1.- GENERAL INFORMATION

Learning unit	Department	Format
General Chemistry Lab I	Chemistry	Lab

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

Type	Lecture hours	Practice hours	Total hours	Credits
Basic Particular Mandatory	None	51	0	3

2.- GENERIC COMPETENCIES

Students relate the theoretical knowledge seen in class with the topics of safety, environmental risk, properties of matter, stoichiometry, gaseous and liquid states as well as the different forms of concentration units in solutions. All this through the experimentation with reagents, analytical techniques, lab material and equipment to develop motor, cognitive and scientific skills.

3.- SPECIFIC CHARACTERISTICS OF THE COMPETENCY

Knowledge	Lab safety and environmental risk. Relationship of theory of General Chemistry I with the development of experimentation chemistry. Lab material and equipment. Computer skills Bibliographic information.
Skills	Writing up scientific reports. Handling of reagents and lab material and equipment. Team and collaborative work. Autonomous learning. Analytical and critical thinking Use of digital resources. Ability to synthesize, analyze and evaluate.
Aptitudes	Personal and collective care. Care and preservation of the environment. Team and collaborative work. Saving material resources, water and energy.
Values	Ethics Honesty Cleanliness Responsibility Tolerance

	Respect Punctuality

4.- TRANSVERSAL COMPETENCIES

☑	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

Introduction to the experimental stage:
1. Lab safety
2. Knowing and handling lab material and equipment.

Experimental stage:
3. The Study of Matter
4. Stoichiometry
5. Wet gases

6.- ASSESSMENT

☑	Numeric grade
☐	
☐	

7.- GRADING CRITERIA OF THE LEARNING UNIT

Indicator of evaluation	Percentage
Practical exams	15
Questionnaires	15

Research activities	15
Experimentation reports	40
Other: attendance	15

8.- REQUIRED MATERIAL (for students)	
☑	Calculator
☑	Periodic table
☑	Lab coat
☐	Text book
☑	Workbook
☑	Other (Work material: gloves, safety glasses, disposable material, etc.)

9.-SPECIFIC CONTENT BY LEARNING UNITS.

Content unit	Generic competency of the content unit	Topics	Class hours	Professor activities	Student activities	Bibliography
Unit 1 Lab safety	Students… know, classify, and identify chemical substances under the national (Mexican) and international regulations to promote environmental culture and ethics when treating and handling matter.	1.1 Guidelines to handle reagents and solutions. 1.2 Hazard pictograms. 1.3 Storing reagents 1.4 Treating chemical waste. 1.5 Classification of reagents depending on their purity level. 1.6 Rules to avoid accidental pollution of reagents and solutions.	9	Professor… -*Presents* a video related to lab safety, personal protection, infrastructure, and proper handling of chemical reagents. - *Displays* and explains the Material Safety Data Sheets (MSDS) and the Mexican Official Regulations *Norma Oficial Mexicana* (NOM-018-STPS-2000) which adopted the NFPA (National Fire Protection Association) diamond and color	Students… -*Ask* professor to clarify doubts when necessary. - *Understand* the importance of the guidelines to relate chemical substances and their degree of hazard. - *Investigate* and answer the book (topic 1 activity 1) about the internal regulations of the General Chemistry lab and the following questionnaire. a) Which information do the MSDS provide?	- Ríos N., Blanco A., Villanueva R. and Cholico D., (2015) *Laboratorio de Química General I*, México - Douglas A. Skoog, West, Holler and Crouch (2015), *Fundamentos de Química Analítica*, 9th edition, Cengage Learning, Mexico. . -Daniel C. Harris (2012) *Análisis Químico Cuantitativo*, 3rd edition (6th original edition),

				codes to indicate the different degrees of hazard danger. (Chart 2*). -*Projects* the labeling and classification hazard pictograms of the United Nations. (1) -*Projects* the chart of chemical substance incompatibility and provides examples about storing and mixing substances. (Chart 3*). -*Emphasizes* the correct treatment of waste in order to let students know the importance of having designed micro scale experimentations to be	b) Why do we have to know the safety sheets of reagents before carrying out an experimentation? -By using the pictograms of the substances stored in the lab, students *relate* the icon, the background color, and the geometric shape with the dangerousness of the substances, mixtures, and work areas. - *Answer* a crossword puzzle from the book (topic 1 activity 2.1) writing the word, according to the pictogram of dangerousness. -*Create* their own table of incompatibility of	Editorial Reverté, Spain. - Davis R., Peek M. and Stanley G., and special contributors (Avalos T., Blanco A., Palacios G., Ríos N.) (2011) *Química*, Whitten K.) 8th Special Edition l, Cengage Learning, Mexico. - Whitten K. Davis R., Peek M. and Stanley G., (2015), *Química* 10th Edition, Cengage Learning, México. - Brown, T., LeMay, H., Bursten, B., Murphy, C. (2014)*Química La Ciencia Central,*. 11th edition. Mexico: Pearson.

