SUBJECT GUIDE

Physical Chemistry

Academic year: 2019-2020
(Last update: 10/05/2019)

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
CHEMISTRY	PHYSICAL CHEMISTRY	2th	2th	6	Compulsory

LECTURERS	Postal address, telephone nº, e-mail address
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	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)

- It is advisable have completed the subjects: Basic Principles of Chemistry, Physics and Physical Chemistry applied to the Pharmacy and Biometrics.
- Have adequate knowledge about Basic Mathematics, General Chemistry and General Physics are strongly recommended.

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

Surface and adsorption phenomena. Properties and characterization of colloidal and macromolecular dispersion. Physical, chemical and molecular kinetics. Electrochemistry.

GENERAL AND PARTICULAR ABILITIES

A. General competences

- CG1

- CG10
- CG15

B. Specific competences

- CE01
- CE03
- CE04
- CE05
- CE06
- CE07
- CE13
- CE15

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

- Understand the theoretical bases of surface phenomena and their practical applications in pharmaceutical technology.
- Know the properties and behavior of the dispersed systems (macromolecules in solution and colloids of association).
- Understand the kinetics of physical (transport and transmembrane phenomena) and chemical processes (order, velocity, molecular kinetics, catalysis and biocatalysis).
- Use electrochemistry knowledge to understand chemical reactions in equilibrium and their applications in biological processes.

DETAILED SUBJECT SYLLABUS

THEORETICAL SYLLABUS

Lesson 1.-Phase equilibria in multi-component systems.
Equilibrium liquid-vapor in ideal solutions: diagrams pressure-composition and temperature-composition. Fractional distillation. Liquid-vapor equilibrium in real solutions. Azeotropic solutions. Liquid-liquid equilibrium. Solid-liquid equilibrium. Eutectic mixtures. Solubility.

Lesson 2.- Surface phenomena.
Surface and interfacial tension. Thermodynamics of surfaces. Gibbs' adsorption isotherm. Substances with superficial activity. Monolayers, micelles, reverse micelles, microemulsions, bylayers lipid membranes, and vesicles.

Lesson 3.- Adsorption on solids.
Gas adsorption on solids. Physisorption and chemisorption. Adsorption isotherms: Freundlich, Langmuir and BET.

Lesson 4.- Colloids and macromolecules.
Classification. Colloidal systems. Colloids thermodynamically unstable. Emulsions. HLB scale. Foams and aerosols. Colloids thermodynamically stable. Colloids of association. Macromolecular solutions. Synthetic polymers. Biopolymers. Averages molecular mass. Molecular interactions. Interaction with water.

Lesson 5.- Properties of colloidal and macromolecular systems.
Osmotic properties: Osmotic pressure. Dialysis and filtration. Donnan effect. Electrical properties: electrical double layer. Electrokinetic phenomena. Chemical equilibrium in macromolecular systems.

Lesson 6.- Transport phenomena.
General characteristics. Concept of flow. Classification of transport phenomena. Thermal conductivity. Viscosity. Newtonian fluids. Rheology. Translational friction coefficient. Non-Newtonian fluids. Intrinsic viscosity. Diffusion. Fick's laws. Transport under centrifugal forces. Sedimentation. Svedberg's equation. Sedimentation equilibrium. Electrical conductivity and molar conductivity. Kolhraush's law.

Lesson 7.- Chemical kinetics (I).
Reaction rates. Equation rate. Kinetics rate constant. Order and molecularity. Analysis of experimental kinetic data. Integration method. Differential method. Formal kinetic of the simplest reactions.

Lesson 8.- Chemical kinetics (II).
Complex reactions. Rate equations and reaction mechanisms. Limiting step and the steady-state approach. Kinetic models: mono-compartmental and bi-compartmental. Application of the kinetic basis to the process of absorption, delivery and elimination of drugs.

Lesson 9.- Molecular kinetics.
Influence of temperature on the reaction rate: Arrhenius' equation. The collisions theory. The transition state theory: potential energy surfaces.

Lesson 10.- Catalysis.
General mechanism of catalysis. Homogeneous catalysis. Acid-base catalysis. Heterogeneous catalysis. Biocatalysis. Kinetics of enzymatic reactions. Michaelis-Menten's equation. Inhibition of enzymatic catalysis.

