## 1.- GENERAL INFORMATION

| Learning unit | Department | Format |
|---|---|---|
| General Chemistry I | Chemistry | Lecture |

| Prerequisites(P) | Corequisites (CO) | Ascribed academy | Module |
|---|---|---|---|
| None | None | Chemistry | M1: Structure of matter |

| Type | Lecture hours | Practice hours | Total hours | Credits |
|---|---|---|---|---|
| Basic Common Mandatory | 51 hrs. | 34 hrs. | 85 hrs. | 11 |

## 2.- GENERIC COMPETENCIES

1. Students solve qualitative and quantitative chemical problems, identifying the properties, composition and physical state of matter as well as the physical and chemical transformations in non-redox reactions that affect the system.
2. Students then report the solution with meaningful results according to the established rules in the mathematical operations.

## 3.- SPECIFIC CHARACTERISTICS OF THE COMPETENCY

| | |
|---|---|
| Knowledge | Students know the following elements:<br>• Properties and changes in matter.<br>• Composition and identification of matter.<br>• Stoichiometry in non-redox reactions.<br>• Gaseous and liquid states. |
| Skills | • Ability to identify and solve problems.<br>• Ability to analyze, synthesize, and evaluate.<br>• Work collaboratively and in teams.<br>• Autonomous learning.<br>• Creativity.<br>• Critical thinking.<br>• Use of digital resources. |
| Aptitudes | • Self-improvement<br>• Leadership<br>• Responsibility for their own learning. |
| Values | • Responsibility<br>• Honesty |

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| | Punctuality<br>Respect to other people's dignity<br>Respect for nature<br>Work culture |

## 4.- TRANSVERSAL COMPETENCIES

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| ☑ | Foreign Language (English) |
| ☑ | Critical, analytical and synthetic thinking. a |
| ☑ | Oral and written expression |
| ☑ | Professional ethics |
| ☑ | Administration of human and material resources |
| ☑ | Leadership and sustainability |
| ☐ | Creativity, innovation and entrepreneurship |
| ☐ | Other |

## 5.- COURSE CONTENT OF THE LEARNING UNIT

1. Study of matter
2. Stoichiometry
3. Gaseous state
4. Liquid state

## 6.- ASSESSMENT

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| ☑ | Numeric grade |
| ☐ | |
| ☐ | |

## 7.- GRADING CRITERIA OF THE LEARNING UNIT

| Indicator of evaluation | Percentage |
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| Departmental exams | 30 |
| Partial exam | 40 |
| Homework | 10 |

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| Research activities | 5 |
| Practice reports | 0 |
| Class participation | 0 |
| Quizzes | 15 |

| 8.- REQUIRED MATERIAL (for students) | |
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| ☑ | Calculator |
| ☑ | Periodic table |
| ☐ | Lab coat |
| ☑ | Text book |
| ☑ | Workbook |
| ☐ | Other |

## 9.-SPECIFIC CONTENT BY LEARNING UNITS

| Content unit | Generic competency of the content unit | Topics | Class hours | Professor activities | Student activities | Bibliography |
|---|---|---|---|---|---|---|
| 1. Study of matter | Students…<br><br>Classify the system to be studied, distinguishing its complexity and physical state of matter in order to interpret its properties and the changes it goes through during a specific process.<br><br>Solve problems using the dimensional analysis method, applying mathematical operations and rounding up to express correct results technically.<br><br>Understand the physical and chemical properties of elements, identifying | 1.1 Matter and energy | 3 | Professor…<br><br>- Introduces the course.<br>- Presents a reading or a video of a physical and/or chemical process.<br>-Presents real life situations to exemplify the importance of the terms precision, exactitude and measurement uncertainty.<br>- Explains and exemplifies the concepts of significant numbers, scientific notation, rules of mathematical | Students…<br><br>- Identify the system (s) through their complexity (element, compound or mixture) and their physical state of matter (solid, liquid or gaseous) in order to relate their properties (physical, chemical, extensive or intensive) as well as the changes and types of energy involved in the proposed situation. | |
| | | 1.2 Numbers | 6 | | | |
| | | 1.3 Introduction to the periodic table. | 4 | | | |
| | | 1.4 Elements | 5 | | | |
| | | 1.5 Compounds | 6 | | | |
| | | 1.6 Mixtures | 5 | | | |

