1. Identification data:

Name of the learning unit:	**Organic chemistry**
Guided time (theory and practice):	**80 hours**
Guided time per week:	**4 hours**
Total autonomous time:	**10 hours**
Modality:	**Scholarized**
Number and type of academic period:	**2° Semester**
Type of learning unit:	**Mandatory**
Cycle:	**First**
Curricular area:	**Introductory to the profession initial training (ACFI-IP)**
UANL credits:	**3**
Elaboration date:	**16/03/2021**
Responsible for elaboration:	**Dr. Aldo Fabio Bazaldúa Rodríguez** **Dr. Raymundo Alejandro Pérez Hernández** **Dra. Martha Patricia Rodríguez Magaña.**
Date of last actualization:	**No aplica**
Responsible for actualization:	**No aplica**

2. Presentation:

The learning unit of Organic Chemistry is constituted in three phases which together allow the student to relate the structure of an organic compound with its bioactivity and thus achieve a better understanding of biological processes. In the first phase, the student will distinguish the theoretical bases of organic chemistry coupled with the ability to recognize the molecular structure of hydrocarbons and their relationship with living beings. Subsequently, in phase 2 the student will develop the necessary competencies to associate the use of organic compounds in industry, their impact on ecosystems, as well as identify the various mechanisms of synthesis for compounds of biological importance such as fats, waxes, proteins, carbohydrates and amines. Once the student has integrated this previous knowledge, in the third phase, he will acquire the fundamentals of spectroscopic techniques and optical activity to be used as tools that allow him to infer the chemical structure of organic compounds. In the learning process, carried out in this unit, the student will be able to understand the close relationship that exists between the structure of organic compounds and the action they exert on living beings, as well as understand the application of biological processes in industry. To finally integrate his knowledge in the elaboration of a monograph on the interaction of organic compounds in biological processes.

3.Purpose:

The purpose of the Learning Unit (UA) is that the student can differentiate the families of organic compounds through their structural characteristics, nomenclature and physicochemical properties. This is relevant as it will allow you to establish your relationship with biological, industrial and everyday life processes.

This UA is related to inorganic chemistry, which precedes it since it provides the basic knowledge about the molecular structure of matter, the stoichiometry of chemical reactions and the ability in the student to characterize and classify matter by its chemical properties and its relationship with biological systems.

In addition, the UA serves as a basis for the following UA of the different educational programs: in the development of this unit of learning will be treated general concepts, on theory of structures and bonds of organic molecules, the chemical, spectroscopic and stereochemical properties of the main families of organic compounds, which manage to arouse the interest of the student in the investigation , applying the scientific method for the design and control of chemical processes that generate goods and services of utility for society.

Organic chemistry contributes to the development of general competencies, since the student easily recognizes the code through which an informative message about concepts is transmitted through the identification of the structural characteristics of organic compounds (2.1.3), work with righteousness in the elaboration of their academic activities (11.1.2) in addition to respecting the ideas of their peers for the realization of collaborative works such as reports (14.1.2).

In the same way, it contributes to the development of the specific competences of the biology educational program since it will help the student so that through the knowledge of the compounds of the families of the organic compounds can estimate the impact on the ecosystems through the investigation of factors that influence it (E2-B).

In the same way, it contributes substantially to the development of the specific competences that a student of Bachelor of Food Science must acquire to manage the conservation of food in a proactive way by knowing the compounds and their characteristics to (E1-LCA) optimize chemical processes involved in the transformation of food as well as their chemical processes (E2-LCA).

In the same way, it contributes to the development of the specific competences that a student of Degree in Genomic Biotechnology must acquire to design protocols that apply to the study of the assessment of the environmental impact of chemical substances (E1-LBG) or implement molecular diagnostic methods to apply them to the solution of problems in the area of chemistry or biotechnology

(E2-LBG) as well as , contribute to the diagnosis of metabolic diseases using genomic strategies (E3-LBG) and also in the design of drugs and clinical treatments for the prevention of diseases thanks to the knowledge of the characteristics of the elements involved in their elaboration (E4-LBG).

