

Lectures and practical exercises

Subject:	Medical Chemistry	Code:	<i>ULCHBKB/MCH-GM/22</i>
Study Programme:	<i>General Medicine</i>	Study Period:	<i>1. semester</i>
Evaluation:	<i>Exam</i>	Subject Type:	<i>compulsory</i>
Content:	<i>2 h lectures and 2 h practical exercises / week</i>		<i>Total 56 hours</i>

Workplace: **Department of Medical and Clinical Biochemistry, UPJŠ in Košice, FM**

<i>Week</i>	<i>Lectures</i> https://portal.lf.upjs.sk/index-en.php	<i>Practical Lessons</i> https://portal.lf.upjs.sk/index-en.php
1.	<p>INTRODUCTION TO MEDICAL CHEMISTRY</p> <ul style="list-style-type: none"> - Definition of terms - International (English) nomenclature - Properties of elements, micro- and macro-elements <p>WATER AND SOLUTIONS</p> <ul style="list-style-type: none"> - Water, properties and biological function of water - Disperse systems, properties of disperse systems - Solutions 	<p>PRINCIPLES OF LABORATORY TECHNIQUE</p> <ul style="list-style-type: none"> - Laboratory safety rules - Equipment of laboratory bench - exercise: <i>Volume measurement</i>
2.	<p>BIOCHEMICAL REACTIONS PROCESS RULES I</p> <ul style="list-style-type: none"> - Kinetics of chemical reaction - Effect of reactant concentration, temperature on reaction rate. Order of reaction rate - Arrhenius, Brønsted-Lowry and Lewis theory - Autoprotolysis, H⁺ exponent - pH of acids and bases. Buffer systems. Hydrolysis of salts - Equilibrium of a chemical reaction, equilibrium constant - Impact of factors on chemical equilibrium 	<p>NOMENCLATURE OF INORGANIC COMPOUNDS (English)</p> <p>CALCULATIONS</p> <ul style="list-style-type: none"> - Stoichiometric calculations
3.	<p>BIOCHEMICAL REACTIONS PROCESS RULES II</p> <ul style="list-style-type: none"> - The basics of chemical thermodynamics - Internal energy, enthalpy, entropy - Gibbs free energy, chemical reaction spontaneity - Precipitation reactions, solubility equilibrium - Complexation reactions, complex formation Redox reactions, redox potential - Electrode potential of metals, Electrochemistry 	<p>CALCULATIONS</p> <ul style="list-style-type: none"> - Solutions <p>VOLUMETRIC ANALYSIS</p> <ul style="list-style-type: none"> - exercise: <i>Standardization of NaOH solution</i>
4.	<p>ORGANIC CHEMISTRY I</p> <ul style="list-style-type: none"> - Alcohols and aldehydes - Carboxylic acids - Functional derivatives of carboxylic acids - Substitutional derivatives of carboxylic acids - Carbonic acid derivatives 	<p>CALCULATIONS</p> <ul style="list-style-type: none"> - Calculation of pH of acid, base, and salt solutions <p>pH MEASUREMENT</p> <ul style="list-style-type: none"> - exercise: <i>Preparation and pH measurement of acetate buffers</i>
5.	<p>ORGANIC CHEMISTRY II</p> <ul style="list-style-type: none"> - Organic sulphur, phosphorus, nitrogen compounds, structure, and biological significance - 5-membered heterocycles with one or more heteroatoms - 6-membered heterocycles with one or more heteroatoms 	<p>CALCULATIONS</p> <ul style="list-style-type: none"> - Calculation of buffers pH <p>BUFFER SYSTEMS</p> <ul style="list-style-type: none"> - exercise: <i>Effect of acids and bases on pH of buffers</i>
6.	<p>1st REVISION TEST</p> <p>ORGANIC CHEMISTRY III</p> <ul style="list-style-type: none"> - Biochemically and medicinally important derivatives of heterocyclic compounds (purines, pyrimidines, hormones, medicinal drug, dyes) - Heterocycles in drugs 	<p>CALCULATIONS</p> <ul style="list-style-type: none"> - Balancing redox reactions <p>PROPERTIES OF ORGANIC COMPOUNDS</p> <ul style="list-style-type: none"> - exercise: <i>Preparation of esters of carboxylic acids</i>

