VNIVERSITAT DE VALÈNCIA

Course Guide
34183 General chemistry I

COURSE DATA

Data Subject	
Code	34183
Name	General chemistry I
Cycle	Grade
ECTS Credits	6.0
Academic year	2015 - 2016

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	1	First term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	1 - Chemistry	Basic Training

Coordination

Name	Department
FOLGADO MATEU, JOSE VICENTE	320 - Inorganic Chemistry

SUMMARY

General Chemistry I is a core subject that is taught during the first semester of year 1 of the Degree in Chemistry. In the curriculum it is worth a total of 6 ECTS credits.

This subject, together with General Chemistry II (core subject taught in year 1, second semester), is mainly intended to provide students with in-depth knowledge of chemistry, based on the knowledge acquired during their secondary education, and with comprehensive information on certain aspects. This should serve to establish the foundations necessary for successfully addressing the further study of the different branches that make up the discipline.

Apart from basic elements such as nomenclature, formulation and stoichiometry, this subject will cover all the aspects related to the subject area, such as atomic structure and periodic properties, molecular structure and chemical bonding, states of aggregation and the different types of solids and of organic functional groups.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

OUTCOMES

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the theories used to describe them.
- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Solve qualitative and quantitative problems following previously developed models.
- Evaluate, interpret and synthesise chemical data and information.
- Recognise and evaluate chemical processes in daily life.
- Understand the qualitative and quantitative aspects of chemical problems.
- 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.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

To name and to formulate the inorganic and organic chemical compounds and to express the composition of the chemical substances and of its miscellanies in the established standard units. (CE1)
To solve any basic problem relative to the quantity of matter involved in a chemical reaction. (C20, CE14)
To solve simple quantitative problems relative to the chemical processes, both in the balance and from a kinetic point of view. (CE6, CE14)
To know the change of the properties typical of the chemical elements as the Periodic Table. (CE2)
To know the characteristics and behavior(manner) of the different states(conditions) of the matter and the theories used to describe them. (CE3)
To know the main types of chemical reaction and its main associate characteristics. (CE4)
To know the relation between macroscopic properties and properties of atoms and individual molecules. (CE11)
To recognize and to value the chemical processes for the daily life. (C9, CE23)
To understand(comprise) the qualitative and quantitative aspects of the chemical problems. (CE24)
To explain in an understandable way phenomena and processes related to basic aspects of the Chemistry. (C1, C2, C12, CE13)
To realize efficiently the tasks assigned like member of a team(equipment) and with genre perspective. (C9, C7)
To demonstrate skills in the interpersonal relations and with genre perspective. (C10)
To use the information technologies and communication of effective form. (C14)
To be able to manage the information of rigorous form. (C13)
To demonstrate leadership capacity. (C19)
To demonstrate sensibility was doing environmental topics. (C21)

These results are detailed in that, at the end of the course, the student must be able to:

• In this subject will be addressed the following learning outcomes contained in the document of the degree within the chemical matter: 1, 2, 4, 5, 6, 7, 8, 10, 19 and 22. These results are detailed in that, at the end of the course, the / the student has to be capable of:
• Use the periodic table. Know the symbols of the chemical elements, blocks and groups of the periodic table.
• Relate the position in the periodic table, the atomic number of an element and the electronic

configuration of the elements.
• Appoint and formulate simple inorganic compounds: binary (hydrogen, oxygen, of nonmetals metals and non-metals together, pseudobinarias combinations (hydroxides and cyanides), ternary compounds (oxoacidos and oxosales) and Quaternary (oxosales acid).)
• Appoint and formulate simple organic compounds: with one or two functions: hydrocarbons (alkanes, alkenes, alkynes and aromatics), halogenated, compounds with oxygen (alcohols, ethers, aldehydes, ketones, acids and esters), sulfur (thiols and Thioethers), with nitrogen (amines, nitriles, amides and nitro derivatives) and halogenated compounds.
• Distinguish between empirical formula and molecular formula and formula.
• Determining the quantities of material involved in a chemical reaction, in gas, with solid or liquid phase or in solution, properly handling the concepts of purity, density, performance, reactive reagents and limiting excess, and concentration, as well as the equation of State of ideal gases and the Dalton partial pressure law.
• Calculate the quantities required to prepare a certain dissolution, whether part of pure substances as impure, correctly using the different forms of expressing concentration.
• Know the parameters that characterize the electromagnetic radiation and know the hypothesis of Plank. Rationalize the wave-corpuscle duality and explain the photoelectric effect.

