

Course number	U-LAS13 10006 LE60				
Course title (and course title in English)	Basic Physical Chemistry (quantum theory)-E2 Basic Physical Chemistry (quantum theory)-E2		Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer, Nguyen Thanh Phuc	
Group	Natural Sciences		Field(Classification)	Chemistry(Foundations)	
Language of instruction	English		Old group	Group B	Number of credits 2
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)		Year/semesters 2026 • First semester
Days and periods	Wed.1	Target year	Mainly 1st & 2nd year students	Eligible students	For science students
[Overview and purpose of the course]					
<p>Physical chemistry is the discipline that studies the basic concepts and principles of the formation of molecules and substances, the nature and characteristics of chemical bonds and molecular structures, chemical equilibrium, and reaction rates.</p> <p>This course is designed as the introductory physical chemistry, specifically aims to learn and understand the principles of quantum mechanics and its applications to the formation of atoms and molecules, the basic constituents of substances. The knowledge learned from this course will be the foundation for learning all areas of chemistry, including advanced-level physical chemistry, organic chemistry, and inorganic chemistry.</p>					
[Course objectives]					
<ul style="list-style-type: none"> • To understand the principles of quantum mechanics • To understand the descriptions of atoms and molecules based on quantum mechanics • To be able to use quantum mechanics to solve for the electronic wavefunctions in atoms and molecules • To understand the description of chemical bonds based on the concept of molecular orbitals 					
[Course schedule and contents]					
<p>The following topics will be covered. The order of topics and subtopics and the number of weeks allocated to each topic is subject to change, depending on the students' understanding.</p> <ol style="list-style-type: none"> 1. Introduction to quantum mechanics [1 week] The breakdown of classical mechanics and the birth of quantum mechanics 2. Quantum mechanical principles [1~2 weeks] Energy quantization, wave-particle duality, the Born interpretation of the wavefunction 3. Examples of Schrodinger equation [1~2 weeks] A particle in a box, tunneling, vibrational and rotational motions 4. Hydrogen atom [1~2 weeks] Atomic orbitals and their energies 5. Multi-electron atoms [1~2 weeks] Electron spin, the Pauli exclusive principle, the periodic table 6. Diatomic and polyatomic molecules [1~2 weeks] Molecular orbitals, linear-combination-of-atomic-orbital (LCAO) approximation 7. Chemical bonds [1~2 weeks] Covalent and ionic bonds 8. Interactions between molecules [1~2 weeks] 					
----- Continue to Basic Physical Chemistry (quantum theory)-E2(2)					

Basic Physical Chemistry (quantum theory)-E2(2)

9. Final paper (report)
10. Feedback [1 week]
Total : 14 classes, 1 Feedback session

[Course requirements]

None

[Evaluation methods and policy]

The evaluation will be based on a final paper (report) (86 points) and class attendance and active participation (14 points).

[Textbooks]

Not used

[References, etc.]

(**References, etc.**)
P. Atkin, J. D. Paula, J. Keeler 『Atkin ' s Physical Chemistry, 11th Edition』 (Oxford University Press)
ISBN:0198769865
D. W. Oxtoby, H. P. Gillis, L. J. Butler 『Principles of Modern Chemistry, 8th Edition』 (Cengage Learning)
ISBN:1305079116

[Study outside of class (preparation and review)]

Students are responsible for the preparation and review of each class.

[Other information (office hours, etc.)]

It is advisable to ask questions and make comments willingly during the class.

Instructor: Nguyen Thanh Phuc (email: nthanhphuc@moleng.kyoto-u.ac.jp)

Office hour: appointment by email (Katsura campus, A4-205)

[Essential courses]

Faculty of Science