Content of the questions on Chemistry.

CHEMISTRY (last two years of high school)

1. Basic Contents

Avogadro hypothesis. Concept of the mole. Molecular weight. Atomic mass.
Isotopes. Inorganic formulation.
Solutions. Forms of expressing concentration: %, M, N, m, X.
Gaseous state: Kinetic theory of gases. General ideal gas law. Dalton's law.
Stoichiometry of chemical reactions.

2. Atomic Structure and Periodic Classification of Elements.

Atomic magnitudes.
Thomson's and Rutherford's model of the atom.
Quantum theory. Bohr's model of the atom and its limitations.
Introduction to quantum mechanics. De Broglie hypothesis. Heisenberg principle. Concept of the orbital and atomic orbitals.
Electron configurations: Pauli's aufbau principle and Hund's rule.
Periodic classification of elements. Periodic properties and relation to position in the periodic table.

3. Chemical Bonds and Properties of Substances.

Concept of the bond. Energy stability of bonded atoms.
Ionic bond. Lattice energy: Born-Haber cycle. Properties of ionic substances.
Covalent bond. Bonding parameters. Lewis' theory. Molecular geometry: Valence bond theory. Hybridization of atomic orbitals. Bond polarity and molecular polarity. Intermolecular forces. Properties of covalent substances.
Metallic bond. Theories. Properties of metals.
Intermolecular bonds.

4. Energy Transformations in Chemical Reactions.

Thermodynamics. Systems. Variables. Pressure-volume work. Heat.
Endothermal and exothermal processes.
Enthalpy: formation, reaction and bond enthalpy. Hess's law.
Entropy. Gibbs free energy and spontaneity of chemical reactions.
Energy applications of chemical reactions.

5. Kinetics and Chemical Equilibrium.

Dynamic aspect of chemical reactions. Reaction speed: factors that affect it. Collision theory. Effective collision. Activation energy. Catalysts and how they work.

Dynamic concept of chemical equilibrium. Equilibrium constant: kc and kp and the relationship between them. Altering equilibrium: Le Chatelier's principle.
Heterogeneous equilibrium. Precipitation reactions: solubility and solubility product. Factors that affect equilibrium.
Applications of kinetics and chemical equilibrium in daily life and in industrial processes: The Haber-Bosch process.

6. Acids and Bases.

General characteristics. Acid-base theories. Arrhenius and Brønsted-Lowry.
Ionic equilibrium of water.
Concept of pH. Calculation and measurement of pH in aqueous solutions of acids and bases.
Strong and weak acids and bases. Neutralization reaction.
Quantitative treatment of aqueous solutions of salts as special cases of acid-base equilibria.
Buffer solutions.
Some acids and bases of interest in industry and in daily life. The problem and consequences of acid rain.

7. Electron Transfer Reactions.

Concept of oxidation-reduction. Concept of oxidizing and reducing agents. Oxidation number.
Adjusting redox reactions. Stoichiometry of redox reactions. Redox titrations.
Concept of standard reduction potential. Scale of oxidizing and reducing agents. Spontaneity of redox reactions.
Applications and repercussions of reduction-oxidation reactions: electric batteries.
Electrolysis. Faraday's laws. Industrial and economic importance. Metal corrosion.

8. Organic Chemistry.

Characteristics of the carbon atom.
Nomenclature and formulation of the main oxygenated and nitrogenated organic compounds. Types of organic reaction: substitution, addition, elimination and oxidation.
Structural and spatial isomerism.
Hydrocarbons. Petroleum and its derivatives.
Organic compounds of interest: alcohols, esters and acids: how they are obtained, their properties and importance.
Polymers and polymerization reactions by addition and condensation.
Evaluation of the use of organic substances in the development of today's society. Environmental problems.

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