

**COURSE DATA****Data Subject**

<b>Code</b>	34240
<b>Name</b>	Chemistry
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. Period year</b>
1105 - Degree in Physics	Faculty of Physics	1 First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1105 - Degree in Physics	4 - Chemistry	Basic Training

**Coordination**

<b>Name</b>	<b>Department</b>
CLEMENTE JUAN, JUAN MODESTO	320 - Inorganic Chemistry
RIBERA HERMANO, ANTONIO LUIS	320 - Inorganic Chemistry

**SUMMARY**

The subject Chemistry is a core subject that is taught in the first course of the graduate degree in Physics during the first semester. In the plan of studies it consists of a total of 6 ECTS credits.

With this course it is intended that a student essentially dives into those knowledge of chemistry that has been gaining in the courses of bachelor and that, in certain aspects, be complete. It is related to other subjects taught in the first year Physics I, Physics II and Introduction to Experimental Physics.

The **descriptors** proposed in this subject are nomenclature, the formulation and the stoichiometry, electronic structure and periodic table, chemical bonding, intermolecular forces, classification of solids, chemical kinetics, equilibrium in chemical reactions: acid- base, solubility and redox and introduction to organic chemistry.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

Physics and Chemistry taught at Highschool

## OUTCOMES

### 1105 - Degree in Physics

- To know how to apply the knowledge acquired to professional activity, to know how to solve problems and develop and defend arguments, relying on this knowledge.
- Ability to collect and interpret relevant data in order to make judgements.
- Problem solving: be able to evaluate clearly the orders of magnitude in situations which are physically different, but show analogies, thus allowing the use of known solutions in new problems .
- Theoretical understanding of physical phenomena: have a good understanding of the most important physical theories (logical and mathematical structure, experimental support, described physical phenomena).
- Modelling & Problem solving skills: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations so as to reduce a problem to an approachable one. Critical thinking to construct physical models.
- Physics general culture: Be familiar with the most important areas of physics and with those approaches which span many areas in physics, or connections of physics with other sciences.
- Foreign Language skills: Have improved command of English (or other foreign languages of interest) through: use of the basic literature, written and oral communication (scientific and technical English), participation in courses, study abroad via exchange programmes, and recognition of credits at foreign universities or research centres.
- Learning ability: be able to enter new fields through independent study, in physics and science and technology in general.
- Communication Skills (written and oral): Being able to communicate information, ideas, problems and solutions through argumentation and reasoning which are characteristic of the scientific activity, using basic concepts and tools of physics.
- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.



- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

## LEARNING OUTCOMES

- Name and formulate simple inorganic and organic compounds.
- Balancing chemical reactions and determine the quantities of material involved in them.
- Predict properties of a particular material from the constituent elements, and if a particular reaction will take place.
- Calculate the amounts of various substances involved in a equilibrium, when achieved, and predict the movement of the equilibrium when conditions change.
- Identify acids and bases, solve acid-base numerical problems and determine the pH of a solution
- Get the solubility of ionic salts in the absence and presence of side reactions.
- Balancing oxidation-reduction reactions and determine the concentrations of the species in the equilibrium.
- Develop a diagram of a galvanic cell and determine the electromotive force of a pile.
- Get the order and the rate constant of simple chemical reactions from experimental data.

## DESCRIPTION OF CONTENTS

### 1. Electronic structure of atoms and periodic table

Bohr's model. Introduction to quantum mechanics. Wave model for the hydrogen atom. Quantum numbers. Hydrogenic atomic orbitals. Effective nuclear charge. Electron configurations. Periodic table. Ionization energy. Electron affinity. Metals, nonmetals and metalloids.



## **2. Chemical bonding**

Basic concepts. Lewis symbols. Covalent and ionic bonding. Bond polarity and electronegativity.

## **3. Molecular geometry and bonding theories**

Molecular shapes. The VSEPR model. Localized covalent bond model. Hybrid orbitals. Molecular orbital model.

## **4. Intermolecular forces, liquids and solids**

A molecular comparison of liquids and solids. Intermolecular forces. van der Waals and London forces. Hydrogen bonding. Influence on the physical properties of the compounds. Classification of solids. Molecular solids. Covalent solids. Ionic solids.

