

MODULE	SUBJECT MATTER	YEAR	SEMESTER	CREDITS	TYPE
CHEMISTRY	PHYSICAL CHEMISTRY	2th	2th	6	Compulsory
<b>LECTURERS (1)</b>			<b>POSTAL ADDRESS, TELEPHONE NO, E-MAIL ADDRESS</b>		
<ul style="list-style-type: none"> <li>• José M<sup>a</sup> Álvarez Pez</li> <li>• Juan Antonio González Vera</li> <li>• Alberto Hernández Gaínza</li> <li>• Ángel Orte Gutiérrez</li> <li>• Bartolomé Quintero Osso</li> <li>• Eva M<sup>a</sup> Talavera Rodríguez</li> </ul>			Departamento de Físicoquímica. Facultad de Farmacia, zona B. 2 <sup>a</sup> planta, despachos n <sup>o</sup> : 194, 195, 196, 199 y 202, y 3 <sup>a</sup> planta despacho n <sup>o</sup> : 309. Correo electrónico: <a href="mailto:jalvarez@ugr.es">jalvarez@ugr.es</a> , <a href="mailto:gonzalezvera@ugr.es">gonzalezvera@ugr.es</a> , <a href="mailto:ahgainza@ugr.es">ahgainza@ugr.es</a> , <a href="mailto:angelort@ugr.es">angelort@ugr.es</a> , <a href="mailto:bqosso@ugr.es">bqosso@ugr.es</a> , <a href="mailto:etalaver@ugr.es">etalaver@ugr.es</a> .		
			<b>TIMETABLE FOR TUTORIALS OR LINK TO WEBSITE</b>		
			<a href="http://fisisoquimica.ugr.es/pages/docencia/curso_2021_doc/horariotutorias2021">http://fisisoquimica.ugr.es/pages/docencia/curso_2021_doc/horariotutorias2021</a>		
<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>					
Degree in Pharmacy					
<b>PREREQUISITES OR RECOMMENDATIONS (if necessary)</b>					
<ul style="list-style-type: none"> <li>• It is advisable have completed the subjects: Basic Principles of Chemistry, Physics and Physical Chemistry applied to the Pharmacy and Biometrics.</li> <li>• Have adequate knowledge about Basic Mathematics, General Chemistry and General Physics are strongly recommended.</li> </ul>					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)</b>					
Surface and adsorption phenomena. Properties and characterization of colloidal and macromolecular dispersion. Physical, chemical and molecular kinetics. Electrochemistry.					

<sup>1</sup> 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/ngc7121/!](http://secretariageneral.ugr.es/pages/normativa/fichasugr/ngc7121/))

## 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, bilayers 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.  
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- **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. Kohlraush'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.

#### BIBLIOGRAPHY

##### BASIC BIBLIOGRAPHY:

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

- 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 INSTRUMENTS, CRITERIA AND PERCENTAGE VALUE OF 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)

[https://fisicoquimica.ugr.es/pages/docencia/curso\\_2021/doc/horariotutorias2021](https://fisicoquimica.ugr.es/pages/docencia/curso_2021/doc/horariotutorias2021)

##### TOOLS FOR TUTORIALS

(Indicate which digital tools will be used for tutorials)

There will be both on-site and virtual tutorials. Proposed telematic media are:

Forums in virtual platform (PRADO and SWAD). 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).

#### MEASURES TAKEN TO ADAPT ASSESSMENT (Instruments, criteria and percentage of final overall mark)

##### Ordinary assessment session

- Adaptative measures have only been proposed for the practical lessons. The written exams 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 exams 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)

[https://fisicoquimica.ugr.es/pages/docencia/curso\\_2021/doc/horariotutorias2021](https://fisicoquimica.ugr.es/pages/docencia/curso_2021/doc/horariotutorias2021)

##### TOOLS FOR TUTORIALS

(Indicate which digital tools will be used for tutorials)

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.
- Practical 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 virtual written exam in the PRADO platform.

Those students that have not attended 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 imposed by the health authorities determination due to the evolution of the pandemic caused by COVID-19.