				carried out during the course. -*Explains* the code of dangerousness in CRETIB residues: NOM-052-SEMARNAT/2005 (chart 4*) -*Explains* the classification of chemical reagents based on their degree of purity and their usage. -*Highlights* the fact that in order to prevent accidents, it is important to know which and how the experimentations will be carried out: the dangerousness of substances and how to treat and handle them.	chemical substances and do some exercises for homework. -Students adopt this chart as a tool for the course. -*Are aware* of the minimization, treatment and/or mitigation of chemical waste to avoid economic, health, and environmental impact. -*Investigate and answer the book* (topic 1 activity 2.3) about the NFPA color and code of different reagents. -*Understand* the importance of the purity level to choose in analytical techniques through their degree and professional careers.	Regulation (CE) number 1272/2008, of the European Parliament and Council on December 16, 2008, (Globally Harmonized System, GHS). Mexican Official Regulations: Norma Oficial Mexicana NOM-018-STPS-2000 Norma oficial mexicana NOM-052-SEMARNAT-2005 Norma oficial Mexicana NOM-054-SEMARNAT-1993

					-*Analyze, answer, and calculate their books* (topic 1 activity 2.2 and 3) to integrate and consolidate their knowledge on the classification, purity, and dangerousness of chemical substances. -*Are aware* of the importance of having good practices at the lab in order to prevent accidents.	
Unit 2 Knowing and handling lab material and equipment	Know, understand, and choose the lab material equipment and basic operations to know the precision	2.1 Mass measurements 2.2 Volume measurement 2.3 Basic operations	6	- *Displays* in images and physically the lab material and equipment, pointing out their appropriate usage and function in each operation.	-*Identify* the material the professor shows them. -*Use* the material and equipment to carry out, record assigned measurements, and	

	and accuracy of the instruments to express the technically correct results.	2.4 Heating instruments and equipment 2.5 Labeling and cleaning lab material. 2.6 Instrument accuracy and precision 2.7 Meaningful numbers		- *Explains* the difference between accuracy and precision in the measurements and their relationship with the used material or instrument. - *Explains* and performs glass cutting and folding.	report the technically correct results. -*Complete* the charts from the book (topic 2 activities 1, 2 and 3) about knowing the lab equipment and material as well as precision, accuracy, and meaningful numbers used to express correct results. -*Create* the necessary capillaries to use in the experimentations 1 and 2 of the book *.	
	Recognize, classify, and compare substances through experimentation,	3.1 Physical changes and properties of matter.		-*Reaffirms* knowledge related to experimentation and its application such as	-*Investigate* before class the safety sheets of the substances to be used in the experimentations	

Unit 3 The Study of Matter	identifying the changes they go through during a physical process and determining the most appropriate technique based on the accuracy to interpret the behavior and properties of matter in its three phases. Identify and quantify substances by experimenting with decomposition and physical chemical reactions to show the Avogadro number, calculate empirical numbers of compounds, and	3.2 Elements and compounds 3.3 Mixtures	18	melting point, boiling point and density. -*Explains* the experimental techniques to use. -*Checks and grades* the procedures, results, conclusions, and reports after each experimentation. -*Explains and consolidates* the relationships between a mole and the Avogadro number to determine the number of atoms, molecules or ions contained in them. -*Explains* the technique to obtain the constant value or Avogadro	-*Answer* a questionnaire to reaffirm the theoretical knowledge of experimentations 1, 2, and 3 before class. -*Carry out* experimentation 1 of the book to determine the melting points of different substances through Thiele's method and so identify a problem sample from that property. -*Carry out* experimentation 2 of the book to determine the boiling points of different substances and so identify a problem sample from that property. -*Compare,* analyze, and relate the collected	

	prove stoichiometry laws. Prepare and separate mixtures using adequate physical methods to identify each one of the components present in these systems through their properties.			number experimentally. - *Explains* the analytical quantitative technique to determine the empirical formula of a chemical substance based on the data obtained experimentally through a combustion reaction and a decomposition reaction. -*Reaffirms* the knowledge to determine correctly the empirical and molecular formulas based on the relationship of element masses that can be obtained experimentally according to the stoichiometry laws.	results with the vapor pressure diagrams based on the temperature of each substance. -*Interpret* the collected results based on atmospheric pressure. -*Carry ou*t experimentation 3 from the book to determine the density of room temperature distilled H_2O through a volumetric flask and a volumetric pipette, and compare the obtained values with the reference information. -*Investigate* before class water densities in 20 to 35 °C temperatures. -*Compare* the collected results and determine	