• Describe experiments that reveal the quantization of energy.
• Streamline lines observed in the spectra of hydrogen using Bohr's model.
• Understand the duality wave is preoperatively diagnosed of matter and the consequences of the Heisenberg Uncertainty Principle.
• To interpret the concepts of wave function and densities of probability of finding an electron.
• Relate the possible combinations of numbers with quantum levels, sublevels and orbital.
• Distinguish the radial and the angled part of the wave functions monoelectronicas. Know represent them qualitatively as the associated quantum numbers.
• Implement the concepts of penetrating power of an orbital, and effective nuclear charge constant shielding polielectronicos atoms.
• Understand the spin quantum number. Spell out the "Pauli Exclusion Principle and the rule of maximum multiplicity Hund and apply the principle of construction to write configurations of minimal energy to atoms and ions polielectronicos.
• Define covalent radius, radio of Van der Waals, radio metal, ionic radius, ionisation energy, electronegativity and electron affinity.
• Justify and predict the variation of the properties of the elements of the periodic table.
• Understand and differentiate the basic types of link.
• Describe the basics associated with the formation of covalent bonds (single or multiple): energy of link, link distance, polarity of link.
• Draw Lewis structures of neutral species and loaded, inorganic and organic, deliberating whether or not they comply with the rule of the octet, identifying possible resonant forms and deciding, if there are several possible structures, which is the most reasonable through the calculation of formal charges.

• Predict molecular geometry through the use of the model of revulsion of pairs of electrons of the layer of Valencia (RPECV).
• Justify and predict the polarity of diatomic and polyatomic molecules, both inorganic and organic.
• Describe the basic elements of the model of covalent bond located and the concept of hybrid orbital.
• Identify the type of hybridisation in simple inorganic molecules and atoms of carbon and heteroatoms of organic molecules.
• Distinguish between constitutional isomers and configuracionales.

• Recognize the main types of isomers and constitutional isomers E/Z.
• Identify the different functional groups in organic molecules and to recognize the structure of the same.
• Define molecular orbital and classify them as Basonat, antienlazantes Basonat or not, and like sigma or pi.
• Draw the molecular orbital diagram of diatomic molecules of representative elements of the first and second period and get their electronic configurations.
• Calculate, from such a diagram, the binding order and give an explanation to molecular properties such as the distances and the energies of link or else your diamagnetic or paramagnetic character.
• Deduce some properties of organic molecules in function of the structure of the functional group containing.
• Identify centers in basic acids and a molecular compound.
• Identify species and nucleofilas electrofilas.
• Identify the different intermolecular forces existing (dipole forces, dispersion, and hydrogen bonds) and describe their characteristics.

• Explain, from them, properties or phenomena of interest (states of aggregation, melting and boiling points and solubilities, etc.)
• Define solid crystalline and amorphous solid.
• Describe the intermolecular forces in the molecular solids, linking it with its structure and properties.
• Describe the fundamental characteristics of the strong covalent bonding, its structure and properties.
• Identify types of solid and predict its properties based on the nature of the interactions between the particles that constitute the crystalline grid.
• Describe the fundamental characteristics of the solid metal structures and their more frequent, relating them to the compact packings of spheres.
• Spell out the fundamental characteristics of the model of the sea of electrons, justifying from the observed properties of the metals.
• Explain the basic features of the theory of bands, justifying, from it, the existence of conductors, insulators, intrinsic and extrinsic semiconductors, both p-type as n.
• Describe the fundamental characteristics of the ionic solids, linking the link type you have and your structure with its properties. Describe the most common structures.
• Define energy of a reticular network ionic and relate them to other thermodynamic quantities through Born-Haber cycles .

• Using molecular models, build the structure of a molecular or ionic species. Make a drawing in perspective within that structure.
• Describe correctly: a graph, a table of values and a structure.
• Justify with rational arguments scientific facts or opinions in a rigorous manner, being drafted in an appropriate manner.
• Obtain, analyze, select, manage, synthesize and present scientific information in an appropriate manner, using adequately the bibliographic sources and information and communication technologies.
• Relate chemical content addressed in the course with phenomena of everyday life and/or environmental interest, being able to explain them.
• Interpret simple phrases written in English on the subjects studied.

