

I GENERAL CHEMISTRY



1. Atomic structure and chemical bonding

- Atomic structure (atomic number, mass number, isotopes, relative atomic and relative molecular mass)
- Periodic table of elements (characterizing the elements, ionization energy, electronegativity and electron affinity)
- Chemical bonds (ionic bond, nonpolar and polar covalent bond)

2. Solutions (concentrations of solution)

- Mass concentration, molar concentration, molality, mass fraction
- Calculations of solution concentrations

3. Chemical kinetics

- Rate of chemical reactions
- Reactions rate and stoichiometry
- Factors that influence the reaction rate
- Gouldberg-Waage rate law (homogeneous and heterogeneous reactions)

4. Energetics

- Thermochemistry: Energy changes in chemical reactions
- Enthalpy, Entropy, Gibbs free energy

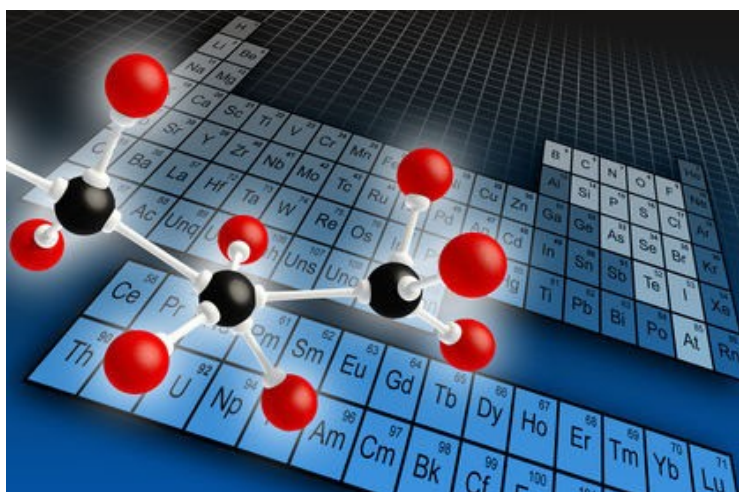
An example problem from GENERAL CHEMISTRY that was given in 2016 Entrance exam:

Which of the following compounds has ionic bond?

- a) C_2H_6
- b) Cl_2
- c) NH_3
- d) $MgCl_2$

The correct answer is d): $MgCl_2$

II INORGANIC CHEMISTRY



1. Oxides

- Acidic, basic, neutral and amphoteric oxides

2. Acids and bases

- General properties of acids and bases
- Arrhenius definition and Bronsted-Lowry definition
- Strengths of acids and bases
- Acid and base dissociation constants
- Ionic product of water, pH, pOH, calculation of pH

3. Salts and buffers

- Types of salt (acidic, basic, neutral salts)
- Neutralization reactions
- Hydrolysis of salts
- Stoichiometry problems
- Buffers

4. Oxidation-reduction reactions

- Oxidation number (state)
- Definitions of oxidation and reduction
- Oxidizing agents, reducing agents
- Redox reactions

An example problem from INORGANIC CHEMISTRY that was given in 2016 Entrance exam:

Anhydride of nitric acid is:

- a) N_2O_3
- b) NO_2
- c) N_2O_5
- d) N_2O

The correct answer is c): N_2O_5

III ORGANIC CHEMISTRY



1. Hydrocarbons

- Nomenclature, structure and reactivity of alkanes, alkenes, alkynes, dienes
- Nomenclature and chemical reactions of aromatic compounds

2. Alcohols and phenols

- Nomenclature of alcohols and phenols
- Chemical reactions of alcohols and phenols

3. Aldehydes and ketones

- Nomenclature of aldehydes and ketones
- Chemical reactions of aldehydes and ketones

4. Carboxylic acids

- Nomenclature of carboxylic acids
- Chemical reactions of carboxylic acids
- Nomenclature and reactions of substituted carboxylic acids
- Derivatives of carboxylic acids

An example problem from ORGANIC CHEMISTRY that was given in 2016 Entrance exam:

The main product obtained in addition reaction of water to 2-methylpropene is:

- a) 2-methyl-1-propanol
- b) 1,2-propanediol
- c) 2-methyl-2-propanol
- d) 1,3-propanediol

The correct answer is c): 2-methyl-2-propanol

IV CHEMISTRY OF NATURAL PRODUCTS



1. Amino acids and peptides

- Classification and structure of amino acids
- Chemical reactions of amino acids and pI
- Peptides

2. Monosaccharides

- Classification: Aldoses and ketoses, pentoses and hexoses
- Fischer and Haworth formulas of monosaccharides, mutarotation
- Stereoisomers of monosaccharides (enantiomers, epimers, anomers)
- Chemical reactions of monosaccharides

3. Disaccharides and Polysaccharides

- Reducing and non reducing disaccharides (maltose, lactose, cellobiose and sucrose)
- Inversion of sucrose
- Homopolysaccharides (starch, glycogen, cellulose)

4. Lipids

- Nomenclature, classification and structure of fatty acids
- Simple lipids-fats and oils
- Reactions of simple lipids

An example problem from CHEMISTRY OF NATURAL PRODUCTS that was given in 2016 Entrance exam:

Which of the following series contains **only** amino acids with **–OH group** in their side chains?

- Tyr, His, Thr
- Thr, Ser, Tyr
- Ser, Thr, Met
- Phe, Tyr, Trp

The correct answer is b): Thr, Ser, Tyr