UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2013/14/1
Course:	Physical Chemistry
Code:	VEMKFKB312A
Responsible department:	Department of Physical Chemistry
Department code:	MKFK
Responsible instructor:	dr. András Dallos

Course objectives:

Teaching physical chemistry via lectures

Course content:

1. Phase equilibria in one component systems. Phase law for one component systems. Liquid-vapour equilibrium. Saturated vapour, saturated liquid, ratio of vapour phase. Clausius-Clapeyron-equation, Antoine-equation. Phase diagrams. The stability of the phase. First and second order phase changes. 2. Phase equilibria in multi-component systems. Phase law for multi-component systems. Liquid-vapour equilibrium in binary mixtures: Raoult-law,p-x,t-x,y-x diagrams. The equation of the equilibrium curve. Real mixtures, aseotropes. Destillation. 3. Condensed phases. Partially miscible liquids. Ternary systems. Liquid-solid equilibria: non miscible components in solid state, partially and completely miscible components, chemical reaction. Colligative properties: boiling point elevation, freezing point depression, osmotic pressure 4. Surface tension. Surface tension, Young-Laplace-equation. Surface work, minimum of free energy. Gas-liquid interface, tension of a curved surface, capillary rise and depression, Kelvin-equation, Eötvös-law, parachor. 5. Adsorption. Gibbs adsorption equation, surface active materials. Surface films, spreading coefficient, Hardy-Harkins-law. Adsoption of gases on solid surfaces, adsorption isoterms, isosteres and isobars. The Langmuir-equation. Chemisorption 6. Adsorption. Heat of adsorption, multilayer adsorption, types of isoterms. The BET-equation. Adsorption from nonelectrolyte solutions. Isoterms. Adsorption from dilute solutions. Adsorption from electrolyte solutions. Double layer, electrokinetic phenomena. Electro-capillarity 7. Chemical equilibrium. The thermodynamics of the chemical equilibrium. Standard free energy change of the reaction. Mass action law. Heterogeneous equilibria. Dissociation equilibria in electrolyte solutions. The change of the equilibrium constant by the temperature and by the pressure. Equilibrium constant in statistical mechanics. 8. Electrodes. Electric potential: Galvani, surface, Volta. The real potential. Nonosmotic membrane equilibrium. Contact equilibrium. The concept of the electrode. Electrode of first and second kind, reference electrodes, gas electrodes, redox electrodes. SHE 9. Galvanic cells. Cell conventions, types. Examples: Daniell cell, Weston cell, concentration cells. Thermodynamics of galvanic cells. Osmotic membrane equilibrium 10. Introduction to reaction kinetics. The rate of the reaction, the order of the reaction, rate equations. Simple reactions, the first order rate law, the second order rate law. The rate constant, the Arrhenius-equation. Experimental methods (isolation,initial rates etc.).Half life. 11. Rate of chemical reactions. Simple reactions. Pseudo first order reactions. Parallel reactions. Consecutive reactions. Equilibrium reactions. Lindemann-mechanism, steady-state approximation. 12. Catalytic reactions. The catalysis. Homogeneous catalysis. Gas reactions, reactions in solutions. Acid-base catalysis. Ensimcatalytic reactions. Autocatalysis. Chemisorption and heterogeneous

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Course content:

catalysis. Five step mechanism. 13. Complex reactions. Chain reactions. Explosions. Photochemical reactions. Fast reactions. Collision theory. Reactions in solutions. Transition state theory. 14. Electrochemical reactions. Ion reactions in solutions. Kinetics of electrode reactions. Activation overpotential: Butler-Erdey-Gruz-Volmer equation. Tafel-equation. Diffusion overpotential. Entropy production of chemical reactions. 15. Summary

Requirements, evaluation and grading:

During the term the student is expected to write tasks related to the theoretical part of the subject. At least 80 % of the tasks have to be prepared and delivered. At the beginning the examination each student will receive 3 input-questions that assess the student's knowledge of the basics of physical chemistry. Students passing all questions will receive an unconditional pass for the comprehensive exam.

Required and recommended readings:

1. Liszi, J.: Fizikai kémia, Veszprém, 1993. Kézirat. 2. Liszi, J., Ruff, I., Schiller, R., Varsányi, Gy.: Bevezetés a fizikai kémiába, Műszaki Könyvkiadó, Budapest, 1993. 3. Atkins,W.,P.: Fizikai Kémia I-III., Tankönyvkiadó, Budapest, 1990.