UAB
Universitat Autònoma de Barcelona

# Physics

Code: 100908
ECTS Credits: 6

2024/2025

| Degree | Type | Year |
|---|---|---|
| 2500252 Biochemistry | FB | 1 |

## Contact

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## Teaching groups languages

You can view this information at the end of this document.

## Prerequisites

The student should be familiar with basic Physics knowledge, especially the topics related to forces or energies. These topics are covered in the secondary school courses If the student has never studied them it would be good to do the propedéutic course of Physics for Biosciences. it is also recommended at least to read a secondary grade textbook including them.

## Objectives and Contextualisation

Because of its fundamental nature, knowledge in physics is very often a necessary tool for the correct understanding of the phenomena described in other sciences. In the specific case of Biotechemistry, for example, to correctly understand the dynamics of chemical reactions within cells, it is completely indispensable to know the physics of diffusion, the field and electrical current or thermodynamics. Without this knowledge a misunderstanding of the biochemistry of the cell is possible.

On the other hand, Physics is required to understand some of the experimental methods that biochemists use daily. In our case, for example, radioactive or fluoescent marking of molecules, centrifugation or magnetic resonance are examples of methods that are clearly based on fundamental physical principles.

The objective of this subject will be the introductory study of all the necessary physical concepts for both, modeling and experimental design in Biochemistry.

Some of the topics will be the starting point of other courses such as Thermodynamics, Bioenergetics and other topics will be fundamental for the practices included in Integrated Laboratories.

## Competences

- Be able to self-evaluate.
- Interpret experimental results and identify consistent and inconsistent elements.
- Understand the language and proposals of other specialists.
- Use the basics of mathematics, physics and chemistry that are required to understand, develop and evaluate the chemical procedures of living matter.

## Learning Outcomes

1. Be able to self-evaluate.
2. Define the emission of electromagnetic radiation.
3. Describe the atomic and nuclear structure of matter.
4. Describe the physical properties of a macroscopic system.
5. Describe the properties of muscle fibres and body fluids in terms of physics.
6. Enumerate the basic principles of mechanics apply them to biological systems.
7. Estimate the biological damage produced by radiation.
8. Explain the different processes by which atomic nuclei emit radiation and the principal characteristics of the interaction between radiation and matter.
9. Identify the principles of thermodynamics.
10. Interpret experimental results and identify consistent and inconsistent elements.
11. Relate the basic mechanisms of electric currents and relate them to nerve impulses.
12. Understand the language and proposals of other specialists.

## Content

1 Basic ideas of kinematics and dynamics.

Position, speed and acceleration.
Intrinsic components of acceleration: types of movements.
Newton's laws: relationship between force and acceleration.

2 Transport of molecules in fluids.
Hydrostatics.
Hydrodynamics.
Viscosity: sedimentation.
Centrifugation; separation of macromolecules.
Diffusion, Fick's law and Brownian motion.

3 Thermodynamics and Statistical Physics.
Kinetic theory.
Calorimetry.
Entropy and Free Energy in Chemical Reactions.

4 Electricity.
Coulomb's law: force between charges, atoms and molecules. Electrostatic contribution to ATP energy.
Dipoles: polar molecules and hydrogen bonds.
Electrophoresis.
Membrane potential.
Ionic pumps: ATP-ase and oxidative phosphorylation.

5 Magnetism.
Magnetic forces: charge in a magnetic field and mass spectrometry.
Magnetic dipole.
Nuclear magnetic resonance: applications to chemistry, molecular structure and medical imaging.

6 Elasticity and Oscillations.
Elasticity. Experiments with macromolecules: DNA and protein stretching.
Harmonic, damped and forced oscillations: optical spectroscopy, energy absorption and resonance.
$H_2O$ oscillations and microwave heating. $CO_2$ oscillations and greenhouse effect.

7 Physical optics
Wave nature of light: electromagnetic waves.

Interference and diffraction.
Light diffraction in crystals and molecules: molecular structure.
Synchrotron radiation.

