



**Universidad de Jaén**  
School of Engineering of Linares

# Physical chemistry

2023-2024

**Grado en Ingeniería Química Industrial**  
**Doble Grado en Ingeniería de Recursos Energéticos e Ingeniería Química Industrial**

CREA



Guías docentes UJA

Horarios de tutorías

Llamamientos PEVAU

# Syllabus 2023-24 - 14412022 - Physical Chemistry (Química física)

## Caption

- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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**DEGREE:** Grado en Ingeniería química industrial (14412022)  
**FACULTY:** SCHOOL OF ENGINEERING OF LINARES  
**DEGREE:** Doble grado en Ingeniería de recursos energéticos e Ing. química industrial (15112032)  
**FACULTY:** SCHOOL OF ENGINEERING OF LINARES  
**ACADEMIC YEAR:** 2023-24  
**COURSE:** Physical Chemistry

## SYLLABUS

### 1. COURSE BASIC INFORMATION

**NAME:** Physical Chemistry  
**CODE:** 14412022 (\*) **ACADEMIC YEAR:** 2023-24  
**LANGUAGE:** English **LEVEL:** 2  
**ECTS CREDITS:** 6.0 **YEAR:** 3 **SEMESTER:** PC

### 2. LECTURER BASIC INFORMATION

**NAME:** BERMEJO ROMÁN, RUPERTO  
**DEPARTMENT:** U127 - QUÍMICA FÍSICA Y ANALÍTICA  
**FIELD OF STUDY:** 755 - QUÍMICA FÍSICA  
**OFFICE NO.:** D - 037 **E-MAIL:** rbermejo@ujaen.es **P:** 953648625  
**WEBSITE:** <http://goo.gl/NSdSB0>  
**ORCID:** <https://orcid.org/0000-0002-8960-3232>  
**LANGUAGE:** English **LEVEL:** 2

### 3. CONTENT DESCRIPTION

#### THEORY AND PROBLEMS.

Matter in equilibrium: thermodynamics. General aspects in thermodynamics: the first and second laws. The concept of entropy. The perfect gas and the real gas. Thermochemistry and its applications. Energy and enthalpy changes in chemical reactions. Thermodynamics properties of liquids.

Phase equilibria in systems. Solutions of non-electrolytes. Liquid-vapor equilibrium. Liquid-solid equilibrium. The colligative properties of solution: boiling-point elevation, freezing-point depression and osmotic pressure. The chemical potential. Cells, chemical reactions and activity coefficients. The nature of the equilibrium state. Chemical equilibrium.

Physical and chemical kinetics. General concepts of kinetics. First and second-order reactions. Activated-complex theory. Theory of reactions kinetics in solution. Chemistry of surfaces. Adsorption processes.

Introduction to macromolecules science: synthetic and natural compounds. An approximation to matter structure: the use of spectroscopy. Rotational, vibrational and electronic spectroscopy. Approximation to fluorescence spectroscopy. Jablonski diagram.

Transport phenomena: diffusion and viscosity.

#### LABORATORY PRACTICES:

- 1.-Molar Partial magnitudes determination. Application to ethanol-water system.
- 2.-Cooling curves obtention. Simple eutectic study in a binary system.
- 3.-Methyl acetate kinetic study. Kinetic parameters determination.
- 4.-Surface tension determination. Application to binary systems.
- 5.-Solid-liquid adsorption study. Active carbon-oxalic acid isotherm determination.

6.-Critic micelar concentration determination using conductivity measurements.

7.-Fluorescence spectroscopy. Physico-chemical parameters determination and Kavanag law determinations using fluorescein.

#### 4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

During the development of the subject, the teacher will answer to the questions proposed in the English language during the corresponding schedule of students tutorials.

In addition the teacher will provide the bibliographic references and other materials in relation with the course (articles, images, ...) in English language.

Teacher will allow students the use of English language for questions and deliver jobs and other materials. Also there will be periodic seminars (at least two per month) in English language to complement the development of classes.

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

#### 5. ASSESSMENT METHODOLOGY

-Written exam about the theoretical contents develop and some problems similars to those resolved during the course.

-Oral exam about the laboratory experiments. It is necessary in order to know the level of the practice contents asimilated during the course by the students.

#### 6. BOOKLIST [\(Access the bibliography in the Library catalog\)](#)

##### MAIN BOOKLIST:

- Physical chemistry. Edition: 2nd ed. Author: Berry, R. Stephen. Publisher: Oxford [etc.]: Oxford University Press, 2000 ([Library](#))
- Atkin's physical chemistry P.W. Atkins... [et al.]. Edition: 8th ed. Author: -. Publisher: Oxford : Oxford University Press, 2006 ([Library](#))
- Physical and chemical kinetics. Edition: 2nd ed. Author: Berry, R. Stephen. Publisher: Oxford [etc.]: Oxford University Press, 2002 ([Library](#))

##### ADDITIONAL BOOKLIST:

- The world of physical chemistry. Edition: [1rst pub., repr.]. Author: Laidler, Keith J.. Publisher: Oxford [etc.]: Oxford University Press, 1995 ([Library](#))
- Physical chemistry : a very short introduction. Edition: -. Author: Atkins, Peter. Publisher: Oxford : Oxford University Press, 2014 ([Library](#))
- Physical chemistry for the life sciences. Edition: 2nd ed. Author: Atkins, Peter William. Publisher: Oxford : Oxford University Press, 2011 ([Library](#))

#### 7. VIRTUAL / CLASSROOM TEACHING SCENARIO

##### 1.-TEACHING METHODOLOGY AND TRAINING ACTIVITIES:

For the development of theory and problem classes, as well as laboratory practices, multimodal or mixed teaching will be used.

