have to solve by themselves may be proposed.

Personalized attention

Methodologies	**Description**
Seminars	Bulletins of questions and problems to be solved by the students will be proposed, and in case of neccessity, students may attend to personal tutories to clarify concepts and help them with their resolutions.
Lecturing	Concepts related with the master session will be asked to the students. In case to need it students may attend to personal tutories to clarify concepts and help them with their resolutions.
Tests	**Description**
Short answer tests	Questions will be asked to the students and in case to need it, students may attend to personal tutories to clarify concepts and help them with the resolutions.
Problem solving	Problems will be asked to the students and in case to need it, students may attend to personal tutories to clarify concepts and help them with the resolutions.

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	Answers to concepts seen in the master session	0	

Seminars	Realisation of exercises of individual form or in group and assistance	0	C23	D1 D4 D5 D6 D7 D9 D12 D14
Short answer tests	1ª announcement. a) Three short written proofs (will eliminate matter until the 2ª announcement). b) In June a final examination to recover the matter or to raise qualifications will be done in a complete examination.	35	C23	D1 D3 D6 D7 D9 D12 D14
Problem solving	1ª announcement: a) Three short written proofs (will eliminate matter until the 2ª announcement). b) In June a final examination to recover the matter or to raise qualifications will be done.	65	C23	D1 D3 D6 D7 D9 D12 D14

Other comments on the Evaluation

- If the student does not have note any in the different sections will consider No Presented, NP.

- July: Evaluation of the second announcement.

a) It will keep the note of the first corresponding announcement to the seminars and master session.

b) The student will be able to do an only proof written on the contents of the complete matter

Sources of information

Basic Bibliography

Young H.D., Freedman R.A., **Física universitaria, con física moderna, Vol.2**, Pearson Educación, 2013

Tipler, P.A., Mosca G., **Física para la ciencia y la tecnología (Vol. 2)**, Reverté, 2010

Gettys, E.; Kéller, F.J. y Skove, M.J., **Física Clásica y Moderna.**, McGraw-Hill, 2010

Complementary Bibliography

Serway, R.A; Beichner R. J., **Física para Ciencias e Ingeniería**, McGraw-Hill, 2010

Lea S.M.; Burke J.R., **Física. La naturaleza de las cosas**, Paraninfo, 2010

Fleisch, D., **A student's guide to Maxwell's equations**, Cambridge University Press, 2008

Recommendations

Subjects that continue the syllabus

Chemistry, physics and geology: Integrated laboratory 2/V11G200V01202
Physics 3/V11G200V01301

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematics 2/V11G200V01203
Chemistry, physics and geology: Integrated laboratory 2/V11G200V01202

Subjects that it is recommended to have taken before

Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103

IDENTIFYING DATA

Chemistry, physics and geology: Integrated laboratory 2

Subject	Chemistry, physics and geology: Integrated laboratory 2			
Code	V11G200V01202			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department	Applied Physics Physical Chemistry Inorganic Chemistry Organic Chemistry Marine Geosciences and Territorial Planning			
Coordinator	Prieto Jiménez, Inmaculada			
Lecturers	Alejo Flores, Irene Alonso Gómez, José Lorenzo Besada Pereira, Pedro Francés Pedraz, Guillermo Gago Duport, Luís Carlos Pérez Arlucea, Marta María Pérez Iglesias, María Teresa Prieto Jiménez, Inmaculada Ramos Docampo, Miguel Alexandre Rodríguez Arguelles, María Carmen			
E-mail	iprieto@uvigo.es			
Web	http://faitic.uvigo.es			
General description	In this matter, students will apply in a more specific way the criteria and practical skills learned in "Integrated Laboratory I". Students will carry out diverse experiments that will allow them to work in more specialized laboratories. There will be a focus on the observation and preparation of a laboratory notebook as well as in the realisation of a final report of the work carried out.			

Competencies

Code	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C25	Handle chemicals safely, considering their physical and chemical properties, including the evaluation of any specific risks associated with its use
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
D12	Plan and manage time properly
D13	Make decisions
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		
Carry out basic experiences in physics in order to demonstrate or apply some of the basic laws.	A5	C27 C28 C29	D4 D6 D7 D8 D9 D13 D14 D15
Handle different equipment in the laboratory of Physics and Chemistry: multimeter, power supplies, oscilloscope, etc.	A5	C26 C27 C29	D6 D14
Analyze how different factors, such as the nature of the reagents, concentration, the presence of a catalyst or temperature...affects the reaction rate.	A5	C28	D3 D7 D9 D13 D14
Adjust the experimental conditions for a chemical process (temperature, agitation, etc.).	A5	C26 C27 C28	D3 D7 D8 D13
Carry out the synthesis of simple organic and inorganic substances.	A5	C25 C26 C27 C28	D1 D3 D4 D9 D12 D13 D14 D15
Distinguish a galvanic cell from an electrolytic cell and know how to build both types of cells.	A5	C25 C28	D1 D3 D4 D7 D8 D12 D13 D14 D15
Handle properly the molecular models for the representation of organic compounds.	A5	C28	D1 D3 D7 D9 D12 D13 D14
Apply the knowledge and skills acquired in solving simple problems of separation, purification and characterization of chemical compounds.	A5	C25 C26 C27 C28	D1 D3 D4 D7 D9 D12 D13 D14
Use diffraction programs and interpret electron microscopy images differentiating the structural information (HREM, SAED) and the morphological information (SEM).	A5	C28	D1 D3 D4 D5 D7 D8 D14

