

KEY CONCEPTS IN GENERAL CHEMISTRY



Jagiellonian University

Medical College

School of Medicine in English

GENERAL CHEMISTRY

1. Electronic structure of atoms

- 1.1. Periodic table of elements;
- 1.2. Electronic configuration of s- and p block elements;
- 1.3. Types of chemical bonding, Lewis structure, geometry of molecules;

2. Mass and number of moles

- 2.1. Atomic mass, atomic masses of isotopes, atomic mass unit, molar mass;
- 2.2. Number of moles and the Avogadro constant;

3. Concentration of solutions and solubility

- 3.1. Solubility definition and calculations;
- 3.2. Percentage concentration;
- 3.3. Mole fraction;
- 3.4. Molarity – molar concentration;

4. Molecular formula of compounds

- 4.1. Inorganic oxides, hydrides, acids, bases, and salts;
- 4.2. IUPAC nomenclature of inorganic compounds (acids, bases, and salts);
- 4.3. Molecular formula vs. weight percentage composition;

5. Chemical reactions and stoichiometry

- 5.1. Balancing chemical reaction equation (mass and charge balance);
- 5.2. Types of inorganic reactions: synthesis, analysis and exchange; substrates and products
 - 5.2.1. Reactions of oxides, acid and bases formations
 - 5.2.2. Salt formation reactions, reactions of salts with acids and salts with bases, neutralization reactions

- 5.3. Reaction yield;
- 5.4. Limiting reactant;
- 5.5. Alloys, oxides – reactions

6. Ideal gas laws

- 6.1. Standard and normal conditions;
- 6.2. Calculations based on the Clapeyron equation;
- 6.3. Isothermal, isobaric and isochoric transformation of gases;

7. Chemical equilibrium

- 7.1. Equilibrium constant - definition and calculation

8. Acid-base equilibria in aqueous solution

- 8.1. Auto-ionization of water and pH scale;
- 8.2. Electrolytic dissociation of weak acids and bases (dissociation constants K_a (acids) and K_b (bases));
- 8.3. Dissociation degree;
- 8.4. Poorly soluble electrolytes – solubility product K_{SP} ;

9. Oxidation-reduction (redox) reactions

- 9.1. Oxidation numbers, balancing redox equation reactions;
- 9.2. Redox potentials, Nernst equation, and electrochemical series of metals;
- 9.3. Voltaic cell potentials;

10. Thermochemistry and basis of thermodynamics

- 10.1. Calculations based on Hess law;
- 10.2. Heat of reaction (enthalpy) of formation and combustion;
- 10.3. Entropy
- 10.4. Gibbs free energy

Keywords: Chemical element, proton, neutron, electron, valence shell, valence electrons, ionic bond, covalent bond, polar molecules, electron configuration, s orbitals, p orbitals, d orbitals, cation, anion, isotope, atomic mass, atomic mass unit, molar mass, mole, the Avogadro's constant, molar concentration, percentage concentration, molar fraction, metals, non-metals, ionic compounds, salt, IUPAC nomenclature, limiting reactant, solute, solution, yield of reaction, standard and normal conditions, the Clapeyron equation (ideal gas law), density, isothermal transformation, isobaric transformation, isochoric transformation, molecular equation, ionic equation, equilibrium constant K, pH, hydronium ion, hydroxide anion, strong and weak electrolytes, dissociation constant, solubility product, oxidation, reduction, oxidation numbers, galvanic (voltaic) cells, standard redox potentials, hydrogen electrode, exo- and endothermic reactions, Hess's law, terms: enthalpy, entropy, enthalpy of formation, enthalpy of combustion, Gibbs free energy.

RECOMMENDED TEXTBOOKS

GENERAL CHEMISTRY

1. Regular chemistry text books (secondary-school level)
2. Dana R. Freeman, William Yu Wang, *Kaplan Essential Review: High School Chemistry*, Paperback, 304 Pages, Published 1999, ISBN-10: 0-684-86821-0 /0684868210, ISBN-13: 978-0-684-86821-9 /9780684868219
3. Peter Atkins, Loretta Jones, Leroy Laverman, *Chemical Principles*, Publisher: W. H. Freeman; 7th edition, ISBN-13: 978-1464183959, ISBN-10: 1464183953 (or any other edition)
4. IUPAC basic definitions of chemical properties and quantities:
<http://goldbook.iupac.org/PDF/goldbook.pdf>
5. IUPAC nomenclature of inorganic compounds: https://www.iupac.org/fileadmin/user_upload/databases/Red_Book_2005.pdf, pages 68 – 83
6. Sample chemistry tests: <http://www.univer360.com/entrance-exam-topicssamples.html>