

**Información del Plan Docente**

<b>Academic Year</b>	2016/17
<b>Academic center</b>	201 - Escuela Politécnica Superior
<b>Degree</b>	437 - Degree in Rural and Agri-Food Engineering
<b>ECTS</b>	6.0
<b>Course</b>	1
<b>Period</b>	First semester
<b>Subject Type</b>	Basic Education
<b>Module</b>	---

**1.Basic info****1.1.Recommendations to take this course****1.2.Activities and key dates for the course****2.Initiation****2.1.Learning outcomes that define the subject****2.2.Introduction****3.Context and competences****3.1.Goals****3.2.Context and meaning of the subject in the degree****3.3.Competences****3.4.Importance of learning outcomes****4.Evaluation****5.Activities and resources****5.1.General methodological presentation**

Theoretical sessions will basically consist in participative master lessons.

Along some practical sessions, focused on previously considered theoretical aspects of the programme, students will be able to resolve some numerical exercises about applied concepts. This participation will be both at individual or reduced student groups level as well depending on the considered subject.

Laboratory sessions will introduce students to laboratory instruments and scientific methodologies as well as the

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corresponding experimental data treatment.

For each practical session some detailed instruction manuscript will be available for students with the detailed methodology to follow and some questions to be answered about the obtained results during experiments. A written formal report will be presented by students at the end of each laboratory session.

Finally, students will be arranged in working groups and some supervised works will be proposed by teacher covering complementary aspects related with general chemistry not considered in ordinary class sessions. The process will be supervised by teacher along some meeting sessions carried out during the term. At the end of the process a final formal written document must be presented by student for its evaluation and a speech report with the essential part of the main work must be presented and evaluated as well.

### 5.2.Learning activities

The offered program to students in order to help them to achieve the expected learning results contemplate the following activities.....

1. Theoretical and practice sessions related with the subjects included in the program
2. Laboratory sessions which includes some of the classical experiments in the field of general chemistry.
3. Supervised Works on several subjects related with general chemistry

### 5.3.Program

#### Theory programme

#### MODULE 1. PRELIMINARY CONCEPTS

Topic 1. Formulation and nomenclature of inorganic chemistry.

Names and symbols of the elements. Oxidation number. Binary compounds. Acids. Salts and saline compounds. Addition compounds.

Topic 2. Stoichiometry and chemical equations.

Chemical equations. Limiting reagent. Yield. Stoichiometric calculations.

#### MODULE 2. ESTADOS DE LA MATERIA

Topic 3. The gaseous state

Pressure and temperature in the changes of state of matter. The gaseous state. The laws of gases. The ideal gases. Mixtures of gases and partial pressures. The real gases: deviations from ideal behaviour of the gases. Cubic equations of state. Van der Waal's equation.

Topic 4. The liquid state

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Characteristics of the liquid state. Properties of liquids. Viscosity and surface tension. Vapour pressure.

### Topic 5 The solid state

Characteristics of the solid state. Crystalline structure of solids. Changes of phase and energies associated with the distinct transitions between the states of matter. Phase diagrams.

## MODULE 3. THERMODYNAMICS AND CHEMICAL KINETICS

### Topic 6. Thermodynamics.

Basic definitions: systems and variables of thermodynamic states. Internal energy: enthalpy and entropy. Principles of thermodynamics. Thermochemistry: Hess's Law.

### Topic 7. Thermodynamics applied to the study of systems of agricultural interest.

Thermodynamic properties of air. Dry air and humidity of air. Vapour pressure and saturation pressure of humid air. Dew point temperature. Absolute, relative and specific humidities. Enthalpy of humid air. Psychrometric diagrams: Mollier's and Carrier's diagrams. Applications: heating and cooling of air. Humidification of air.

### Topic 8. Chemical kinetics

Factors which influence the speed of a chemical reaction. Speed of chemical reactions. Equation of velocity and the integration of kinetic equations of simple orders. Half-life of a reagent. Temperature and speed of reaction. Arrhenius equation. Activation energy. Catalysis and catalysts.