Attending the last years the courses have consisted of groups of students below the limited capacity in the classroom (classroom A-12, maximum capacity of 16 students) and Chemistry laboratory L-041 (maximum capacity of 16 students). These maximum permitted capacity data have been provided by the occupational risk prevention service of the University of Jaén.

If the number of students enrolled in the 2021-2022 academic year exceeds the permitted capacity, the guide would be modified in the corresponding sense to meet the corresponding adaptation criteria.

In this way, the following activities are proposed.

**Activity 1.1.-** 7 practical sessions in specialized laboratories. Format: 100% face-to-face. 7 practical sessions of two hours each are carried out in the corresponding laboratories.

**Activity 1.2.-** Theory sessions on the contents of the program. Format: 100% face-to-face. 32 sessions of participatory master classes will be held, lasting one hour each, held in the corresponding classroom.

**Activity 1.3.-** Problem solving sessions. Format: 100% face-to-face. They will consist of 14 face-to-face sessions of one hour each, to be developed in the corresponding classroom.

**Activity 1.4.- Tutorships.**

In format: face-to-face and online. Some tutorials will be done in person and others online (synchronous and asynchronous)

**2.-EVALUATION SYSTEM.****2.1.-Ordinary call.**

It will be carried out by means of continuous evaluation in face-to-face format and by means of a theory and problems exam using the following tests:

Delivery and correction of all the problems of the subject (15%), delivery-correction of the laboratory practice notebook (25%). Theory exam (30%) and problems (30%).

**2.2.-Extraordinary call.**

Written exam in face-to-face format. A part corresponding to theory questions on the corresponding program and laboratory practices (60%) and another part corresponding to problems (40%).

**3.-RESOURCES.**

The face-to-face classes on Theory and Problems will be developed using different materials such as documents in different formats (Word, powerpoint, pdf, videos, etc ...)

The laboratory classes will be developed directly in the laboratory and a laboratory practice notebook must be prepared and delivered for its corresponding evaluation.

Privacy clause:

Where appropriate, the teaching staff involved in the teaching of this subject reserves the right not to give consent for the capture, publication, retransmission or reproduction of their speech, image, voice and professorial explanations, in the exercise of their teaching duties, within the scope of the University of Jaén.

**8. VIRTUAL TEACHING SCENARIO****1.-TEACHING METHODOLOGIES AND TRAINING ACTIVITIES**

For the development of theory classes and problems, as well as laboratory practices, online teaching will be used.

**Activity 1.1.-** 7 practical sessions in specialized laboratories. Format: online. The 7 practical sessions are replaced by online training activities: viewing videos, performing the corresponding calculations, preparing the graphs and analyzing the results obtained. There will be 7 practical sessions of 2 hours each

**Activity 1.2.-** Theory sessions on the contents of the program. Format: online. There will be 32 sessions of participatory master classes, one hour each, conducted by videoconference.

**Activity 1.3.-** Problem solving sessions. Format: online. They will consist of 14 online sessions synchronously, lasting one hour each.

**Activity 1.4.- Tutorships.**

Format: online. All online tutoring sessions will be held (synchronous and asynchronous)

**2.-EVALUATION SYSTEM.****2.1.-Ordinary call.**

It will be carried out through continuous evaluation using the following tests: Delivery and correction of all the problems of the subject (30%), delivery-presentation of works (15%), delivery-presentation of seminars (15%), attendance to classes and individualized questions during the development of the same (10%) ) and delivery-correction of the laboratory practice notebook (30%).

**2.2.-Extraordinary call. Online exam.**

Online exam. Questions about the theory program (35%), the problems (35%) and laboratory practices (30%).

### 3.-RESOURCES.

Theory and Problems online classes will be developed using the google-meet platform and different documents in different formats such as: Word, powerpoint, pdf, videos, etc, will be used as support.

The laboratory classes will be developed through a virtual laboratory for which different resources have been prepared (new practice notebook adapted to online teaching, Word files, power point, pdf, videos, etc ...) for monitoring and preparing each of the experimental practices proposed in the subject.

Privacy clause:

Where appropriate, the teaching staff involved in the teaching of this subject reserves the right not to give consent for the capture, publication, retransmission or reproduction of their speech, image, voice and professorial explanations, in the exercise of their teaching duties, within the scope of the University of Jaén.

#### DATA PROTECTION CLAUSE (on line exams)

**Institution in charge of data processing:** Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

**Data Protection Delegate:** [dpo@ujaen.es](mailto:dpo@ujaen.es)

**Purpose:** In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

**Legitimacy:** compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

**Addressees:** service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

**Storage periods:** those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

**Rights:** you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection [www.ctpdandalucia.es](http://www.ctpdandalucia.es)

#### CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

**Person in charge:** Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; [www.ujaen.es](http://www.ujaen.es)

**Data protection delegate (DPO):** TELEFÓNICA, S.A.U. ; Email: [dpo@ujaen.es](mailto:dpo@ujaen.es)

**Procedure aim:** To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

**Period for record storage:** Images will be kept during legal term according to regulations in force

**Legitimacy:** Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

**Data recipients (transfers or assignments):** Any person allowed to get access to every teaching modality

**Rights:** You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council [www.ctpdandalucia.es](http://www.ctpdandalucia.es)

