

**INTERAMERICAN UNIVERSITY OF PUERTO RICO
METROPOLITAN CAMPUS
SCIENCE AND TECHNOLOGY FACULTY
NATURAL SCIENCES DEPARTMENT**

SYLLABUS

I. GENERAL INFORMATION

Course title	:	General Chemistry II
Code and number	:	CHEM 2212
Crédits	:	4 credits
Academic term	:	
Professor	:	
Office hours	:	
Office telephone	:	
Email	:	

II. DESCRIPTION

The study of the fundamental principles of chemistry and its applications, with an emphasis on the quantitative study of structural and energetic properties associated with matter and its transformations. It includes themes related to solid and liquid states, solutions, thermodynamics, chemical kinetics, equilibrium, and electrochemistry, among others. It requires 45 hours of lecture and 45 hours of lab. Requirements: MATH 1500 or MATH 1511 and CHEM 1111.

III. OBJECTIVES

1. Apply the concepts of molecular geometry, polarity of molecules and intermolecular forces to explain the macroscopic properties of matter.
2. Differentiate physically, as well as thermodynamically, between the solid, the liquid and the gas state of matter.
3. Demonstrate skills in the preparation, dilution and concentration determination of solutions.
4. Apply the fundamental laws of thermodynamics to chemical systems.
5. Apply concepts of reaction kinetics to determine the reaction order, the factors affecting the speed of the reaction and the mechanism.
6. Apply the basic principles of chemical equilibria to predict the direction of a reaction, its spontaneity and conditions that affect the equilibrium.
7. Differentiate, theoretically and experimentally, between acids and bases.
8. Determine and calculate the degree of acidity and alkalinity of different solutions (pH).
9. Differentiate between galvanic and electrolytic cells, both experimentally and thermodynamically.

Terminal Objectives

1. Describe intermolecular forces in order to explain the macroscopic properties of the states of matter and its transformations. Visualize the geometrical structures of common ions and compounds.

- Describe and apply the concepts of thermodynamics and chemical variables such as free energy, heat and reaction entropy to evaluate spontaneity of reactions and their relationship to the binding energies.
- Describe, analyze and apply the principles and variables that govern chemical kinetics (speed, order, activation energy, catalysis and transition state) to chemical reactions and describe their mechanisms.
- Describe and apply the concepts of chemical equilibrium and its mathematical expression. Evaluate the equilibrium constant and apply it in determining the concentration of species present. Establish the relationship between chemical equilibrium and chemical thermodynamics.
- Know and categorize acidic and basic solutions, their relative strength and neutralization reactions. Evaluate the acid-base equilibria and buffer calculations.
- Apply the concepts discussed in class experimentally in a research-based environment.

GRADUATE PROFILE COMPETENCES ADDRESSED IN THIS COURSE

- Know the procedures and regulations for handling, use and disposal of chemicals.
- Analyze qualitative and quantitative chemistry problems using suitable instrumentation and technology.

IV. THEMATIC CONTENTS

Themes-Chapter	Chapter (6th Ed.)
1. Covalent bonds and molecular structure	Ch. 7 (7.1-7.12)
2. Liquids, solids and solutions	Ch. 10 (10.1-10.6, 10.8-10.10 10.11). Ch.11 (11.1-11.8)
PARTIAL TEST #1	
3. Thermochemistry	Ch. 8
4. Chemical Kinetics	Ch. 12 (12.1-12.5, 12.7-12.12, 12.14-12.15)
PARTIAL TEST #2	
5. Chemical Equilibria	Ch. 13
6. Acid-Base Equilibria	Ch. 14 (14.1-14.10, 14.12-14.15) Ch. 15 (15.1-15.8)
PARTIAL TEST #3	
7. Electrochemistry	Ch. 17 (17.1-17.5)
FINAL EXAM: THEMES 1-6 (90%); 7 (10%)	

V. ACTIVITIES

A. Laboratory Practices

- Entrega de equipo, reglas de seguridad y MSDS*
- ¿Cómo son las moléculas?*
- ¿Por qué el alcohol es soluble en agua y el aceite no?*
- ¿Cómo podemos describir una solución?*
- ¿Cuánto tiempo me toma?*
- ¿Cómo podemos describir un equilibrio?*
- ¿Se puede alterar un equilibrio?*

8. *¿Cuán agrio es el vinagre?*
9. *¿Cómo funciona un amortiguador?*
10. *¿Cuán activos son los metales?*
11. *Examen Práctico y Entrega de Equipo*

B. Teaching Strategies

We recommend using strategies such as:

1. teamwork
2. cooperative learning
3. demonstrations
4. software application in data collection and group discussion
5. movies
6. simulations
7. conceptual maps

VI. EVALUATION

1. The evaluation of the course consists of:
 - A. A theoretical part, which consists of three partial tests (100 pts. each) and a final exam (125 pts.; themes 1-6 → 90%, theme 7 → 10%). These tests correspond to 70% of the final grade.
 - B. An experimental part, which corresponds to 30% of the final grade.

