UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	General Chemistry
Code:	VEMKAKB212B
Responsible department:	Department of General and Inorganic Chemistry
Department code:	MKAK
Responsible instructor:	dr. Ottó Horváth

Course objectives:

Acquirement of basic knowledge of general chemistry and chemical calculations.

Course content:

1. Basic structure of atoms; nucleus (protons ad neutrons) and electrons. Bohr's model of hydrogen; the theory of stationary orbitals and the frequency theory. 2. Basics concepts of quantum mechanics; the dual nature of matter, particle and wave properties, Heisenberg's uncertainty principle. The basic equation of wave mechanics. The quantum mechanical description of hydrogen atom; quantum numbers and atomic orbitals. Introduction of the electron spin quantum number, the Pauli exclusion principle. Building-up principle, electron configurations and periodicity. The periodic table of elements. 3. Some periodic properties; atomic radius, ionization energy, electron affinity, and electronegativity. Basic concepts of chemical bond. Types of chemical bond: covalent, ionic, and metallic. 4. Covalent bond; formation, Lewis electron-dot formulas, multiple bonds. Basic concepts of he LCAO-MO method. Description of the electronic structure of H2 by LCAO-MO method, the concepts of bonding and anti-bonding molecular orbitals. Application of the method to description of electronic structures of homonuclear (N2 O2, F2) two atomic molecules. 5. Energy, length and angle of bonds. The VSEPR model. The space-requirement of bonding and non-bonding electron pairs. The relationship between the electronegativity and the space-requirement of a bonding pair. Geometrical structure of molecules. 6. Chemical properties and compounds of elements. 7. Gas phase; the gas laws (the ideal-gas equation), kinetic molecular theory, properties of gas mixtures, deviation from the ideal behavior (the van der Waals equation). Application of gas laws to one-component sysetms and gas mixtures. 8. Properties of liquids and solids. Intermolecular forces. Typical properties of pure liquids. Properties of solutions. Colloids. Calculations for preparation of solutions. Concentration units and their conversions. 9. Crystalline and amorphous substances. Structures of crystalline substances; types of crystal lattices and unit cells, crystal systems. Phase transitions; melting, boiling. Calculations of colligative properties (osmotic pressure, boiling-point elevation, freezing-point depression). 10. Chemical equilibrium, the equilibrium constant, the reaction quotient. Le Chatelier's principle; changes of concentrations of reactants and products, the roles of temperature and pressure in equilibria. The effects of catalysts. Thermodynamics and equilibrium. Spontaneous physical and chemical processes; the entropy function. The send law of thermodynamics. The free enthalpy function. The standard free enthalpy. The relationship betwen the change of the free enthalpy and the equilibrium constant. 11. Chemical equilibrium in solution. Acid-base theories; Arrhenius's A-B theory, self-ionization of water, the pH of a solution. pH of solutions of strong acids and bases. Acid-base theories of Brönsted and Lowry, as well as of Lewis. 12. pH of solutions of weak acids and bases. Buffer solutions. Acid-base titrations.

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Course content:

13. Calculations with redox equations (oxidation number). Redox titrations. Basic concepts in electrochemistry; electrochemical cell, electromotive force, electrode potential. Electrochemical driving force. Galvanic (or voltaic) cells, batteries, storage cells. Electrolysis. Electrochemical calculations. 14. Basic concepts of reaction kinetics; reaction rate and its experimental determination. The temperature dependence of reaction rate. Arrhenius equation. Collision and transition state theories. Elementary reactions, relationship between the rate law and the mechanism. 15. Writing examination paper.

Requirements, evaluation and grading:

The examination paper at the end of the semester should be written at min. satisfactory level. For the first 3 (qualification) exercises of the paper should be got at least 80% of the possible points. Of these 3 exercises, for the calculation of concentration should also be got at least 80% of the possible points.

Required and recommended readings:

Horváth Attila, Sebestyén Attila, Zábó Magdolna: Általános Kémia, Veszprémi Egyetemi Kiadó, 1991 Bodor Endre: Szervetlen Kémia I., Veszprémi Egyetemi Kiadó, 1994 Maleczkiné Szeness Márta: Kémiai számítások-kémiai gondolatok, Veszprém, 1995 Geoff Rayner-Canham: Descriptive Inorganic Chemistry (2nd ed.), W. H. Freeman and Co., New York, 2000 Ebbing D. D.; General Chemistry, Houghton Mifflin Co, Boston, 1984 Cotton F. A., Wilkinson G.; Basic Inorganic Chemistry, J. Wiley and Sons, New York, 1976 Masterton, W. L. and Hurley C. N.; Chemistry: Principles and Reactions, Saunders College Publishing, Philadelphia, 1989