



## Information about the subject

**Degree:** Bachelor of Science Degree in Biotechnology

**Faculty:** Faculty of Veterinary Medicine and Experimental Sciences

**Code:** 1100209 **Name:** Thermodynamics and Kinetics

**Credits:** 6,00 **ECTS Year:** 2 **Semester:** 2

**Module:** Chemistry for Biomolecular Sciences

**Subject Matter:** Chemistry Physics **Type:** Compulsory

**Department:** Basic and Cross-disciplinary Sciences

**Type of learning:** Classroom-based learning

**Languages in which it is taught:** Spanish

### Lecturer/-s:

1102

Angela Moreno Galvez (**Responsible Lecturer**)

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## Module organization

### Chemistry for Biomolecular Sciences

Subject Matter	ECTS	Subject	ECTS	Year/semester
Chemistry	12,00	General Chemistry	6,00	1/1
		Organic Chemistry	6,00	1/2
Chemistry Physics	6,00	Thermodynamics and Kinetics	6,00	2/2

## Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

- R1 The student has understood and assimilated the contents of the subject.
- R2 The student is able to solve problems or case studies related to the subject contents, by using different resources (bibliographic, IT, etc.).
- R3 The student is able to work in a laboratory, carrying out basic operations correctly and taking into account the corresponding safety standards. He/she understands the planning, development and purpose of the experience, and is able to contrast and validate the obtained results.
- R4 The student is able to write an intelligible and organized text on different aspects of the subject.
- R5 The student is able to present and defend his/her work adequately.
- R6 The student seeks bibliographic information from different sources and can analyze it with a critical and constructive spirit.
- R7 The student collaborates with the teacher and his/her peers throughout the learning process; he/she works in a team; treats everyone with respects, is proactive and fulfills the organization rules of the course.



## Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

BASIC		Weighting			
		1	2	3	4
CB1	Students acquire and understand knowledge in their field of study based on general secondary education but usually reaching a level that, although supported on advanced text books, also includes aspects involving state-of-the-art knowledge specific to their area.		X		
CB2	Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study.			X	
CB3	Students are able to collect and interpret relevant data (generally in their field of study) and give opinions that involve reflection on relevant social, scientific or ethical issues.			X	
CB4	Students can communicate information, ideas, problems and solutions to a specialized or non-specialized audience.		X		
CB5	Students develop the necessary learning skills to undertake further studies with a high level of autonomy.			X	

GENERAL		Weighting			
		1	2	3	4
CG01	Capacity to analyze and synthesize.				X

SPECIFIC		Weighting			
		1	2	3	4
CE22	Knowing and understanding contents, principles and theories related to biotechnology.				X



CE23	Knowing how to use laboratory equipment and to carry out basic operations for each discipline including: safety measures, handling, waste disposal and activity register.								X
CE24	Knowing basic and instrument laboratory techniques in the different areas of biotechnology.								X
CE25	Knowing how to analyze and understand scientific data related to biotechnology.								X
CE29	Contrasting and checking results of biotechnological experimentation.								X
CE30	Solving and analyzing problems posed by biotechnology.								X
CE31	Describing and calculating important variables of processes and experiments.								X

## TRANSVERSAL

### Weighting

		1	2	3	4
CT02	Capacity to organize and plan.			X	
CT03	Mastering Spanish oral and written communication.			X	
CT05	Knowing and applying Basic ITC skills related to Biotechnology.			X	
CT06	Capacity to manage information (capacity to look for and analyze information coming from different types of sources).			X	
CT07	Problem solving.			X	
CT08	Decision making		X		
CT09	Capacity to work in interdisciplinary and multidisciplinary team.			X	
CT10	Interpersonal skills.		X		
CT11	Understanding multicultural and diverse environment	X			
CT12	Critical and self-critical capacity.				X
CT13	Ethics.		X		



CT14	Capacity to learn				X
CT15	Capacity to adapt to new situations			X	
CT16	Capacity to produce new ideas (creativity)				X
CT17	Leadership abilities	X			
CT18	Taking initiatives and enterprising spirit		X		
CT19	Capacity to apply theoretical knowledge			X	
CT20	Research skills				X
CT21	Sensitivity to environmental issues		X		



## Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R4, R5	60,00%	Written test
R4, R5, R6, R7	20,00%	Submission of papers
R3, R5	20,00%	Laboratory test

### Observations

According to the general evaluation and qualification regulations, the preferred evaluation system will be by means of continuous evaluation and will be implemented in the following items:

- Delivery of laboratory reports.
- Questionnaires

This subject cannot be assessed by means of a single assessment.