8 Some ideas of quantum physics
Einstein-Planck and de Broglie equations.
Quantification of energy levels: particle in a box.
Bohr atom: absorption and emission spectra. Fluorescence.
Some ideas of nuclear physics: Radioactivity.

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Problem solving classes | 12 | 0.48 | |
| Theory classes | 29 | 1.16 | |
| Type: Supervised | | | |
| Practices | 5 | 0.2 | |
| Type: Autonomous | | | |
| Homework | 35 | 1.4 | |
| Reading of educational material | 10 | 0.4 | |
| Resolution of computer assisted questionaries | 20 | 0.8 | |
| Watching educational videos | 5 | 0.2 | |

The subject will be given alternating different types of methodologies:

- Master classes where the general concepts of the different topics will be introduced

- Solving problems where the teachers will solve the exercises previously selected in previous days

- Resolution of autocorrection questionnaires through a computer using the Moodle platform

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

## Continous Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Computer assisted practices | 20% | 30 | 1.2 | 12, 10, 1 |
| Exams | 80% | 4 | 0.16 | 2, 5, 3, 4, 6, 7, 8, 9, 10, 11 |

ORDINARY ASSESSMENT:

The assessemnt consists of two partial tests and a set of online practices. The weight of each partial test will be around 40% each. These weights may vary a bit depending on the number of topics contained in each one. The rest of the note (20%) will come out of the marks obtained in the practices carried out during the course. The student must obtain a grade higher than 3.5 in the partial tests so that he can perform the average with the practices. In case this grade is not obtained, the final grade will not be approved even if the total average is greater than 5.

Recovery assessment:

At the end of the semester there will be a second exam for each of the partial tests. This will be for all those students who have not passed the ordinary tests or who want to improve their grades. If a student presents to one of these recovery tests, he will renounce the qualification obtained in the test of the ordinary part. The final grade will be calculated as in the ordinary evaluation with the recovery grades replacing the previous ones. To participate in the second exam, students must have been previously evaluated in a set of activities whose weight is at least 2/3 of the subject. The students will obtain a grade of "Not evaluated" when the evaluation activities carried out have a weight of less than 67% in the final grade.

SINGLE ASSESSMENT:

The single evaluation consists of a single synthesis test that includes the contents of the entire theory and problems program. The note obtained in this synthesis test is 100% of the final note of the subject.

The single assessment test will be performed at the same time as the date set in the calendar for the last continuous assessment (seecond partial test) and the same recovery system will be applied as for the continuous evaluation.

## Bibliography

Basic bibliography


- Jou, Mirabent, David, et al. *Física para ciencias de la vida (2a. ed.)*, McGraw-Hill España, 2009.

  *ProQuest Ebook Central*, https://ebookcentral.proquest.com/lib/uab/detail.action?docID=3194961.


Further reading.


- Sternheim, M. M. y Kane. Física (2a. ed.). Editorial Reverté, 2016. eLibro, https://elibro.net/es/lc/uab/titulos/100529.
- A., Tipler, Paul, Mosca, Gene, FÍSICA PER A LA CIÈNCIA I LA TECNOLOGIA VOLUM 1 (CATALÁN). 1. Madrid, España, Reverté, 2016. INGEBOOK. 2021-06-30 10:20:04.0
- A., Tipler, Paul, Mosca, Gene, FÍSICA PER A LA CIÈNCIA I LA TECNOLOGIA VOLUM 2 (CATALÁN). 1. Madrid, España, Reverté, 2016. INGEBOOK. 2021-06-30 10:24:01.0


## Software

- Virtual Campus.
- pdf reader.

## Language list

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (PAUL) Classroom practices | 311 | Catalan | first semester | afternoon |
| (PAUL) Classroom practices | 312 | Catalan | first semester | afternoon |
| (TE) Theory | 31 | Catalan | first semester | afternoon |