Contents
Topic

- Determination of the specific resistance of a conductor (1 session)

- Ohm´s law: DC circuits (1 session)

- Calibration of a thermistor (1 session)

- Electromagnetic induction phenomena: induced currents , Faraday and Lenz laws. Transformer. (1 session)

- Theorem of transfer of maximum power in a circuit (1 session)

- Chemical equilibrium: Study of equilibrium of dissociation of a chemical reaction (2 sessions)

- Chemical kinetics: Kinetic study of a chemical reaction (2 sessions)

- State equation of the ideal gases (1 session)

- Synthesis of simple inorganic compounds (2 sessions)

- Inorganic reactions in aqueous medium (1 session)

- Galvanic and electrolytic cells. The Nernst equation (2 sessions)

- Synthesis of simple inorganic compounds (2 sessions)

- Representation of organic molecules: Molecular models (1 session)

- Separation techniques: Solid- liquid extraction and thin layer chromatography (1 session)

- Separation techniques: Thin layer chromatography and column chromatography (1 session)

- Synthesis of simple organic compounds (1 session)

- Synthesis of organic polymers (1 session)

- Introduction to morphological and microestructural characterization of crystals with optical microscopy with polarised light (2 sessions)

- Introduction to crystal growth techniques in the laboratory: Methods of supersaturation and monocrystals generation. Polymorphism. Crystal growth in gels. (1 session)

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practices	72	40	112
Studies excursion	8	10	18
Short answer tests	2	6	8
Laboratory practice	3	9	12

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

Methodologies

	Description
Laboratory practices	Laboratory practices will be carried out in sessions of 3 hours each. The student will have the support material on the FAITIC platform, so they can have previous knowledge of the experiments to be performed.
Studies excursion	Each student individually will prepare a document on the subject of the practice. Attendance is mandatory to be able to be evaluated.

Personalized attention

Methodologies	Description
Laboratory practices	Time dedicated by the professor to answer all the doubts and questions raised by the students throughout the course. The student will consult with professors what clarifications he deems appropriate to better understand the subject and successfully develop the tasks that were proposed. These consultations will be addressed during the tutoring schedule.
Studies excursion	The student will consult with faculty what clarifications he deems appropriate in order to better understand the subject and successfully develop the tasks that were proposed

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practices	The teacher will monitor the experimental work done by students in the laboratory sessions, as well as the notebook. Since it is a matter of experimental type, the attendance at laboratory sessions is mandatory. It is important indicate that the non-attendance will be penalized in the final grade. If the number of absences is greater than 3, it will suppose to suspend the matter. Days missed will count as zeros in the lab note. In this section, the following points have special relevance: - How student works in the laboratory, including its degree of autonomy. - How student solves the problems that arise when making practice. - Knowledge necessary to carry out the practice. - Material cleaning and treatment. - Calculations needed to perform the work. - Development of laboratory notebook/reports.	40	A5	C25 C26 C27 C28 C29	D1 D3 D4 D5 D6 D7 D8 D9 D12 D13 D14 D15
Studies excursion	It will realise a report on the subject of the practice of field. The assistance is compulsory to be able to be evaluated.	10	A5	C27 C28	D1 D7 D14 D15
Short answer tests	It will realise a proof written relative to concrete aspects of the operations realised in the laboratory.	25	A5	C28 C29	D1 D6 D7 D14
Laboratory practice	It will realise a practical proof (session of laboratory) that will allow to evaluate the skills purchased by the students.	25	A5	C25 C26 C28	D1 D7 D9 D12 D13 D14

Other comments on the Evaluation

To be evaluated the student has to obtain a minimum note in the different sections that comprises the evaluation. This minimum note is of 3.5 in the theoretical and practical tests and in the field, and 4 in the assessment of laboratory practices.

Attendance at more than two practical sessions will imply that the student is already being evaluated, therefore, their qualification it can not be "Not Presented".

A responsible and honest behavior of the students who study this subject is required. No form of copy in any type of report,

work or test. Fraudulent behavior may suppose suspending the subject during a full course.

In the second call, the evaluation will carry out of the following way:

A theoretical-practical test in which the results of the student's learning will be evaluated: 50%.

The score reached by the student during the course will be maintained in the following sections: follow-up of the work of laboratory (40%) and outdoor study/field practices (10%).

