



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 Lab II		Academic Department: Chemistry		Course Format: Lab	
Prerequisites (P) Analytical Chemistry Lab I	Corequisites (CO) Analytical Chemistry II	Ascribed Academy: Quantitative and Qualitative Analysis		Module: M3: Analysis and characterization.	
Type Basic, common, and mandatory	Practice hours 68	Lecture hours 0	Total hours 68	Credits 5	

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 the 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 selective and gravimetric separations.

...apply the calculations and programs in order to use the analytical tools to solve a specific problem.

3.- SPECIFIC CHARACTERISTICS OF THE COMPETENCY

Knowledge	Students apply the reactions that involve simultaneous equilibria in a practical way. -...apply the fundamentals of the different reactions in non-aqueous solutions practically. ...separate specific samples quantitatively through gravimetric methods and common processes. ... analyze and interpret a number of quantitative data in a statistical way.
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 both individually and in groups.



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	<ul style="list-style-type: none">- reflect, argument, discover, and connect knowledge and results with everyday life.- do research responsibly.- apply the appropriate format for the research projects and the practice reports, talking about the results and making conclusions based on the objective of the task.
Values	<p>Students...</p> <ul style="list-style-type: none">- 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

<input checked="" type="checkbox"/>	Foreign language (English)
<input checked="" type="checkbox"/>	Analytical, critical and synthetic thinking.
<input checked="" type="checkbox"/>	Oral and written expression
<input checked="" type="checkbox"/>	Professional ethics
<input checked="" type="checkbox"/>	Administration of human and material resources
<input type="checkbox"/>	Leadership and sustainability
<input checked="" type="checkbox"/>	Creativity, innovation and entrepreneurship
<input type="checkbox"/>	Others

5.- COURSE CONTENT OF THE LEARNING UNIT

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

6.- ASSESSMENT

<input checked="" type="checkbox"/>	Numeric grade
<input type="checkbox"/>	
<input type="checkbox"/>	



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7.- GRADING CRITERIA FOR THE LEARNING UNIT

Indicator of evaluation	Percentage
Practical test	30
Partial exam	20
Homework	5
Research activities	5
Practice reports	40
Class Participation	0

8.- REQUIRED MATERIAL (for students)

<input checked="" type="checkbox"/>	Calculator
<input checked="" type="checkbox"/>	Periodic Table
<input checked="" type="checkbox"/>	Lab coat
<input checked="" type="checkbox"/>	Text book
<input checked="" type="checkbox"/>	Work manual
<input checked="" type="checkbox"/>	Safety glasses, individual pipet bulb, cleaning material, crucible.



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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 equilibria in an aqueous solution	Students understand the influence and the effect of simultaneous equilibria on a number of cases involved in a reaction medium, identifying the cases in which this type of reaction takes place.	Simultaneous equilibria practices -Effect of the concentration, temperature and catalysts over the equilibria. - Determination of the hardness of unbuffered water. - Determination of calcium in unbuffered milk. - Determination of direct reducing sugar and total reducing sugar in a piece of candy - Precipitation and solubility of protein in an egg white through pH.	8 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 variables that are involved in simultaneous equilibria. - States theoretical and practical problems. - Guides through the practice.	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.	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., <i>Química Analítica</i> (2005), 8th Edition. Mexico: Thomson. Harris D.C., (2007). <i>Análisis Químico Cuantitativo</i> , 3rd edition. Spain: Reverté.