				-*Checks* students' abilities to apply and develop knowledge during the experimentations. -*Checks and grades* the procedures, results conclusions and reports turned in after each experimentation. -*Consolidates* the classification of matter in pure substances, elements and compounds as well as homogeneous and heterogeneous mixtures. -*Consolidates* the physical processes of mixture separation: decantation, adsorption, absorption, filtering, distillation,	the density of different samples (juice, milk, etc.) through the most precise method. -Before class, students *investigate* the safety sheets of the substances used in experimentation 4 and 5 and complete the requested summary. -*Build up* a small glossary from different sources of terms that will help them answer a questionnaire for experimentation 4. -*Calculate* and show the Avogadro number from the data obtained in experimentation 4. -*Investigate* the determination of the empirical formula in different bibliographic	

				evaporation, centrifugation crystallization, chromatography etc. that can be applied in the analytical techniques of the experimentations. -*Explains* the separation of pigments in a sample of chloroplasts through paper chromatography, identifying the different substances of the mixture through their color and their delay factor. -*Checks and grades* the procedures, results conclusions and reports turned in after each experimentation.	sources and answer a questionnaire that consolidates the theoretical knowledge of the experimentation. -*Carry out experimentations* 4 and 5. -*Develop* a procedure and calculate the empirical formula from the data obtained in the basic analysis through a decomposition reaction. -*Investigate* before class the safety sheets involved in experimentation 6. -*Answer* a questionnaire before class to consolidate the theoretical knowledge of experimentation 6.	

					-*Collect* information at the moment of carrying out experimentation 6 about chloroplast separation. Demonstrate that they are a mixture of pigments with different colors: chlorophyll-a (deep green), chlorophyll b (green), carotenes (light yellow) and xanthophyll (yellowish orange). *Identify* the substances through the obtained data about the coloring and delay factors.	
Unit 4 Stoichiometry	Identify, describe and experiment qualitatively and quantitatively different types of reactions in aqueous systems, supporting the data on solubility	4.1 Chemical equations 4.2 Calculations based on chemical equations. 4.3 Reactions in aqueous solutions.	12	-*Presents* examples of chemical reactions to identify whether they are redox or non-redox as well as the classification based on the applied process: combustion, neutralization,	-*Investigate before* class different bibliographic sources to answer a questionnaire about the rules of solubility in order to apply them in the experimentation.	

	rules, concentration expressions and separation methods to calculate concepts related to stoichiometry.			combination, synthesis, decomposition, sequential, etc. -*Explains, gives examples and consolidates* the balance method by trial and error for chemical equations, simple redox and non-redox. -*Creates* a diagram, placing the chemical equation in the center to describe around it the qualitative and quantitative information that is obtained through the experimentations. -Explains the charts and the analytical technique for experimentation # 7.	-*Investigate* before class the safety sheets involved in experimentation 7 and writes a summary about them. -*Carry out experimentations* 7, following the guidelines of the professor. -*Carry out, predict and realize* when two substances in aqueous solution react through an ionic exchange, generating a precipitate and describing the outcomes of experimentation 7 to compare them with the theory. -*Carry out and* complete the balance of precipitation reactions	

				-*Checks and grades* the procedures, results, conclusion, and reports turned in after each experimentation. -*Explains, gives examples and consolidates* the concepts of limiting reagent, percentage of excess reagent, percentage of theoretical performance and percentage of conversion (relating the reality with the theory). -*Explains* the analytical technique to carry out experimentation 8, considering the purity of the chemical reagents used in the experimental process.	(metathesis) of the different experimental chemical equations through the trial and error method. -*Investigate* before class the safety sheets involved in experimentation 8 and writes a summary about them. -*Determine* the stoichiometric coefficient of a reaction to calculate quantitatively the amount of substances that are consumed or produced in the experimentations and compare them to the theory. -*Apply* the concept of limiting and excess	