Sources of information

Basic Bibliography

Complementary Bibliography

Atkins, P.; Jones, L., **Principios de Química**, 5ª, Panamericana, 2012

Chang, R.; Goldsby, K.A., **Química**, 12ª, McGraw-Hill, 2017

Petrucci, R.; Herring, F.G.; Madura, J.D.; Bissonnette, C., **Química General**, 11ª, Pearson, 2017

Tipler, P.A.; Mosca, G., **Física para la Ciencia y la Tecnología**, 6ª, Reverte, 2010

Atkins, P.; de Paula, J., **Química Física**, 8ª, Panamericana, 2008

Shoemaker, D. P.; Garland, C.W.; Nibler, J.W., **Experiments in Physical Chemistry**, 8ª, McGraw-Hill, 2008

Beckmann, W., **Crystallization: Basic Concepts and Industrial Application**, John Wiley & Sons, 2013

Martínez Grau,M.A.; Csákÿ, A.G., **Técnicas Experimentales en Síntesis Orgánica**, 2ª, Sintesis, 2012

Wade, L.G., **Química Orgánica**, 7ª, Pearson Educación, 2012

Recommendations

Subjects that are recommended to be taken simultaneously

Physics: Physics 2/V11G200V01201
Geology: Geology/V11G200V01205
Mathematics: Mathematics 2/V11G200V01203
Chemistry: Chemistry 2/V11G200V01204

Subjects that it is recommended to have taken before

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103
Chemistry: Chemistry 1/V11G200V01105

IDENTIFYING DATA				
Mathematics: Mathematics 2				
Subject	Mathematics: Mathematics 2			
Code	V11G200V01203			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department	Mathematics			
Coordinator	Mirás Calvo, Miguel Ángel Hervés Beloso, Francisco Javier			
Lecturers	Hervés Beloso, Francisco Javier Mirás Calvo, Miguel Ángel			
E-mail	fjherves@uvigo.es mmiras@uvigo.es			
Web	http://http://faitic.uvigo.es/			
General description	This course covers theoretical and practical topics of Calculus (several variables), optimization e statistics. It is intended to improve the student's abilities in comprehension and use of mathematical language. It will also give the student the necessary general computation skills and the basic knowledge of mathematics-oriented software.			

Competencies	
Code	
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
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
D12	Plan and manage time properly
D13	Make decisions
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	
To relate curves and surfaces with geometrical objects and functions of several variables.	C29	D6 D9
To compute the volume of three-dimensional domains and basic surface integrals as well as using polar, spherical and cylindrical coordinates.	C29	D6
To apply the basic notions and rules of the calculus of several variables.	C29	D3 D6 D9
Differentiating implicitly	C23	D3 D9
To express and solve optimization problems without constraints	C23 C29	D1 D3 D4 D6 D7 D14

To model and solve practical problems using differentiable and integral calculus techniques.		C22 C23 C29	D3 D6 D7 D9 D12 D13 D14
To use an appropriate graphic, numerical and symbolical software to solve practical problems of calculus of several variables.		C22 C29	D4 D5 D6 D7 D13 D14
To compute eigenvalues and check whether a matrix is diagonalizable.		C29	D3 D6 D9
To stablish the definiteness of a quadratic form.		C29	D3 D6 D9
To use adequate software to solve linear algebra problems.		C22 C29	D3 D4 D5 D6 D7 D9 D12 D13 D14
To perform a descriptive statistical data analysis		C22 C29	D4 D5 D6 D7 D9 D12 D13 D14
To compute probabilities in different spaces and apply the concept of random variable to model real situations.		C23 C29	D3 D6 D9
To use basic statistical software.		C22 C23 C29	D1 D4 D5 D6 D7 D14
To write or make and oral presentation of mathematical concepts.	A4	C23	D1 D3 D4 D5 D8 D12 D13 D14 D15

Contents	
Topic	
Chapter 1: Eigenvalues and symmetric matrices	Computation of eigenvalues. Diagonalizable matrices. Sign of a quadratic form
Chapter 2: Calculus of several variables	Intoduction to real funcions of several variables. Continuous and differentiable functions. Higher order derivatives. The chain rule. Implicit differentiation. Computation of extreme points
Chapter 3: Multiple integration	Integrals of functions of two and three variables on bounded domains. Polar, spherical and cylindrical coordinates. Surface Integrals

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	30	50
Problem solving	26	36	62
Computer practices	6	3	9
Essay questions exam	3	20	23
Laboratory practice	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	The teachers will lecture on the theoretical foundations of the topics cover in the course; they will present possible applications; they will formulate problems, questions and exercises; and they will propose tasks and activities with orientations on the methods and techniques needed.
Problem solving	In this activity, the students, individually or in group, must solve problems and exercises. The students must be able to find a convincing mathematical model, use the appropriate technique according to the available information and give a sound interpretation of the results.
Computer practices	Activities designed to learn how to use mathematical software to make numerical computations and plotting of functions and data.

