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MEDICAL UNIVERSITY - PLEVEN

FACULTY OF MEDICINE

**DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY, PHYSICS AND
BIOPHYSICS**

EXAMINATION TOPICS

**“CHEMISTRY” LECTURE COURSE FOR FIRST YEAR
MEDICAL STUDENTS, 2015 / 2016**

**ENGLISH MEDIUM COURSE OF TRAINING
SPECIALTY OF MEDICINE**

ACADEMIC DEGREE MASTER

PROFESSIONAL QUALIFICATION DOCTOR OF MEDICINE

- I. CHEMICAL BOND AND MUTUAL INFLUENCE OF THE ATOMS IN THE MOLECULES**
 1. Chemical bonding. Valence bond theory. Molecular orbital theory. Hybridization.
 2. Noncovalent interactions – nature, types, importance.
 3. Hydrogen bond – nature, types, importance.
 4. Coordination compounds - definition, composition, stability, isomerism. Bonding in coordination compounds – theories. Chelate compounds. Biological and medical importance.
 5. Conjugated systems with open and cyclic chains. Aromaticity of arenes, nonbenzenes and heterocyclic compounds.
 6. Inductive and mesomeric effects. Electronic effects of the substituents. Importance for properties of the molecules.
- II. SPATIAL STRUCTURE OF THE MOLECULES**
 7. Isomerism. Structural isomerism - types. Tautomerism.
 8. Stereoisomerism. Geometrical isomerism. Conformation. Optical isomerism.

III. PRINCIPLES OF MOLECULAR REACTIVITY

9. Criteria for predicting the direction of chemical reactions. Equilibrium constant, entropy and free energy.
10. The relationship between free energy and equilibrium constant. Exergonic, endergonic and anergonic processes. Coupled processes. Compounds with energy – rich bonds.
11. Chemical kinetics. Molecularity and order of reactions. Rate equations.
12. Temperature dependence of reaction rate. Activation energy, the Arrhenius equation.
13. Oxidation–reduction reactions. Some definitions. Types of redox reactions.
14. Criteria for predicting the direction of redox reactions – the Nernst equation. Rate of oxidation–reduction reactions. Redox catalysts. Biological oxidation.
15. Acids and bases according to the theories of Arrhenius, Brønsted–Lowry and Lewis. General concept.
16. Autoionization of water, ion product of water, pH, methods to measure pH.
17. Strength of acids and bases – pK_a and pK_b . Henderson–Hasselbalch equation. Buffers.

IV. METHODS FOR CHEMICAL ANALYSIS OF BIOMATERIALS

18. Qualitative analysis. Chemical reactions for identification of some cations and anions with biological importance. Concrements.
19. Concentration of solutions, methods of expression and calculation. Clinical importance.
20. Quantitative analysis. Principle of volumetric (titrimetric) analysis.
21. Acid–base volumetric analysis. Titration curves.
22. Redox titrations. Potassium permanganate titrations (Permanganatometry). Importance.
23. Complexometric titrations. Complexonometry.
24. Photometric analysis – principles and applications in clinical laboratory and biochemistry.

V. HYDROCARBONS, MONO- AND POLYFUNCTIONAL DERIVATIVES OF THE HYDROCARBONS

25. Hydrocarbons and halogen derivatives of hydrocarbons with medico-biological importance. Fundamental types of organic reactions.
26. Alcohols and phenols, thiols, ethers, amines, and their derivatives. Representatives. Characteristic chemical reactions with medico-biological importance.
27. Carbonyl compounds. Classification. Main representatives from aldehydes, ketones, quinones. Structure and reactivity of the carbonyl group. Characteristic chemical reactions with medico-biological importance for aldehydes, ketones, and quinones.
28. Carboxylic acids. Representatives. Structure of carboxylic group and characteristic chemical reactions for carboxylic acids.
29. Functional derivatives of carboxylic acids – characteristics and types. Main chemical properties.

VI. HETEROFUNCTIONAL DERIVATIVES OF THE HYDROCARBONS. MAIN METABOLITES AND SOME IMPORTANT DRUG SUBSTANCES.

30. Characteristic of the heterofunctional derivatives of hydrocarbons. Aminoalcohols, aminophenols and their derivatives with medico–biological importance.
31. Hydroxycarboxylic acids – characteristics, classification, isomerism, properties, representatives.
32. Aldehyde and keto acids – characteristics, classification, isomerism, properties, representatives. Carbonic acid and its derivatives.
33. Derivatives of benzene as drugs.

VII. BIOLOGICALLY IMPORTANT HETEROCYCLIC COMPOUNDS

34. Heterocyclic compounds – definition, classification and characterization. Five–membered heterocycles with one heteroatom. Pyrrole, indole and their derivatives.
35. Natural pyrrole pigments. Mioglobin, hemoglobin and bilirubin.
36. Five–membered heterocycles with two heteroatoms – pyrazole and imidazole. Analgesic and other derivatives.
37. Six–membered heretocycles with one heteroatom – group of pyridine.

38. Six- and seven-membered heterocycles with two heteroatoms – pyrimidine, diazepine and their derivatives.
39. Heterocyclic compounds with fused rings – purine, pteridine and their derivatives.

VIII. BIOPOLYMERS AND THEIR MONOMERS

40. Amino acids – characteristics, classification. Standard α -amino acids. Isomerism, physical properties. Amphoteric and chemical properties of amino acids. Peptides.
41. Carbohydrates – characteristics, classification. Monosaccharides – structure, isomerism, physical properties chemical properties, representatives.
42. Disaccharides – types, properties, representatives.
43. Polysaccharides – types, representatives and main important properties. Heteropolysaccharides.

IX. LIPIDS AND LOW-MOLECULAR MASS BIOREGULATORS

44. Lipids – classification, fatty acids. Simple lipids. Fats – structure and properties.
45. Complex lipids. Phosphoglycerides, sphingolipids and glycolipids – types, structure, properties, representatives.
46. Nonsaponifiable lipids. Terpenes and carotenoids – characteristics, types, structure, representatives.
47. Steroids – characteristics, representatives.