PHYSICAL CHEMISTRY

SCHOOL	NATURAL SCIENCE		
ACADEMIC UNIT	BIOLOGY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE - ELECTIVE		
COURSE CODE	**BIO_ΦΥΧ**	**SEMESTER**	**G**
COURSE TITLE	PHYSICAL CHEMISTRY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	3

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	There are not prerequisite courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching could be performed in English, in case of foreign students attend the course
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://eclass.upatras.gr/modules/document/?course=BIO230

1. LEARNING OUTCOMES

Learning outcomes

At the end of this course the student should be able to:

- Have a concise knowledge on the basic concepts of Kinetics and Thermodynamics.
- Distinguish between a descriptive and an interpretative theory
- Describe how a descriptive and how an interpretative theory emerges. 4
- Predict the ideal gas behavior and interpret deviations of real gasses.
- Predict the phase changes of a system consisting of one component.
- Interpret physical phenomena, such as diffusibility of gasses, osmosis and boiling point elevation after dissolving a nonvolatile solid.
- Assemble a distillation apparatus (simple or fractional) and interpret how the separation of the different components of a mixture can be performed.
- Predict the reactions spontaneity at constant T and P.
- Explain the significance of a rate law and the rate constant of a reaction.
- Integrate the rate laws for first- and second order reactions.
- Write the rate laws for elementary unimolecular and bimolecular reactions.
- Write the Arrhenius equation and use it for the Arrhenius equation parameters calculation.
- Understand and use the steady-state approximation for simplifying the analysis of a kinetic scheme.

General Competences

At the end of the course the student will have further developed the following skills/competences:

- Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating physical chemistry
- Ability to apply such knowledge and understanding to the solution of qualitative and quantitative problems nature.
- Ability to adopt and apply methodology to the solution of unfamiliar problems.
- Ability to interact with others on inter- or multidisciplinary problems.

2. SYLLABUS

Scientific Method, the method by which Science advances: Kinetic Molecular Theory, as an example of a descriptive theory - Formulating a theory starting from empirical laws - The Ideal

Gas Law as an outcome of Scientific Method - Interpretation of empirical laws and predictions of ideal gas behavior - Real gasses (virial and van der Waals equations) - **Thermodynamics, as an example of an interpretative theory:** Basic definitions needed to describe a thermodynamic system - The First Law of Thermodynamics - The principle of maximum Entropy and the second Law of Thermodynamics - Equilibrium conditions, spontaneous changes and equilibrium - Legendre's transformations - Definition and properties of new thermodynamic functions (F, H and G) - Thermodynamic degrees of freedom - Gibbs-Duhem equation - Phase diagrams of pure substances and ideal solutions - The freezing point depression and boiling point elevation - Osmotic pressure - The temperature composition diagram and fractional distillation - Spontaneous Reactions at constant T and P - **Kinetics:** Reaction rates - Reaction order and molecularity - Rate constant of a reaction - Order determination of a reaction by "The integrated method" and "The Differential Method" - Rate laws from the mechanism of a reaction - The steady-state approximation - The temperature dependence of reaction rates - Theories of elementary reactions.

3. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures and solving problems face-to-face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	• Presentation only of figures by PowerPoint. • Problem-solving seminars for the instructive solution of synthetic problems.	
TEACHING METHODS	***Activity***	***Semester workload***
	• Lectures (3 conduct hours per week × 13 weeks) • Problem solving by students	39
	Hours for private study of the student and optional problems solving given in each lecture	33
	Final written examination at the end of semester (3 conduct hours × 1 time)	3
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	• Final written examination of short-answer questions, in Greek • Lectures are supported by problem-solving modules, which are not compulsory. Students who have attended successfully these modules, get a bonus if they secure the minimum passing mark in the final written examinations. • Written examination Greek grading scale: 1-10. Minimum passing grade: 5.	

4. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- «Physical Chemistry» G. Karaiskakis, Eds.: P. Travlos-E. Kostarakis, Athens, 1995.
- «Physical Chemistry», N. Katsanos, Ed. Papazisi, 3rd ed. έκδοση, Athens 1993.
- "Atkins' Physical Chemistry" P. Atkins and J. de Paula, 8th ed., Oxford University Press, 2006.

Related academic journals: