COURSE GUIDE FOR

FÍSICA Y FISICOQUÍMICA APLICADAS A LA FARMACIA

Academic year 20-21

(Date last update: 30/06/2020)

(Date approved in Department Council: 30/06/2020)

MODULE	SUBJECT MATTER	YEAR	SEMESTER	CREDITS	TYPE
Physics and Mathematics	Physiscs and Physical Chemistry applied to the Pharmacy	1st	1st	6	Compulsory

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	TIMETABLE FOR TUTORIALS OR LINK TO WEBSITE
	http://fisicoquimica.ugr.es/pages/docencia/curso_2021/_doc/horariotutorias2021
BELONGS TO UNDERGRADUATE DEGREE PROGRAMME	AND ALSO TO OTHER UNDERGRADUATE DEGREE PROGRAMMES
Degree in Pharmacy	

PREREQUISITES OR RECOMMENDATIONS (where applicable)

- Basic knowledges in Mathematics, General Chemistry, General Physiscs and Biology are strongly recommended

BRIEF DESCRIPTION OF CONTENT (ACCORDING TO OFFICIAL VALIDATION REPORT)

[1] Consult any updates in Acceso Identificado > Aplicaciones > Ordenación Docente

(∞) This course guide should be filled in according to UGR regulations on assessment of student learning: (http://secretariageneral.ugr.es/pages/normativa/fichasugr/ncg7121/!)

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

GENERAL AND SPECIFIC COMPETENCES

OBJECTIVES (EXPRESSED AS EXPECTED LEARNING OUTCOMES)

- 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 SYLLABUS

THEORY:

Theoretical syllabus:

Topic 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.

Topic 2. Thermodynamic systems. Gases
Thermodynamic systems. Thermodynamic state. Thermodynamic equilibrium. Equation of state. Ideal gas. Real gas. Deviations from ideal-gas. Intermolecular interactions. Isotherms for a real gas.

Topic 3. Introduction to Thermodynamics.
Work and heat. The first law of thermodynamics. Internal energy. Enthalpy. Heat capacities. Spontaneous processes. The second law of thermodynamics. Entropy.

Topic 4.- 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.

Topic 5.- 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.

Topic 6. 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

Topic 7. Reaction equilibrium.
Ideal gas reaction equilibrium. Partial pressure, concentration and mole-fraction equilibrium constants. Temperature dependence of the equilibrium constant

Topic 8.- 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.

Topic 9.- 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.

Topic 10.- 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.

Topic 11.- 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.

PRACTICE:
Seminars/Workshops
At the end of each lesson, there will be a seminar with practical problems.

Laboratory work

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

BIBLIOGRAPHY

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-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

RECOMMENDED LINKS

The Journal of Chemical Education

TEACHING METHODOLOGY

- Master classes for theroy teaching
- Practical seminars regarding application problems of each lesson
- Practical lessons in the laboratory
- Quiz and test from online platforms for continuous evaluation

ASSESSMENT (ASSESSMENT INSTRUMENTS, CRITERIA AND PERCENTAGE VALUEOF FINAL OVERALL MARK, ETC.)

All the evaluation processes will be carried out according to the normative of the University of Granada.

1. Ordinary call

- Written exams about theoretical concepts. Percentage of the final mark: 50-55%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.

- Written exams about mathematic resolution of application problems. Percentage of the final mark: 25-30%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.

- Practical lessons. Percentage of the final mark: 10%.
  It is compulsory to attend to all practical lessons. The global mark is divided in two tasks:
  - Laboratory book 30%
  - Exam about practical contents : 70%

- Continuous evaluation and attending to theoretical classes. 10%.

2. Extraordinary call and single final evaluation

- Written exams about theoretical concepts. Percentage of the final mark: 55-60%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.

- Written exams about mathematic resolution of application problems. Percentage of the final mark: 30-35%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.
- Practical lessons. Percentage of the final mark: 10%.

