SUBJECT GUIDE Academic year 2019-2020

Physics and Physical Chemistry applied to the Pharmacy

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Physics and Mathematics	Physiscs and Physical Chemistry applied to the Pharmacy	1st	1st	6	Compulsory

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Luis Crovetto González (A and C grups) **María Eugenia García Rubiño (E and F grups)** **Juan Antonio González Vera (B and D grups)** **Delia Miguel Álvarez (B and D grups)**	**TUTORING HOURS** http://fisicoquimica.ugr.es/pages/docencia/curso_1920/_doc/horariotutorias1920
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT	
Pharmacy Degree	
PREREQUISITES and/or RECOMMENDATIONS (if necessary)	
Basic knowledges in Mathematics, General Chemistry, General Physiscs and Biology are strongly	

recommended

BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)

The subject lays foundations in the key areas of chemical thermodynamics, material and chemical equilibria and study of solutions with application in Pharmacy courses.

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

•To gain knowledge about chemical and physical phenomena and their applications in biological and biochemical processes and in pharmaceutical technology.
•To demonstrate detailed understanding of thermodynamics, in order to get a better understanding to their applications in Chemistry, Biology and Pharmaceutics.
•To gain knowledge on the criteria and the variations of thermodynamic properties in the phase and chemical equilibria

•To know the theoretical models for ideal solutions and to how to use them to the study of properties of real solutions (electrolyte and non-electrolyte solutions) as well as reactions carried out in solution.

DETAILED SUBJECT SYLLABUS

Theoretical syllabus:

Lesson 1.- Basic concepts in Physics.
Magnitudes and units. States of matter. Molecular weight. Mole. Molar mass. Density. Definitions for the system composition. Energy. Kinetic and potential energy. Velocity. Linear momentum. Newton's laws. Rotational motion: angular velocity, angular momentum. Harmonic oscillator. Waves. Electrostatics. Coulombic interactions. Electric field. Electric current and potency.

Lesson 2.- Introduction to Thermodynamics.
Thermodynamic systems. Thermodynamic state. Thermodynamic equilibrium. Equation of state. Ideal gas. Real gas. Deviations from ideal-gas. Intermolecular interactions. Isotherms for a real gas. Work and heat. The first law of thermodynamics. Internal energy. Enthalpy. Heat capacities. Spontaneous processes. The second law of thermodynamics. Entropy.

Lesson 3.- Material equilibrium.
Entropy and equilibrium. Criteria for the equilibrium and spontaneity in system at T constant: Gibbs and Helmholtz functions. Chemical potential. General condition for material equilibrium in closed systems. Phase equilibrium. Chemical equilibrium.

Lesson 4.- Thermochemistry.
Standard enthalpies of formation and reaction. Determination of heats of reaction. Calorimeters. Temperatura dependence of reaction heats. Standard Gibbs energy of formation and reaction.

Lesson 5.- One-Component Phase Equilibrium.
The phase rule. One-component phase equilibrium. The Clapeyron equation. Solid–liquid Equilibrium. Clausius-Clapeyron equation. Liquid–vapor and solid–vapor Equilibrium

Lesson 6.- Reaction equilibrium.
Ideal gas reaction equilibrium. Partial pressure, concentration and mole-fraction equilibrium constants. Temperature dependence of the equilibrium constant

Lesson 7.- Ideal solutions.
Solutions. Composition. Ideal solution. Raoult's law. Thermodynamic of ideal solutions. Ideal-dilute solution. Henry's law Deviations from Raoult's and Henry's laws. Reaction equilibrium in ideal and ideal-dilute solutions. Solubility of gases in liquids.

Lesson 8.- Nonideal solutions. Non-electrolyte solutions.
Thermodynamics of nonideal solutions. Activity and activity coeffcients. Relationship between activity coefficients and vapor pressure. Reaction equilibrium in nonideal solutions. Heterogeneous equiliria. Partition coefficients for a solute in a two-partially miscible phases.

Lesson 9.- Nonideal solutions. Electrolyte solutions.
Electrolyte solutions. Thermodynamic of electrolyte solutions. The Debye–Hückel theory of electrolyte solutions. Reaction equilibrium in electrolyte solutions. Water ionization equilibrium. Weak acids and bases ionization equilibria. Degree of dissociation. Definition of pH. Solubility product. Hydrolisis. Buffers. Buffer capacity.

Lesson 10.- Colligative properties.
Colligative properties. Vapor pressure lowering. Boiling point elevation. Freezing point depression. Osmotic Pressure. Osmosis. Colligative properties in electrolyte solutions. Biological applications of the colligative properties: Osmosis, tonicity and osmolarity.

Practical Sessions in the laboratory:

Session 1. Measurement of the heat of combustión using an adiabatic bomb calorimeter.

Session 2. Potentiometric titration of phosphoric acid.

Session 3. Determination of molecular mass by measuring the lowering of the freezing point (Crioscopy)

Session 4. Determination of the equivalence point for a weak acid by conductivity measurements

READING

- FÍSICA Y FISICOQUÍMICA APLICADAS A LA FARMACIA, J.M. Alvarez Pez, L. Crovetto González, A. Orte Gutiérrez, M.J. Ruedas Rama y E.M. Talavera Rodríguez. Editorial Técnica Avicam, 2017
- FÍSICA CLÁSICA Y MODERNA, W.E. Gettys, McGraw-Hill, 1999.
- FISICOQUÍMICA para las ciencias químicas y biológicas. Raymond Chang. McGraw-Hill. 2008.
- FISICOQUÍMICA PARA FARMACIA Y BIOLOGÍA. P. Sanz Pedrero. Masson-Salvat. 1992.
- FISICOQUÍMICA quinta edición. I. N. Levine. McGraw-Hill. 2003.
- QUÍMICA FÍSICA. Atkins de Paula. Panamericana. 2008.