UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	Environmental chemistry primer
Code:	VEMKFTB214K
Responsible department:	Department of General and Inorganic Chemistry
Department code:	MKAK
Responsible instructor:	dr. Ottó Horváth

Course objectives:

Introduction of the chemical processes taking place spontaneously in the nature, and demonstration of the human impact on these natural processes. Introduction of the organic, inorganic and physico-chemical basis connecting to the previous processes.

Course content:

Environmental chemistry, inorganic chemistry
General characterization of the chemical processes in our natural environment. Evolution of the natural environment. Chemistry of the lithosphere. Soil chemistry. The structure and properties of water, the chemistry of aqueous solutions. The hydrosphere. Structure, composition, and properties of the atmosphere Chemical reactions in the atmosphere. Man-made pollution of the natural environment. General characterization of the environmental chemistry of the elements, biogeochemical cycles. Environmental chemistry of biologically important elements (C, O). Environmental chemistry of biologically important elements (N, S, P). Environmental chemistry of some metals. Transport processes of man-made pollutants. Chemical and biochemical transformations of pollutants.
Classification of elements considering their electronic structure, physical and chemical properties. Physical and chemical properties of hydrogen. Its production, application, and compounds. Physical and chemical properties of oxygen. Its production, application, and compounds. Physical and chemical properties of nonmetals. Their most important inorganic compounds, aboundance in the nature, production, application and practical use. Properties of main-group metals. Their most important inorganic compounds, aboundance in the nature, production, and application. Physical and chemical properties of metaloids. Their most important inorganic compounds, aboundance in the nature, production, and application.
Physical and chemical properties of transition metals. Their most important inorganic compounds, aboundance in the nature, production, and application. Physical and chemical properties of lanthanides and actinides. Their most important inorganic compounds, aboundance in the nature, production, and application. Physical and chemical properties of noble gases. Their most important inorganic compounds, aboundance in the nature, production, and application.
Physical chemistry
Basics of chemical thermodynamics, internal energy, thermal energy, heat, work, volumetric work. The first and the second law of thermodynamics. Conditions of thermal, mechanical and chemical equilibrium. Definitions, interpretations, properties and uses of energy functions. Heat capacities. Thermochemistry. Thermodynamic properties of perfect gases. Equations of state for real gases, and the properties of real gases. Condensed states: crystals and liquids; special structures: water, liquid crystals, glasses. Mixtures: ideal and

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Course content:

real mixtures, properties of mixing. The activity. Electrolyte solutions (solvation, Debye-Hückel-theory). Fourier-, Newton-, Fick-equations. Diffusion in condensed phases. Transport in electrolyte solutions (ionic mobility). Diffusion potential. Electrochemical potential. Phase equilibria in one-component systems. Liquid-vapour equilibrium. Clausius-Clapeyron-equation. Phase diagrams of one-component systems. Phase law. Phase equilibria in multi-component systems. Liquid-vapour equilibrium in binary mixtures: Raoult-law. Real mixtures, aseotropes. Destillation. Condensed phases. Partially miscible liquids. Liquid-solid equilibria. Colligative properties: boiling point elevation, freezing point depression, osmotic pressure. Surface tension. Adsorption. Chemical equilibrium. Equilibria in electrolyte solutions. Electric potential. Electrodes. Galvanic cells. The rate of the chemical reaction, the order of the reaction, rate equations. Simple reactions, the first order rate law. Half life. Second order reactions.

Organic chemistry
Electrophilic addition and elimination reactions of alkenes. Synthesis of alkynes. Vinylation reactions. Dienes and polyenes. Aromatic compounds. Isoprenoids. Terpenes, steroids. Alkyl- and aryl halides. Halogenation reactions. Organic halides and the environment. Compunds with OH functional group: alcohols and phenols. Properties of the carbonyl group. Synthesis of aldehydes and ketones. Nucleophilic additions. Redox reactions. Importance of hydroxy-oxo compounds and carbohydrates. Carboxylic acids and their derivatives. Organosulphur compounds. Amines, amino acids and peptides. Organometallic compounds. Properties and reactivity of the metal-carbon bond. Heterocyclic compounds with five- and six-membered rings. Condensed heterocycles. Alkaloids, porphyrins. Nucleosides, nucleotides and nucleic acids. RNA and DNA. The genetic code.

Requirements, evaluation and grading:

Written examination: for pass mark min. 40% ought to be reached in each topic (environmental and inorganic; physical; and organic chemistry

Required and recommended readings:

Ajánlott tankönyvek, jegyzetek:
Papp S.: Bevezetés a környezetkémiába, Veszprémi Egyetemi Kiadó, 1999.
Papp, S.,Kümmel, R.: Környezeti kémia, Veszprémi Egyetemi Kiadó, 2005
Liszi, J.: Fizikai kémia, Veszprém, 1993. Kézirat.

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Required and recommended readings:

Atkins,W.,P.: Physical Chemistry, Oxford University Press, 1990.
Markó-Farády: Szerves kémia I-VIII. (VE kézirat).
Lempert Károly: Szerves kémia, Műszaki Kiadó, Budapest, 1976.
Kajtár Márton: Változatok négy elemre: Szerves kémia, Gondolat, Budapest, 1984.