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| | their location on the periodic table to infer their behavior when combined chemically.<br><br>Identify the existing chemical particles of a given system, analyzing their constitutions to solve problems that involve mass, number of moles, molecules, atoms, or ions.<br><br>Identify a compound by calculating the electronegativity of its elements as well as its composition in order to write its formula and then predict its physical and chemical properties.<br><br>Identify a mixture (solution, emulsion or suspension), | | | operations and rounding up.<br><br>-Explains and gives examples of the dimensional analysis method.<br><br>-Shows a periodic table to explain the periodic properties of the elements: metallic/non-metallic and their electronegativity in order to relate the importance in the behavior of the elements when combined chemically.<br><br>-Explains and gives examples of the concepts atom, ion, molecule allotrope, isotope and isotone. | -Solve problems using the dimensional analysis method.<br><br>-Convert units, magnitudes and matter, respecting the rules of the mathematical operations such as round up.<br><br>-Interpret the periodic table based on the families, series, groups, periods, atomic number, and atomic mass of the elements.<br><br>-Relate the periodic properties of the elements to their position on the periodic table. | |

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| | distinguishing its components and properties.<br><br>Classify, quantify and use separation methods in the solutions of a given industrial process. | | | -Explains and gives examples of quantities: percentage of isotope abundance, nuclear, atomic, and molar masses, number of moles and particles.<br><br>-Shows a list of compounds in order to analyze their character (ionic and covalent; polar or non-polar) and their relationship with the general properties of substances.<br><br>-Explains the rules of the IUPAC (International Union of Pure and Applied Chemistry) and ACS (American Chemical Society) for inorganic compounds. | -Answer exercises to identify the type of particle based on its number of protons, neutrons or electrons, its symbology and/or its electronic configuration.<br><br>-Solve problems related to the quantities mentioned before.<br><br>- Answer exercises in order to identify the name or formula of a specific compound, and to infer their physical or chemical properties.<br><br>-Solve problems that involve the | |

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| | | | | -Explains and gives examples of the mass composition and the mass percentage of a compound to determine its empiric formula as well as its molecular formula.<br><br>- Shares real life situations to identify the type of mixture and the separation methods suitable for the properties of this compound.<br><br>Reviews the quantification forms of solutions: molarity, molality, molar fraction, mass percentage, and volume percentage.<br><br>Exemplifies the design of flow chart by | mass composition and percent of a compound to establish its empiric and molecular formula.<br><br>-Solve exercises to identify and propose methods of mixture separation.<br><br>- Solve exercises to quantify or prepare solutions.<br><br>-Solve problems using flow charts and mass balance in the industrial processes.. | |

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| | | | | blocks and the calculation of matter balance in a stationary state process by using processes that involve two-unit operations max where solutions intervene. | | |
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| 2. Stoichiometry | Students<br>balance chemical reactions and determine quantities of reagent moles and theoretical products to calculate the conversion and efficiency percentage in chemical processes based on real data. | Reactions and chemical equations. | 4 | Professor<br>Presents examples of chemical reactions to identify their type, redox or non-redox as well as their classification based on the applied process: combustion, neutralization, combination, shifting and others.<br><br>Explains and gives examples of the balance method for in | Students<br>Answer exercises to classify and balance non-redox reactions.<br><br>Solve problems related to the concepts seen in this unit.<br><br>Solve problems related to the described reactions. | |
| | | Calculations based on equations | 10 | | | |
| | | Calculations based on industrial processes. | 8 | | | |

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| | | | | redox chemical equations.<br><br>Explains and gives examples of the following concepts: limiting reagent, percentage of reagent in excess, percentage of efficiency and percentage of conversion.<br><br>Explains and gives examples of simultaneous and consecutive reactions common in industrial processes. | | |
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| **Unit 3**<br>Gaseous state | Understand the differences of matter in their different physical states, relating them to their behavior. | General properties of the states: solid, liquid, and gaseous. | 2 | Professor…<br>Explains the general properties of matter in 3 states. Define the | Students…<br>infer through examples the properties of | |

