University of Belgrade - Faculty of Pharmacy
List of teaching units for the preparation of the entrance exam

I General and Inorganic Chemistry

• Chemical substances
Types and classification.

• Atomic structure
Atomic and mass number. Isotopes. Relative atomic mass. Electronic configuration and Periodic Table of the Elements. Ionization energy and electron affinity. Atomic and ionic radius.

• Chemical bonds
Ionic bond. Covalent bond. Polarity of molecules. Hydrogen bond. Aggregate states of substances. Molar volume of gases.

• Solutions
Solubility. Saturated and supersaturated solutions. Quantitative composition of the solution (percent by mass, molar concentration, mass concentration).

• Chemical reactions
Equations of chemical reactions. The amount of substance. Molar mass of the substance. Stoichiometric calculations based on chemical equations. Thermal changes in chemical reactions. Standard heat of chemical reaction. The Law of Mass Action. Chemical equilibrium. Application of Le Chatelier's principle.

- **Acids, bases and salts**

Electrolyte solutions. Electrolytic dissociation. Degree of electrolytic dissociation, strong and weak electrolytes. Ionic reactions. Protolytic theory of acids and bases. Ionic product of water. pH value of aqueous solutions of strong acids and strong bases. Acid-base properties of aqueous salt solutions. Buffers (composition and properties).

• Oxidoreduction reactions

Equations of oxidoreduction reactions. Oxidation number, oxidation and reduction. Oxidizing and reducing agents. The galvanic series (or electropotential series) of metals

• Inorganic chemistry

Periodic properties of the elements. Chemical properties of elements within: 1st and 2nd groups, 13-17th groups, 3-12th groups (chromium, manganese, iron, copper, zinc, silver) and their compounds.

II Organic Chemistry

- **Structure and properties of organic compounds**
- **Classification of organic compounds and functional groups**
- **Chemical reactivity of organic compounds and types of reactions**
- **Alkanes**
  - Structure and stereochemical aspect of structure (Constitutional Isomers of Alkanes)
  - Nomenclature of Alkanes
  - Preparation of Alkanes
  - Reactivity of Alkanes
- **Alkenes**
  - Structure, Stereoisomerism in Alkenes
  - Nomenclature
  - Preparation of Alkenes
  - Reactivity of Alkenes
- **Alkynes**
  - Structure
  - Nomenclature
  - Preparation of Alkynes
  - Reactivity
- **Dienes**
  - Structure of Dienes
  - Conjugated Dienes
- **Cycloalkanes**
  - Structure
  - Nomenclature
  - Cycloalkane stereochemistry (Conformations of Cyclohexane)
  - reactivity of cycloalkanes
- **Arenes**
  - Structure
  - Nomenclature of arenes and some Benzene Derivatives
  - Aromaticity
  - Reactivity of Arenes (Aromatic Substitution: Halogenation, Sulfonation, Nitration)

- **Alkyl and aryl halides**
  - Structure
  - Nomenclature
  - Preparation of Alkyl and aryl halides
  - Reactivity

- **Alcohols (monohydroxy and polyhydroxy alcohhols)**
  - Structure
  - Nomenclature
  - Chirality and configuration
  - Preparation of Alcohols (via Grignard Reagents)
  - Reactivity (Substitution, Dehydration, Oxidation)

- **Phenols**
  - Structure
  - Nomenclature
  - Preparation of Phenols
  - Reactivity

- **Ethers**
  - Structure
  - Nomenclature
  - Preparation
  - Reactivity

- **Aldehydes and ketones**
  - Structure and Acidity of the α-CH bond
  - Nomenclature
  - Preparation
  - Reactivity (Introduction to Nucleophilic Addition Reactions - with Grignard Reagents, alcohol, ammonia and its derivatives)

- **Carboxylic acids**
  - Structure, Acidity of Carboxylic acids (unsubstituted monocarboxylic- and □-halo carboxylic acids)
  - Nomenclature
  - Preparation
  - Reactivity
  - Dicarboxylic acids

- **Carboxylic acid derivatives (chlorides, amides, anhydrides, esters)**
  - Structure and reactivity
  - Nomenclature

- **Organic sulfur compounds**
  - Thiols
  - Sulphides
  - Sulfonic acids

- **Organic nitrogen compounds**
  - structure and properties

- **Amines**
  - Structure, Basicity
  - Nomenclature
  - Prepation of Amines
  - Reactivity

- **Heterocyclic compounds**
  - Structure and Nomenclature
  - Heterocycles with single heteroatom, properties (five-membered, six-membered)
  - Heterocycles with two heteroatoms, properties (five-membered, six-membered, condensed)
  - Alkaloids and vitamins that contain heterocycles in the structure

- **Carbohydrates**
  - Monosaccharides: Classification, Properties (Cyclic Structures of Monosaccharides)
  - Reactivity (Oxidation of Monosaccharides)
  - Oligosaccharides: Structure, Properties of Disaccharides
  - Polysaccharides: Properties of Starch and Cellulose

- **Proteins**
  - Amino acids: Structure and Classification
  - Properties of amino acids, and their reactions
  - Proteins- Properties, Structure, Classification

- **Nucleic acids**
  - Purine and Pyrimidine bases
  - Mononucleotide definition and structure
  - DNA and RNA structures

- **Lipids**
  - Fatty acids (Definition, Structure, Classification and Properties)
  - Saponifiable lipids and their reactions: neutral fats, waxes, phosphoglycerides, sphingolipids
  - Unsaponifiable lipids: steroids, terpenoids

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