Lesson 11.- Electrochemistry.
Electrochemical systems. Thermodynamics of electrochemical processes. Galvanic cells. Daniell's cell. Nernst's equation. Types of electrodes. Normal electrode potentials. Classification of galvanic cells. Applications of the f.e.m. measurements.

LABORATORY SESSIONS AND SEMINARS:

Seminars
• Problems solving

Laboratory sessions
• Session 1: Spectrophotometric determination of the rate of a chemical reaction.
• Session 2: Obtaining the characteristic parameters of the Freundlich isotherm.
• Session 3: Study of temperature effect on the viscosity of a liquid determined by the Hoppler method.
•Session 4: Determination of the critical micelle concentration of an ionic surfactant by measurements of electrical conductivity.

READING

BASIC READING

- J.M. Alvarez Pez, L. Crovetto González, A. Orte Gutiérrez, J.M. Paredes Martínez, M.J. Ruedas Rama y E.M. Talavera Rodríguez (2017) Fisicoquímica. Editorial Técnica Avicam.
- J.M. Alvarez Pez, L. Crovetto González, A. Orte Gutiérrez, M.J. Ruedas Rama y E.M. Talavera Rodríguez (2017) Física y Fisicoquímica Aplicadas a la Farmacia. 2ª ed. Editorial Técnica Avicam.
- R. Chang (2008) Fisicoquímica. 3ª ed. Mc Graw Hill.

- T. Engel, P. Reid (2006) Química Física. Pearson Educación S.A.
- P. Atkins, J. de Paula (2008) Química Física. Ed. Med. Panamericana.
- I.N. Levine, (2014) Principios de Fisicoquímica. 6ª ed. Mc Graw Hill Education.
- P. Sanz, (1992) Fisicoquímica para Farmacia y Biología. Masson-Salvat, Barcelona.
- J. Bertrán Rusca y J. Núñez Delgado, coords. (2002) Química Física, Vol:I y II, Ariel Ciencia, Barcelona.
- D.W. Wall (2004) Fisicoquímica. 3ª ed. International Thomson.

COMPLEMENTARY READING

- K.C. van Holde, W.C. Johnson y P.S. Ho (2006) Principles of Physical Biochemistry, 2ªed.
- I.Tinoco, Jr.K. Sauer, K.C.Wang y J.D.Puglisi (2002) Physical Chemistry. Principles and Applications in Biological Sciences. 4ª.ed. Pearson.
- K.J. Laidler (1978) Physical Chemistry with Biological Applications. The Benjamin/Cumming Publishing.

ASSESSMENT. (ASSESSMENT CRITERIA, CONTRIBUTION OF THE DIFFERENT ACTIVITIES ON THE FINAL MARK, ETC.)

Two different types of assessments will be considered:

A) Continous assessment. The final mark for those students included in this assessment, will comprises three parts:
1. Written exam about the contents of the subject programme. It will consists of answering questions (types: tests, applications, theoretical...) and solving numerical problems. To pass this exam it will be mandatory to demonstrate a homogeneous knowledge of the subject. The contribution of this part to the final mark will be 80%, distributed in 50-55% the theoretical part and 25-30 % in the problem solving.
2. To obtain a positive evaluation is necessary to assist to all practice sessions and present a lab-report with the description and resolution of the experiments realized, and to pass the practical exam carried out by a written and/or oral exercise. Complete practice sessions and pass the exam will be prerequisites for approve the subject. The contribution of practical work to the final mark will be 10%.
3. Other activities: oral presentation, lectures attendance, general attitude during the course and participation in class and/or laboratory, will be evaluated and will contribute with 10% to the final mark.

B) One examination. The students who fulfil the requirements specified by the University of Granada and presented in time the corresponding solicitude (two weeks after their registration), shall have the right to make this class of examination. It consists of a just one exam. Exam will consists of answering all questions necessaries (types: tests, applications, theoretical….), lab sessions and solving numerical problems. To pass this exam it will be mandatory to demonstrate a homogeneous and unambiguous knowledge of the subject.

FURTHER INFORMATION

- The teaching will be made exclusively in Spanish
- The attendance to practical sessions in laboratory is obligatory.
- The attendance to the lectures is highly recommended.