

**Información del Plan Docente**

<b>Academic Year</b>	2016/17
<b>Academic center</b>	100 - Facultad de Ciencias
<b>Degree</b>	452 - Degree in Chemistry
<b>ECTS</b>	6.0
<b>Course</b>	1
<b>Period</b>	Second semester
<b>Subject Type</b>	Basic Education
<b>Module</b>	---

**1.Basic info****1.1.Recommendations to take this course****1.2.Activities and key dates for the course****2.Initiation****2.1.Learning outcomes that define the subject****2.2.Introduction****3.Context and competences****3.1.Goals****3.2.Context and meaning of the subject in the degree****3.3.Competences****3.4.Importance of learning outcomes****4.Evaluation****5.Activities and resources****5.1.General methodological presentation**

This course is oriented to acquire the basic knowledge on geological materials (minerals, rocks, soils and fossil fuels), their principal features, and their industrial uses. A significant part of the course is focused on the structure, properties and study of the crystalline matter, as these topics are directly related to chemistry. In order to fulfill these objectives, lectures are designed to introduce to the student the basic theoretical concepts which, on the other hand, are applied in the practical sessions. These practicals are devoted to a more detailed study of crystal symmetry, its description and representation and to the identification, classification and description of the properties of geological materials (minerals and rocks).

## 5.2. Learning activities

This course is divided into four learning activities:

Activity #1: Lectures, designed to introduce the basic concepts developed during the course (35 hours)

Activity #2: Practicals on symmetry and geometrical crystallography, working on crystallographic models.(7 hours)

Activity #3: Practicals on identification of minerals and rocks (10 hours).

Activity #4: *Field work* (8 hours, one-day field trip)

## 5.3. Program

Lectures

### *Part I. Crystalline matter and minerals*

- Lecture 1. Introduction to Geology. The definition of mineral.
- Lecture 2. The crystalline state and crystalline matter. Periodical lattices. The seven crystal systems. The five two-dimensional lattices. The Bravais lattices. Introduction to internal symmetry.
- Lecture 3. Symmetry and rotation. Stereographic projection. Internal and external symmetry. Crystal forms. Crystal growth.
- Lecture 4. Minerals. Structure and chemical composition. Classification and relevant groups.

### *Part II. Rocks and other geological materials*

- Lecture 5. Structure and composition of the Earth. Geological cycles. Rock-forming environments: sedimentary, igneous and metamorphic.
- Lecture 6. Magmas and their crystallization. Plutonic rocks vs. volcanic rocks.
- Lecture 7. Metamorphism and metamorphic factors. Metamorphic rocks.
- Lecture 8. Sedimentary rocks and their formation. Siliciclastics, carbonate rocks and evaporites.
- Lecture 9. Coals and oil. Components and evolution stages. Reservoir rocks and oil traps.
- Lecture 10. Soils and soil components. Texture and structure. Introduction to soil chemistry. Soil degradation.

### *Part III. Uses and applications of minerals and rocks*

- Lecture 11. Minerals as commodities: industrial minerals, ores and gem minerals..
- Lecture 12. Quartz, zeolites and feldspars. Industrial clays.
- Lecture 13. Elements, oxides and hydroxides, sulphates, halides and carbonates.
- Lecture 14. Nitrates, phosphates and borates.

Practicals

Practicals are divided in laboratory classes (part I and part II) and field work.

### *Part I. Practicals on symmetry and geometrical crystallography.*

These practical sessions are oriented to the identification of symmetry elements and symmetry classes of selected crystallographic models, learning to represent these elements in stereographic projection.

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### *Part II. Practicals on identification of minerals and rocks*

These practical sessions are oriented to the identification of the relevant properties of selected mineral and rock hand specimens.

#### *Field work*

One all-day field trip is scheduled in this course to study and explain several geological outcrops, where the identification of rocks and minerals can be contextualized. To attend this activity, the students must have attended to the first two tests of the course (comprising lectures 1 to 4 and 5 to 10), obtaining at least 5 points in one of them.

### **5.4.Planning and scheduling**

Lectures, practical sessions and examination dates will follow the scheduling fixed by the Science Faculty, which is published in its website (<https://ciencias.unizar.es/calendario-y-horarios>). Practical sessions start three weeks after the beginning of the lectures and each students must attend one two-hour practical session per week.

### **5.5.Bibliography and recommended resources**

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| <b>BB</b> | Ashman, M. R.. Essential soil science : a clear and concise introduction to soil science / M. R. Ashman and G. Puri .<br>Malden [etc.] : Blackwell, 2002  |
| <b>BB</b> | Bloss, F. Donald. Crystallography and Crystal Chemistry : an introduction / F. Donald Bloss . - 2nd printing Washington : Mineralogical Society of America, 2000  |
| <b>BB</b> | Chang, L. L. Y.. Industrial mineralogy : materials, processes and uses / Luke L. Y. Chang, Bs., Ph. D. New Jersey : Prentice Hall , cop. 2002.  |
| <b>BB</b> | Klein, Cornelis. Manual de mineralogía : basado en la obra de J.D. Dana / Cornelis Klein, Cornelius S. Hurlbut, Jr. ; [versión española por J. Aguilar Peris] . - 4a. ed., 2. reimp. Barcelona [etc.] : Reverté, D.L. 2001                    |
| <b>BB</b> | Tarback, Edward J. : Ciencias de la tierra : una introducción a la geología física / Edward J. Tarback, Frederick K. Lutgens ; ilustrado por, Dennis Tasa ; revisión técnica, Dolores García del Amo. . - 10 ed. Madrid : Pearson, D.L. 2013. |

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### Online resources:

Cursos online de Cristalografía y Mineralogía de la UNED -  
[<http://www.uned.es/cristamine/>]

Gemologia MLLOPIS. Modelos cristalográficos en 3D -  
[<http://gemologiamllopis.com/cristalografia/#a>]

Grupos Puntuales de simetria. UAB. Dpto de Geología -  
[<http://departaments.uab.cat/geologia/PSG>]

Solid State Structures. University of Wisconsin Online Resources -  
[<http://education.mrsec.wisc.edu/pmk/index.html>]

Webmineral - [<http://www.webmineral.com>]