COURSE DATA

DATA SUBJECT

Code: 34063
Name: Physical Chemistry
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Facultat de Farmàcia i Ciències de L'alimentació	1	Second quarter
1201 - Degree in Pharmacy	Facultat de Farmàcia i Ciències de L'alimentació	1	Second quarter
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Facultat de Farmàcia i Ciències de L'alimentació	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	Physical chemistry	COMPULSORY
1201 - Degree in Pharmacy	Physical chemistry	COMPULSORY
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	COMPULSORY

COORDINATION

FRANCES MONERRIS ANTONIO

SUMMARY

Physicochemistry is a compulsory subject located in the first year, second semester, of the Degree in Pharmacy and it is endowed with 6 ECTS credits.

The pharmacist is the professional expert in the medical drug and with this course the student is expected to deepen and become familiar with the physicochemical processes that accompany the different stages of the life of a medical drug, from its discovery, synthesis and/or extraction, isolation, chemical stability and kinetics, to its formulation, dosage and distribution in the organism.

Taking as a starting point the Principles of Thermodynamics studied in the Physics course during the first term, Physicochemistry will deal with the study of energy exchange, criteria of spontaneity and equilibrium of chemical processes, phase equilibria in systems of one or more components, partitioning and extraction phenomena, the colligative properties of dilute solutions, the speed and mechanisms of chemical reactions,

surface phenomena, the transport of matter through diffusion and the optical, kinetic, osmotic and electrical properties of macromolecular systems.

It has a part of Theory and Problems that is taught in the classroom with the whole group and another part of Laboratory Practices that will be carried out in the laboratory in subgroups of 16 students.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is very convenient that the students had study Mathematics II and Physics in 2nd Bachillerato. The course of Physics (34108), studied in the 1st semester, is basic and essential for the development and the adequate learning of this discipline.

COMPETENCES / LEARNING OUTCOMES

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Act with autonomy in learning, making informed decisions in different contexts, issuing judgements based on experimentation and analysis, and transferring knowledge to new situations.

Apply the knowledge acquired to solve physicochemical problems and elaborate and defend arguments.

Collaborate effectively in work teams, assuming responsibilities and leadership roles and contributing to collective improvement and development.

Contribute to the design, development and implementation of solutions that respond to social demands, taking into account the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical thinking in the field of the degree programme, considering aspects such as professional ethics, moral values and the social implications of the different activities carried out.

Develop laboratory experiences and know how to evaluate scientific data related to medicines and healthcare products.

Know and apply the physical and chemical laws and principles to determine the properties of pharmaceutical systems.

Know and understand, within the field of the degree programme, gender inequalities in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem solving.

Know how to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

Know the fundamentals of adsorption processes.

Know the fundamentals of diffusion processes in dissolution, drug release from polymeric matrices, release from capsules, etc.

Know the physicochemical properties of active principles and excipients, as well as possible interactions between them.

Know the principles of chemical kinetics and their application in the study of drug stability and pharmacokinetics.

Know the properties of real solutions.

Module: Chemistry. Know and understand the characteristics of reactions in solution, the different states of matter and the principles of thermodynamics and their application to pharmaceutical sciences.

Module: Chemistry. Know the physicochemical characteristics of the substances used for the manufacture of medicines.

Propose creative and innovative solutions to complex situations or problems within the field of knowledge, to respond to diverse professional and social needs.

Understand the basic behaviour of macromolecules based on their physicochemical properties.

DESCRIPTION OF CONTENTS

0. INTRODUCTION

Physical Chemistry concept. Analysis of the Teaching Guide of the Subject

1. THERMOCHEMISTRY

Heat of reaction. Thermochemistry laws. Reference states. Formation, reaction and combustion entalphies. Calorimeter bomb. Variation of the heat of reaction with temperature: Kirchoff equation. Entropy changes in chemical reactions. Heat of solutions.

2. SPONTANEITY AND EQUILIBRIUM CONDITIONS

Spontaneity of the processes. Concept of thermodynamics potential. Hemholtz and Gibbs energies: their variation in different processes. Chemical potential. Differential forms of the thermodynamics potentials. Spontaneity and equilibrium criteria for thermodynamic processes.

