VNIVERSITAT DE VALÈNCIA

Course Guide
33939 General Chemistry

COURSE DATA

Data Subject	
Code	33939
Name	General Chemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1205 - Degree in Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
1205 - Degree in Human Nutrition and Dietetics	8 - Chemistry	Basic Training

Coordination

Name	Department
VERDEJO VIU, BEGOÑA	320 - Inorganic Chemistry

SUMMARY

General Chemistry is a basic course taught during the first semester of first year Grade in Human Nutrition and Dietetics. Current study plan (curriculum) includes 4,5 theoretical credits and 1,5 laboratory credits.

The theoretical part attempts to provide the student the concepts and bases of chemistry in general, with special emphasis to those concerning the chemical elements and their compounds, while, at the same time, trying to highlight a scientific vision of reality, a fundamental aspect of university education. Students should achieve solid bases to enterpret and build the potential applications and uses of inorganic compounds, not only to undertake the study of other courses with chemical contents, but also in carrying out the different aspects of the professional activities specific to this Grade, in research, teaching or industry.

Concerning theory lectures, they attempt that students consolidate and expand their knowledge on atomic structure, chemical bonding (both, in individual molecules and in solids), stoichiometric relationships, acid-base concepts, oxidation-reduction, and reactivity, as well as those principles determining kinetics and thermodynamic aspects of chemical transformations.

With respect to laboratory work, students should achieve basic technical skills and be able to perform experimental studies concerning some of the concepts covered in the theoretical lectures

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Formulation and stoichiometry basic knowledge

OUTCOMES

1205 - Degree in Human Nutrition and Dietetics

- Practise the profession with respect for other health professionals and acquire skills to work in teams.
- Communicate effectively, both orally and in writing, with people, with health or industry professionals and with the media, knowing how to use information and communication technologies, especially those related to nutrition and lifestyles.
- Recognise the need to maintain and update professional competence, with particular emphasis on independent and lifelong learning of new facts, products and techniques in the field of nutrition and food, and on motivation for quality.
- Acquire basic training for the research activity, be able to formulate hypotheses, collect and interpret information for problem solving using the scientific method, and understand the importance and the limitations of scientific thought in the field of health and nutrition.
- Develop the ability to estimate the risks associated with the use of chemicals and laboratory processes.
- Acquire skills for presenting a project orally or in writing.

LEARNING OUTCOMES

- Students should consolidate and extend the general chemistry knowledge achieved in high school related to atomic structure, periodicity, chemical bonding, molecular structure, states of matter, and chemical reaction.

- Students should achieve solid bases on facts, concepts, and essential principles of Chemistry to be able to adequately used them in different situations and in the study of other courses with important chemical contents.
- Basic aspects and current applications should be highlighted, with especial emphasis on those relevant in the field of nutrition.
- The course should develop in the students the ability to lay-out and solve numerical problems, correctly using units and interpreting the results with analytical and critical mind.
- Laboratory work attempts to train the students in:

- manipulating chemical reagents, treatment of chemical waste and compliance with security regulations.

- basic laboratory techniques, such as mass and volume measurements, preparation of solutions, filtration, separation, centrifugation, etc.

- the use of instrumentation of chemical interest.

- the study of different types of chemical reactions, such as redox and acid-base reactions.

- the interpretation of experimental facts by means of synthesis and reactivity of inorganic compounds of interest to nutrition.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO THE STUDY OF CHEMISTRY

Branches of Chemistry. Physical and chemical, intensive and extensive properties of matter. Classification of matter. Treatment of measurements in chemistry. Atomic composition. Atomic nucleus. Isotopes. The concept of bonding and its different types. Electronegativity and bond polarity.The chemical reaction. Stochiometric calculations. Limiting reagent and percent yield of chemical reactions.

2. THERMOCHEMISTRY AND THERMODYNAMICS

Energy, heat, and work. Principles of thermodynamics. State functions. Enthalpy of physical and chemical changes. Hesss law. Enthalpy of formation. Entropy. Gibbs free energy. Criteria of spontaneity of chemical changes.