## **5. Metals**

General of metallic bonding. Compact packings. Periodic trends of metallic properties. Electron-sea model of metallic bonding. Band theory of electric conductivity. Electric conductors, semiconductors and insulators. Magnetism in transition metals.

## **6. Chemical reactions in aqueous solution**

Review of basic organic-inorganic formulation and nomenclature. Stoichiometry problems: Mole Concept. Limiting reactants. Gases. Solutions. Properties of aqueous solutions. Strong and weak electrolytes. Concentrations of solutions. Solubility and precipitation. Solubility product constant. Effect of temperature on solubility. Acid-base reactions.

## **7. Thermochemistry**

Enthalpy. Enthalpies of reaction. Hess's law. Enthalpy of formation.

## **8. Chemical kinetics**

Reaction rates: factors that affect reaction rates. Reaction order and stoichiometry. The Arrhenius equation.

## **9. Chemical equilibrium**

The Chemical equilibrium. The equilibrium constant. Heterogeneous equilibria. Gibbs free energy. Relation between Gibbs energy and equilibrium constant. Spontaneous. Modification of equilibrium conditions: Le Châtelier's principle. Variation equilibrium constant with temperature: van't Hoff equation.

**10. Electrochemistry**

Oxidation-reduction reactions. Balancing redox equations. Voltaic cells and their emf. Standard reduction potentials. Electrochemical series. Nernst equation. Relation between cell potential and equilibrium constant. Batteries. Electrolysis.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Tutorials	15,00	100
Preparation of evaluation activities	15,00	0
Preparing lectures	75,00	0
<b>TOTAL</b>	<b>150,00</b>	

**TEACHING METHODOLOGY**

The development of the subject is structured concerning two axes: the sessions of theory and the tutorships.

The classes of theory include an overview of the topic and all key concepts for the understanding of them. During these sessions it will be explained to the student a series of problems-type in order to identify the essential elements of approaching and solving the problems of this subject. In them, the exposure of the subject will be held by the teacher to the whole group.

The tutorials scheduled during the semester are 15 sessions. In them, the teacher guides students to deal by themselves with similar or more complex problems than those presented in theory. Once the work is completed, the problems will be corrected and analyzed by the students themselves on the board.

**EVALUATION**

The following evaluation systems will be used:

- Tests consisting of written exams.
- Continuous assessment of the activities and questionnaires through the Aula Virtual.
- Continuous assessment of each student based on classroom activities, participation and degree of involvement in the teaching-learning process.

The assessment of student learning will take into account all aspects stated in the methodology section of this guide. Students who do not attend class regularly must choose the mode B.





## **FIRST CALL**

### **Mode A:**

Final grade: consisting of three parts:

- Tests consisting of written exams (60%).
- Continuous assessment of the activities and questionnaires through the Aula Virtual (30%).
- Continuous assessment of each student based on classroom activities, participation and degree of involvement in the teaching-learning process (10%).

The grade of the written exam must be equal to or greater than 4.5 in order to average. The minimum overall grade to pass the subject is 5.0.

**Mode B** (only those students who have passed in previous courses the virtual questionnaires through the Aula Virtual and the continuous evaluation will be able to take advantage of this mode):

Students may choose to be evaluated solely by means of an exam about the items covered in the lectures, tutorials and seminars, so that the teacher could assess whether the student has acquired skills and knowledge related to the subject. The minimum exam grade to pass the subject is 5.0.

## **SECOND CALL**

In the second round, the same way that the first one will be followed.

## **REFERENCES**

### **Basic**

- 1.- QUÍMICA: LA CIENCIA CENTRAL, T. L. Brown, H. E. Lemay, Jr, B. E. Bursten, C. J. Murphy y P. Woodward. Pearson, 11<sup>o</sup> ed., 2009.

### **Additional**

- 2.- QUÍMICA GENERAL, R.H. Petrucci, W.S. Harwood, F.G. Herring, Ed. Pearson Educación (Prentice Hall), 2003.
- 3.- QUÍMICA, R. Chang, Ed. Mc Graw Hill, 10<sup>a</sup> ed., 2010.
- 4.- INTRODUCCIÓN A LA NOMENCLATURA DE SUSTANCIAS QUÍMICAS, W.R. Peterson., Ed. Reverte, 2010.