ADMISSIONS EXAM
CONTENTS OF CHEMISTRY

SCHOOL OF MEDICINE
UNIVERSIDAD DE NAVARRA

Universidad de Navarra

1. BASIC CONTENTS

- Avogadro's hypothesis. The concept of the mole. Molecular mass. Atomic mass. Isotopes.
- Inorganic formulae.
- Solutions. Ways to express concentration: %, M, N, m X.
- The gaseous state: the kinetic theory of gases. The general law of perfect gases. Dalton's law.
- Stoichiometry of chemical reactions.

2. ATOMIC STRUCTURE AND THE PERIODIC TABLE OF THE ELEMENTS.

- Atomic magnitudes.
- The atomic models of Thomson and Rutherford.
- Quantum theory. The atomic model of Bohr and its limitations.
- Basic quantum mechanics. De Broglie hypothesis. Heisenberg principle. The concept of orbitals and atomic orbitals.
- Electron configurations: Pauli's principle and Hund's rule.
- Periodic classification of the elements. Periodic properties and relationship with position in the periodic table.

3. THE CHEMICAL BOND AND PROPERTIES OF SUBSTANCES.

- The concept of bonding. Energetic stability of bonded atoms.
- The ionic bond. Lattice energy: the Born-Haber cycle. Properties of ionic substances.
- The covalent bond. Bonding parameters. Lewis' theory. Molecular geometry: valence bond theory. Atomic orbital hybridization. Bond polarity and molecular polarity. Intermolecular forces. Properties of covalent substances.
- Metallic bonding. Theories. Properties of metals.
- Intermolecular forces.

4. ENERGY TRANSFORMATION IN CHEMICAL REACTIONS

- Thermodynamics. Systems. Variables. Pressure-volume work. Heat.
- Endothermic and exothermic processes.
- Enthalpy: enthalpy of formation, of reaction and of bond formation.
- Entropy. Gibbs free energy and spontaneity of chemical reactions.
- Energy applications of chemical reactions.

5. KINETICS AND CHEMICAL EQUILIBRIUM.

- The dynamic aspect of chemical reactions. Reaction velocity: influencing factors. Theory of collisions. Effective collisions. Activation energy. Catalysts and their function.
- The dynamic concept of chemical equilibrium. The equilibrium constant: Kc and Kp and the relationship between them. Alterations in equilibrium: the Le Chatelier's principle.
- Heterogeneous equilibria. Precipitation reactions: solubility and solubility products. Factors that affect equilibrium.
- Applications of kinetics and chemical equilibrium in everyday life and in industrial processes. The Haber-Bosch process.

6. ACIDS AND BASES

- General characteristics. Acid-base theory: Arrhenius and Brönsted-Lowry.
- Ionic equilibrium of water.
- The concept of pH. Calculation and measurement of pH in aqueous solutions of acids and bases.
- Strong and weak acids and bases. Neutralization reactions.
- Quantitative treatment of aqueous solutions of salts as specific cases of acid-base equilibrium.
- Buffer solutions.
- Some acids and bases of industrial and everyday interest. The problem of acid rain and its consequences.

7. ELECTRON TRANSFER REACTIONS.

- The concept of oxidation-reduction. The concept of oxidizers and reducers. Oxidation number.

- Balancing redox reactions. Stoichiometry of redox reactions. Redox evaluation. Experimental methods.

- The concept of standard reduction potential. Scale of oxidizers and reducers. Spontaneity of redox reactions.

- Applications and repercussions of oxidation-reduction reactions: electrical batteries and cells.

- Electrolysis. Faraday's laws. Industrial and economic importance. Corrosion of metals and its prevention.

8. ORGANIC CHEMISTRY

- Characteristics of the carbon atom.

- Nomenclature and formulae of the main oxygenated and nitrogen-containing organic compounds. Types of organic reaction: substitution, addition, elimination and oxidation-reduction.

- Structural and spatial isomers.

- Hydrocarbons. Petroleum and its derivatives.

- Organic compounds of interest: alcohols, esters and acids: how to obtain them, properties and relevance.

- Polymers and polymerization reactions by addition and condensation.

- Evaluation of the use of organic substances in the development of current society. Environmental problems.