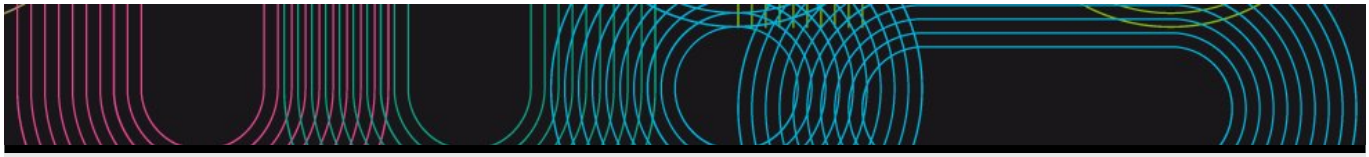

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Chemistry: Chemistry II** | | | | |
| Subject | Chemistry:<br>Chemistry II | | | |
| Code | V11G200V01204 | | | |
| Study programme | (*)Grao en Química | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Basic education | 1st | 2nd |
| Teaching language | | | | |
| Department | | | | |
| Coordinator | Peña Gallego, María de los Ángeles | | | |
| Lecturers | García Fontán, María Soledad<br>Losada Barreiro, Sonia<br>Peña Gallego, María de los Ángeles<br>Prieto Jiménez, Inmaculada<br>Teijeira Bautista, Marta | | | |
| E-mail | qfpena@vigo.es | | | |
| Web | http://faitic.uvigo.es | | | |
| General description | Chemistry II pretends to introduce a microscopic vision of the matter, providing to students the basis for the understanding of disciplines more specific, that will give in future courses, and explaining the nature of the matter. | | | |

| 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<br>C9<br>C19 | D1<br>D3<br>D4<br>D6<br>D7<br>D8<br>D9<br>D12<br>D13<br>D14<br>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<br>C19 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>D13<br>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<br>C9 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>D14 |
| Use the models of bonding to explain the structure of the main functional groups. Relate its structure with its macroscopic properties. | C1<br>C9 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>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<br>C2<br>C19 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>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<br>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<br>C19 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>D14 |
| Describe the types of polymers. Describe the types of colloids and his properties. Explain the behavior of surfactants. | C9 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>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<br>C19 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>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<br>C19 | D1<br>D3<br>D4<br>D7<br>D8<br>D9<br>D12<br>D14 |

## Contents

| Topic | |
|---|---|
| Subject 1: Atomic structure | Structure of the hydrogenic atoms: atomic orbital, function of radial distribution, forms of the atomic orbital. Polyelectronic atoms: Penetration and shielding, effective nuclear charge, "aufbau". Atomic parameters: atomic, ionic, covalent and van der Waals radius. 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. Bonding in alkenes and alkynes. |
| Subject 3: Nuclear chemistry | Nuclear reactions. Types of radioactive disintegration. Stability of nuclei. Kinetical of the radioactive disintegrations. Artificial transmutations. Nuclear fission. Nuclear fusion. Nuclear radiation: effects and units. Applications of the radioactivity. |
| Subject 4: Solid state | Structure of the simple solids. Sphere packing. Structure of the metals. Alloys. Metallic bonding. Semicondutors. Ionic solids. Energetic aspects. |
| Subject 5: Elements of the main groups | Elements of the main groups. Physical properties. Chemical properties. Natural resources. Some methods of significant obtaining. |
| Subject 6: Acid-base | Acid-base theories. Brönsted acids and bases: acid and base strength. Concept of pKa. Relationship between structure and acidity. Lewis acids and bases: Definition, examples. Fundamental types of Lewis acid-base reactions. Dissolvent as acids and bases. Hard and soft acids and bases: Classification, interpretation of the interactions between hard and soft acids and bases. |
| Subject 7: Electrochemical | Eº and Gibbs free energy. Nerst Equation. Concentration cells. Batteries. Fuell cells. Electrolysis. Commercial electrolytic processes. Corrosion. |
| Subject 8: Organic Compounds and functional groups | Structure and geometry. Approach and nomenclature of organic compounds. Physical properties. |
| Subject 9: Isomery | Geometrical isomery. Conformational stereoisomery. Configurational stereoisomery. |
| Subject 10: Polymers | Polymer types according to origin, composition, structure and behaviour in front of heat. Copolymerization. Mechanisms of polymerization. Molecular structure of the polymers. Biopolymers. Colloids and surfaces. Surface tension and surfactants. |

