

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			Department			Forma	t		
Physical Chemistry I Chemistry Lecture					2				
Prerequisites(P)	Corequisites (CO)	As	scribed Academy Module						
General Chemistry II	Physical Chemistry Lab	Pł	hysical Chemistry M1: Strue			cture of	matter		
Туре	Lecture hours	Ρ	Practice hours Total Hours				Credits		
Basic Particular	68	0	0 68			9			
Mandatory									

2.- GENERIC COMPETENCIES

- -Problem solving
- -Synthesis and analysis.
- -Behavioral abilities
- -Value consolidation
- Teamwork.
- -Computer skills
- Information managing
- -Oral and written production
- -Discerning and decision-making
- -Ability to be critical towards others and towards themselves
- -Communicate their ideas through chemical language
- Analyze situations using basic concepts of physical chemistry
- Judge based on experience and knowledge.
- -Solve problems in different contexts.
- -Do research on scientific and technological innovations to develop and solve problems.
- Offer solutions to problems.
- -Utilize information and communication technologies to process and interpret information.

3 SPECIFIC CHARACT	TERISTICS OF THE	COMPETENCIES

	Students
Knowledge	know the basic concepts of physical chemistry. understand the concepts of energy involved in chemical reactions. apply the relationship pressure-temperature-volume and the thermodynamic principles in order to predict physicochemical properties.



	develop oral and written skills by making reports about different topics in the class.
Skills	 Students learn autonomously. distinguish ideal systems from non-ideal systems. understand thermodynamic concepts and their importance in physical and chemical processes. create solution paths of physical and chemical problems using reported thermodynamic data. observe and/or propose situations or problems related to energy and design resolution strategies. reason, conceptualize, and express critical opinions using physicochemical tools. work collaboratively, expressing their point of views with an open mind and considering those of others with a critical approach.
Aptitudes	observe and/or propose situations or problems related to energy and design resolution strategies. reason, conceptualize, and express critical opinions using physicochemical tools. identify and solve problems based on the formulation of hypotheses and the application of essential principles analytically. relate knowledge from different fields and apply it in ordinary situations. develop study habits and manage their learning
Values	 Students develop and reaffirm values such as responsibility, honesty, tolerance, respect, solidarity, disposition, positive attitude towards individual and teamwork.



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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
 - Other

5.- COURSE CONTENT OF THE LEARNING UNIT

UNIT 1 Pressure, Volume, Temperature relationships

- 1.1 Zero law of thermodynamics
- 1.2. State equations
- 1.2.1 Compressibility coefficient
- 1.2.2. Coefficient of volumetric expansion
- 1.2.3. Ideal Gases
- 1.2.4 Real Gases
- 1.2.5 Liquids and Solids

UNIT II First law of thermodynamics

- 2.1. Energy, work and heat
- 2.2 First law of thermodynamics
- 2.3 Reversible and irreversible processes
- 2.4 Enthalpy and heat capacity
- 2.5 q, w, DU, DH calculations in physical processes.
- 2.6 Thermochemistry

UNIT III Second law of thermodynamics

- 3.1. Spontaneous and non-spontaneous processes
- 3.2 Carnot cycle
- 3.3 Second law of thermodynamics
- 3.4 Entropy changes in physical processes.

UNIT IV Third law of thermodynamics



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- 4.1. Entropy and molecular disorder.
- 4.2 Absolute entropy calculation.
- 4.3 Entropy changes in chemical reactions

UNIT V Functions of free energy

- 5.1 Gibbs free energy
- 5.2 Helmholtz free energy
- 5.3 Free energy changes in physical and chemical processes.
- 5.4 Spontaneity of a reaction.

6 AS	SESSMENT
>	Numeric grade

7 GRADING CRITERIA OF THE LEARNING UNIT							
Indicator of evaluation	Percentage						
Departmental exams	30						
Partial exam	40						
Homework	20						
Research activities	5						
Practice reports	5						
Class participation	0						
Other: Presentations	0						

8 RF	QUIRED MATERIAL (for students)
۲	Calculator
•	Periodic table
	Lab coat
	Text book
	Workbook
V	Other: Thermodynamic tables, tablet, computer.





