



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

1.- GENERAL INFORMATION

Learning Unit Analytical Chemistry II		Academic Department Chemistry		Course Format Lecture
Prerequisites(P) Analytical Chemistry I	Corequisites (CO) Analytical Chemistry Lab II	Ascribed Academy Qualitative and Quantitative Analysis	Module M3 Analysis and characterization	
Type Basic, common, and mandatory	Lecture Hours 51	Practice Hours 0	Total hours 51 hrs.	Credits 7

2.- GENERIC COMPETENCIES

Students...

...understand the practical knowledge of the chemical reaction in aqueous and non-aqueous solutions through the study of the effect of secondary equilibria over the displacement and quantity of the main reaction.

...know the effect of phenomena and parameters that are involved in the basic separation processes (precipitation, ionic exchange, and solvent extraction).

...include the practical and simplified study of the effect of simultaneous equilibria and their use in the design of simple, selective, and gravimetric separations.

...apply the calculations and programs in order to handle the analytical tools to the solution of a specific problem.

3.- SPECIFIC CHARACTERISTICS OF THE COMPETENCY

Knowledge	Students... ...relate the knowledge of the different reactions that involve simultaneous equilibria. ...recognize the foundations and differences of the reactions in non-aqueous solutions. ...know the gravimetric analytical and separation methods in specific samples. ...analyze and interpret a number of quantitative data statistically.
Skills	Students... ...are able to analyze samples in different solvents. ...apply and select classical methods in the evaluation of samples. ...detect mistakes and interpret results in data. ...apply separation techniques. ...handle lab material and instruments.
Aptitudes	Students... ...are willing to review bibliographic information individually and in groups. ...reflect, argument, discover, and connect knowledge and results with everyday life. ...are responsible when doing research work.



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

	...apply the appropriate format for the research projects.
Values	Students... ...are aware of the team they belong to and its members, establish bonds, and promote communication, critical thinking, tolerance, respect and responsibility.

4.- TRANSVERSAL COMPETENCIES

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

5.- COURSE CONTENT OF THE LEARNING UNIT

Unit 1 Introduction to the simultaneous equilibrium in an aqueous solution.
Unit 2 Equilibrium in a non-aqueous solution.
Unit 3 Gravimetric analysis
Unit 4 Separation and extraction methods.
Unit 5 Statistical analysis.

6.- ASSESSMENT

☒	Numeric grade
☐	
☐	



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

7.- GRADING CRITERIA OF THE LEARNING UNIT

Indicator of evaluation	Percentage
Departmental exams	30
Partial exam	35
Homework	10
Research activities	15
Practice reports	0
Class participation	10

8.- REQUIRED MATERIAL (for students)

☒	Calculator
☒	Periodic table
☐	Lab coat
☐	Text book
☐	Workbook
☐	



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

9.-SPECIFIC CONTENT BY LEARNING UNITS

Content unit	Generic competency of the content unit	Topics	Class hours	Professor activities	Student activities	Bibliography
Unit 1 Introduction to the simultaneous equilibrium in an aqueous solution.	Students... -Understand the influence and the effects of a number of cases of simultaneous equilibria involved in a reaction medium, identifying those cases in which this type of reaction takes place.	Effect of the reaction medium in the equilibria. Le Chatelier Principle	1 h	Professor... - Teaches the fundamentals of the topic. - Leads the students to apply the knowledge in a practical way to identify the effect of the variables that are involved in simultaneous equilibria. - States theoretical and practical problems.	Students... -Participate actively and analyze the information. - Solve conceptual and numerical problems stated by the teacher. - Create maps and schemes comparing the different equilibria.	Charlot G. <i>Química Analítica General - Soluciones acuosas y no acuosas</i> (1971). Volume I, Barcelona: Toray-Masson. Skoog D.A., West D.M., Holler F.J., Crouch S.R., (2005) <i>Química Analítica</i> , 8th Edition. Mexico: Thomson. Harris D.C., <i>Análisis Químico Cuantitativo</i> (2007), 3rd edition. Spain Reverté.
		Simultaneous equilibrium acid-base/ compound	2 h			
		Simultaneous equilibrium acid-base /redox	2 h			
		Simultaneous equilibrium Complex/redox	2 h			
		Solubility and precipitation in the simultaneous equilibrium.	1 h			