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| | Infer the laws of gases based on the variables (P, V, n and T).<br><br>Understand the behavior of gasses when they are mixed.<br><br>Solve problems using gas kinetics.<br><br>Understand the differences between ideal gas and real gas. | Laws of ideal gases | 7 | variables of gases (P, V and T)<br><br>Mentions the laws of ideal gases and applies them to the systems that involve chemical and physical processes.<br><br>Defines Dalton's law and applies it in examples that involve chemical and physical processes.<br><br>Explains the kinetic theory of gases.<br><br>Presents the reasons to define whether a gas is ideal or real. | matter in its 3 states.<br><br>Investigate the laws of gases based on the variables (P, V, n and T) and do some exercises to apply these concepts.<br><br>Answer exercises of ideal gases mixtures.<br><br>Do exercises applying the kinetic theory of gases.<br><br>Do exercises applying the laws of real gases and compare them with ideal gases in pure substances. | |
| | | Ideal gas mixtures | 7 | | | |
| | | Kinetic theory of ideal gases. | 2 | | | |
| | | Real gases | 2 | | | |
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| 3. Liquid state | Determine the state of a system interpreting the stage diagram of the substance, using vapor tables, or applying the Clausius – Clapeyron equations to solve problems related to the gas recollection over humid surfaces, saturation, humidity percentage, and condensation.<br><br>Build the heating map of a substance, identifying the temperatures of the different changes of state to solve problems about total sensitive and latent heat in a specific process. | Intermolecular attraction forces and general properties of liquids. | 4 | Professor…<br>Explains intermolecular forces: hydrogen bridge, dipole-dipole, and London dispersion present in samples of substances and gives examples of the general properties of liquids: superficial tension, boiling point, fusion point, capillarity, and viscosity.<br><br>Shows phase diagrams of different substances to explain the physical changes they can go through as well as properties such as critical point and triple point.<br><br>Shows a heat map of a substance, relating | Students…<br>Do some exercises to infer the properties of a substance through its intermolecular forces.<br><br>Do exercises to identify concepts.<br><br>Build the phase diagram based on fusion, vaporization sublimation, critical, and triple points.<br><br>Design a heat map and calculate the heat involved in a given process (sensible and latent). | |
| | | Changes of state | 4 | | | |
| | | Liquid evaporation and vaporization | 2 | | | |
| | | Clausius-Clapeyron equation | 4 | | | |
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| | | | | the state change temperatures and the sensible and latent heat involved in a process.<br><br>Based on the heat map, professor gives examples of gas recollection: humid surfaces, saturation, percentage of humidity, and substance condensation.<br><br>Defines and gives examples of the Clausius-Clapeyron equation. | Solve problems about the topics of this unit.<br><br>Solve problems using the Clausius-Clapeyron equation to calculate the vapor pressure or boiling temperatures of a substance in liquid-vapor and solid-vapor equilibrium | |

Professor's methodology:

1. For each topic of this course, professor assigns an activity before class in which students find literature about the subject in order to promote responsibility and autonomous learning.
2. At the beginning of each class, the teacher reaffirms the concepts that students learned before through interactive learning (brainstorming, solving examples, etc.), or individual learning (quizzes, questionnaires, etc.).
3. At the end of the session, professor assigns exercises for the students to practice outside school in order to reaffirm the acquired knowledge.

**COURSE EVIDENCE**
**(Deliverables)**

Partial Exam
Departmental exam
Quizzes
Homework
Workbook

Haga clic aquí para escribir texto.

**Textbook:**

**Brown T**., LeMay JR., H. Bursten, B., Murphy C, Woodward P. (2014) *Química, La Ciencia Central*. Pearson, 12th Ed. Mexico.

**Basic bibliography**

**Whitten K.** Davis R., Peek M. and Stanley G. (2015), *Chemistry*, Cengage, 10th Ed., , Mexico.

**Whitten K.** Davis R., PeekM, Stanley G *et al*. (2011) *Chemistry*, Cengage, 8th Special ed. Mexico.

**Chang R.** and Golldsby K., (2013). *Chemistry*, Mc Graw Hill Education, 11th Ed. China.

**Petrucci R.**, Herring H., Madura J., Bissonnette C.(2011), *Química General*, Pearson, 10th Ed. Mexico.

**Rosenberg J.,** Epstein L., Krieger P. (2014) *Química Schaum*, Mc Graw Hill Education, 10th Ed. Mexico.

**Sorum C.H.,** Boikess R.S. (1999) *Cómo resolver problemas de química general*., Paraninfo, 7th Ed., Spain.

**Complementary bibliography:**

**Felder Richard M.** and Rousseau Ronald W.(2015), *Principios Elementales de los Procesos Químicos*, Limusa Wiley, 3rd Ed.

**Himmelblau** David M., (2003) *Balances de materia y energía*, Prentice Hall 6th Ed. Mexico.

**Levine Ira N.**, (1996) Fisicoquímica, Mc Graw Hill, 4th Ed. Spain.

**Maron & Prutton, (**1999) Fundamentos de fisicoquímica, Limusa, Mexico.

**Perry R. H. and Green D.W.,** Manual de Perry del Ingeniero Químico, 7th Ed., Mc Graw Hill.

**Stanley E. Manahan**, (2006) Introducción a la química ambiental. Reverté, S. A., UNAM. Spain.

**Chemical bonds and properties of matter.**

**Retrieved from:** http://concurso.cnice.mec.es/cnice2005/93_iniciacion_interactiva_materia/curso/materiales/enlaces/enlaces1.htm

**Nomenclature of inorganic compounds.**

**Retrieved from:** http://depquim.cucei.udg.mx/Juegaquim

**Gaseous state:**

**Retrieved from:** http://www.juntadeandalucia.es/averroes/recursos_informaticos/andared02/leyes_gases/index.html