The complete written test consists of a written test of theoretical content and a written test of practical content (problem solving). It is necessary to obtain a minimum of 4.5 out of 10 in each of them to average. You also need to score a minimum of 4.5 out of 10 on the Lab Test to average.

Attendance to the practicals is compulsory.

The use of tools based on artificial intelligence (AI) is subject to the teacher's criteria, who may establish specific limits or conditions depending on the training or assessment activity.



## MENTION OF DISTINCTION:

In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with 9 Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

## Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

- M1 Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.
- M2 Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.
- M3 Activities carried out in spaces with specialized equipment.
- M4 Supervised monographic sessions with shared participation..
- M5 Application of multidisciplinary knowledge.
- M6 Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.
- M7 Set of oral and/or written tests used in initial, formative or additive assessment of the student
- M8 Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning.



M9 Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform.

## IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
ON-CAMPUS CLASS M1	R1, R2, R7	37,00	1,48
PRACTICAL CLASSES M2	R1, R4, R5, R6, R7	5,00	0,20
LABORATORY M3	R3	8,00	0,32
SEMINAR M4	R2, R7	3,00	0,12
GROUP PRESENTATION OF ASSIGNMENTS M5	R4, R5, R6, R7	3,00	0,12
TUTORIAL M6	R5, R7	2,00	0,08
ASSESSMENT M7	R1, R2, R3, R4, R5, R6, R7	2,00	0,08
<b>TOTAL</b>		<b>60,00</b>	<b>2,40</b>

## LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
AUTONOMOUS GROUP WORK M8	R3, R4, R5, R6, R7	18,00	0,72
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, R3, R4, R5, R6	72,00	2,88
<b>TOTAL</b>		<b>90,00</b>	<b>3,60</b>





## Description of the contents

Description of the necessary contents to acquire the learning outcomes.

### Theoretical contents:

Content block	Contents
Thermochemistry	Basic thermodynamic concepts and Zero Principle: Temperature First and Second Principles: Enthalpy, Entropy, and Free Energy Thermodynamics and Equilibrium: Laws of chemical combinations. Chemical Species: Stoichiometry and Chemical Equilibrium Phase transitions Colligative properties
Chemical kinetics	Kinetics of chemical reactions. Chemical catalysis. Introduction to biocatalysis. Transportation phenomena.
Laboratory	Determination of the differential heat of dissolution of a solute. Discoloration reaction kinetics in phenolphthalein in basic medium. Catalysis. Kinetic study of the hydrolysis of an ester. Cryoscopy. Determination of the molecular mass of a solute.



## Organization of the practical activities:

	Content	Place	Hours
PR1.	Determination of the differential heat of dissolution of a solute.	Laboratory	2,00
PR2.	Discoloration reaction kinetics in phenolphthalein in basic medium.	Laboratory	2,00
PR3.	Catalysis.	Laboratory	2,00
PR4.	Kinetic study of the hydrolysis of an ester. Cryoscopy. Determination of the molecular mass of a solute.	Laboratory	2,00
PR5.	Review of calculations and procedures, collaborative work	Lecture room	5,00

## Temporary organization of learning:

Block of content	Number of sessions	Hours
Thermochemistry	18,00	36,00
Chemical kinetics	8,00	16,00
Laboratory	4,00	8,00



## References

Fisico-Química. Atkins P. W. Ed. Addison-Wesley Iberoamericana, 1986  
Química Física. Díaz-Peña M., Roig Muntaner. Ed. Alambra, 1983  
Manual de Termodinámica. Gandía V. Ed. Universitat de Valencia, 1995  
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Química. R. Chang. Ed. Mc Graw-Hill, 1997.  
Química principios y reacciones. W. I.Masterton y C.N. Hurley. Ed. Thomson. Paraninfo, 2003.  
Fundamentos de fisicoquímica. S.H.Marón y C.F. Prutton. Ed. Limusa, 1998.  
Química curso universitario. B.M. Mahan y R.J. Myers.Ed. Addison-Wesley Iberoamericana,1990.  
Química general. J.B. Umland y J.M. Bellana, Ed.Thomson, 1999.