In the same way, it contributes to the development of the specific competences that a student of Chemistry, Bacteriology and Parasitology must acquire to design protocols that apply to the study of the environmental impact assessment of chemical substances (E1-QBP) or implement analytical methods to apply them to the solution of problems in the area of chemistry, microbiology or biotechnology (E2-QBP) as well as , contribute to the diagnosis of metabolic diseases through the identification of the structure of the compounds (E3-QBP) always performing under standards of continuous improvement, applying the scientific method for the correct application of the regulations to meet the requirements that are established (E4-QBP).

4. Competencies of the graduation profile:

General competences to which this learning unit contributes:

Instrumental competences:
2. Use logical, formal, mathematical, iconic, verbal and nonverbal languages according to their life stage, to understand, interpret and express ideas, feelings, theories and currents of thought with an ecumenical approach.

Personal and social interaction skills:
11. Practice the values promoted by the UANL: truth, equity, honesty, freedom, solidarity, respect for life and others, respect for nature, integrity, ethical behavior and justice, in your personal and professional field to contribute to building a sustainable society.

Integrative competences:
14. Resolve personal and social conflicts, in accordance with specific techniques in the academic field and your profession for proper decision-making.

Specific competences to which the learning unit contributes:

Biology

2. Practice the values promoted by the UANL: truth, equity, honesty, freedom, solidarity, respect for life and others, respect for nature, integrity, ethical behavior and justice, in your personal and professional field to contribute to building a sustainable society.

Integrative competences:
14. Resolve personal and social conflicts, in accordance with specific techniques in the academic field and your profession for proper decision-making.

Specific competences to which the learning unit contributes:

Food Science

1. Manage the conservation of food proactively, through the use of physicochemical and microbiological techniques of food analysis with a comprehensive view of its composition and the modifications that these present as a result of the handling and storage conditions to guarantee its quality and safety.

2. Optimize processes involved in food processing, by monitoring and evaluating the effect of process conditions on the physical, chemical and biological characteristics of raw materials and products, working in a multidisciplinary way, with respect for the environment to contribute to the improvement of the productivity of companies in the food industry.

Genomic Biotechnology

1. Design experimental protocols related to biological chemistry, using the theoretical, methodological and instrumental knowledge, traditional and cutting-edge, of the exact sciences, biology and chemistry, which are applied in the study of natural phenomena and biodiversity, in a logical, creative and purposeful way, in order to conserve biotic resources and the environment for the benefit of society.

2. Develop molecular diagnostics through the identification of pathogenic organisms, applying traditional and cutting-edge techniques effectively, as well as the use of innovative tools in their detection, which allow the study and treatment of genetic diseases in the health, economic and social fields.

3. Design strategies for the detection, modification and selection of genomes, through the identification of genes, proteins or cellular metabolic components, following the current regulations on biosafety of Genetically Modified Organisms (GMOs) and evaluating their

competitive advantage when compared to what is traditionally used, in order to develop biotechnological products, processes and services in the health sectors , agricultural, livestock, industrial and environmental.

4. Design drugs and clinical treatments, through the selection of microorganisms with productive metabolic pathways in the market of prebiotics, probiotics and additives, as well as viral genomes of biotechnological application in the agricultural, livestock, industrial and environmental sectors that allow it to develop products and processes in the prevention of diseases.

Chemistry, Bacteriology and Parasitology

1. Design experimental protocols related to biological chemistry, using the theoretical, methodological and instrumental knowledge, traditional and cutting-edge, of the exact sciences, biology and chemistry, which are applied in the study of natural phenomena and biodiversity, in a logical, creative and purposeful way, in order to conserve biotic resources and the environment for the benefit of society.

2. Implement analytical methodologies in chemical-biological, microbiological and biotechnological laboratories that are applied to biomedical, agricultural, industrial and/or environmental problems, to provide results supported by the validation of the processes used, for the benefit of the health and economy of the community.

3. Contribute to the diagnosis of autoimmune, metabolic and infectious diseases through the biochemical study of the cellular response in living beings, to contribute to the treatment that guarantees an optimal state of health.

4. Develop systems of continuous improvement and quality assurance of chemical-biological, microbiological and biotechnological processes, applying current national and international regulations through compliance with the established requirements, to determine in a rigorous and objective way the properties of the products obtained, for the good of society.