Lectures and practical exercises

7.	<p>SACCHARIDES AND THEIR IMPORTANT DERIVATIVES</p> <ul style="list-style-type: none"> - The relationship between structure and biological properties of saccharides - Biologically important monosaccharides and their derivatives - Disaccharides and polysaccharides - Complex saccharides and their importance 	<p>CALCULATIONS</p> <ul style="list-style-type: none"> - Spectrophotometric calculations <p>SPECTROPHOTOMETRY</p> <ul style="list-style-type: none"> - exercise: <i>Spectrophotometric determination of copper with ammonia</i>
8.	<p>LIPIDS AND STEROIDS</p> <ul style="list-style-type: none"> - Basic structure and classification of lipids - Fatty acids, their medical importance - Eicosanoids - Complex lipids - Steroids – classification, importance 	<p>SACCHARIDES</p> <ul style="list-style-type: none"> - exercise: <i>Nitrochromium reaction</i> - exercise: <i>Seliwanoff's reaction</i> - exercise: <i>Tollen's reaction</i> - exercise: <i>Tollen's reaction (silver mirror)</i> - exercise: <i>Fehling's reaction</i> - exercise: <i>Lugol test</i>
9.	<p>AMINO ACIDS, PEPTIDES</p> <ul style="list-style-type: none"> - Classifications of amino acids, biochemical properties and their use in biochemistry - Amino acid derivatives and their biochemical significance - Peptides – structure, peptide bond, properties - Biochemically important peptides (e.g. glutathion) 	<p>LIPIDS</p> <ul style="list-style-type: none"> - exercise: <i>Hydrolysis of neutral lipids by lipase</i> - exercise: <i>Detection of double bonds in fatty acids</i>
10.	<p>PROTEINS</p> <ul style="list-style-type: none"> - Spatial structure, classification, physical-chemical properties, biological and biomedical importance - Functional protein dispersity - Complex proteins and their function - Isolation methods and their use in medical practice 	<p>AMINO ACIDS</p> <ul style="list-style-type: none"> - exercise: <i>Ninhydrin reaction</i> - exercise: <i>Xanthoprotein reaction</i> - exercise: <i>Foli's reaction</i> - exercise: <i>Determination of unknown protein</i>
11.	<p>NUCLEIC ACIDS</p> <ul style="list-style-type: none"> - Nucleotides and nucleosides - Biochemically important nucleotides with high energy hydrolysis - DNA and RNA - structure and biologic properties - Nucleic acid analysis techniques, their use in medical practice (restriction enzymes, PCR) 	<p>PROTEINS</p> <ul style="list-style-type: none"> - exercise: <i>Reversible precipitation of proteins</i> - exercise: <i>Irreversible precipitation of proteins</i> - exercise: <i>Biuret reaction</i>
12.	<p>2nd REVISION TEST</p> <p>NATURAL COMPOUNDS, VITAMINS</p> <ul style="list-style-type: none"> - Terpenes, alkaloids and flavonoids - structure physical-chemical properties, biological significance - General properties of vitamins - structure and their importance in biochemistry (e.g. coenzymes) and in medicine 	<p>NUCLEIC ACIDS I</p> <ul style="list-style-type: none"> - exercise: <i>Isolation of nucleoproteins from eukaryotic cells</i> - exercise: <i>Hydrolysis of nucleoprotein</i>
13.	<p>OXIDATIVE STRESS</p> <ul style="list-style-type: none"> - Biological importance of free ions in biosphere - Formation of oxygen and nitrogen radicals - Antioxidants 	<p>NUCLEIC ACIDS II</p> <ul style="list-style-type: none"> - exercise: <i>Detection of nucleic acids components</i> <p>3rd REVISION TEST – practical exercises, seminars</p>
14.	<p>MEMBRANES AND TRANSPORT</p> <ul style="list-style-type: none"> - Structure of biological membranes - Membrane proteins - Transport of substances across biological membrane - Free diffusion, facilitated diffusion - Active transport, group translocation 	<p>EVALUATION OF STUDENTS' WORK</p> <ul style="list-style-type: none"> - Final evaluation of practical exercises - Credit donation