COURSE DATA

Data Subject	
Code	34742
Name	Chemistry I
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	3 - Chemistry	Basic Training

Coordination

Name	Department
GARCIA LOPERA, ROSA	315 - Physical Chemistry
PASCUAL-AHUIR GINER, JUAN LUIS	315 - Physical Chemistry

SUMMARY

The subject Chemistry I is a basic subject that is taught in the first year and first semester of the Degree in Chemical Engineering. The curriculum consists of a total of 6 ECTS credits. This subject, together with Chemistry II (basic of the second year), intends, essentially, that the student deepens in the knowledge of General Chemistry.

The contents of the subject Chemical I focus on the study of chemical reactions, and specifically are: **Stoichiometry. Solutions Fundamentals of chemical reactivity. Chemical thermodynamics Chemical kinetics. Chemical balance. Ionic balance in solution**. (Document VERIFICA).

The theory classes will be taught in Spanish and the practices and laboratory classes as shown in the file of the subject available on the Degree website.

The **general objectives** of the subject are:

• Homogenize the previous knowledge of the General Chemistry discipline. It is intended that they know the concepts and essential principles of chemistry and know how to use them properly.

• Establish solid foundations so that they can successfully continue learning in later subjects and deepen their knowledge of fundamental parts of the discipline such as thermodynamics, chemical kinetics, material equilibria, dissolutions and ionic equilibria in solution.

• Achieve that they acquire the basic terminology of Chemistry and know how to use it, expressing the ideas with the precision required in the scientific field. Also, it is intended that they know the conventions and correctly manage the units.

• Develop the ability to pose and solve numerical problems in Chemistry, as well as to interpret and analyze the results obtained.

• Getting them to be able to search and select information in the field of Chemistry.

• Enhance your skills for teamwork.

• Encourage and encourage those values and attitudes inherent to scientific activity.

• Raise awareness about environmental issues.

The **specific objectives** derived from the content of the subject are:

• Perform stoichiometric calculations in gaseous reactions and in solution.

• Understand the concept of state function and know and apply the three laws of Thermodynamics.

• Relate the variations of enthalpy, entropy and free energy of a reaction with the equilibrium constant and the reaction quotient.

• Know the different ways of expressing the equilibrium constant and the principle of Le Châtelier to predict the displacement of chemical equilibrium.

• Identify and justify the acid-base character of different types of substances and mixtures.

• Solve numerical problems of buffer or buffer solutions.

• Distinguish between solubility and solubility product and define what factors affect each one and in what way.

• Know the concepts of oxidation-reduction and the keys of the operation of a galvanic battery.

• Apply the Nernst equation to calculate the electromotive force of a battery.

- Understand the concepts of reaction velocity, velocity law, velocity constant, reaction order, elementary stage, mechanism and molecularity, integrated equations and average life time.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

In order to successfully address the subject, it is imperative that students possess some previous knowledge, according to the level required in high school courses:

Nomenclature and formulation chemistry, both inorganic and organic
Setting of chemical reactions
Basic stoichiometric calculations
Identification of the acidic-basic common compounds
Obtaining oxidation states of the elements and chemical species
Calculation of simple derivatives and integrals
Logarithms and exponentials

OUTCOMES

1401 - Degree in Chemical Engineering

- G3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering.
- G7 - Ability to analyse and assess the social and environmental impact of technical solutions.
- B4 - Ability to understand and apply the basics of general chemistry, organic and inorganic chemistry and their applications in engineering.

LEARNING OUTCOMES

To get the skills G3, G4 y B4, after completing the course, the student should be able to:

- Appoint and make the most basic inorganic chemicals.
- Solve basic problems of stoichiometry (relative to the amount of material involved in a chemical reaction).
- Solve simple quantitative problems of chemical processes both in the balance as kinetically.
- Identify the major types of chemical reaction and its associated features.
- Explain so understandable phenomena and related to basic aspects of chemistry processes.
- Understand the qualitative and quantitative views of a chemical problema.

Moreover, related to the adquisition of other abilities related to skills G4 and B4, the student will be able to:

- Define function of state and identify which thermodynamic quantities are and which are not.
- Use properly sign criteria for the transfer of energy as heat and work.
- List the three principles of thermodynamics.
- State the law of Hess and use it to calculate reaction enthalpies.
- Define standard state standard enthalpy of reaction and standard enthalpy of formation.
- Predict the spontaneity of a reaction estimating the sign of the change in Gibbs free energy.
- State general chemical equilibrium condition and using the ratio to determine the reaction forward direction of a reaction.
- Write the expressions of the equilibrium constant and calculate the amounts of the substances in the balance, both through the use of partial pressures and concentrations
- Analyze qualitative and quantitative variation of the equilibrium constant with temperature.
- Predicting the movement of a chemical equilibrium by applying the principle of Le Chatelier.
- State the acid-base Arrhenius and Bronsted-Lowry theories, and identify the acid and base chemicals.
- Define the concepts of pH and buffer solution.
- Solve numerical problems using simple acid-base constants and material balances and load.
- Express the solubility product of ionic salts according to their solubility.
- Predict the effect on the solubility of a salt of various variables or factors.