Personalized attention	
Methodologies	**Description**
Problem solving	Each student can ask the teachers for advise and guidance related to the contents and activities of the course. They will be attended during tutorial hours.
Computer practices	Questions and doubts related to the computer classes will be attended during tutorial hours.

Assessment						
	Description	Qualification	Training and Learning Results			
Problem solving	The student must solve some given problems and exercises within the time and under the conditions specified by the teacher. The activities can be of very different types: go out to the blackboard, written assingment, oral presentation, puzzle,...	15	A4	C23	D1 D3 D4 D6 D7 D8 D9 D12 D13 D14 D15
Essay questions exam	Final exam. A formal individual examination consisting on theoretical and practical questions that will take place right after the classes period.	80		C22 C29	D3 D6 D7 D9 D12 D13 D14
Laboratory practice	Practical exercise to evaluate the student degree of knowledge and application of the mathematical software used in the lab clasess.	5		C22 C29	D4 D5 D6 D7 D14

Other comments on the Evaluation

Second call (failed subject):

To pass the subject the student must obtained a global score greater or equal than 50% of the possible highest score.

The student who fail the subject in the first call must repeat the final exam in July. The other marks will be maintained.

A final mark or qualification will be assigned to those students who attend any of the final exams.

Sources of information

Basic Bibliography

Complementary Bibliography

Robert G. Mortimer, **Mathematics for physical chemistry**, Elsevier, 2013

Besada, M.; García, J.; Mirás, M.; Vázquez, C., **Cálculo diferencial en varias variables**, Garceta, 2011

E. Steiner, **The Chemistry Maths Book**, Oxford University Press, 2008

Besada, M.; García, J.; Mirás, M.; Quinteiro, C.; Vázquez, C., **Un mar de Matemáticas. Matemáticas para os graos de Ciencias**, Servicio de Publicacións. Universidade de Vigo, 2016

Real Sociedad Matemática Española, **Centro virtual de divulgación de las Matemáticas**,

R. Larson, R. Hostetler; B. H. Edwards, **Cálculo esencial**, Itemex, 2010

Robert A. Adams; Christopker Essex, **Calculus. A complete course**, Pearson, 2013

William Bober, Chi-Tay Tsai; Oren Masory, **Numerical and analytical methods with MATLAB**, CRC Press, 2013

Dingyu Xue; Yangquan Chen, **Solving applied mathematical problems with MATLAB**, CRC Press, 2009

Mirás Calvo, Miguel Ángel; Sánchez Rodríguez, María Estela, **Técnicas estadísticas con hoja de cálculo y R: azar y variabilidad en las ciencias naturales**, Servizo de Publicación. Universidade de Vigo, 2018

Recommendations

Subjects that continue the syllabus

Numerical methods in chemistry/V11G200V01402

Subjects that are recommended to be taken simultaneously

Physics: Physics 2/V11G200V01201
Geology: Geology/V11G200V01205
Chemistry, physics and geology: Integrated laboratory 2/V11G200V01202
Chemistry: Chemistry 2/V11G200V01204

Subjects that it is recommended to have taken before

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103
Chemistry: Chemistry 1/V11G200V01105

IDENTIFYING DATA				
Chemistry: Chemistry 2				
Subject	Chemistry: Chemistry 2			
Code	V11G200V01204			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department	Physical Chemistry Inorganic Chemistry Organic Chemistry			
Coordinator	Pérez Juste, Ignacio			
Lecturers	Castro Fojo, Jesús Antonio Hervés Beloso, Juan Pablo Pérez Juste, Ignacio Silva López, Carlos			
E-mail	uviqpipj@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Chemistry II pretends to provide to students the basis for the understanding of disciplines more specific, that will give in future courses.			

Competencies	
Code	
C1	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: Major aspects of chemical terminology, nomenclature, units and unit conversions.
C2	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: types of chemical reactions and its main characteristics
C5	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: Characteristics of the different states of matter and the theories used to describe them
C9	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: characteristic properties of the elements and their compounds, including group relationships and variations in the periodic table
C12	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: structural features of chemical elements and their compounds, including stereochemistry
C19	Apply knowledge and understanding to solve basic problems of quantitative and qualitative nature
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
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
D12	Plan and manage time properly
D13	Make decisions
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	
Interpret the functions of radial distribution and the angular representations of the s, p, d and f orbitals. Describe the configuration in the fundamental state of atoms and ions. Justify the variations of different atomic parameters along the Periodic Table. Interpret the electronegativity and the polarizability of an atom.	C5 C9 C19	D1 D3 D4 D6 D7 D8 D9 D12 D13 D14 D15

