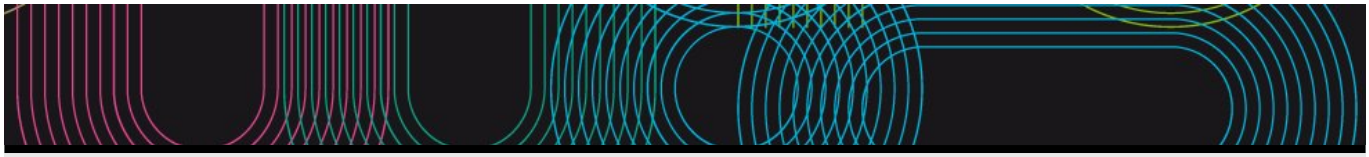
Universidade Vigo

Subject Guide 2020 / 2021



IDENTIFYING DATA				
Geology: Geology				
Subject	Geology: Geology			
Code	V11G201V01106			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Gago Duport, Luís Carlos			
Lecturers	Gago Duport, Luís Carlos			
E-mail	duport@uvigo.es			
Web				
General description	The study of the structure of matter in a crystalline state -objective of Crystallography- is of great relevance for the understanding of the most diverse phenomena in the field of Chemistry, therefore, after a general view of the Earth as a geochemical system, the Approach of the subject Geology corresponding to the first year of the degree in Chemistry is mainly oriented towards the study of crystalline structures and crystallization mechanisms. These topics are approached from the point of view of Crystallography, Mineralogy and Geochemistry. Starting from the thermodynamic and kinetic mechanisms that lead to the formation of crystalline phases, structural aspects, crystallographic notation and diffraction are studied. As a corollary, the importance of these processes is introduced for the study of natural (mineral) crystals and synthetic materials, such as semiconductors, pharmaceuticals, biological macromolecules, and ceramic materials, among others.			

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
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
B1	Autonomous learning ability
B3	Ability to manage information
B4	Ability for analysis and synthesis
C4	Use computer tools properly to obtain information, process data, perform computational calculations and calculate matter properties
C9	Know the structural aspects of chemical elements and their compounds, including stereochemistry
C10	Know the characteristics of the different states of matter and the theories used to describe them
C15	Know the main techniques of structural research, including spectroscopy
C16	Know the relationship between macroscopic properties and properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids, crystals and other materials
D3	Ability to communicate in both oral and written form in Spanish and / or Galician and / or English

Learning outcomes				
Expected results from this subject	Training and Learning Results			
Describe and explain the Earth as a system.	A1 A3	B3	C10 C16	D3
Differentiate the processes that generate minerals and rocks in nature.	A3	B4	C9 C10 C15 C16	
Distinguish the stages of nucleation and crystalline growthin in the crystallization process.			C9 C10 C16	

Use concepts as periodicity, symmetry and morphology to describe crystals.	A1		C9 C10 C15 C16	
Use of the crystallographic notation and its application to the structural characterisation of crystalline solids.	A3	B3 B4	C9 C15	D3
Describe and apply the basic principles of diffraction for structural analysis.			C4 C9 C10 C16	
Use isotopic analysis techniques for measuring the geological time and following geochemical processes.	A1	B1 B3 B4	C4 C15	

Contents

Topic	
The Earth as a Geochemical System: Rocks forming minerals	Geochemical evolution of the Earth. Plate Tectonic. The rocks cycle. Comparison of Earth with other planets in the solar system: The case of of Mars.
The crystallization process: thermodynamic and kinetic aspects.	Differences between nucleation and crystal growth.Crystal growth kinetics. Structural aspects.
Characterization of crystalline solids: structure vs. morphology.	Microscopic and macroscopic approaches to crystalline solids
Geometric crystallography: Periodicity and symmetry in the crystals.	Two-dimensional lattices. Point symmetry. Schoenflies and Hermann-Mauguin notations of point symmetry elements and clases. Bravais lattices. Microscopic symmetry Space groups. Miller indices and zone axes. Fractional coordinates
X-ray crystallography: Bragg's Law and the Phase problem	The physical basis of diffraction. Diffraction by crystals lattices and radiation sources. The Bragg Law The reciprocal lattice. Diffraction Patterns. Indexing of diffraction diagrams. powder diagrams and monocrystal diagrams Quantitative Analysis. The Phase problem. Methods of resolution of structures from diffraction datasets.
Isotopes in Geology: Measuring the geological time with radiactive isotopes. Analyzing kinetic processes by fractionation of stable isotopes.	Radioactive isotopes and stable isotopes. Isotopic dating techniques. The Isochrone method. Kinetic tracking of processes using stable isotopic techniques. Notation and units. Rayleigh fractionation.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	6	34	40
Laboratory practical	6	0	6
Mentored work	1	5	6
Lecturing	26	70	96
Objective questions exam	1	0	1
Problem and/or exercise solving	1	0	1