DESCRIPTION OF CONTENTS

1. INTRODUCTION.

The chemical language. Periodic table, groups and blocks. Review of basic formulation and chemical nomenclature in inorganic and organic chemistry. Problems of stoichiometry: mole concept. Limiting reagent. Gases. Solutions. Ways of expressing concentration.

2. ATOMIC STRUCTURE.

Review of Bohr atomic model. Introduction to quantum mechanics. Wave model for the hydrogen atom. Quantum numbers. Hydrogenic atomic orbitals.

3. POLYELECTRONIC ATOMS AND PERIODIC PROPERTIES

Effective nuclear charge. Electronic configurations. Ionisation energy. Electron affinity. Electronegativity. Atomic sizes.

4. CHEMICAL BOND I.

Basic concepts. Lewis structures. VSEPR model for the molecular structure. Located covalent bond model. Hybrid orbitals. Hybridisation of ethane, ethene and ethyne.

5. CHEMICAL BOND II.

Advanced concepts. MO model. Application to diatomic molecules of the first and second period. Isomerism.

6. STRUCTURE, BOND AND BEHAVIOUR OF MOLECULES

Organic functional groups: reactivity centres. Acidity and basicity. Oxygen and nitrogen bases. Nucleophilicity and electrophilicity of molecular compounds.

7. MOLECULAR SOLIDS.

Intermolecular forces. Hydrogen bond. Influence on the physical properties of the compounds.

8. NON MOLECULAR SOLIDS.

Structural classification and bond-type classification. Ionic solids energetics. Lattice energy. Transition towards covalency. Validity and application of the model.

9. NON-MOLECULAR SOLIDS II. METALLIC SOLIDS AND COVALENT NETWORKS

Solids with covalent network. Metallic solids: characteristics and packings. Models for the metallic bonding. Band theory. Electric conductors, semiconductors and insulators.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	51,00	100
Tutorials	9,00	100
Study and independent work	40,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the subject is structured around three items: theory sessions, seminars and problem-solving sessions, and tutorials. Theory lectures will serve to offer an overview of the topic dealt with and will focus on its key concepts. Also, they will provide recommended resources for an in-depth further study of the subject.

Problem-solving sessions will follow two different strategies: in some sessions, the lecturer will explain a set of typical problems through which students can learn to identify the essential elements of the approach and to solve the problems proposed. The lecturer will lead the session by giving the lecture to the whole group of students; in other sessions, however, the students will play a leading role, as it will be them who will have to deal with similar and more complex problems. Once completed, the problems will be corrected and analysed by students themselves at the board. Most of the sessions will follow this second strategy and the first type will be used to the strict minimum.

Seminars will provide a monographic view of some practical aspects of the subject area (nomenclature, problems, examples of daily chemistry, of environmental and/or technological interest, etc.) and work will be carried out in active and participatory teams.

With regard to tutorials, 9 sessions have been scheduled throughout the semester. In them, the lecturer will guide the student on all the elements that make up the learning process, both in regard to global approaches and specific issues. For these sessions, students will be given a list of questions and problems that will serve to strengthen their knowledge and to practise each of the areas covered.

EVALUATION

The following assessment systems will be used:

• Tests consisting of written exams

• Assessment of group tutorials, seminars and projects

• Continuous assessment of each student based on classroom activities, participation and degree of involvement in the teaching-learning process

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

FIRST EXAMINATION SITTING

Mode A

Final mark: consisting of three parts:

• Written exam (80%)

• Assessment of group tutorials, seminars and projects (15%)

• Continuous assessment of each student based on classroom activities, participation and degree of involvement in the teaching-learning process (5%)

The mark obtained in the written exam must be equal to or greater than 4.5 in order count towards the final mark. The minimum overall mark to pass the subject is 5.0.

Mode B

Students may choose to be assessed only through a written exam on the contents covered in the lectures, tutorials and seminars, so that the lecturer can assess whether the student has acquired the skills and knowledge required. The minimum exam mark to pass the subject is 5.0.

SECOND EXAMINATION SITTING

In the second attempt, the same assessment process will be followed.

REFERENCES

Basic

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