				-*Checks and grades* the procedures, results conclusions and reports turned in after each experimentation. -*Explains* and consolidates the activity series of metals in aqueous solutions to predict if a metal will be oxidized or not by a specific acid. -*Explains and consolidates* the most common forms of dissolution concentration: percentage of mass, percentage of volume, ppm, molarity, molality, normality to be used in all the analytical techniques of all the	reagents and identify these substances in a balanced equation to determine the reaction performance. -*Answer* a questionnaire before class and solve a problem that implies developing a strategy to determine the limiting reagent. -*Carry out* experimentation # 8 to determine the amount of substances that are consumed or produced, determining the limiting reagent and the reaction performance from the data obtained in the experimentation in order to understand why the real performance is lower than the theoretical performance.	

				experimentations with aqueous reactions. -*Explains* the analytical technique used in experimentation # 9, showing the diagram of sequential reactions to relate the different physicochemical processes that occur during the experimentation and that involve different types of reactions: combination, decomposition, substitution, metathesis and redox. -*Explains the analytical technique of* experimentation 10, which implies a metathesis reaction to determine the molar and normal	-*Draw* flowcharts to show the development of the experimentations in order to distinguish the different physical and chemical processes that take place. -*Carry out* experimentation 9 y and answer a questionnaire to consolidate the theoretical knowledge and to relate it to the experimentations. -*Create* a conceptual map or check the formula sheets to describe the different ways to express the dissolution concentrations. -*Investigate* before class the safety sheets	

				concentration of a solution through the data obtained during the experimentation. -*Relates* the theoretical foundations of the stoichiometry laws with the experimentation. -*Checks and grades* the procedures, results conclusions and reports turned in after each experimentation.	involved in experimentation 10 and writes a summary about them. -*Answer* multiple-choice exercises from the book and a crossword puzzle to consolidate students' theoretical knowledge and experimental knowledge. -*Carry out* experimentation 10 and determines the molar and normal concentration of a solution through the data obtained with different chemical and physical processes, relating them to their theoretical foundations.	

Unit 5 Wet gases	Apply the gas and Dalton's laws, experimenting with physical processes and chemical reactions that generate gases, collecting them over wet surfaces to calculate concepts related to stoichiometry.	5.1 Liquid and gas properties. 5.2 Dalton's law 5.3 Stoichiometry in gas systems collected in liquids.	6	-*Reaffirms* the characteristics that distinguish gases, liquids and solids. -*Consolidate* the properties of gases and liquids such as standard pressure, atmospheric pressure, manometric pressure, absolute pressure, vapor pressure, percentage of relative humidity, etc. -*Reaffirms* gas and Dalton laws. -*Explains and consolidates* the mixture of different substances that react among them to generate a gas that is possible to recollect and determine its	-*Compare* the characteristics of liquids solids and gases. -*Investigate* how to measure the different types of gas pressures and the units used to express it, including atmospheric and vapor pressure in order to relate it to the data obtained during the experimentation. -*Create* a conceptual map to involve the gas and Dalton's laws. -*Investigate* before class the safety sheets involved in experimentation 11 and writes a summary about them. -*Get* the H2O vapor pressure charts of	

				volume through water displacement of a container to relate theoretical knowledge to the experimentation and calculate the reaction's performance. -*Checks and grades* the procedures, results conclusions and reports turned in after each experimentation.	different temperatures as well as the barometric pressure at the site of the experimentation. -*Carry out* a previous investigation *and* answers a previous questionnaire for the experimentation to consolidate the theoretical knowledge. -*Carry out* experimentation # 11 to determine the percentage of performance of the gases generated from the different chemical reactions and collected over liquids with the data obtained experimentally.	

Professor's methodology for learning unit 3 (experimental stage)

1. For each of the topics, professor assigns activities before class: questionnaires, flow charts, search for information and calculations (when necessary) in order for the students to become autonomous and for them to know the work in detail.
2. In order to avoid accidents in the lab, it is essential for the students to know which and how the experimentations will be carried out and how hazardous the substances are. This will occur before the actual practice when students investigate how to handle and treat these substances according to the safety sheets.
3. At the end of the experimentations, students will calculate and report the results, the discussion of the results and the conclusions of the experimentations in the General Chemistry Lab I book in order to reaffirm their knowledge.

COURSE EVIDENCE
(Deliverables)

1. Professor asks students for an individual report about each lab session, following the guidelines in the book of General Chemistry. Students turn in this workbook in due time and manner.
2. At the end of the course, students turn in the reports organized by dates, with an adequate cover page, spiral-bound together, and in due time and manner.
3. At the end of the course, students turn in the General Chemistry Lab I Workbook with the reports of the experimentations in due time and manner.

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