



IDENTIFYING DATA

Geology: Geology

Subject	Geology: Geology			
Code	V11G200V01205			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Gago Duport, Luís Carlos			
Lecturers	Gago Duport, Luís Carlos			
E-mail	duport@uvigo.es			
Web	http://fatic.uvigo.es			
General description	The study of the structure of the matter in crystalline state, aim of the Crystallography, is of importance for the understanding of the most diverse phenomena, in the field of the Chemistry. Consistently, the approach of the Geology of first course of the degree in Chemistry is preferably oriented to the knowledge and characterisation of the crystalline structures and of the mechanisms of crystallisation that tackle from the point of view of the Crystallography, the Mineralogy and the Geochemistry. Of particular way, the technicians of diffraction have turned into the most spread between the chemical researchers for the characterisation and determination of structures of the most diverse substances: superconducting materials, mineral, organic compounds, inorganic, pharmaceutical products, biological macromolecules, and ceramic materials, amongst other, thus in the course seat, from an introductory and intuitive point of view, the bases of the diffraction and show the main experimental technicians associated to the process of characterisation of crystalline solids.			

Competencies

Code	
C1	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: Major aspects of chemical terminology, nomenclature, units and unit conversions.
C14	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: relationship between macroscopic properties and properties of individual atoms and molecules, including macromolecules
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
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
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
3. Comprise the bases of the geometrical crystallography like half for the structural characterisation of the crystalline solids, including the basic concepts like periodicity and symmetry.	D1 D3 D5 D9 D12

5. Know the basic appearances of the notation *cristalográfica and his application to the characterisation so much of the symmetry in the molecules (*Schoenflies) as to the structural characterisation of the glasses (*Hermann-*Mauguin).	C1	D1 D7 D8 D13 D14 D15
6. Understand the basic principles of the diffraction like technician for the structural analysis and the concepts *cristalográficos associated: Law of *Bragg, reciprocal cell, problem of the phases.	C1 C14	D1 D3 D5 D9 D15
10. Understand the processes of isotopic exchange in crystalline solids and know his applications for the measure of the geological time and like markers of thermodynamic and kinetical conditions.	C1	D1 D4 D5 D15
7. Purchase a basic knowledge on the principles for the structural determination by means of diagrams of diffraction of rays.		D1 D4 D5 D9 D15
6. Understand the basic principles of the diffraction like technician for the structural analysis and the concepts *cristalográficos associated: Law of *Bragg, reciprocal cell, problem of the phases.	C1	D1 D5 D7 D15
5. Know the basic appearances of the notation *cristalográfica and his application to the characterisation so much of the symmetry in the molecules (*Schoenflies) as to the structural characterisation of the glasses (*Hermann-*Mauguin).	C1	D1 D5 D7 D14 D15
1. Know and comprise, the crystallisation like a process of transition of phase, differentiating the stages of *nucleación and crystalline growth.	C1	D1 D3 D9 D14 D15
8. Know of basic form the derivative information of the distinct technicians of diffraction : *R-X, electrons, neutrons and his main applications in the field of the science of materials and of the molecular characterisation.	C1	D14 D15
9. Purchase a practical experience in the handle of programs of diffraction and in the interpretation of images of *microscopía electronic differentiated the structural information (*HREM, *SAED) and morphological (SEM).	C1 C27	D1 D4 D5 D8 D15
1. Know and comprise, the operation of the Earth like system.	C1	D1 D3 D9 D12 D15
2. Be able to characterise the interaction between the different *reservorios, the physical processes, chemists and biological *involucrados as well as the different scales space-temporary associated.	C1	D1 D4 D7 D9 D13 D15
(*)	C1	D1 D3 D7 D8 D14 D15
(*)	C1	D1 D3 D4 D7 D15