3. SOLUTIONS

Intermolecular forces: Van der Waals forces. Hydrogen bond. Physical states of matter: gases, liquids, and solids. Spontaneity of the dissolution process. Dissolution of solids in liquids. Solubility rules. Dissolution of liquids. Dissolution of gases. Saturation. Solubility and solubility product. Effect of temperature on solubility. Molarity; mole fraction; percentage of solute w/w, w/v, v/v; normality. Equivalent. Colligative properties of solutions: vapor pressure depression, boiling-point increase, freezing-point depression, osmotic pressure. Osmolarity. Iso- hyper- and hypotonic solutions. Colligative properties and dissociation of electrolytes. Colloids. Tyndall effect. Hydrophilic and hydrophobic colloids.

4. CHEMICAL EQUILIBRIUM

Reversibility and dynamic nature of chemical equilibrium. Equilibrium spontaneity. Thermodynamic aspects of chemical equilibrium. Equilibrium constant and reaction quotient. Homogeneous and heterogeneous equilibria. Factors affecting chemical equilibria. Le Chateliers law. Free energy and equilibrium constant.

5. ACID-BASE EQUILIBRIA

Acid-Base concepts: Arrhenius, Bronsted and Lewis. Bronsted acids and bases in water. Neutralization. Acid-base character of oxides. Water autoionization; Kw. Strength of acids and bases. Acid-base equilibrium constant: Ka (pKa), Kb (pKb), Kw (pKw). Leveling and differentiating effects of solvent. Molecular structure and acid strength. Polyprotic acids. Definition of pH and pH scale. pH calculations. Acid-base indicators. Acid-base titration curves. Buffer solutions. Hydrolysis. Acid-base character of aqueous solutions of salts.

6. REDOX EQUILIBRIA

Oxidation and reduction concepts. Redox reactions. Half-reactions. Electrochemical cells. Cell potential and free energy of redox reactions. Electrode potentials. Electrochemical series and activity of elements. Nerst equation. Systematic methods for balancing redox reactions: The ion-electrode method; the Valence Change Method.

7. ATOMIC STRUCTURE

Quantum-mechanical atomic model. The Scrhrodinger equation for the hydrogen atom. Quantum numbers and atomic orbitals. Polyelectronic atoms. Electronic configuration. The Periodic Table. Periodicity.

8. THE CHEMICAL BOND

Covalent bond. Lewis structures. Resonance. Molecular geometry: the VSEPR model. Molecular Orbital Theory.

9. CHEMICAL KINETICS

Basic concepts: rate of reaction, rate equation, order of reaction. Elementary reactions. Molecularity of elementary reactions. Net reaction. Rate determining step. Reaction mechanism. Activation energy. Activated complex or transition state. Stationary state approach. Effect of temperature on the rate of reaction. Catalysis.

10. LABORATORY SESSION 1: INTRODUCTION TO LABORATORY TECNIQUES

A. Basic material of laboratory. Products labelling and transferring sanples weight. Measure of liquid volums. Burette utilization.
B. Preparation of solutions.

11. LABORATORY SESSION 2: SAMPLES SEPARATION

A. Separation milk casein and identification of serum components.
B. Distillation of a commercial wine.

12. LABORATORY SESSION 3: ACID-BASE EQUILIBRIA.

A. Potentiometric titration of acetic acid.
B. Determination of acidity of a commercial vinegar.
C. Buffer solutions.

13. LABORATORY SESSION 4: REDOX EQUILIBRIA

A. Redox r3eactions. Batteries.
B. SO2 titration in wines.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	4,00	0
Development of individual work	4,00	0
Study and independent work	15,00	0
Readings supplementary material	6,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	15,00	0
Resolution of case studies	6,00	0
TOTAL	**147,00**	

TEACHING METHODOLOGY

This course is structured in three types of activities: theory lectures, tutorials (recitations), seminars, and laboratory sessions.