5. Phase structure:

Phase 1. Structure and chemical properties of aliphatic and aromatic hydrocarbons.
Element of competence: Identify the general structural characteristics of aliphatic and aromatic hydrocarbons, to recognize their relationship with their chemical properties and biological processes.

Evidence	Performance criteria	Learning activities	Content	Resources
Evidence 1. Synthesis. Carbon hybridizations and participation of hydrocarbons in biological processes. .	Compares the characteristics that identify each of the carbon hybridizations. Using a comparative table, it describes the structural characteristics, opening angle of the hybridized lobes (include images made using the Chem-Draw program), type of bond they can form and the family of hydrocarbons to which it gives rise, as well as examples of compounds belonging to each of these groups of compounds. Answer all the items marked for the comparative table proposed by the teacher. Includes clear and crisp images. It describes the influence that different	Compares the characteristics that identify each of the carbon hybridizations. Using a comparative table, it describes the structural characteristics, opening angle of the hybridized lobes (include images made using the Chem-Draw program), type of bond they can form and the family of hydrocarbons to which it gives rise, as well as examples of compounds belonging to each of these groups of compounds. Answer all the items marked for the comparative table proposed by the teacher. Includes clear and crisp images. It describes the influence that different	**Structure of organic molecules** • Electronic carbon configuration. • Hybrid orbitals. • Sp, sp^2, sp^3 hybridization • Single bond formation and carbon-carbon multiple bonds. • Molecular geometry. **Alkanes and cycloalkanes** • Molecular description of organic structures. • Stability of organic molecules. • Introduction to hydrocarbons. • -Structure of alkanes and cycloalkanes. • nomenclature. **Alkanes and cycloalkanes.** • Structural isomery • Structure of methane	classroom In focus Computer equipment Chem- Draw Program Evaluation tools Workbook nexus Platform Internet L.G. Wade. (2016) Organic Chemistry. Chapters 1,3, 8, 9, 16 and 17.

.	hydrocarbons have on biological processes, highlighting the relationship between structure and biological activity: a) Importance of alkanes in plants. b) Enzymatic relationship with *cis*- and *trans*- isothermal c) Biological impact of stereoisomerism in cycloalkanes. Consider the analyses done in the workbook. Write the synthesis with an extension of 2 quartiles, with letter size 11 or 12 and a maximum line spacing of 1.5. It is based on reliable sources. Reference in the APA format the fonts used.	hydrocarbons have on biological processes, highlighting the relationship between structure and biological activity: a) Importance of alkanes in plants. b) Enzymatic relationship with *cis*- and *trans*- isothermal c) Biological impact of stereoisomerism in cycloalkanes. Consider the analyses done in the workbook. Write the synthesis with an extension of 2 quartiles, with letter size 11 or 12 and a maximum line spacing of 1.5. It is based on reliable sources. Reference in the APA format the fonts used.	• Ethene conformation. • cyclohexane • *cis-trans isomery*. • Reactions of alkanes • combustion **Alkenes and alkines** -Structural characteristic. -Nomenclature. Isomery. • *Cis-trans* and *E-Z* geometric isomers. • Chemical properties. • Halogenation • hydrogenation • hydration **Aromatic hydrocarbons** • Structural description and properties of benzene. • resonance • Aromatic, antiaromatic and non-aromatic compounds. • Hüeckel rule. • Nomenclature of benzene derivatives.	
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			• Properties of aromatic compounds. • Halogenation • Renting Friedel – Crafts.	

Phase 2. Structure and properties of halogenated, oxygenated and nitrogenous compounds.
Element of competence: Associate the molecular structure of halogenated, oxygenated and nitrogenous organic compounds with their physical and chemical properties to understand the biological importance of the family of alcohols, esters, amines and amines.

