

Week	Lectures	Practical exercises <a href="http://portal.lf.upjs.sk">http://portal.lf.upjs.sk</a>
1	<b>INTRODUCTION TO MEDICAL CHEMISTRY</b> <ul style="list-style-type: none"> <li>- International (English) nomenclature</li> <li>- Properties and biological importance of water</li> <li>- Solution, their properties (diffusion and osmosis)</li> <li>- Electrolytes in body liquids</li> <li>- Solubility product</li> </ul> <p style="text-align: right;"><i>RNDr. Stupák</i></p>	<b>Principle of laboratory technique</b> <ol style="list-style-type: none"> <li>1. Safety in chemical laboratory (1.1)</li> <li>2. Basic equipment of laboratory (1.3, 1.4)</li> <li>3. Volume measurements and pipetting (1.5)</li> <li>4. Video: Laboratory technique I.II.III</li> </ol> <p style="text-align: right;"><i>RNDr. Stupák</i></p>
2	<b>ACID BASE REACTIONS, pH, BUFFERS</b> <ul style="list-style-type: none"> <li>- Acid base reactions</li> <li>- pH of weak acids and bases, hydrolysis of salts</li> <li>- Buffer system and colloid solution.</li> <li>- Properties of colloidal solution</li> <li>- Thermodynamics in living systems</li> <li>- Energy and kinetics of chemical reactions</li> <li>- Oxidation-reduction reactions in living organisms</li> </ul> <p style="text-align: right;"><i>RNDr. Mašlanková</i></p>	<b>Preparation of solutions</b> <ol style="list-style-type: none"> <li>1. Recrystallization of lead (II) iodine (2.2)</li> </ol> <p><u>Seminar- Calculations I.</u></p> <ul style="list-style-type: none"> <li>- Calculation of solution concentration</li> <li>- Stoichiometric calculations (16.1)</li> </ul> <p style="text-align: right;"><i>Mgr. Urban</i></p>
3	<b>NON-METAL ELEMENTS AND THEIR COMPOUNDS IN DENTAL MEDICINE</b> <ul style="list-style-type: none"> <li>- Non metallic elements and inorganic compounds of calcium and phosphorus</li> <li>- Chemical structure of bones and teeth</li> <li>- Dental ceramics and its properties (fragility, strength, hardness, density, thermal conductivity, optical properties)</li> <li>- Dental porcelain and cements</li> </ul> <p style="text-align: right;"><i>RNDr. Stupák</i></p>	<b>Volumetric analysis</b> <ol style="list-style-type: none"> <li>1. Standardization of NaOH solution (4.5)</li> <li>2. Determination of acetic acid – instruction</li> <li>3. Determination of ammonia in waste water (4.6)</li> </ol> <p><u>Seminar- Calculations II.</u></p> <ul style="list-style-type: none"> <li>- The principles of volumetric analysis</li> <li>- Calculations involving titration</li> </ul> <p style="text-align: right;"><i>RNDr. Stupák</i></p>
4	<b>METAL AND THEIR ALLOYS</b> <ul style="list-style-type: none"> <li>- Structure and properties of metals, hardening and recrystallization, Cooling curves of metals and their alloys</li> <li>- Crystallographic systems</li> <li>- Noble metals and their alloys</li> <li>- Classification of dental alloys, amalgams, their composition, structure and properties</li> <li>- Crystalline structure of pure metals</li> </ul> <p style="text-align: right;"><i>RNDr. Stupák</i></p>	<b>pH of acids and bases</b> <ol style="list-style-type: none"> <li>1. Preparation of acetate buffers (5.1) Buffering capacity (5.2)</li> <li>2. Determination of iodine in Lugol solution (5.3)</li> </ol> <p><u>Seminar – Calculation III.</u></p> <p>Calculations of pH of the solutions and buffers</p> <p style="text-align: right;"><i>Mgr. Urban</i></p>
5	<b>DERIVATES OF HYDROCARBONS</b> <ul style="list-style-type: none"> <li>- Carboxylic acids and their derivatives (salicylic acid, nicotinic acid, fatty acids)</li> <li>- Medical and toxicological significance</li> <li>- Significant organic nitrogen compounds, derivatives of carbonic acid (urea and its derivatives), guanidine and its derivatives (creatine and creatinine)</li> <li>- Organic compounds of sulfur, phosphorus, esters of phosphorus acid and their biological significance</li> </ul> <p style="text-align: right;"><i>RNDr. Mašlanková</i></p>	<b>Precipitation and complex reactions</b> <ol style="list-style-type: none"> <li>1. Solubility of halides (6.1)</li> <li>2. Solubility of silver halides (6.3)</li> <li>3. Complex formation of tetraamminocopper (II) ion (6.2)</li> <li>4. Complexometric determination of calcium</li> </ol> <p><u>Seminar – Calculations IV.</u></p> <p>Calculation of red.-ox. reactions Calculation of solubility product <math>K_s</math></p> <p style="text-align: right;"><i>RNDr. Stupák</i></p>
