PCM - Physics and Chemistry of Matter -S7



PHYSIQUE

PHYSICS

Lecturers:Emmanuel DROUARD, Anne-Segolene CALLARD, Magali PHANER| Lecturers : 16.0 | TC : 22.0 | PW : 0.0 | Autonomy : 5.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The aim of this course is to provide the basic knowledges of quantum physics necessary to describe both the matter at microscopic scale and the main processes of radiation - matter interaction (emission, diffusion, absorption). These processes will be addressed both from classical and quantum point of view, and studied in particular in the frame of applications such as light sources and detectors, and lasers.

Keywords : Quantum mechanics, atomic and nuclear physics, photon - matter interactions, wave propagation in media

Programme	 Wave propagation, dispersion. Classical description of electromagnetic waves/material media interactions: optical properties of dielectrics and metals. Limits of classical physics. Wave - particle duality. Schrödinger equation and applications. Atomic and molecular physics. Physics of the nucleus. Semiclassical/quantum description of the photon matter interaction. Light sources and detectors. Principles of laser. Properties and applications of lasers.
Learning outcomes	 To be able to apply the Schrödinger equation to simple systems. To know how to rely macroscopic properties of matter to their microscopic origins. To know how to describe the different radiation - matter interactions. To be able to give the orders of magnitude of the energies implied in these interactions.
Independent study	Objectifs : Understanding and assimilating the course.
	Méhodes : Now how to remake and interpret tutorials. On line exercises & multiple choice training. Microtest and Questions/Answers session with teachers.
Core texts	 B. Cagnac, ATOMES ET RAYONNEMENT, INTERACTIONS ÉLECTROMAGNÉTIQUES, Dunod, 2005 B. Cagnac L'ATOME, UN ÉDIFICE QUANTIQUE., Dunod, 2007 B.E. Saleh, M.C. TeichFUNDAMENTAL OF PHOTONICS, Wiley, 2007
	Mark=100% knowledge. Mark of knowledge = 85 % final exam + 15%.

Assessment



CHIMIE

CHEMISTRY

Lecturers: Virginie MONNIER-VILLAUME, Naoufel HADDOUR | Lecturers : 8.0 | TC : 12 | PW : 0.0 | Autonomy : 5.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

This lecture aims to provide bases in chemistry and physico-chemistry of materials necessary to understand properties of materials at the microscopic scale (kinetics, reactivity, thermodynamics, weak bonds, electrochemistry). Applications such as new materials to produce energy (organic solar cells), power plants or vehicles working with renewable fuels, will be used to illustrate quantum chemistry and molecular interactions notions.

Keywords : Chemistry, materials, molecular orbitals, statistical thermodynamics, weak bonds, kinetics, electron transfer

Programme	 Quantum model of the chemical bond. Introduction to statistical thermodynamics. Chemical reactivity and elements of chemical kinetics. Electron transfer at interfaces. Weak bonds.
Learning outcomes	 Build and use a diagram of molecular orbitals for a molecular structure. Make the link between physico-chemical properties at the macroscopic and at the microscopic scale of the matter. Identify molecular interactions and binding energies involved in a molecule. Select adapted theoretical knowledge to be applied to concrete new problems in chemistry.
Independent study	Objectifs : Learn and digest basic notions before each lecture, to use them between lectures and tutorials. Understand the links between the different notions of the lecture. Remobilize lecture concepts in concrete new situations.
	Méhodes : Reading of the duplicated lecture notes and self-evaluation with the corrected exercises on Moodle platform.
Core texts	Michel GUYMONT, STRUCTURE DE LA MATIÈRE. ATOMES, LIAISONS CHIMIQUES ET CRISTALLOGRAPHIE, Belin, 2003 P. W. ATKINS, J. DE PAULA CHIMIE PHYSIQUE, De Boeck, 2013 J. P. PEREZ, A. M. ROMULUSTHERMODYNAMIQUE. FONDEMENTS ET APPLICATIONS., Masson, 2001
Assessment	Final mark = 100% Knowledge. Knowledge = 70% final exam + 30% continuous assessment.



TRAVAUX PRATIQUES CHIMIE-PHYSIQUE, PHOTONIQUE

LAB SESSIONS PCM

Lecturers: Christelle YEROMONAHOS, Anne LAMIRAND | Lecturers : 0.0 | TC : 0.0 | PW : 24.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

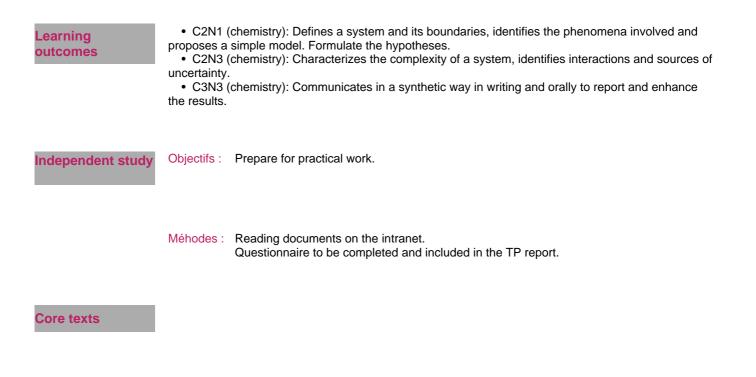
This training makes it possible to grasp through experience, and therefore in a more intuitive way, fundamental concepts tackled in the "UE PCM" and to see their applications, particularly in the industrial field. It also makes it possible to tackle important concepts for an engineer, related to measurement and in particular to the development of measurement protocols. It is given only in the form of practical works.

Keywords : Nanotechnology, Imaging, Laser, Spectroscopy, Chromatography, Chemical kinetics, Electrochemistry, Intermolecular bonds

Programme

- Students will follow 3 practical works (TP) in physics: Frequency analysis - Fourier optics. Infrared thermography / solar cell. Spectrophotometry.

- The students will follow 3 practical works (TP) in chemistry: Electrochemical study of galvanic corrosion of metals. Study of redox reactions by UV-Visible spectrophotometry - Chemical kinetics. Gas chromatography.



Assessment

Score = 20% knowledge + 80% know-how. Knowledge score = preliminary test. Know-how score = 37.5% report + 62.5% handling and participation.