- Set redox reactions in acidic and basic medium, identifying the oxidant and reductant.
- Use a table of redox potential to predict whether or not there is a reaction between two species.
- Draw the outline of a galvanic cell.
- Apply the Nernst equation to calculate the electromotive force of a pile.
- Linking the electromotive force of the battery with the change in Gibbs free energy of reaction and the equilibrium constant.
- define the concepts of speed, rate equation and write simple integrated order kinetics 0, 1 and 2 equations.
- Identify the variables that appear in the Arrhenius equation.

The practical work in the laboratory will allow to (related to skills G4, G7 y B4):

- Properly handle the usual stuff in a chemistry lab.
- Making the most common basic laboratory operations.
- Treat chemical waste properly and implement security measures in the laboratory.
- Analyze the results and make conclusions based on logical chemical concepts acquired.
- Write and draw up a lab-book.

DESCRIPTION OF CONTENTS

1. ESTEQUIOMETRIC CALCULATIONS

Mole concept. Limiting reagent. Gases. Solutions. Ways to express concentration

2. THE ENERGY OF THE CHEMICAL REACTIONS

Chemical systems. State functions. Processes. Energy, heat and work. First law of thermodynamics. The enthalpy of chemical reactions. Hess law. Standard enthalpy of formation.

3. PREDICTING THE CHEMICAL CHANGE

Spontaneity. Second law of thermodynamics. Entropy and absolute entropies. Third law of thermodynamics. Gibbs free energy. Criterion of spontaneity and equilibrium.

4. CHEMICAL EQUILIBRIUM

General condition of chemical equilibrium. Chemical equilibrium in ideal gas systems. Variation of the equilibrium constant with temperature. Gas heterogeneous equilibrium systems. Le Chatelier's principle.

5. ACID-BASE EQUILIBRIA

Definitions of acids and bases: Arrhenius and Bronsted-Lowry (protonic). The self-ionization of water. pH scale. Strength of acids and bases. Equilibrium constants. Calculation of pH and equilibrium concentrations. Salts. Hydrolysis. Buffer solutions.

6. SOLUBILITY EQUILIBRIA

Equilibrium between ionic solids and saturated solutions. Solubility and solubility product. Factors affecting solubility.

7. ELECTROCHEMICAL REACTIONS (REDOX)

Electrochemical systems. Oxidation-reduction reactions. Galvanic cells. Battery electromotive force. Electrode potentials. Nernst equation.

8. RATE OF CHEMICAL REACTIONS

Rate equation. Integrated simple kinetic equations. Reaction mechanisms. Limiting step approach. Influence of temperature on the reaction rate. Arrhenius equation. Concept of catalysis.

9. GENERAL CHEMISTRY LABORATORY

5 sessions of 3 hours each are held:

1. INTRODUCTION TO WORK IN THE CHEMICAL LABORATORY.
Safety standards. Material and instrumentation. Waste treatment. Heavy and balances. As volumes.
2. PREPARATION OF SOLUTIONS AND MEASUREMENT OF PH.
Solutions from solids from liquids and for dilution. Measurement, analysis and discussion of the pH of the solutions.
3. ACID-BASE TITRATIONS.
Ratings acid -base indicator.
4. OXIDATION-REDUCTION.
Qualitative redox reactions. Galvanic cells.
5. KINETIC BLEACHING PHENOLPHTHALEIN in BASIC MEDIA BY USING ABSORBANCE MEASUREMENTS.
Rate equation. Integrated equations. Absorbance. Lambert-Beer law. I spectrophotometer.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	15,00	100
Classroom practices	15,00	100
Development of group work	10,00	0
Study and independent work	20,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	20,00	0
Resolution of online questionnaires	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the course is structured around four areas: the theory sessions; the problems and seminars; the laboratory and self-employment non-contact, on-line or in writing.

In the **theory sessions**, an overview of each topic will be featured and will affect the key concepts of it. Also, the most suitable for further preparation of the subject in depth resources are indicated. As a complement, after the end of each topic to be solved at home with fixed date on-line questionnaires for each topic. When the subject and time are favorable, the **zappers** or control technique is used remotely to solve quizzes / puzzles group; and teaching methodology **flipped** (inverted class) in which concepts are prepared at home and reviewed to reach the classroom through tests (to get the skills G3, G4 y B4).