Evidence	Performance criteria	Learning activities	Content	Resources
Evidence 2. Diagram of nomenclature and chemical reactions of the alkyl halides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines and amines families; synthesis of organic compounds of biological importance: carbohydrates, triglycerides, lactams and peptides.	Develops the IUPAC nomenclature rules of each of the following families of organic compounds: alkyl halides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines and amines, in addition to including examples proposed by the teacher. Include in the diagram the reaction mechanisms of the chemical properties of	The professor explains about the various properties, as well as the uses of the organic compounds included in the content corresponding to stage 2 supported with illustrations. • The student develops a graphic organizer to identify the properties and uses of the organic compounds described. • The student analyzes and interprets	**Alkyl halides.** • Structural characteristics. • uses • nomenclature • Chemical properties. • **Alcohols and ethers** • Structural characteristic and generalities. • nomenclature.	classroom In focus Computer equipment Evaluation tools Workbook Nexus Platform Internet L.G. Wade (2016) Organic Chemistry. Chapters 6,10, 11, 18, 19, 20 and 21.

	the organic compounds described above, SN2, oxidation of alcohols (synthesis of aldehydes, ketones and carboxylic acids) and synthesis of oxides. For each of these mechanisms it is important to develop the correct chemical structures, their reagents and catalysts. Steps should not be omitted from reactions. It is important to consider that when describing IUPAC nomenclature and reaction mechanisms it must be organized, logical and well distributed. Performs IUPAC naming examples and mechanisms of action by hand. It describes the chemical reactions needed to synthesize carbohydrates, triglycerides, lactams and peptides.	characteristic reactions of the organic compounds included in this section. • The student recognizes the properties and chemical behavior of the polarized covalent bond: alkyl halides. • The student draws up a comparative table to describe the synthetic potential of alcohols and transform them into a wide range of compounds. • The professor uses a face-to-face exposure to expose the reaction mechanism of substitution and elimination reactions in alcohols. • The student solves the exercises raised in the exercise book on the reaction mechanisms in which the alcohols participate. • The student describes the relationship	• Chemical properties. Oxidation of alcohols: • Primary • Side • Tertiary • Biological oxidation of alcohols: • Rupture of ethers with hydracids. (HBr and HCl) • **Aldehydes and ketones.** • structure • nomenclature • Chemical properties. • Obtaining from alcohols. • Oxidation of aldehydes. • **carbohydrates** • synthesis • **Carboxylic acids and esters.** • structure • nomenclature • Chemical properties	

	It describes the biological importance of each of these structures, based on the analysis carried out in the workbook. Prepare a document in .pdf format. It includes a cover page which will contain the identification data of the university, the faculty, the learning unit, the evidence and the student. Share the diagram through a screenshot, in addition to including the link corresponding to that document. Identifies in the diagram the family of organic compounds that it has as its origin It shows in an organized way the various reactions requested. Synthesizes information of biological importance to be appropriate to a diagram.	between the structure and physical properties of ethers and their structural relationship with alcohols, employing the workbook. • The teacher shows the students the contrast of the low reactivity of ethers with respect to alcohols. • The student, using the workbook, analyzes the reactions that occur by nucleophilic attack on the carbon of the carbonyl group. • The professor explains the general formula, structure and nomenclature of aldehydes and ketones. Solves the proposed exercises • The student together with the teacher analyzes the chemical properties of aldehydes and ketones. • The student develops a graphic organizer to	• Reaction of carboxylic acids and derivatives • Fisher esterification • Hydrolysis of esters 1. Formation of ethers and esters • **triglycerides** • -Hydrogenation of triglycerides • -Saponification of fats and oils • **Amines and dies** • Structural characteristics. • nomenclature • Chemical properties • Synthesis of lipids • Formation of lactams • Amino acid reactions • -Esterification • -Acylation of the amino group	

	It bases with reliable bibliography. Reference in APA format the fonts used.	describe the general formula, nomenclature, as well as the structure of carboxylic acids and esters. • Solves the exercises proposed for the families of carboxylic acids and esters in the exercise notebook. • The professor enunciates the general formula, nomenclature, as well as the structure of amines and amines. • The student solves the exercises proposed in the workbook, which correspond to the nomenclature of amines and amines. • The student identifies and describes the chemical properties of both amines and amines. The student presents the first training exam (Ponderable Activity 2.1), consisting of multiple-choice		

		reagents, relationship and short response reagents.		

Phase 3. Identification of functional groups by spectroscopy and stereoisomeric of organic molecules.
Element of competence: Distinguish the functional groups of the various families of organic compounds through infrared and ultraviolet-visible spectroscopy to relate them to their structural characteristics and their stereochemistry with their impact on biological processes.