Recognize the atomic orbitals involved in a bonding. Build diagrams of OM for diatomic molecules and deduce properties of the bonding. Define overlap integral. Apply the method of hybridization to explain the bonding in simple molecules.	C5 C19	D1 D3 D4 D7 D8 D9 D12 D13 D14
Describe the state of aggregation of the elements and his behaviour in front of oxygen and water. Describe the natural resources of the elements and some methods of obtaining.	C5 C9	D1 D3 D4 D7 D8 D9 D12 D14
Use the models of bonding to explain the structure of the main functional groups. Relate its structure with its macroscopic properties.	C1 C9	D1 D3 D4 D7 D8 D9 D12 D14
Identify the acidic protons in an Brönsted acid. Classify the Brönsted acids. Predict the acidity and basicity of organic compounds. Identify acids and bases of Lewis and types of acid-base reactions. Identify acids and bases as hard or soft and explain its interaction.	C1 C2 C19	D1 D3 D4 D7 D8 D9 D12 D14
Represent the three-dimensional structure of organic molecules. Apply the principles of stereochemistry. Determine the absolute configuration. Apply the nomenclatures R/S and Z/Y.	C1 C12	
Explain the bonding solids. Relate structure and properties in amorphous solids. Describe the supercondutivity. Interpret one model structure. Predict the coordination number in function of the relation of ionic radii. Use the cycle of Born-Haber to determine the lattice enthalpy.	C5 C19	D1 D3 D4 D7 D8 D9 D12 D14
Define the standard potentials of reduction. Calculate the variation of energy of Gibbs in a redox reaction. Explain an electrochemical cell. Predict the products and its quantities in a electrolysis.	C1 C19	D1 D3 D4 D7 D8 D9 D12 D14
Characterize the types of radiation in a radioactive disintegration. Write nuclear reactions. Calculate the nuclear binding energy and the half life of an isotope. Describe the reactions in nuclear chain. Enumerate examples of the use of radioisotopes.	C1 C19	D1 D3 D4 D7 D8 D9 D12 D14

Contents	
Topic	
Subject 1: Structure of matter	Structure of the hydrogenic atoms. Polyelectronic atoms. Atomic parameters. Lanthanide contraction. Electronegativity. Polarizability.
Subject 2: Chemical bonding	Theory of OM. Types of orbital: sigma, pi, delta. Diagram of energies for diatomic homo- and heteronuclear molecules.
Subject 3: Organic Compounds and functional groups	Structure and geometry. Approach and nomenclature of organic compounds. Physical properties.

Subject 4: Isomery	Geometrical isomery. Conformational stereoisomery. Configurational stereoisomery.
Subject 5: Solids	Structure of the simple solids. Structure of the metals. Alloys. Metallic bonding. Semicondutors. Ionic solids. Energetic aspects.
Subject 6: Acid-Base properties of the main group elements and their compounds	Brönsted acids and bases. Lewis acids and bases.
Subject 7: Redox properties of the main group elements and their compounds	Oxidants and reductants. Nerst Equation.
Subject 8: Electrochemisty	Concentration cells. Batteries. Fuell cells. Electrolysis. Commercial electrolytic processes. Corrosion.
Subject 9: Nuclear chemistry	Nuclear reactions. Radioactive disintegration. Artificial transmutations. Nuclear fission. Nuclear fusion. Nuclear radiation. Applications of the radioactivity.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	38	64
Seminars	26	40	66
Essay questions exam	3	11	14
Essay questions exam	2	4	6

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

Methodologies

	Description
Lecturing	In these sessions, we present the general aspects of the program
Seminars	This teaching activity will be employed to solve some problems or exercises proposed related with the matter. These exercises will be delivered previously to the student through the platform Tem@ expecting that the student work them. In these sessions, we can collect questions or short problems to control the progress of the students.

Personalized attention

Methodologies	Description
Seminars	During all the educational period the students will be able to consult all type of doubts related with the matter. These queries will attend so much in schedules of tutorials as of seminars.

Assessment

	Description	Qualification	Training and Learning Results	
Seminars	Students attitude and participation in seminar classes will be valued. Short questions and hand-made problems will be also proposed to track students' progress. Grading in this section will be only considered if students reach a mark equal or above 5/10 in the written exams.	15	C1 C2 C5 C9 C12 C19	D1 D3 D4 D6 D7 D8 D9 D12 D13 D14 D15
Essay questions exam	A final written test will be proposed to evaluate the adquired competences. To) If the first written test was passed, the final examinationwill be dedicated to the matter explained since then. b) Those students who have not passed the first written test will have to examine of all the matter. In this case, the weight of the final examination in the qualification will be the sum of the corresponding to both written tests.	40	C1 C2 C5 C9 C12 C19	
Essay questions exam	At half-semester, a first written test will be proposed about the matter explained so far. This exam will be eliminatory of matter in the final test if students reach a mark equal or above 5/10. Those students not reaching this mark will have to repeat this part of the examination in the final written test.	45	C1 C2 C5 C9 C12 C19	

Other comments on the Evaluation

Students must attend all tests performed along the course. The participation in the evaluation activities throughout the semester or in some of the assessment tests involve the condition of Presented and therefore the student will be graded.