Evaluation Criteria	Points	%
Partial test # 1 or Substitute grade	100	17.5
Partial test # 2 or Substitute grade	100	17.5
Partial test # 3 or Substitute grade	100	17.5
FINAL Exam	125	17.5
Laboratory	100	30

2. None of the exams will be eliminated, but the student can opt to substitute the lowest grade in the partial tests with a Substitute grade (100 accumulated points). These 100 accumulated points consist of 80 points on quizzes through Blackboard, 10 points on homeworks and 10 on attendance. The lowest Quizz grade will be eliminated and the rest will be normalizad with the following formula, $((Q1 + Q2 \dots \dots + Q8)/80) * 80$.
3. No replacement tests will be offered. Students that are absent from a partial test, due to excused medical reasons, will use their substitute grade and/or the final test will be counted double.
4. A defficient grade (54.4 % or less in class or lab) means that the student will not pass the course.
5. The following evaluation scale will be applied to the final grade:

100-85 A
 84-75 B
 74- 65 C
 64-55 D
 54-0 F

VII. EDUCATIONAL RESOURCES

o McMurray, J. E.; Fay, R. C.; Robinson, J. K. *Chemistry*; 7th Edition, Pearson Education, Inc.:USA, 2015. ISBN-13: 978-0-321-94317-0

o *Manual de Laboratorio de Química General I*; Rosario, B., Ed.; Universidad Interamericana de Puerto Rico, Recinto Metropolitano: San Juan, PR, 2016.

VIII. SUPPLEMENTARY INFO

1. *Materia y Energía. El Estado Gaseoso*, Dra. Irma Y. Zea, Publicaciones Yorkshire 2009.
2. *Reacciones Químicas. Balance de Ecuaciones*, Dra. Irma Y. Zea, Publicaciones Yorkshire 2009.
3. *Propiedades Atómicas y la Tabla Periódica*, Dra. Irma Y. Zea, Publicaciones Yorkshire 2009.
4. *Essential Chemistry: A Core Text for General Chemistry*, Raymond Chang; Segunda Edición, McGraw Hill, ISBN 0-07-290500-X.

ELECTRONIC REFERENCES:

5. CambridgeSoft-Life Science Enterprise Solutions, <http://www.camsoftcorp.com>, 25/07/2015.
6. Chemistry Software and other Software Resources!, <http://www.cachesoftware.com>, 25/07/2015.
7. Falcon Software, <http://www.falconsoftware.com>, 25/07/2015.
8. Some Internet Chemistry Sites Compiled by Gary Wiggins Indiana University Chemistry Library (wiggins@indiana.edu), <http://www.indiana.edu/~cheminfo/slaind98.html>, 25/07/2015.
9. Journal of Chemical Education, <http://jchemed.chem.wisc.edu/>, 25/07/2015.
10. Chemtutor Atomic Structure, <http://www.chemtutor.com>, 25/07/2015.
11. Chemistry Tutorials & Drills, <http://www.chemistry-drills.com>, 25/07/2015.
12. The Measure of Matter all about units, measurements, and error, <http://www.chem1.com/acad/webtext/matmeasure/>, 25/07/2015.
13. VSEPR Rules, <http://www.chem.purdue.edu/gchelp/vsepr/rules2.html>, 25/07/2015.
14. UNCCChem Glossary, <http://www.shodor.org/unchem/glossary.html>, 25/07/2015.

IX. Special Notes

- A. **Subsidiary services or special needs:** Any student who requires auxiliary services or special assistance must request them at the beginning of the course, or as soon as they acquire knowledge of their needs, through the corresponding record in the Guidance Office with Mr. José Rodríguez.
- B. **Honesty, fraud and plagiarism:** Dishonesty, fraud, plagiarism any other inappropriate behavior in relation to academic work constitute major infractions sanctioned by General Student Manual. Major infractions, as specified in General Student Manual, may result in

suspension from the University for a definite period exceeding one year or permanent expulsion from the University, among other sanctions.

- C. **Use of Electronic Devices:** Cell phones and other electronic devices, that could interrupt the teaching and learning or alter the environment conducive to academic excellence, shall be disabled. The use of electronic devices that allow access, store or send data during tests or examinations is prohibited.

D. Cumplimiento con las disposiciones del Título IX

The Federal Higher Education Act, as amended, prohibits discrimination based on sex in any academic, educational, extracurricular, or athletic activity or any other program or employment, sponsored or controlled by an institution of higher education regardless of whether it takes place inside or outside the institution's premises, as long as the institution receives federal funds.

As provided by current federal regulations, a Title IX Assistant Coordinator has been designated in our academic unit to provide assistance and guidance regarding any alleged incidents of discrimination based on sex or gender, sexual harassment or sexual assault. You can contact the Assistant Coordinator __Sr. George Rivera__, at extension _2262 or 2147, or by email griverar@metro.inter.edu.

The Normative Document entitled Standards and Procedures for Responding to Alleged Violations of Title IX Provisions is the document that contains the institutional rules for channeling any lawsuit that is filed based on this type of claim. This document is available on the website of the Inter-American University of Puerto Rico (www.inter.edu).

Revised on: november 2016