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Unit 2 Equilibria in aqueous and non-aqueous solutions.	<p>-Students recognize and distinguish the effect of the reaction parameters and equilibria in a solution with non-aqueous solvents.</p> <p>-Understand its influence in the analysis of sample and observes the conditions that are appropriate for the application of these solvents.</p>	<p>Equilibria practices in a non-aqueous solution.</p> <p>-Acidity index, peroxide index, and iodine index in edible oils.</p> <p>- Determination of metronidazole with perchloric acid.</p> <p>- Determination of nicotine with perchloric acid.</p> <p>-Determination of albuterol with perchloric acid.</p> <p>-Determination de loperamide hydrochloride.</p> <p>-Determination of amantadine hydrochloride.</p> <p>-Determination of nalidixic acid</p> <p>-Determination of mercaptopurine</p>	12 h	<p>Professor</p> <p>- Guides the students to apply the knowledge in a practical way to identify the effect of the variables that are involved in simultaneous equilibria.</p>	<p>Students...</p> <p>- Participate actively and analyze the information.</p> <p>- Solve conceptual and numerical problems stated by the teacher.</p> <p>- Write a lab report, discuss and argument the results.</p>	<p>Charlot G. <i>Química Analítica General - Soluciones acuosas y no acuosas</i> (1971). Volume I, Barcelona: Toray-Masson.</p> <p>Skoog D.A., West D.M., Holler F.J., Crouch S.R., (2005). <i>Química Analítica</i>, 8th Edition. Mexico: Thomson.</p> <p>Harris D.C., (2007). <i>Análisis Químico Cuantitativo</i>, 3rd edition. Spain: Reverté.</p>
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Unit 3 Gravimetric analysis	Students apply the basic knowledge of equilibria to understand the foundations of separation and quantifications of an analyte through a gravimetric analysis.	Gravimetric practices <ul style="list-style-type: none">- Determination of humidity, total solids, ashes, and ethereal extract.- Determination of silver and copper in metallic alloys.- Determination of sulfates in gypsum or in a salt.- Determination of nickel in a metallic alloy.	14 h	Professor... <ul style="list-style-type: none">- 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.- Guides through the practice.	Students... <ul style="list-style-type: none">- Participate actively and analyze the information.- Solve conceptual and numerical problems stated by the teacher.- Write a lab report, discuss and argument the results.	<p>Orozco D.F. (1989). <i>Análisis químico cuantitativo</i>. 18th edition. Mexico: Porrúa.</p> <p>Harris D.C., (2007) <i>Análisis Químico Cuantitativo</i>, 3rd edition. Spain: Reverté.</p> <p>Harvey D. (2000). <i>Modern Analytical Chemistry</i>. 2nd edition. USA: Mc Graw Hill.</p>
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Unit 4 Separation and extraction methods	Students identify theoretically the different extraction and separation methods, knowing their foundations, uses, advantages and disadvantages for the selection of the most suitable method in a solid or liquid sample.	Separation and extraction practice <ul style="list-style-type: none"> - Determination of humidity through steam stripping. - Determination of fat through the Gerber method. - Extraction and separation of chlorophyll. - Extraction of iodine from Isodine. - Extraction of benzoic acid. - Distillation of brandy and determination of esters and aldehydes. - Liquid extraction of organic compounds in a homogenous means (naphthalene and salicylic acid). 	16 h	<ul style="list-style-type: none"> - Teaches the fundamentals of the topic. - Leads the students to relate the separation and extraction processes in a practical way with a chemical foundation to isolate in order to quantify the substances. - States theoretical and practical problems. - Guides through the practice. 	Students... <ul style="list-style-type: none"> - Participate actively and analyze the information. - Solve conceptual and numerical problems stated by the teacher. - Write a lab report, discuss and argument the results. 	Harvey D. Modern Analytical Chemistry. 2nd edition. USA: Mc Graw Hill; 2000 Skoog D.A., West D.M., Holler F.J., Crouch S.R., <i>Química Analítica</i> , 8th Edition. Mexico: Thomson; 2005
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Unit 5 Statistical analysis	Students recognize the adequate statistical parameters of analytical data through specialized software in the statistical chemical analysis.	Statistical analysis practice Collecting data - Analysis of statistical parameters through software. - Variance analysis through software. - Collecting a calibration curve. - Regression and correlation analysis through software.	18 h	Professor... - Teaches the fundamentals of the topic and the use of software for statistical analysis. - Leads the students to use the statistical software in order to detect the variation, limits and influence of variables in experimental data. - States theoretical and practical problems. - Guides through the practice.	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.	Miller J.N. Miller J.N. (2012) <i>Estadística y Quimiometria para Química analítica</i> . 4th edition. Spain: Prentice Hall. Harvey D. (2000) <i>Modern Analytical Chemistry</i> . 2 nd 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.
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COURSE EVIDENCE (Deliverables)

Learning evidence:

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

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