3. PHASE TRANSITIONS: PURE SUBSTANCE

The phase rule. Chemical potential-temperature diagram. Clapeyron equation: Phase diagram. Clasiuss-Clapeyron equation: applications. Vapour pressure: influence of external pressure. Polymorphic transitions. Troutons rule.

4. PHASE TRANSITIONS: BINARY SYSTEMS. L-V EQUILIBRIUMS

Immiscible liquids systems. Fractional by vapour current: application to molecular mass calculation. Miscible liquids systems. Raoult and Henry laws. Gases solubility in liquids. Fractional distillation and azeotrope mixtures. Non-ideal solutions.

5. PHASE TRANSITIONS: BINARY SYSTEMS. S-L AND L-L EQUILIBRIUMS

Solids-liquids solubility. Cooling curves. Phase diagrams

6. COLLIGATIVE PROPERTIES

Depression of vapour pressure. Elevation of boiling point. Depression of freezing point. Osmotic pressure. Anomalous colligative properties. Application for the preparation of injectables.

7. DISTRIBUTION AND EXTRACTION EFFECTS

Distribution of a solute between immiscible solvents. Simple and multiple distribution. Association and dissociation influence. Pharmaceutical applications. Ferguson principle and Overton Meyer rule

8. THE RATES OF CHEMICAL REACTIONS

The rates of reactions. Rate equations. Reaction order and molecularity.- Integrated rate laws. Reactions of order 0, 1, 2 and 3. Half-lives and time constants. Reaction order determination. Influence of temperature. Arrhenius equation. Molecular kinetics.

9. REACCIONES COMPLEJAS

Simultaneous, equilibrium and consecutive reactions. Consecutive reactions with one equilibrium step. The steady-state approximation.

10. CATALYSIS AND PHOTOCHEMISTRY

General mechanism. Classification. Homogeneous catalysis: specific and general acid-base catalysis. Heterogeneous catalysis. Enzyme catalysis: general mechanism. Michaelis-Menten mechanism. Enzyme inhibition. Photochemistry: laws. Quantum yield. Photochemistry sequences.

11. SURFACE EFFECTS. ADSORPTION

Generalities. Adsorption types. Experimental study. Physisorption: BET isotherm. Chemisorption: Langmuir and Freundlich isotherm. L-L adsorption: Gibbs adsorption equation.

12. MATTER TRANSFER: DIFFUSION

Thermodynamic approach to diffusion: Fick's laws. Determination of the diffusion coefficient: Stokes-Einstein equation, moving boundary method and porous disk method. Applications: Diffusion and molecular and kinetic parameters, dialysis and ultracentrifugation, isoosmotic and isotonic solutions.

13. COLLOIDS AND MACROMOLECULES

Classification and general properties. Preparation and purification. Stability. Molecular weight distribution. Optical, kinetics, osmotic and electric properties.

14. LABORATORY

Thermochemistry.
Solubility diagram.
Heat of solution.
Colligative properties.
Kinetic study.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00
Theory	37,00
Laboratory	20,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	27,00
Preparation of lessons	35,00
Preparation for assessment activities	18,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

Learning processes. The development of the subject will be organized , mainly, throughout three activity types: theoretical and practical classes, laboratory practical classes and presence tutorials.

Theoretical and practical classes. The students must acquire the basic knowledge enclosed in the subject contents through their individual study and the assistance to the theoretical classes. In these classes, to which the student must assist among 2-3 week hours, the professor will provide a global vision of the theme, stress in those critical concepts for the understanding of them, answer to eventual doubts and questions and give special importance to the problem solutions.

For the individual study and the preparation of the chapter with some depth, it will provide to the students with a basic and complementary bibliography, web sites and supporting informatics material, and as well instructions and advices for the management of the information sources. In addition, the student will have in the "virtual aula" of the whole complementary information that it would be considered adequate for the best comprehension of each chapter, and as well with he material show in the supporting presentations used in each class.