Study of theory contents. Students should acquire the basic knowledge included in the syllabus by means of their individual study and assistance to the lectures. During such lectures, the professor will set and explain a global perspective of each subject, will emphasize the key concepts needed for its understanding, and will answer questions from the students. To help in their individual study and in depth preparation of each subject, students will be provided with basic and complementary bibliography, internet addresses and supporting computer equipment, as well as the instructions and advice for handling information sources.

During the development of theoretical and practical activities, different examples regarding the applicability of the items studied in the course to the Sustainable Development Goals (SDG) will be pointed out. The proposed subjects for the preparation of the Coordinated Seminars will be also linked to the SDG. It is pursued to provide to the students, knowledge, abilities and motivation to understand and face the above-mentioned SDG, meanwhile reflection and critical thinking are promoted.

Laboratory work. Laboratory sessions are structured around four main components. In the first place, students must undertake a preparatory work before going to the laboratory, consisting in an effort to understand the laboratory guide provided for each experiment, review of the theoretical concepts involved, answering a set of previous questions, and preparing an outline of work process. During lab attendance, the professor will make a brief explanation of the keys aspects of the experimental work to be undertaken and will assist and monitor the students during the session. The student should analyze the observed facts and will answer some post-laboratory questions. By the end of the course all students will take a written exam on some questions directly related with the carried-out experiments.

Tutorials. During tutorials are meant to solve any doubt raised during theory lectures and to orient students about the most effective work methodology to improve their learning performance.

Coordinated Seminars. Students may have to prepare and make an oral presentation of a work on a subject of current interest relative to the course outline.

Attendance to seminars, laboratory sessions and tutorials is mandatory. Missing seminar and tutorial attendance will have a negative impact on the final grade. Missing any of the laboratory session will prevent passing the course

EVALUATION

Learning evaluation of students will take into account all aspects exposed in the methodology section of this teaching guide and will be carried out by the professor in a continuous way.

Final grade will be calculated by weighing 75% the score assigned by the professor in evaluating the exams, and participation in lectures, tutorials, and seminar (Th) (in the theory part “Th”, the participation represents a 15% and the exam a 85%, but a minimum score of 5 over 10 is required in the exam).

The score obtained in the laboratory work (Lab) will represent a 15% of the final grade. Finally, the grade obtained in the coordinated seminar (CSem) will represent a 10% of the final grade:

$$\text{Final grade (score)} = 0.75\text{Th} + 0.15\text{Lab} + 0.1\text{CSem}$$

In order to pass the course, a minimum score of 5 over 10 is required, both in the final exam as well as in the laboratory work.

Students who do not achieve the minumum grade in the theory or laboratory part in the first call, must do an exam about the corresponding part in the second call, which will have the same characteristics as the first one. For the calculation of the total mark, the participation and seminar scores will also be considered.

REFERENCES

Basic

- QUÍMICA. Chang R. Ediciones McGraw-Hill. Décima edición, 2010.

  QUÍMICA. La Ciencia Central. Brown T.L., Lemay H.E., Bursten B. E. y Murphy C. J. Editorial Pearson. Décimoprimera edición. 2009.

  QUÍMICA GENERAL Enlace Químico y Estructura de la Materia. Petrucci R.H., Harwood, W.S. y Herring F.G. Prentice Hall. Octava edición, 2003.(Vol.I)

Additional

- QUÍMICA GENERAL Reactividad química. Compuestos inorgánicos y orgánicos. Petrucci R.H., Harwood, W.S. y Herring F.G. Prentice Hall. Octava edición, 2003.(Vol.II)

  PRINCIPIOS DE QUÍMICA. Atkins P.W. y Jones L. Editorial Panamericana. Tercera edición, 2005.

  FUNDAMENTOS DE ENLACE Y ESTRUCTURA DE LA MATERIA. E. Colacio Rodríguez. Base Universitaria, Anaya, 2004.