CHEMISTRY ENTRANCE EXAM SYLLABUS

SCHOOL OF MEDICINE

UNIVERSITY OF NAVARRA

1. BASIC CONCEPTS

Avogadro's hypothesis. Concept of mole. Molecular mass. Atomic mass. Isotopes.

Inorganic formulation.

Solutions. Ways to express the concentration: %, M, C, V, n.

Gas state: Kinetic theory of gases. General law of perfect gases. Dalton's Law.

Stoichiometry of chemical reactions.

2. ATOMIC STRUCTURE AND PERIODIC CLASSIFICATION OF ELEMENTS

Atomic mass and unit.

Thompson and Rutherford atomic method.

Quantum theory. Bohr's atomic model and its limitations.

Introduction to quantum mechanics. De Broglie hypothesis. Heisenberg principle.

Orbital concept and atomic orbitals.

Electron configurations: Pauli's principle and Hund's rule.

Periodic classification of the elements. Periodic properties and relationship to position on the periodic table.

3. CHEMICAL BONDS AND PROPERTIES OF SUBSTANCES

Concept of bonding. Energy stability of bonded atoms.

Ionic bonding. Lattice energy: Born-Haber cycle. Properties of ionic substances.

Covalent bonding. Bond parameters. Lewis theory. Molecular geometry: Valence bond theory. Hybridization of atomic orbitals. Bond polarity and molecular polarity.

Intermolecular forces. Properties of covalent substances.

Metallic bonding. Theories. Properties of metals.

Intermolecular bonds.

4. ENERGY TRANSFORMATIONS IN OILIC REACTIONS

Thermodynamics. Systems. Variables. Pressure-volume work. Heat.

Endothermic and exothermic processes.

Enthalpy: enthalpy of formation, reaction and bond. Hess's Law.

Entropy. Gibbs free energy and spontaneity of chemical reactions.

Energy applications of chemical reactions.

5. KINETICS AND EQUILIBRIUM

Dynamic aspect of chemical reactions. Reaction rate: influencing factors. Collision theory. Effective collisions. Activation energy. Catalysts and how they work.

Dynamic concept of chemical equilibrium. Equilibrium constants: kc and kp, relation between them. Equilibrium disturbances: Le Chatelier's principle.

Heterogeneous equilibria. Precipitation reactions: solubility and solubility product. Factors influencing equilibrium.

Applications of chemical kinetics and equilibrium to everyday life and industrial processes: The Haber-Bosch process.

6. ACIDS AND BASES

General characteristics. Acid-base theories: Arrhenius and Brõnsted-Lowry.

Ionic balance 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 particular cases of acid-base balances.

Buffer solutions.

Some acids and bases of industrial and everyday life interest. The problem of acid rain and its consequences.

7. ELECTRON TRANSFER REACTIONS

Concept of oxidation-reduction. Concept of oxidizing and reducing agents. Oxidation number.
Balancing redox reactions. Stoichiometry of redox reactions. Redox titrations. Experimental treatment.
Concept of standard reduction potential. Oxidation and reduction potential. Spontaneity of redox reactions.
Applications and repercussions of oxidation-reduction reactions: electrical cells and batteries.
Electrolysis. Faraday's Laws. Industrial and economic importance. Corrosion of metals and its prevention.

8. ORGANIC CHEMISTRY

Characteristics of the carbon atom.
Nomenclature and formulation of the main oxygenated and nitrogenous organic compounds. Types of organic reactions: substitution, addition, elimination and oxidation-reduction.
Structural and spatial isometry.
Hydrocarbons. Petroleum and its derivatives.
Organic compounds of interest: alcohols, esters and acids. Obtaining, properties and importance.
Polymers and addition and condensation polymerization reactions.
Assessment of the use of organic substances in the development of today's society. Environmental problems.