Evidence	Performance criteria	Learning activities	Content	Resources
Evidence 3. Report of the spectroscopic (Infrared and Uv-Vis) and stereochemical characteristics of organic compounds	Infers on the various signals obtained from an Infrared spectrum for the compound proposed by the professor. It examines the signals obtained in a UV-vis spectrum of the aforementioned compound. It highlights the stereochemical characteristics of the suggested organic compound. Develops a reflection focused on the importance of the techniques described in the report for its application in a	1. The professor describes the electromagnetic spectrum and the importance of the infrared region. He then describes the characteristic absorptions of the main families of organic compounds. 2. The student solves reinforcement exercises using IR spectra and exercises. 3. The students in a group form elaborate a scheme with the help of the students where they summarize the various absorption	**Infrared spectroscopy.** 1. electromagnetic spectrum. 2. The infrared region. 3. Molecular vibrations. 4. Identification of functional groups. 5. Infrared spectroscopy of hydrocarbons. 6. Characteristic absorptions of alcohols and amines. 7. -Characteristic absorptions of carbonyl compounds.	classroom In focus Computer equipment Khan Academy Evaluation tools Workbook. Nexus Platform Internet L.G. Wade (2016) Organic Chemistry. Chapters 5, 12 and 15.

	methodology that allows to contribute to structural elucidation. Prepare the report in .pdf format. It includes a cover page showing the identification data of the university, faculty, learning unit, evidence and student. Develops the report considering the various spectroscopic and stereochemical characteristics. Write using a letter of size 11 or 12 with a line spacing of 1.5. It includes clear images of structures and spectra. Reflect on the subject requested by Professor Fundamental with reliable bibliography Reference in APA format	data for each of the families of organic compounds. 4. The student, using the didactic material, IR tutorial, and additional information performs exercises in which he identifies the structural characteristics of the functional groups of various families of organic compounds through IR spectroscopies. 5. The professor describes the basis of UV-Vis spectroscopy. 6. The teacher provides the necessary information for the student to identify the SPECTRA of UV-Vis spectroscopy. 7. The student prepares a table describing the different characteristics of UV-Vis spectra. 8. The student makes a tree diagram	8. -Characteristic absorptions of carbon-nitrogen bonds. **Ultraviolet-visible spectroscopy** 1. Spectral region 2. UV light and electronic transitions. 3. Obtaining an ultraviolet spectrum. 4. Applications **Chirality in organic chemistry.** 1. Description of the concept of stereochemistry. 2. chirality 3. Enantiomers 4. Optical activity 5. Biological discrimination of enantiomers 6. Racemic mixture. 7. Diastereomers 8. Physical properties of diastereomers.	

		where he describes the various applications of the spectroscopic technique described above. 9. The professor defines stereochemistry and the concept of chirality, providing examples. 10. The student makes a didactic exhibition where he will show the usefulness of polarized light and the existence and characteristics of enantiomers. 11. The student describes the characteristics of diastereoisomeres as well as their physical properties and their importance at the biological level. 12. The student using the didactic tools provided by the teacher and the	**Relationship of organic compounds and their reactions with biological processes.** Alkaloids: effect on the central nervous system. 1. nicotine Amines: Release and reuptake of neurotransmitters. 2. Fluoxetine Flavonoids and phenols: 1. Antioxidant activity	

		workbook recognizes the characteristics of stereoisomery of optically active compounds to relate the structure of an organic compound with its biological activity. 13. The professor using a master class describes the importance of organic compounds with biological activity. 14. The student presents the first training exam (Ponderable Activity 3.1), consisting of multiple choice reagents, relationship and short response reagents.		