Indicate that the final grade of the matter will be:

- That obtained with the continuous evaluation (15% seminars + 45% first written test + 40% final written test) for those students that reach an equal or upper punctuation to 5 points on 10 in the first written test. The assistance to the two written examinations is compulsory.

- That obtained only in the final written test after examining of all the matter for those students that have not reached an equal or upper punctuation to 5 points on 10 in the first proof written, that is, 15% seminars + 85% final written test.

Assessment in July: The same rules are applied.

Sources of information

Basic Bibliography

Chang, R. and Goldsby, K. A., **Química**, 12ª, McGrawHill: Mexico, 2017

Petrucci, R.A. et al., **Química general: Principios y aplicaciones modernas.**, 11ª, Madrid: Pearson Educación, D.L., 2017

Whitten, K.W., **Química**, 10ª, Cengage Learning, 2015

Brown, T.L.; Lemay, H.E.; Bursten, B.E.; Murphy, C.J.; Woodward, P.M., **Química. La ciencia central.**, 12ª, Pearson: Naucalpan (Mejico), 2014

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Quiñoá, E. e Riguera, R., **Nomenclatura y representación de los compuestos orgánicos.**, 2ª, McGraw Hill Interamericana, 2005

Complementary Bibliography

Frenking, G.and Shaik, S., **The Chemical bond.**, Weinheim: wiley-VCH, 2014

Tan, J. and Chan K.S., **Understanding Advanced Physical Inorganic Chemistry.**, World Scientific Publishing, Singapore, 2017

Pfenning, B.W., **Principles of Inorganic Chemistry.**, 1ª, Wiley, 2015

Jr Wade, L.G., **Química Orgánica.**, 7ª, Pearson-Educación de México, 2012

Carey, F., **Química Orgánica.**, 9ª, McGraw Hill: Interamericana, 2014

Yurkanis, B.P., **Química Orgánica.**, 9ª, Pearson-Prentice Hall, 2008

Recommendations

Subjects that continue the syllabus

Physical chemistry I/V11G200V01303
Inorganic chemistry I/V11G200V01404
Organic chemistry I/V11G200V01304

Subjects that are recommended to be taken simultaneously

Physics: Physics 2/V11G200V01201
Geology: Geology/V11G200V01205
Mathematics: Mathematics 2/V11G200V01203
Chemistry, physics and geology: Integrated laboratory 2/V11G200V01202

Subjects that it is recommended to have taken before

Biology: Biology/V11G200V01101
Physics: Physics I/V11G200V01102
Mathematics: Mathematics 1/V11G200V01104
Chemistry, physics and biology: Integrated laboratory 1/V11G200V01103
Chemistry: Chemistry 1/V11G200V01105

IDENTIFYING DATA				
Xeoloxía: Xeoloxía				
Subject	Xeoloxía: Xeoloxía			
Code	V11G200V01205			
Study programme	Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán			
Department	Xeociencias mariñas e ordenación do territorio			
Coordinator	Gago Duport, Luís Carlos			
Lecturers	Gago Duport, Luís Carlos			
E-mail	duport@uvigo.es			
Web	http://faitic.uvigo.es			
General description	O estudo da estrutura da materia en estado cristalino, obxectivo da *Cristalografía, é de relevancia para a comprensión dos fenómenos máis diversos, no ámbito da Química. Consecuentemente, a formulación da Xeoloxía de primeiro curso do grao en Química está preferentemente orientado cara ao coñecemento e caracterización das estruturas cristalinas e dos mecanismos de *cristalización que se abordan desde o punto de vista da *Cristalografía, a Mineraloxía e a *Geoquímica. De maneira particular, as técnicas de *difracción convertéronse nas máis difundidas entre os investigadores químicos para a caracterización e determinación de estruturas das máis diversas sustancias: materiais superconductores, minerais, compostos orgánicos, inorgánicos, produtos farmacéuticos, *macromoléculas biolóxicas, e materiais *cerámicos, entre outros, por iso no curso sentan, desde un punto de vista *introductorio e *intuitivo, as bases da *difracción e móstranse as principais técnicas experimentais asociadas ao proceso de caracterización de sólidos cristalinos.			

Competencias	
Code	
C1	Demostrar coñecemento e comprensión de feitos esenciais, conceptos, principios e teorías en: aspectos principais da terminoloxía química, nomenclatura, conversións e unidades
C14	Demostrar coñecemento e comprensión de feitos esenciais, conceptos, principios e teorías en: relación entre propiedades macroscópicas e propiedades de átomos e moléculas individuais, incluíndo as macromoléculas
C27	Monitorizar, mediante observación e medida de propiedades físicas e químicas, acontecementos ou cambios e documentalos e rexistralos de xeito sistemático e fiable
D1	Comunicarse de forma oral e escrita en polo menos unha das linguas oficiais da Universidade
D3	Aprender de forma autónoma
D4	Procurar e administrar información procedente de distintas fontes
D5	Utilizar as tecnoloxías da información e das comunicacións e manexar ferramentas informáticas básicas
D7	Aplicar os coñecementos teóricos á práctica
D8	Traballar en equipo
D9	Traballar de forma autónoma
D12	Planificar e administrar adecuadamente o tempo
D13	Tomar decisións
D14	Analizar e sintetizar información e obter conclusións
D15	Avaliar de modo crítico e construtivo o entorno e a si mesmo