DESCRIPTION OF THE EXERCISES WHICH WILL CONSTITUTE SINGLE FINAL ASSESSMENT AS ESTABLISHED IN UGR REGULATIONS

• This description is reported in the assessment section	
SCENARIO A (ON-CAMPUS AND REMOTE TEACHING AND LEARNING COMBINED)	
TUTORIALS	
TIMETABLE (According to Official Academic Organization Plan)	TOOLS FOR TUTORIALS (Indicate which digital tools will be used for tutorials)
https://fisicoquimica.ugr.es/pages/docencia/curso_2021/_doc/horariotutorias2021	There will be both on-site and virtual tutorials. Proposed telematic media are: Forums in virtual platform (PRADO) . e-mail
MEASURES TAKEN TO ADAPT TEACHING METHODOLOGY	
• **Theory lessons**: Teaching methodology will be the same proposed in the previous section about "teaching methodology". In this case, the master classes will be broadcasted in real time to those students that can not attend if the number of people in the classes is limited by the health situation. • **Practical lessons**: Due to the limited capacity of the facilities of the faculty there will be two days of practical lessons in the lab and two days of virtual lessons, concerning to the theoretical aspects of the two on-site tasks. • **Continuous evaluation** .In these cases methodology will be the same proposed in the previous section about "teaching methodology" and there will be preferentially developed on-site. In case there will be capacity limitation virtual media will be used (Google Meet, PRADO Kahoot, etc).	
MEDIDAS DE ADAPTACIÓN DE LA EVALUACIÓN (Instrumentos, criterios y porcentajes sobre la calificación final)	
Ordinary assessment session	
• Adaptative measures have only been proposed for the practical lessons. The written examns of this section will be in virtual through the PRADO platform. The percentages are those described in the assesment section	
Extraordinary assessment session	
• Adaptative measures have only been proposed for the practical lessons. The written examns of this section will be in virtual through the PRADO platform. The percentages are those described in the assesment section. For those students that have attended to the practical lessons and have not passed the exam there will be a virutal written exam in the PRADO platform. Those students that have not atended to the practical lessons will have to pass a practical exam in the laboratory. The evaluation will be carried out by the teachers in charge of the practical lessons.	
Single final assessment	
• There is no adaptative measures in this type of assessment	

SCENARIO B (ONCAMPUS ACTIVITY SUSPENDED)	
TUTORIALS	
TIMETABLE (According to Official Academic Organization Plan)	TOOLS FOR TUTORIALS (Indicate which digital tools will be used for tutorials)
https://fisicoquimica.ugr.es/pages/docencia/curso_2021/_doc/horariotutorias2021	There will exclusively virtual tutorials. Proposed telematic media are: Forums in virtual platform (PRADO) -Google meet -email communication
MEASURES TAKEN TO ADAPT TEACHING METHODOLOGY	

• Theory:
  • Synchrony classes through Google-Meet
  • Recorded videos of the theoretical lessons.
• Practial lessons:
  • All the practical lessons will be virtual and attending is compulsory by Google-Meet videoconference.
• Seminars:
  • The seminars related with the application problems will be taught by Google Meet. Students will provide the solutions by PRADO or email.
  •
• Continuous assessment:
  • Quiz, test and games through PRADO, SWAD and Kahoot.	

MEASURES TAKEN TO ADAPT ASSESSMENT (Instruments, criteria and percentage of final overall mark)	
Ordinary assessment session	
• Written exams about theoretical concepts. . Percentage of the final mark: 42-58%. Individual exams by PRADO platform. • Written exams about theoretical concepts. . Percentage of the final mark: 22 - 38%. Individual exams by PRADO platform • Practical lessons assessment. Percentage of the final mark: 10%, divided in two tasks: Laboratory book 30% Exam about practical contents : 70% • Continuous assessment. Percentage of the final mark: 10-20%.	
Extraordinary assessment session	
• Written exams about theoretical concepts. . Percentage of the final mark: 55-60%. • Individual exams by PRADO platform.	

- Written exams about theoretical concepts. . Percentage of the final mark: 30 - 35%.
  Individual exams by PRADO platform

- Practical lessons assessment. Percentage of the final mark: 10%,

Single final assessment

- Written exams about theoretical concepts. . Percentage of the final mark: 55-60%.
  Individual exams by PRADO platform.

- Written exams about theoretical concepts. . Percentage of the final mark: 30 - 35%.
  Individual exams by PRADO platform

- Practical lessons assessment. Percentage of the final mark: 10%,
  For those students that have attended to the practical lessons and have not passed the exam there will be a virutal written exam in the PRADO platform.

  Those students that have not atended to the practical lessons will have to pass a practical exam in the laboratory. The evaluation will be carried out by the teachers in charge of the practical lessons

ADDITIONAL INFORMATION (if necessary)

The move to scenario A to scenario B will be impossed by the health authorities determination due to the evolution of the pandemic caused by COVID-19.