

SUMMARY:

Atomic structure, periodic classification and properties of elements. Chemical bonding; structure and properties of the substances. Notions of physicochemistry: thermodynamics, chemical equilibria and electrochemical cells

PROGRAM:

1. International System of Units

2. Definition of units commonly used in general chemistry for energy, mass, time, space, volume, pressure, temperature, density and velocity.

3. Stoichiometry and Chemical Arithmetic

The mol. Molecular weight and weight formula. Chemical formulas. Molecular formulas. Balancing equations.

Calculations based on chemical equations. Calculations with limiting reactants.

4. Atomic Structure and Periodic Table

Electrical nature of matter. The charge of the electron. The nucleus of the atom. The Periodic Law and the Periodic Table. The electron spin and the exclusion principle of Pauli. The electronic configuration of the elements. The Periodic table and the electronic configurations. The spatial distribution of electrons.

5. The chemical bond

Lewis symbols. The covalent bond. Polar molecules and electronegativity. Oxidation and reduction. Oxidation number.

Nomenclature and chemical compounds. Other bonding forces. Crystalline solids. Types of crystals. The theory of the bands of solids. Defect in crystals. The ionic bond. Factors that influence the formation of ionic compounds.

6. Metals, nonmetals and metalloids. Trends in metallic behavior. Chemical properties and typical products.

7. Metalloids and Nonmetals

The free elements. Oxygen compounds of nonmetals. Oxoacids and oxoanions. Polymeric oxoacids and oxoanions.

8. Chemical Reactions in Aqueous Solution

Terminology in solutions. Electrolytes. Chemical equilibrium. Ionic reactions. Acids and bases in aqueous solutions.

Preparation of inorganic salts by double exchange reactions. Reduction–oxidation reactions. Balancing reduction-oxidation reactions. Quantitative aspects of solutions: molarity. Equivalent weights and normality.

9. Solutions Properties

Types of solutions. Units of concentration. The process of dissolution. Heat of dissolution. Solubility and Temperature.

Fractional crystallization.

10. Chemical Equilibrium

Law of mass action. The equilibrium constant. Kinetics and equilibrium. Thermodynamics and equilibrium. Relationship of K_p and K_c . Heterogeneous equilibrium. Principle of Le-Chatelier-Braun. Equilibrium calculations.

11. Acids and Bases in water

Definitions. Forces of acids and bases. Ionization of water and pH. Dissociation of weak electrolytes. Buffers.

Hydrolysis. Indicators.

12. Solubility - Solubility product. Common ion effect and solubility.

13. Thermochemistry

ΔH , specific value. First Law of Thermodynamics. Spontaneity of reactions, ΔG , ΔS , second law of thermodynamics.

14. Reaction rate

Catalysis

15. Relationship between properties and structure.

16. Oxidation and reduction

17. Polymers

BIBLIOGRAPHY

-P. Atkins & L. Jones, Chemical Principles: The quest for insight, 2^a ed., W.H. Freeman, 2002.

-J.C. Kotz & P. Treichel Jr., Chemistry & Chemical Reactivity, Saunders College Publishing, 4^a ed., 1999.