Resultados de aprendizaxe		
Expected results from this subject		Training and Learning Results
3. Comprender as bases da *cristalografía xeométrica como medio para a caracterización estrutural dos sólidos cristalinos, incluíndo os conceptos básicos como periodicidade e *simetría.		D1 D3 D5 D9 D12
5. Coñecer os aspectos básicos da notación *cristalográfica e a súa aplicación á caracterización tanto da *simetría nas moléculas (*Schoenflies) como á caracterización estrutural dos cristais (*Hermann-*Mauguin).	C1	D1 D7 D8 D13 D14 D15
6. Entender os principios básicos da *difracción como técnica para a análise estrutural e os conceptos *cristalográficos asociados: Lei de *Bragg, cela *recíproca, problema das fases.	C1 C14	D1 D3 D5 D9 D15

10. Entender os procesos de intercambio *isotópico en sólidos cristalinos e coñecer as súas aplicacións para a medida do tempo xeolóxico e como marcadores de condicións termodinámicas e *cinéticas.	C1	D1 D4 D5 D15
7. Adquirir un coñecemento básico sobre os principios para a determinación estrutural mediante *diagramas de *difracción de raios.		D1 D4 D5 D9 D15
6. Entender os principios básicos da *difracción como técnica para a análise estrutural e os conceptos *cristalográficos asociados: Lei de *Bragg, cela *recíproca, problema das fases.	C1	D1 D5 D7 D15
5. Coñecer os aspectos básicos da notación *cristalográfica e a súa aplicación á caracterización tanto da *simetría nas moléculas (*Schoenflies) como á caracterización estrutural dos cristais (*Hermann-*Mauguin).	C1	D1 D5 D7 D14 D15
1. Coñecer e comprender, a *cristalización como un proceso de transición de fase, diferenciando as etapas de *nucleación e crecemento cristalino.	C1	D1 D3 D9 D14 D15
8. Coñecer de forma básica a información derivada das distintas técnicas de *difracción : *R-*X, electróns, neutróns e as súas principais aplicacións no ámbito da ciencia de materiais e da caracterización molecular.	C1	D14 D15
9. Adquirir unha experiencia práctica no manexo de programas de *difracción e na interpretación de imaxes de microscopía electrónica diferenciado a información estrutural (*HREM, *SAED) e morfolóxica (*SEM).	C1 C27	D1 D4 D5 D8 D15
1. Coñecer e comprender, o funcionamento da Terra como sistema.	C1	D1 D3 D9 D12 D15
2. Ser capaz de caracterizar a interacción entre os diferentes *reservorios, os procesos físicos, químicos e biolóxicos involucrados así como as diferentes escalas espazo-temporais asociadas.	C1	D1 D4 D7 D9 D13 D15
(*)	C1	D1 D3 D7 D8 D14 D15
(*)	C1	D1 D3 D4 D7 D15

Contidos	
Topic	
O proceso de *cristalización	Aspectos termodinámicos da *nucleación e crecemento cristalino. *Cinética do crecemento cristalino. Factores estruturais asociados.
Os sólidos cristalinos	Estrutura cristalina. Aspectos *microscópicos. Morfoloxía cristalina: aspectos *macroscópicos.
Conceptos básicos de *cristalografía xeométrica	Periodicidade e *simetría. Redes *bidimensionales. Grupos de *simetría puntual. Notacións de *Schoenflies e *Hermann-*Mauguin.
Redes *tridimensionales	Grupos espaciais. Índices de Miller. Coordenadas *fraccionarias e eixos de zona.
*Cristalografía de raios X	A rede *recíproca. Transformada de *Fourier e *difracción no espazo *recíproco.

Técnicas de *difracción	Métodos de *monocristal e de po. Espectros de *difracción de raios X: Lei de *Bragg. Esfera de *Ewald. Factor de estrutura. O problema da fase.
Interpretación de espectros de *difracción	Análise de *diagramas de *difracción de po. Determinación estrutural mediante *microscopia electrónica de alta resolución (*HREM). Métodos de caracterización de materiais non cristalinos.
Algunhas aplicacións das técnicas de *difracción	Caracterización de materiais *cerámicos e aliaxes. Determinación da estrutura de proteínas. Análise *textural de materiais *amorfos e mostras biolóxicas. Seguimento en tempo real de transicións de fase.
Crecemento de cristais en medios naturais	*Biomineralización. Ambientes *evaporíticos. Modelos de predición de precipitación de fases cristalinas.
*Geocronología	Isótopos radioactivos. Estabilidade nuclear. Mecanismos de descomposición. Vida media. Sistemas de *datación temporal: *K-*Ar, *Rb-*Sr, *Sm-*Nd, Ou-*Th-Pb, 14*C. Outros métodos de *datación: pegadas de fisión.
Isótopos estables en Xeoloxía	Relación *isotópica. Factores que determinan o *fraccionamiento *isotópico. Aplicacións como marcadores *cinéticos e termodinámicos de procesos *geoquímicos.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	26	52	78
Resolución de problemas	13	26	39
Estudo de casos	2	13	15
Outros	0	14	14
Exame de preguntas obxectivas	4	0	4