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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 Pressure, Volume, Temperature relationships	the content unit -Problem solving -Synthesis and analysis -Behavioral abilities -Value consolidation - Teamwork -Computer skills - Information managing -Oral and written production -Discerning and decision-making -Ability to be critical towards others and towards	1.1 Zero law of thermodynamics 1.2. State equations 1.2.1 Compressibility coefficient 1.2.2. Coefficient of volumetric expansion 1.2.3. Ideal Gases 1.2.4 Real Gases 1.2.5 Liquids and Solids	2 h 12 h	 Professor -Proposes an ice breaker to get to know the group -Applies a diagnostic test to determine previous knowledge. -Lectures -Leads an activity to analyze the importance of using real gas formulas and the difference from liquids and solids. 	Students BEFORE: -Read their scientific calculator instruction manual. -Investigate and remember concepts involving the properties of pressure, temperature and volume to be used in class. -Gather tables of constants for the	Gilbert W. Castellan Fisicoquímica 2nd Edition Addison Wesley Samuel H. Maron. Fundamentos de fisicoquímica Limusa Raymond Chang Fisicoquímica 3rd Edition Mc Graw Hill Ira N. Levine Fisicoquímica Volume I 5th Edition
	themselves -Communicate				state equations to be used in class.	Mc Graw Hill



their ideas		-Assigns evercises	- Gather tables of	
		-Assigns exercises		
through chemica		to solve problems	integration and	
language		about the unit.	derivation.	
- Relate				
physicochemical		-Assesses the unit	DURING:	
concepts and			-Solve exercises	
their application.			and problems	
			after the	
			explanation, and	
			applying what was	
			seen.	
			AFTER:	
			-Solve homework	
			exercises related	
			to the learning	
			unit.	



	-Problem solving -Synthesis and analysis. -Behavioral	2.1. Energy, work and heat	4 h	Professor -Leads a discussion on the	Students BEFORE: -Read the chapter about the Zero and	Gilbert W. Castellan Fisicoquímica 2nd Edition Addison Wesley
UNIT 2 First law of thermodynamics	abilities -Value consolidation - Teamwork. -Computer skills - Information managing -Discerning and decision-making -Ability to be critical towards others and towards themselves -Communicate their ideas	2.2 First law of thermodynamics	4 h	 -Lectures -Assigns problem and exercises solution about the unit. -Leads a discussion on the greenhouse effect and its relationship to the first law of thermodynamics. 	First Laws of thermodynamics. -Gather tables of heat capacity to be used in class. -Gather tables of formulas for integration and derivation. Hadison Wester Samuel H. Mark Fundamentos of fisicoquímica Limusa -Gather tables of formulas for integration and derivation. Hadison Wester Fundamentos of fisicoquímica Samuel H. Mark Fundamentos of fisicoquímica Samuel H. Mark fisicoquímica	Samuel H. Maron
		2.3 Reversible and irreversible processes	4 h			Fundamentos de fisicoquímica Limusa Raymond Chang
		2.4 Enthalpy and heat capacity	2 h			Fisicoquímica 3rd Edition Mc Graw Hill
		2.5 q, w, DU, DH calculations in physical processes.	4 h		-Discuss the importance of energy identifying each type.	Ira N. Levine <i>Fisicoquímica</i> Volume I 5th Edition Mc Graw Hill
	through chemical language - Analyze situations using basic concepts of physical	2.6 Thermochemistry	2 h	-Leads a discussion on thermochemistry. -Assesses the unit.	-Identify why some depend on a trajectory and why others do not.	



	chemistry		-Solve exercises	
	- Judge based on		and problems after	
	experience and		the explanation of	
	knowledge.		the topic.	
	-		-	
	-Solve problems		-Gather tables of	
i	in different		updated	
	contexts.		thermodynamic	
			properties.	
	-Do research on			
	scientific and		-Investigate the	
1	technological		greenhouse effect	
li	innovations to		and its relationship	
	develop and solve		to the first law of	
	problems.		thermodynamics.	
			-Read about	
	- Offer solutions		thermochemistry.	
1	to problems.			
			-Discuss the	
			concepts of	
			exothermic and	
			endothermic	
			reactions.	
			(Thermochemistry).	
			AFTER:	



					-Solve homework exercises related to the learning unit.	
	Droblom colving	2.1 Spontanoous		Drofossor	Studenter	
	- Problem solving	3.1. Spontaneous		Professor		Cilbert W. Castallan
	-Synthesis and	and non-	2 h	-Leaus a	DEFURE: Bood the chapter	Gilbert W. Castellan
	allalysis.	spontaneous			-Redu the chapter	and Edition
		processes	<u>C</u> h	thermedynamics	about the second	Addison Masley
	Value	3.2 Carnot Cycle	011	thermouynamics.	thermodynamics	Addisoff wesley
	consolidation	3.3 Second law of	4 h	loctures	thermouynamics.	
		thermodynamics				Samuel H. Maron
	- Teaniwork.			- Assigns	-Discuss the second	Santuerni. Maron. Eundamentos de
UNIT 3	-Computer skins			- Assigns	-Discuss the second	fisicoquímica
Second law of	- Information			problems and	thormodynamics	Limuca
thermodynamics	-Oral and written			about the unit	thermouynamics.	LIITUSa
	production				-Analyze why it has	Raymond Chang
	-Discorning and	2 1 Entropy		-Assassas the unit	different	Fisicoquímica
	decision-making	changes in physical	2 h	-Assesses the unit	statements	3rd Edition
	-Ability to be				statements.	Mc Graw Hill
	critical towards	processes.			-Discuss the	
	others and				difference between	Ira N. Levine
	towards				ideal processes and	Fisicoquímica Volume I
	themselves				real processes and	5th Edition
	-Communicate				rear processes.	Mc Graw Hill
	their ideas					