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Master Session | 26 | 38 | 64 |
| Others | 0 | 4 | 4 |
| Troubleshooting and / or exercises | 26 | 38 | 64 |
| Long answer tests and development | 2 | 10 | 12 |
| Short answer tests | 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 |
|---|---|
| Master Session | In these sessions, we present the general aspects of the program |

| | |
|---|---|
| Others | In the different activities we pay attention to transversal competitions collected in the memory of the degree. |
| Troubleshooting and / or exercises | Each week we employe two hours to the resolution of 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.<br>In these sessions, we can collect questions or short problems to control the progress of the students. |

## Personalized attention

| Methodologies | Description |
|---|---|
| Troubleshooting and / or exercises | Students can ask teachers questions to understand the subject in the tutorial hours |

## Assessment

| | Description | Qualification | Training and Learning Results |
|---|---|---|---|
| Others | In the different activities, we pay attention to transversal competitions collected in the memory of the degree. | 5 | D1<br>D3<br>D4<br>D6<br>D7<br>D8<br>D9<br>D12<br>D13<br>D14<br>D15 |
| Troubleshooting and / or exercises | In the seminars we can collect questions or short problems in order to know the progress of the student. | 20 | C1<br>C2<br>C5<br>C9<br>C12<br>C19 |
| Long answer tests and development | Test for evaluation of the competitions purchased in the matter. It is necessary a minimum of 4 on 10 in this test to take into account the other evaluation notes. | 45 | C1<br>C2<br>C5<br>C9<br>C12<br>C19 |
| Short answer tests | The students will have two test along the course on the matter explained in the sessions and seminars | 30 | C1<br>C2<br>C5<br>C9<br>C12<br>C19 |

## Other comments on the Evaluation

Students must attend all tests performed along the course.

The final note will be the highest obtained by comparing the final exam note and the final exam note ponderated with continuous evaluation.Assessment in July: It is governed by the above

## Sources of information

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Basic Bibliography

Química. R. Chang. 10ª Ed. McGraw-Hill, 2010.

Química General, 10ª Ed. R. A. Petrucci, W. S. Harwood e F.G. Herring. Ed. Prentice Hall, 2011.

Química General, 5ª Ed. K.W. Whitten, R.E. Davis e M.L. Peck. Ed. McGraw-Hill, 1998.

Química. Brown, LeMay, Bursten, Murphy. 11ª Ed., Pearson Educación, 2009.

Química. McMurry, Fay. 5ª Ed. Pearson Educación, 2009

Principios de Química, 3ª Ed. Atkins, Jones. Ed. médica panamericana, 2005.

Complementary Bibliography

1. Chemical Bonding. M. J. Winter. Oxford : Oxford University Press, 1994.
2. Química General Superior. W.L. Masterton, E.J. Slowinski e C.L. Stanitski. Ed. McGraw-Hill Interamericana, 1987.
3. Química General. T.L. Brown, H.E. Lemay e B.E. Bursten. Ed. Prentice Hall, 1998.
4. Química General. P.W. Atkins. Ed. Omega, 1992.
5. Química Orgánica. L. G. Wade. Pearson Educación, 5ª ed. Madrid 2004.
6. Química Inorgánica Descriptiva. G. Rayner-Canham. Pearson Educación, 2ª Ed. 2000.

## 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 II/V11G200V01201
Geology: Geology/V11G200V01205
Mathematics: Mathematics II/V11G200V01203
Chemistry, physics and geology: Integrated laboratory II/V11G200V01202

### 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