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

Metodoloxía docente

	Description
Lección maxistral	Explícanse os principios básicos da *cristalización como proceso e das estruturas dos sólidos cristalinos a partir das ideas de periodicidade e *simetría das redes cristalinas. Introdúcese ao alumno ás técnicas de *difracción.
Resolución de problemas	Empregaranse os seminarios para a preparación de traballos prácticos asociados ao proceso de crecemento de cristais. e se *tabajara con programas de *resolucion de estruturas mediante *difraccion e microscopía *electronica
Estudo de casos	Se traballará con programas de resolución de estruturas a partir de datos difracción de raios X e mediante fotografías de microscopía electrónica de transmisión (HREM) para observar as aspectos nanoestructurales das fases cristalinas.
Outros	Realizaranse presentacións por grupos con para expor os resultados e *principlaes conclusións dos traballos desenvolvidos por grupos acerca dos procesos de crecemento cristalino. e caracterización estrutural

Atención personalizada

Methodologies	Description
Resolución de problemas	A resolución de exercicios realizarase durante os seminarios, mediante preguntas e respostas ás cuestións formuladas na clase.
Outros	Desenvolveranse na aula de informática e en case teórica así como mediante *l realización de *tutorías ou consultas empregando a plataforma Tema ou o correo electrónico.
Estudo de casos	desenvolverase na aula de informática, durante os seminarios, empregando programas de edificación de raios X e mediante o tratamento de imaxes de microscopio electrónico de transmisión (HREM

Avaliación

	Description	Qualification	Training and Learning	Results
Resolución de problemas	Valorarase a realización de traballos prácticos realizados por grupos durante os seminarios	30	C1 C27	D3 D7 D9 D14 D15
Estudo de casos	Se valorarán os coñecementos xerais -quiñidos nos seminarios- sobre os métodos de difracción e o seu uso para a resolución de estructuras cristalinas.	5	C1 C14	D7 D9 D14

Outros	Se valorará la participación individual en los seminarios y clases teóricas.	5	C1	D1 D4 D8 D14
Exame de preguntas obxectivas	avaliarase o grao de comprensión dos conceptos e definicións *cristalográficos, asociados á parte teórica.	60	C1 C14	D1 D9 D14

Other comments on the Evaluation

A avaliación na segunda convocatoria consistirá na realización dun exercicio teórico sobre os conceptos básicos da Cristalografía desenvolvidos durante as clases magistrales. O exercicio poderá incluír tamén prácticas cuestións relacionadas cos métodos de resolución e análise de crystalline structures realizados nos seminarios.

Bibliografía. Fontes de información

Basic Bibliography

Andrew Putnis, **Introduction to Mineral Sciences**, 1ª,

Robert A. Evarestov, V.P. Smirnov, **Site symmetry in cristals : theory and applications**, 2ª,

Complementary Bibliography

Edward Tarbuck y FredericK Lutgens, **Ciencias de la Tierra. Una introducción a la Geología Física**, 8ª,

Christofer Hammond, **The Basic of Crystallography and Diffraction**, 3ª,

Jose Luis Amorós, **El Cristal : morfología, estructura y propiedades físicas**, 4ª,

Rousseau, J.-J., **Basic crystallography**,

Vitalij K. Pecharsky, Peter Y. Zavalij, **Fundamentals of powder diffraction and structural characterization of materials**,

Douglas, Bodie E., **Structure and chemistry of crystalline solids**, 1ª,

Woolfson, M. M., **An Introduction to X-ray crystallography**, 2ª,

Salvador Galí Medina, **Cristalografía : teoría particular, grupos puntuales y grupos espaciales**, 1ª,

Recomendacións

Subjects that continue the syllabus

Química inorgánica I/V11G200V01404
Determinación estrutural/V11G200V01501

Subjects that are recommended to be taken simultaneously

Física: Física II/V11G200V01201
Matemáticas: Matemáticas II/V11G200V01203
Química, física e xeoloxía: Laboratorio integrado II/V11G200V01202
Química: Química II/V11G200V01204

Subjects that it is recommended to have taken before

Bioloxía: Bioloxía/V11G200V01101
Física: Física I/V11G200V01102
Matemáticas: Matemáticas I/V11G200V01104
Química, física e bioloxía: Laboratorio integrado I/V11G200V01103
Química: Química I/V11G200V01105