6. Evaluation:

	Item	Weight(%)
1	**Evidence 1**. 1. Report of carbon hybridizations and their characteristics. a) synthesis. Participation of hydrocarbons in biological processes.	6

	Weighted activity 1.1. First partial examination, consisting of multiple-choice reagents, ratio and short-response reagents.	10
2	**Evidence 2**. 1. Booklet of nomenclature exercises and chemical reactions of the alkyl halide, alcohol, ether, aldehyde, ketone, carboxylic acid, amine and amine families. a) Synthesis diagram of organic compounds of biological importance: carbohydrates, triglycerides, lactams and peptides.	7
	Weighted activity 2.1. Second partial examination, consisting of multiple-choice reagents, ratio and short-response reagents.	15
3	**Evidence 3.** Report of the spectroscopic (Infrared and Uv-Vis) and stereochemical characteristics of organic compounds.	7
	Weighed activity 3.1. Third partial examination, consisting of multiple-choice reagents, ratio and short-response reagents.	25
Total:	**PIA**	30
	100 points	100

7. Integrative learning product:
Monograph on the interaction of organic compounds in biological processes.

8. Literature:

Ambareen Shaikh & Jyotsna S. Meshram | (2015) Design, synthesis and pharmacological assay of novel azo derivatives of dihydropyrimidinones, Cogent Chemistry, 1:1, 1019809, DOI: 10.1080/23312009.2015.1019809

Brown, Theodore L.; LeMay, Jr., H. Eugene; Bursten, Bruce E.; Murphy, Catherine J.; Woodward, Patrick. (2014). Química la ciencia central. 12a edición, México. Pearson.

Indranirekha Saikia, Arun Jyoti Borah, and Prodeep Phukan Chemical Reviews. (2016). Use of Bromine and Bromo-Organic Compounds in Organic Synthesis. Recuperado de: https://pubs.acs.org/doi/10.1021/acs.chemrev.5b00400

Jeremy Tipton, Ticia Barnicki, and Eugene T. Smith (1998). Qualitative Analysis of Herbs by Gas Chromatography/Mass Spectrometry (GC/MS). An Undergraduate Instrumental Analysis Laboratory Exercise 1 / VOL. 3, NO. 3 ISSN 1430-4171 The CHEMICAL Educator. https://doi.org/10.1007/s00897980204a

Khan Academy. (2021). Química Orgánica. https://es.khanacademy.org/science/organic-chemistry American Chemical Society-Colección de revistas

Ruiz Cerrillo, Salvador (2020). Realidad aumentada y aprendizaje en la química orgánica. Apertura, 12(1),106-117.[fecha de Consulta 7 de Mayo de 2021]. ISSN: 1665-6180. Disponible en: https://www.redalyc.org/articulo.oa?id=68863614007

Soderberg Timothy. (2016). Organic Chemistry with a Biological Emphasis. University of Minnesota Morris Digital Well.

Wade, L.G. Jr., (2016). Química Orgánica. 9a. edición, México. Pearson Prentice-Hill Hispanoamericana, S.A

Annex1. PIA instructional guide

Integrative learning product: Monograph on the interaction of organic compounds in biological processes.

Instructions:	The integrative learning product will be divided into two activities, a monograph and the presentation of a poster: Research report, this will describe the chemical nature of two organic compounds, per person, as well as their reported biological activity and their mechanism of action on biological processes suggested by the professor. The written document must be made following the following structure: title, index, introduction, development and conclusion. For its elaboration consider the following points: 1. Physical description of the compound. 1. Description of physical properties. 2. Develop a theoretical framework on reported biological activity for the chosen organic compounds. 3. Description of the interaction of organic compounds with the biological process selected. 4. In the conclusion section the student must express a personal position on the importance (biological, food or industrial) of the selected organic compounds, as well as describe a

	possible relationship of the functional groups or structure with the assigned biological activity. The monograph will be made using Arial letter or Time New Roman No. 12, justified, with a line spacing of 1.5 and with standard margins. Poster: Prepare a poster with the information described of one of the compounds that make up the research report. The poster will be displayed on the dates assigned by the academy of basic chemistry.
	Monograph (20 puntos) Poster presentation(10 puntos)
Criterios de evaluación:	Monograph: this activity must contain the description of the structure, the physical and chemical properties of each compound, as well as describe in writing and by means of diagrams its interaction with biological processes. Poster: in the development of this activity will be evaluated the elaboration of the poster (organization and design), the participation and collaboration of the team, the correct description of the chemical compound exposed, as well as its interaction in biological processes, in addition to correctly answering the questions made by the evaluator of the poster.
Modalidad:	Team