Laboratory classes. In first place, the student must complete a preliminary work previous to the assistance to the lab consisting in the comprehension of the guide of each lab practice, the review of the theoretical concepts implying the preparation of a scheme of the work procedure. In the lab, the professor will do a summary exposition of the most important aspects of the experimental work and will help to the student during the session.The selection and consumption optimization of reagents for the generation of least waste have been deeply considered in the preparation of the Lab Sessions, in order to raise awareness of the students in the proper use of them as a part of sustainable development. Once finished the experimental work, the student will examine the observed facts and carry out the needed calculations, using the calculation pages prepared for that in the lab computers. Likewise, it will be mandatory the presentation of the practical notebook, individually prepared, that it will be evaluated by the professor, together with a exam about questions related to the development of the lab practices.

Tutorials. The students will come to them in groups of 16 students (3 sessions of 1 hour). In those tutorials the doubts that could appear during the theoretical classes will be solved and the students will be directed about the methods of work more useful to improve their performance of learning, proposing, in this case, new activities improving the previous knowledge.

EVALUATION

The evaluation of the students' learning will take into account all the formative aspects that are addressed in this subject and will be carried out in a continuous way by the teacher.

The evaluation will be divided into 15% of continuous evaluation, 25% of laboratory practices and 60% of the exam. The grade, therefore, will be calculated as follows:

FINAL GRADE = Theory exam grade x 0.60 + Global laboratory grade x 0.25 + Continuous evaluation grade x 0.15.

To pass the course it is necessary to obtain:
- A minimum grade of 5 points out of 10 in the theory exam.
- A minimum grade of 4 points out of 10 in the laboratory exam.
- A minimum grade of 5 points out of 10 in the global laboratory grade.
- A minimum grade of 5 points out of 10 in the final grade of the course obtained in the calculation of the above equation.

Continuous evaluation: 15% of the grade will come from this section and may consist of questionnaires, problem workshops, tutorials, deliveries, attendance, etc.

Theory exam: It will correspond to 60% of the grade. At the end of the semester there will be a written theory exam consisting of conceptual or reasoning questions and numerical problems that will allow the student to demonstrate the degree of assimilation of the fundamental concepts. Occasionally, topics to be developed may be included to demonstrate the capacity of synthesis and exposition.

Laboratory: It will correspond to 25% of the grade, of which 60% will evaluate the work and participation of the student in the laboratory and the delivery of results and the remaining 40% will evaluate the examination on matters relating to the development of lab practices carried out. Laboratory attendance is MANDATORY ATTENDANCE and, therefore, NOT RECOVERABLE, in accordance with the provisions of Article 6.5 of the UV Evaluation and Grading Regulations for Undergraduate and Master's Degrees. In the event that, for justified reasons, it is not possible to attend any of these activities, it must be communicated with sufficient notice. In this way, the person in charge of the subject will be able to assign the student a session in another group. In this regard, the realization of any practice in a laboratory group other than the one initially assigned must always be done with prior notice to the professors involved. It will be allowed to miss only one practice as long as the absence is justified by a force majeure cause and has not been able to be recovered in another group. The professor will have the final authority to decide if the absence is justified by force majeure. An excused absence to a practice implies that it will not be evaluated. Students who repeat the course and who have passed the laboratory practices of previous courses (grade equal to or higher than 5 points out of 10 in the overall laboratory grade), will keep the laboratory grade for three academic years counted from the course in which this block is approved. Failure to appear or to achieve the minimum compensable grade in the laboratory practical exam in either of the two calls will entail the repetition of the entire block of practices in subsequent academic years.

Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents. In the event of fraudulent practices, the "Action Protocol for fraudulent practices at the University of Valencia" will be applied (ACGUV 123/2020): https://www.uv.es/sgeneral/Protocols/C83sp.pdf

REFERENCES

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- P. Atkins y J. de Paula. Química Física. 8ª Edición. Ed. Médica panamericana (2008).

- R.H. Petrucci, F. G. Herring, J. D. Madura y C. Bissonnette. Química General. Principios y Aplicaciones Modernas. 11ª Edición. Pearson (2017).

- T. Engel y P. Reid. Química Física. Editorial Pearson (2006).

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