through chemical	-Solve exercises	
language	and problems after	
- Judge based on	the explanation of	
experience and	the topic.	
knowledge.		
-Solve problems	AFTER:	
in different	-Solve homework	
contexts.	exercises related to	
-Do research on	the learning unit.	
scientific and		
technological		
innovations to		
develop and solve		
problems.		
-Utilizes		
information and		
communication		
technologies to		
process and		
interpret		
information.		
- Relate concepts		
of physical		
chemistry and		
their application.		



	-Problem solving	4.1. Entropy and	2 h	Professor	Students	Gilbert W. Castellan
	-Synthesis and	molecular disorder	211	-Leads a	BEFORE:	Fisicoquímica
	analysis.	4.2 Absolute		discussion about	-Read the third	2nd Edition
	-Behavioral	entropy	2 h	absolute entropy.	chapter about the	Addison Wesley
	abilities	calculation			third law of	
	-Value			-Lectures	thermodynamics.	
	consolidation				-Make an	Samuel H. Maron.
	- Teamwork.			 Assigns problem 	integration of	Fundamentos de
	-Computer skills			and exercises	concepts of the	fisicoquímica
	- Information			solution about the	zero, first and	Limusa
	managing			unit.	second law of	
UNIT 4	-Oral and written		2 h		thermodynamics.	Raymond Chang
thermodynamics	production			-Assesses the unit	DURING:	Fisicoquímica
	-Discerning and				-Discuss the	3rd Edition
	decision-making				importance of	Mc Graw Hill
	-Ability to be	4.3 Entropy			having entropy as a	
	critical towards	chemical reactions			property with	Ira N. Levine
	others and				absolute value in a	<i>Fisicoquímica</i> Volume I
	towards				specific	5th Edition
	themselves				temperature.	Mc Graw Hill
	-Communicate					
	their ideas				-Solve exercises	
	through chemical				and problems after	
	language				the explanation	
	- Analyze				and applying what	
	situations using				was seen.	
	basic concepts of					



	physical chemistry - Judge based on experience and knowledge. -Solve problems in different contexts. -Do research on scientific and technological innovations to develop and solve problems. -Relates chemical concepts to their application.				AFTER: -Solve homework exercises related to the learning unit.	
	-Problem solving -Synthesis and analysis. Pohavioral	5.1 Gibbs free energy 5.2 Helmholtz free	4 h 2 h	Professor -Lectures - Assigns problem	Students BEFORE: -Read the chapter	Gilbert W. Castellan Fisicoquímica 2nd Edition
UNIT V Gibbs Functions of free energy	-Senavioral abilities -Value consolidation - Teamwork.	5.3 Free energy changes in physical and chemical processes.	4 h	solution about the unit. - Assesses the unit	remember, and understand the concepts of physical	Samuel H. Maron.



			0			
	-Computer skills				equilibrium seen in	Fundamentos de
	- Information				General Chemistry.	fisicoquímica
1	managing				DURING:	Limusa
	-Oral and written				-Investigate about	
	production				the applications of	Raymond Chang
	-Discerning and				Gibss and	Fisicoquímica
	decision-making				Helmholtz'	3rd Edition
	-Ability to be				energies. in teams.	Mc Graw Hill
	critical towards					
	others and				-Discuss the	Ira N. Levine
1	towards				applications of	<i>Fisicoquímica</i> Volume I
1	themselves				Gibss and	5th Edition
	-Communicate		4 h		Helmholtz'	Mc Graw Hill
1	their ideas	5.4 Spontaneity of			energies in class.	
1	through chemical	a reaction.				
	language				-Solve exercises	
	- Analyze				and problems after	
:	situations using				the explanation	
	basic concepts of				and applying what	
	physical				was seen.	
	chemistry					
	- Judge based on				AFTER:	
	experience and				- Solve homework	
	knowledge.				exercises related to	
	-Solve problems				the learning unit.	
i	in different				-Discuss the impact	
	contexts.				of Gibbs and	



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technological innovations to develop and solve problems. -Relates chemical concepts to their application.	careers. - Analyze the problem of global warming in teams and its repercussions of the new equilibria in our environment. - Offer solutions in the short, middle and long run				
	and long run.				
- Partial Exam - Departmental exam - Practice reports					

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