האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

PHYSICAL CHEMISTRY FOR PHARMACY & EARTH SCIENCES - 69167

Last update 20-07-2017

HU Credits: *6*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *Chemistry*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Dr. Elad Gross*

Coordinator Email: *elad.gross@mail.huji.ac.il*

Coordinator Office Hours: *By appointment*

Teaching Staff:
Dr. Raam Uzdin
Mr. Roy Noff
Mr. Omri Rulf

Course/Module description:
The course introduces the basic laws of physical chemistry for pharmacy and earth sciences students. It specifically deals with thermodynamics and kinetics.

Course/Module aims:
The goal of the course is to introduce two branches of physical chemistry: kinetics and thermodynamics.

In kinetics, to present the basic concepts of reaction rate for general and enzymatic reactions and in thermodynamics to introduce the basic rules and their use.

Learning outcomes - On successful completion of this module, students should be able to:
1. Be acquainted with the fundamentals of physical chemistry - thermodynamics and kinetics - and to be able to discuss them using science terminology, and qualitative and quantitative considerations.

2. Understand the energetic concepts that drive chemical reactions and physical changes

3. Understand the relationship between macroscopic properties and the molecular make up of matter

4. Know the fundamental concepts of chemical kinetics.

Attendance requirements(%):
None

Teaching arrangement and method of instruction: Lecture and Exercise

Course/Module Content:
Part A - Thermodynamics
Gas Properties
• Gas Phase (Pressure, Measurement, Temp)

• Gas laws (Individual gas law, Ideal gas law, gas mixtures, Molar fraction and partial pressure)
1st law of Thermodynamics - Concepts and Mechanisms
• Molecular interactions (Compressibility factor, Virial coefficient, condensation, critical constants)
• Van-der-waals equation (validity, Variables)
• Ideal state principal
• 1st law (work heat and energy, energy conservation, formal notation, Mechanical definition of heat)
• Work and heat (work by expansion, heat interaction, enthalpy, adiabatic process)
• Functions of state and exact differentials (path and state function)
• Thermodynamic resultants (Internal energy changes, enthalpy relation to temperature)
2 nd and 3 rd law- Concepts and Mechanisms
• Spontaneous process (energy distribution, entropy, 3rd law)
• System operation (Helmholtz free energy, Gibbs free energy, standard Gibbs free energies of formation)
Phase Diagram
• Phase Diagrams (Phase stability, Standard diagrams)
• Phase transitions (Thermodynamic criteria for equilibrium, Stability conditions, Phase boundaries, Ehrenfest classification)
• Liquid Surface (tension, curvature, capillary forces)
• Thermodynamics of mixtures (fractional molar equivalents, thermodynamics of mixture,
Chemical potential of solutions)
• Solution properties (liquid solutions, colligative properties)
• Activity (solute and solvent activity, standard solutions activity)
• Phase, Components,Degrees of freedom) (definitions, phase laws)
• Two components phase diagram (vapor pressure, temperature- composition, liquid-liquid, liquid-solid)
Chemical equilibrium
• Spontaneous chemical reactions (minimal Gibbs energy, equilibrium composition)
• equilibrium reaction to condition change (mass, temperature, acidity)

Part B - Kinetics
Molecules in motion
• Gaseous molecular motion (kinetical gas model, participle collision, effusion rate, ideal gas transport properties)
• Liquid molecular motion
• Diffusion (Thermodynamic analysis, diffusion equation and statistical analysis)
Chemical reaction rate
• Experimental chemical kinetics (methods, rate of reaction, integrated rate law, reactions at equilibrium proximity, reaction rate temperature variability)
• Rate laws (elementary reactions, sequential elementary reactions, Single component reactions)
Kinetics of compound reactions

• Chain reactions (rate laws, combustion)
• Polymerization kinetics (Step- growth polymerization, chain growth polymerization)
• Homogeneous catalysis

Required Reading:
The course is based on the book:
Physical Chemistry by P. Atkins and J. de Paula (7th or 8th editions). A full and detailed list of relevant chapters and page numbers will be handed out.
In addition, the presentation slides can be found in the website.

Additional Reading Material:

Course/Module evaluation:
End of year written/oral examination 100 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 0 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information:
Course website - Moodle.