The sessions of **problems and seminars** will be developed following two different strategies. In a session-type problems, its approach and its rigorous numerical solution will be explained. In them the spotlight will fall primarily on the teacher or the teacher giving the presentation to the entire group. In other sessions, however, the spotlight will entirely to the students, who will face similar problems and / or more complex. Once the work is completed, the problems will be corrected and analyzed by the students on the blackboard. Most sessions will be held in accordance with this second strategy (restricting the sessions of the first type to the minimum required) and will be unfolded in the classroom into two subgroups. In some of these sessions (Seminar type) also work, a monograph, practical aspects of the subject (problems, examples of everyday chemistry, environmental interest applications and / or technology, etc ...) in an active, participatory and team. Zappers technical or remote controls in groups to solve a revision test of knowledge (to get the skills G4 y B4).

Laboratory sessions will be compulsory and will be developed in groups of 16 students (maximum) with the advice of a / a teacher / a present at all times. The / students work in pairs and, prior to the session, will have information on experiences performed (laboratory screenplay) and should answer some previous tasks in the laboratory work (on-line questionnaire available on Virtual Classroom). The head teacher will discuss the characteristics of the experience at the beginning of the session. Following the development of supervised laboratory work, the / students should develop and collect in a laboratory notebook experience results and answer a series of questions. Pre- and post-lab questions will serve for evaluation and will be delivered electronically Virtual Classroom (to get the skills G4, G7 y B4).

Finally, the **non-attendance and autonomous work** is structured on the basis of evaluation deliverables and activities planned in the schedule of the subject, such as resolution of tests, quizzes online in Virtual Classroom, issues and problems of type examination, puzzle Aronson in groups, tasks to do at home following consultation or display of written or audiovisual materials, etc. (to get the skills G3, G4 y B4).

EVALUATION

Modality A:

The evaluation of the learning of the "assistant" students will be of a **formative** nature and will be carried out with a continuous evaluation of the progress and work developed throughout the course. For this, the attendance and active participation in class, in tutorials and in all those activities that are programmed will be taken into account; and on the other hand, the resolution of all those activities that are proposed to work autonomously (multiple choice tests, questions, numerical problems, dossiers, seminars, etc ...). Another part of the note is obtained with the evaluation of the laboratory practices. Finally, the knowledge and skills acquired will also be assessed through exams throughout the course.

Specifically, the following quantitative model is proposed:

1. Assistance and active participation 5%

2. Activities deliverable throughout the course 25%

3. Laboratory Practices 20%

4. Partial exams and/or final 50%

However, in order **to pass** the subject, attendance at all laboratory sessions is considered non-recoverable and compulsory, as well as having passed the tests or exams to average with the rest of the items that make up the evaluation. There will be two exams, halfway through the semester and at the end. These tests are considered approved when the grade is equal to or higher than 5 out of 10. The first partial exam will allow, if approved, to eliminate subject. They consist of a part of theoretical questions of reasoning and another of solving numerical problems. The exam grade will be the average of the one obtained in both parts, as long as in each of them the grade is equal to or higher than 4.0. Otherwise, the exam will be suspended. Students who do not pass the first official call (January) must be presented in the second call (June/July) to the exam, which is the only recoverable part of the evaluation.

*** NOTE-1**: If any student of this modality obtains more grade according to the criterion of the B modality, they will be qualified with this last option, that is, always with the most favorable.

Modality B:

B.1) Those students who do not wish to attend class regularly or perform activities throughout the course, will be evaluated with an alternative model that is specified as follows:

1. Laboratory Practices 20%

2. Final exam 60%

so that at most you can get an 8 out of 10.

B.2) Those students who can not ** attend class regularly will be evaluated with an alternative model that is specified as follows:

1. Laboratory Practices 20%

2. Individual deliverable activities 20%

3. Partial exams and/or final 60%

In both cases (B.1 or B.2) **to approve** it is considered not recoverable and compulsory attendance at all laboratory sessions. In case B.2, two exams will be done, halfway through the semester and at the end. These tests are considered approved when the grade is equal to or higher than 5 out of 10. The first partial exam will allow, if approved, to eliminate subject. They consist of a part of theoretical questions of reasoning and another of solving numerical problems. The exam grade will be the average of the one

obtained in both parts, as long as in each of them the grade is equal to or higher than 4.0. Otherwise, the exam will be suspended. Students who do not pass the first official call (January) must be presented in the second call (June / July) to the exam, which is the only recoverable part of the evaluation.

**** NOTE-2:** Those students who choose this modality because they are working, must adequately justify their employment situation.

In any case, the evaluation system will be governed by what is established in the Evaluation and Qualification Regulations of the University of Valencia for Degrees and Masters:

https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=start&idEdictoSelected=5639

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ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available