Contents

Topic

The process of crystallisation	Thermodynamic appearances of the *nucleación and crystalline growth. Kinetic of the crystalline growth. Structural factors associated.
The crystalline solids	Crystalline structure. Microscopic appearances. Crystalline morphology: macroscopic appearances.
Basic concepts of geometrical crystallography	Periodicity and symmetry. Two-dimensional networks. Groups of punctual symmetry. Notations of *Schoenflies and *Hermann-Mauguin.
Three-dimensional networks	Space groups. Indexes of Miller. Fractional coordinates and axes of zone.
Crystallography of X-rays	The reciprocal network. Transformed of Fourier and diffraction in the reciprocal space.
Techniques of diffraction	Methods of *monocrystal and of dust. Spectrums of diffraction of X-rays: Law of *Bragg. Sphere of *Ewald. Factor of structure. The problem of the phase.
Interpretation of spectrums of diffraction	Analysis of diagrams of diffraction of dust. Structural determination by means of electronic microscopy of high resolution (*HREM). Methods of characterisation of materials no crystalline.
Some applications of the techniques of diffraction	Characterisation of ceramic materials and alloys. Determination of the structure of proteins. Analysis *textural of amorphous materials and biological samples. Follow-up in real time of transitions of phase.
Growth of glasses in natural means	*Biomineralización. Environments *evaporíticos. Models of prediction of precipitation of crystalline phases.
Geochronology	Radioactive isotopes. Nuclear stability. Mechanisms of decomposition. Half life. Systems of temporary dating: *K-*Ar, *Rb-*Sr, *Sm-*Nd, Or-*Th-*Pb, ¹⁴ C. Other methods of dating: footprints of fission.
Stable isotopes in Geology	Isotopic relation. Factors that determine the isotopic fractionation. Applications like kinetic and thermodynamic markers of processes *geoquímicos.

Planning

	Class hours	Hours outside the classroom	Total hours
Tutored works	2	13	15
Master Session	26	52	78
Troubleshooting and / or exercises	13	26	39
Others	0	14	14
Multiple choice tests	4	0	4

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

Methodologies

	Description
Tutored works	They are works that realises each student of individual way and will consist in the characterisation *cristalográfica of a crystalline substance in the structural appearances, *composicionales and morphological. They adopt the format of a small work of investigation and carry implicit the knowledge and handle of the concepts and nomenclature explained in the theoretical classes and seminars.
Master Session	They explain the basic principles of the crystallisation like process and of the structures of the crystalline solids from the ideas of periodicity and symmetry of the crystalline networks. It enters to the student to the techniques of diffraction.
Troubleshooting and / or exercises	They will employ the seminars for the preparation of practical works associated to the process of growth of glasses. And *tabajara with programs of *resolution of structures by means of *difraccion and *microscopía *electronica
Others	They will realise presentations by groups with to expose the results and *principales conclusions of the works developed by groups about the processes of crystalline growth. And structural characterisation

Personalized attention

Methodologies	Description
Tutored works	These works will realise during the seminars using crystallographical software where the notation of symmetry of Herman-Mauguin is employed.
Troubleshooting and / or exercises	They developed in the classroom of computing, during the seminars, employing programs of X-ray diffraction and by means of the treatment of images of electron microscopy (HREM).
Others	They will develop in the classroom of computing and in marry theoretical as well as by means of tutorials and/or queries employing the platform Tema or the email.

Assessment

Description		Qualification	Training and Learning Results	
Tutored works	It will value that the concepts explained in the theory are employed properly, as well as the notation and nomenclature *cristalográfica. Also appearances like the coherence in the development of the work and the precision in the measures and in the quantification of the results.	10	C1 C14 C27	D1 D3 D4 D5 D7 D8 D12 D13 D14
Troubleshooting and / or exercises	It will value the realisation of practical works realised by groups during the seminars	30	C1 C27	D3 D7 D9 D14 D15
Others	It will value the exhibition in groups of the conclusions obtained in the works realised in the seminars about the resolution of structures	20	C1	D1 D4 D8 D14
Multiple choice tests	It will evaluate the degree of understanding of the concepts and definitions *cristalográficos, associated to the theoretical part.	40	C1 C14	D1 D9 D14

Other comments on the Evaluation

The evaluation in the second announcement will consist in the realisation of a theoretical exercise about the basic concepts of the Crystallography and his application to the resolution of structures, developed during the classes *magistrales. Likewise, it will be necessary realise a practical exercise in the handle of the computer tools for the analysis of crystalline structures employees during the course.

Sources of information

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. Zavaliy, **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,

Recommendations

Subjects that continue the syllabus

Inorganic chemistry I/V11G200V01404

Structural Determination/V11G200V01501

Subjects that are recommended to be taken simultaneously

Physics: Physics II/V11G200V01201

Mathematics: Mathematics II/V11G200V01203

Chemistry, physics and geology: Integrated laboratory II/V11G200V01202

Chemistry: Chemistry 2/V11G200V01204

Subjects that it is recommended to have taken before

Biology: Biology/V11G200V01101

Physics: Physics I/V11G200V01102

Mathematics: Mathematics I/V11G200V01104

Chemistry, physics and biology: Integrated laboratory I/V11G200V01103

Chemistry: Chemistry I/V11G200V01105