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

Methodologies

	Description
Problem solving	Seminars will be used to solve practical exercises about nucleation and crystal process and to solve issues related to crystallographic notation and concepts
Laboratory practical	They will be dedicated to the study of the crystallization process, analyzing three aspects: (1) Crystallization in nature: mineral recognition (2) Optical microscopy with polarized light. (3) Crystal growth from solutions and silica gels in the laboratory.
Mentored work	A short paper will be write by groups of about 5 students where the crystallization summarizing the laboratory work. Some guidelines concerning formats and content will be given before the realization. A seminar will be assigned to guide each working group in this task.
Lecturing	First, the basic principles of crystallization are analyzed from a geological and thermodynamic point of view. Further, we introduce to the student the fundamentals of isotope geochemistry. Next themes are devoted to the structural characterization of crystals, analyzing the concepts of periodicity and symmetry in 2D and 3D crystalline lattices. Finally we introduce the principles and practical aspects of diffraction techniques applied to the estructural analysis

Personalized assistance

Methodologies	Description
Problem solving	The resolution of exercises will be carried out during the seminars by answering to the questions raised in class.
Mentored work	They will be developed in the computer classroom and in theoretical class as well as through the realization of tutorials or consultations using the Tema platform or the electronic mail.

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	The activity carried out in the mineralogy laboratory will be evaluated	10	
Mentored work	The performance of a report / work that summarizes the activity carried out in the crystallization laboratory will be evaluated.	10	
Objective questions exam	Exam with short questions and multiple choice questions, as well as exercises, about the content developed in the theoretical classes and/or in the seminars	80	

Other comments on the Evaluation

Sources of information

Basic Bibliography

Andrew Putnis, **Introduction to Mineral Sciences**, 9780521429474, 6ª, Cambridge University Press, 2008

Edward Tarbuck y FredericK Lutgens, **Ciencias de la Tierra. Una introducción a la Geología Física**, 10ª, Pearson, 2013

Complementary Bibliography

Christofer Hammond,, **The Basic of Crystallography and Diffraction**, 3ª, Oxford University Press, 2009

Jose Luis Amorós, **La gran aventura del cristal**, 978-84-669-3539-5, 1ª, Ediciones Complutense, 2017

Carmelo Giacovazzo et al., **Fundamentals of Crystallography**, 2ª, Oxford University Press,

Recommendations

Subjects that continue the syllabus

Chemistry: Chemistry 2/V11G201V01109

Subjects that are recommended to be taken simultaneously

Physics: Physics 2/V11G201V01107
Mathematics: Mathematics 2/V11G201V01108
Chemistry: Chemistry Lab II/V11G201V01110
Chemistry: Chemistry 2/V11G201V01109

Subjects that it is recommended to have taken before

Biology: Biology/V11G201V01101
Physics: Physics I/V11G201V01102
Mathematics: Mathematics 1/V11G201V01103
Chemistry: Chemistry Lab I/V11G201V01105

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or with a wide time period) by the students and the professor through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep

- Resolution of problems.
- Works *tutelados.

- Lesson *magistral.

* Educational methodologies that modify

- Laboratory teaching

* Mechanism no face-to-face of attention to the students (*tutorías)

-Virtual office of the professor.
-Communication via email and *faitic.

* Modifications (if they proceed) of the contents to give

Substitute the seminars in the laboratory and in the classroom of computing by works and exercises made with computer programs of free software. The installers of software are provided to the students through faitic together tutoriales, that will remain recorded in youtube or ianother reservory of software, available for the students.

-The theory goes to develop by means of the employment of virtual classrooms and additional information contributed in faitic in shape of short questions and exercises of *autoevaluación. The theoretical contents are complemented by means of the realisation of short works (1 page). These works explain in very synthetic form questions of actuality proposed by the professor on topics associated to the Geology and Crystallography

-As virtual classrooms will employ those provided by Uvigo.

-I will expose the important conceptual lines that will be complemented with questions and exercises proposed in the application Faitic.

* Additional bibliography to facilitate the self learning.

https://jp-minerals.org/vesta/en/doc.html

https://www.epfl.ch/schools/sb/research/iphys/teaching/crystallography/

* Other modifications

=== ADAPTATION OF THE EVALUATION ===
* Test already made
The exams which were evaluated previously to the application of the plan of Contingency keeps his initial % value (step 7) with regard to the final note. The note obtained during the plan of contingency will apply to the part still no evaluated in the moment of his implantation.

* activities that are modified :
From the moment of application of the plan of Contingency we will evaluate the following activities that will be averaged with the qualifications obtained in the already evaluated activities before the moment of the application of the plan of contingency :

- The presentation of Works tutorialized, until the (50%) of the note obtained during the length of the plan of contingency.

-The resolution of Questions and Exercises in the platform Faitic: (30%) of the note obtained during the length of the plan of contingency.

-The realisation of exercises on subjects of crystallography, structures and diffraction of X-rays. It will value until (20%) of the note during the length of the plan of contingency.