## MODULE 4. SOLUTIONS AND EQUILIBRIUMS

### Topic 9. Solutions

Expressions of concentration. Use of solutions in chemical reactions. Relation: temperature to solubility. Colligative properties. Colloids.

### Topic 10. Chemical equilibrium

Homogeneous equilibrium. Heterogeneous equilibrium. Constants of equilibrium and related calculations. L' Chatelier's Principle.

### Topic 11. Acids and bases

The acid-base concept of Arrhenius. The acid-base concept of Bronsted. Acid-base properties of water. Ionic product of water. Concept of pH. Strong and weak electrolytes. Constants of ionization. Resolution of problems of ionization and pH. Acid-base properties of salts. Hydrolysis.

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Topic 12. Acid-base equilibriums

Effect of the common ion. Buffer solution. Titrations. Indicators.

Topic 13. Equilibriums of Solubility.

Concept of solubility and modes of expressing it. Effect of the common ion on solubility. pH and solubility. Complex ion equilibrium and solubility.

Topic 14. Redox equilibriums.

Redox reactions and equilibriums. Standard potential of electrode. Electrochemical cells. Spontaneity in redox reactions

Batteries. Corrosion. Electrolysis

### Laboratory Sessions

Session 1. Determination of the hardness of water.

Session 2. Conductivity of electrolytes. Kohlraush's Law.

Session 3. Kinetics of a chemical reaction.

Session 4. Solutions. Preparation of a solution. Concentration of solutions.

Session 5. Distillation of a commercial wine. Determination of the alcoholic content.

Session 6. Acid-base equilibriums in solution. Indicators. Acid-base reactions.

Session 7. Redox reactions. Oxidants and reducing agents. Electron transfer reactions. Reaction of metals with the H<sup>+</sup> ion (non oxidant acids) and with oxidant acids. Displacement reactions.

### 5.4.Planning and scheduling

Activity/Week	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Tot
Classroom activity																			
Theory	2	2	2	2	2	2	2	2	2	2	2	2			2				30

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Seminars	2	2						2	2	2		2								16
Laboratory sessions			2	2	2	2					2		2				2			14
Team work																	1			1
Evaluation									1										4	5
non presencial work																				
Individual work	4	4	4	2	4	2	4	4	2	3	8	2	2	2	4	4	3	8	6	70
Team work			2		2				2		2	2	2	2						14
TOTAL	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		150

### 5.5. Bibliography and recommended resources

#### Basic Bibliography

- Química general : principios y aplicaciones modernas / Ralph H. Petrucci ... [et al.] ; traducción, Concepción Pando García-Pumarino, Nerea Iza Cabo ; revisión técnica, Juan A. Rodríguez Renuncio . 10ª ed. Madrid [etc.] : Prentice Hall : Person educación, 2011
- Chang, Raymond. Química / Raymond Chang; revisión técnica, Rodolfo Álvarez Manzo, Silvia Ponce López, Rosa Zugazagoitia Herranz ; [traducción, Erika Jasso Hernán D' Bourneville] . 10ª ed. México [etc.] : McGraw-Hill, cop. 2010
- Whitten, Kenneth W.. Química general / Kenneth W. Whitten, Raymond E. Davis, M. Larry Peck ; con la colaboración con ensayos de Ronald A. DeLorenzo, Middle Georgia College ; traducción, Eduardo Gayoso Andrade, José Manuel Vila Abad . 5ª ed., (3ª ed. en español) Madrid [etc.] : McGraw-Hill, D.L. 1998

#### Complementary Bibliography

- Brown, Theodore L.. Química : La ciencia central / Theodore L. Brown, H. Eugene LeMay, Bruce E. Bursten ; traducción Héctor Javier Escalona y García, M. en C. Roberto Escalona ; Revisión técnica Ma. del Carmen Doria Serrano . 3a ed. en español México [etc.] : Prentice-Hall Hispanoamericana, cop. 1998.
- Amigo Martín, Pablo. Termotecnia : aplicaciones agroindustriales / Pablo Amigo Martín . Madrid [etc.] : Mundi-Prensa, 2000.