UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2015/16/1
Course:	Problem Solving Practice In Physical Chemistry
Code:	VEMKFKB322A
Responsible department:	Department of Physical Chemistry
Department code:	MKFK
Responsible instructor:	dr. Dezső Boda

Course objectives:

Solution of physical chemistry problems.

Course content:

1. An introduction to chemical thermodynamics. Equilibrium. Calculation of internal energy, work, and heat. The laws of thermodynamics. Carnot-cycle, thermodynamic efficiency, steam engines, refrigerators. Entropy, Gibbs and Helmholtz free energies, molar heat capacities. 2. Thermochemistry: Hess-law, Kirchoff-equation. 3. Maxwell relations, volumetric properties, Changes of U, H, G, F, and S as functions of p, V, and T. 4. Thermodynamic properties of the ideal gas and their calculation from the molecular partition functions. Changes in the state of the ideal gas. Poisson equation.. 5. p,V,T properties of the imperfect gases. Fugacity, virial equation, equations of states of imperfect gases. Law of corresponding states. Joule-Thompson effect. 6. Electronic and magnetic properties of molecules. Crytal energy from the Born-Haber cycle. Calculation of thermodynamic properties of crystals. Hagen-Poiseuille law. 7. Mixtures, gas mixtures. Partial molar quantities. Ideal mixtures. Activity. Real mixtures, thermodynamic excess quantities. Electrolyte solutions. 8. Conductive transport equations. Diffusion in condensed matter. Conduction in electrolytes, ionic mobility, dissociation. 9. Phase rule for one component systems. Vapour-liquid equilibrium. Saturated vapour and liquid. Clausius-Clapeyron equation. Solid-liquid and solid-vapour equilibria. 10. Phase rule for multicomponent systems. Vapour-liquid equilibria of binary mixtures. Raoult-law. Henry's law. Colligative properties, increase of boiling point, decrease of freezing point. Calculation of osmotic pressure. 11. Surface tension. Young-Laplace equation. Surface work,minimum of free energy. Gibbs adsorption isotherm. Surface active materials. Langmuir-equation. Chemisorption. Heat of adsorption,multilayer adsorption,types of isoterms.The BET-equation. 12. Thermodynamic condition of chemical equilibrium. Standard Gibbs energy change of the reaction. Mass action law.Heterogeneous equilibria. Dissociation equilibria in electrolyte solutions. 13. Electrode potential. Electrode of first, second kind, reference electrodes, gas electrodes,redox electrodes. Concentration cell. Thermodynamics of galvanic cells. 14. 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. Equilibrium reactions. Temperature-dependence of reaction rate: Arrhenius-equation. Ion-reactions in solutions. Kinetics of electrode reactions. Tafel-equations. Diffusion polarisation. Entropy production of chemical reactions. 15. Test.

Requirements, evaluation and grading:

The attendance of the practices and the solution of a test at the end of the semester are obligatory.

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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. 4. Tanszéki munkaközösség: Fizikai kémiai példatár I-II. Veszprém, 1995.