KD1500 Physical Biochemistry 7.5 credits

Fysikalisk biokemi

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for KD1500 valid from Autumn 2014

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Completed upper secondary education including documented proficiency in English corresponding to English A. For students who received/will receive their final school grades after 31 December 2009, there is an additional entry requirement for mathematics as follows: documented proficiency in mathematics corresponding to Mathematics A.

And the specific requirements of mathematics, physics and chemistry corresponding to Mathematics E, Physics B and Chemistry A.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

This course is aimed at giving biotechnology students basic knowledge in physical biochemistry, and to show how thermodynamics and kinetics is applied in biology. The course contains different part that systematically point out the most important aspects of physical chemistry for biological applications, where each part inclues a case study with an exercise. The course contains to main areas: Biokemical themodynamics, and kinetics for biological and biochemical processes.

Upon completion of the course the student is expected to be able to:

- Give an account for the first and second laws of thermodynamics

- Describe the terms internal energy, enthalpy, entropy, and Gibbs free energy

- Give an account for the driving forces in biological and biochemical systems based on basic thermodynamic theory

- Use and analyse the thermodynamic driving forces to describe biological processes

- Derive basic reaction kinetics

- Based on kinetic theory draw conclusions of biochemical processes such as enzymatically catalyzed reactions

Course contents

Biochemical thermodynamics

A living organism is in constant change. Ions are pumped across membranes, neurotransmitters diffuse through the cytoplasm, proteins are built, formed, and degraded, molecules are degraded for energy. The driving forces behind these processes can be described with the laws of thermodynamics. From given conditions the course of action can be predicted. In this course we will go through the concepts and put them in a biological perspectiv, we show how biologival and biochemical processes can be understood from basic physical chemistry.

The course involve the concepts: The first law of thermodynamics, inner energy and enthalpy, the second law of thermodynamics, entropy, Gibbs free energy, phase equilibrium and phase transitions examplified by biopolymers and bioaggregates, chemical equilibrium, effects of catalysts and temperature, proton transfers and equilibria, ion and electron transport.

Kinetics in Biochemistry

Kinetics is the science of chemical reaction rates. By studying how fast an enzyme degrades a substrate detailed information of the reaction mechanism can be obtained. Which substrate

binds first, is the co-factor bound to the same site in the enzyme, how is the product inhibiting the reaction? By thorough analysis of the reaction deeper understanding of these phenomena can be obtained.

Includes the physical chemical concepts: Reaction cross sections, reaction laws and mechanisms, komplex biochemical processess, enzyme catalysis.

Course literature

Physical Chemistry of the Life Sciences, P. Atkins och J. de Paula, 2nd Edition, Oxford University Press, UK. (2010). ISBN 9780199564286.

Examination

- TEN2 - Examination 2, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Examination 1, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Assignment, 1.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.