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

Unit 2 Equilibrium in non-aqueous solution	Students... -Recognize and distinguish the effect on the reaction parameters and equilibria in a solution with non-aqueous solvents. Understand its influence in the analysis of sample and observe the conditions that are appropriate for the application of these solvents.	General properties of the usual solvents.	1 h	Professor... -Teaches the fundamentals of the topic. - Guides the students to apply the knowledge in a practical way to identify the effect of the different solvents used in reactions. - States theoretical and practical problems.	Students... - Participate actively and analyze the information. - Solve conceptual and numerical problems stated by the teacher. - Write a lab report, discuss and argument the results. - Create maps and schemes comparing the equilibria in aqueous and non-aqueous solutions.	Charlot G. <i>Química Analítica General - Soluciones acuosas y no acuosas</i> (1971). Volume I, Barcelona: Toray-Masson. Skoog D.A., West D.M., Holler F.J., Crouch S.R., (2005) <i>Química Analítica</i> , 8th Edition. Mexico: Thomson. Harris D.C. (2007), <i>Análisis Químico Cuantitativo</i> . 3rd edition. Spain: Reverté.
		Acid-base reactions in dissociating molecular solvents.	2 h			
		Acid-base reactions in non-dissociating molecular solvents.	2 h			
		Acid-base reactions in ionized solvents.	1 h			
		Complex reactions and redox in non-aqueous solvents.	2 h			
		Precipitation and solubility in non-aqueous solvents.	1 h			



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

Unit 3 Gravimetric analysis	Students...	Introduction to gravimetric analysis	1 h	Professor... - Teaches the fundamentals of the topic. - Guides the students to identify the different gravimetric methods to quantify and separate substances - States theoretical and practical problems.	Students...	Orozco D.F. <i>Análisis químico cuantitativo</i> (1989). 18th edition. Mexico: Porrúa. Harris D.C. (2007), <i>Análisis Químico Cuantitativo</i> , 3rd edition. Spain: Reverté. Harvey D. (2000). <i>Modern Analytical Chemistry</i> 2nd edition. USA: Mc Graw Hill.
	Apply the basic knowledge of equilibrium to understand the foundations of basic separations and the quantification of an isolated analyte through a gravimetric analysis	Precipitation gravimetry	2 h		- Participate actively and analyze the information.	
		Volatilization gravimetry	2 h		- Solve conceptual and numerical problems stated by the teacher.	
		Gravimetry by deposition	1 h		- Create maps and schemes comparing the different gravimetric methods.	
Unit 4 Separation and extraction methods	Students...	Fundamentals of the separation process. (efficiency and performance)	2 h	Professor... - Teaches the fundamentals of the topic. - Guides the students to relate	Students...	Harvey D. (2000) <i>Modern Analytical Chemistry</i> . 2nd edition. USA: Mc Graw hill.
	-Identify in a theoretical way the different separation and extraction	Separation by size: filtration and dialysis.	1 h		- Participate actively and analyze the information.	



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

	methods of substances, knowing their foundations, uses, advantages and disadvantages in order to select the most appropriate method in a solid or liquid sample.	Separations by mass and density: centrifugation.	1 h	the different separation and extraction processes with chemical foundations to isolate and later quantify the substances. - States theoretical and practical problems.	- Solve conceptual and numerical problems stated by the teacher. - Create maps and schemes comparing the different extraction and separation techniques.	Skoog D.A., West D.M., Holler F.J., Crouch S.R., (2005) <i>Química Analítica</i> , 8th Edition. Mexico: Thomson.
		Separations by complex formation: masking	1 h			
		Separations by physical state distillation, sublimation, recrystallization	2 h			
		Separations by charge: precipitation, ionic exchange, electrodeposition, volatilization	2 h			
		Separations by partition: decantation, chromatography	2 h			
		Liquid-liquid extractions Partition coefficient Quotient distribution.	2 h			
		Liquid-liquid extractions with no secondary reactions	2 h			
		Liquid-liquid extractions with acid-base reaction	1 h			
		Liquid-liquid extractions with metallic chelates	1 h			



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química

Unit 5 Statistical analysis	Students... Identify adequate statistical parameters to evaluate the analytical data through specialized programs in statistical chemical analysis.	Mistakes in the quantitative analysis: random and systematic error.	2 h	Professor... - Teaches the fundamentals of the topic. - Guides the students to apply the statistics to detect the variance, limits and influence of factors in experimental data.	Students... - Participate actively and analyze the information. - Solve conceptual and numerical problems stated by the teacher.	Miller J.N. Miller J.N. (2012) <i>Estadística y Quimiometría para Química analítica</i> . 4th edition. Spain: Prentice hall. Harvey D. Modern <i>Analytical Chemistry</i> (2000). 2nd edition. USA: Mc Graw Hill. Skoog D.A., West D.M., Holler F.J., Crouch S.R., 2005, <i>Química Analítica</i> , 8th Edition. Mexico: Thomson.
		Analytical data evaluation: media, standard deviation, coefficient of variance, confidence limits, detection limits, and quantification limits.	3 h			
		Unifactorial and multifactorial, regression and correlation.	6 h			

COURSE EVIDENCE (Deliverables)

- Evidence of readings through analysis, conceptual maps, comparative tables, and summary tables.
- Completed exercise pages.
- Written exams

Haga clic aquí para escribir texto.



UNIVERSIDAD DE GUADALAJARA

Centro Universitario de Ciencias Exactas e Ingenierías
Secretaría Académica / Coordinación de la Licenciatura en Química
Comité de Innovación Curricular de la Licenciatura en Química