6	<b>HETEROCYCLES</b> <ul style="list-style-type: none"> <li>- Five or six-membered ring heterocycles with 1 or more heteroatoms (including condensed rings)</li> <li>- Biochemically and medically important derivatives of heterocyclic compounds (co-enzymes, vitamins, amino acids, purines, pyrimidines, carbohydrates, hormones, medicines, dyes).</li> <li>- Heterocyclic compounds as drugs</li> </ul> <p style="text-align: right;"><i>Mgr. Urban</i></p>	<b>Principles of spectrophotometry</b> <ol style="list-style-type: none"> <li>1. Calculation of concentration based on spectrophotometric measurement (16.7)</li> <li>2. Spectrophotometric determination of copper (7.1)</li> </ol> <p><b>Repeating test from inorganic chemistry (1<sup>st</sup> to 4<sup>th</sup> week)</b></p> <p style="text-align: right;"><i>Mgr. Urban</i></p>
7	<b>POLYMERIZATION AND POLYCONDENSATION</b> <ul style="list-style-type: none"> <li>- Polymerisation, polycondensation and polyaddition.</li> <li>- Some macromolecules resulting from the polycondensation, their importance and use in the synthesis of synthetic materials used in dentistry</li> <li>- Dental plastics, their composition and chemical importance</li> </ul> <p style="text-align: right;"><i>RNDr. Stupák</i></p>	<b>Reaction of hydrocarbon derivatives</b> <ol style="list-style-type: none"> <li>1. Ethanol test in expired air (8.1.2)</li> <li>2. Reaction of phenols (8.1.3)</li> <li>3. Reduction of Fehling reagent (8.2.1)</li> <li>4. Lestradet test for acetone (8.2.2)</li> </ol> <p><u>Seminar –organic chemistry I.</u></p> <p style="text-align: right;"><i>RNDr. Stupák</i></p>

8	<p><b>IMPRESSIONS MATERIALS</b></p> <ul style="list-style-type: none"> <li>- Impressions materials, their chemical composition and importance</li> <li>- Model plaster (production, setting plaster, mixing ratio, volume change of plaster, strength)</li> <li>- Modelling materials (wax), moulding materials (thermal expansion, thermal inversion, refractorines, porosity, volume changes).</li> </ul> <p style="text-align: right;"><i>RNDr. Stupák</i></p>	<p><b><u>Properties of organic acids</u></b></p> <ol style="list-style-type: none"> <li>1. Detection of lactic acid (8.3.2)</li> <li>2. Preparation of carboxylic acid esters (8.3.5)</li> <li>3. Determination of salicylic acid (8.3.3)</li> </ol> <p style="text-align: center;">Seminar – organic chemistry II.</p> <p style="text-align: right;"><i>Mgr. Urban</i></p>
9	<p><b>SACCHARIDES</b></p> <ul style="list-style-type: none"> <li>- Saccharides and their important derivatives</li> <li>- Relationship of structure and biological properties of saccharides</li> <li>- Monosaccharides, disaccharides and polysaccharides (configuration, conformation, reactions)</li> <li>- Mucopolysaccharides – basic structure and properties</li> <li>- Proteoglycans – modulators of growth factors</li> <li>- Glycoproteins – structure and function</li> </ul> <p style="text-align: right;"><i>prof. Mareková</i></p>	<p><b><u>Heterocyclic compounds – properties and reactions</u></b></p> <ol style="list-style-type: none"> <li>1. Solubility of uric acid (9.1)</li> <li>2. Reducing properties of uric acid (9.2)</li> <li>3. Detection of uric acid (9.3)</li> </ol> <p><b>Repeating test from organic chemistry (5<sup>th</sup> to 8<sup>th</sup> week)</b></p> <p style="text-align: right;"><i>RNDr. Stupák</i></p>
10	<p><b>LIPIDS AND STEROIDS</b></p> <ul style="list-style-type: none"> <li>- Structure and classification of lipids</li> <li>- Fatty acids, eicosanoids and their biomedical importance, derivatives of fatty acids</li> <li>- Complex lipids – phospholipids, glycolipids, lipoproteins</li> <li>- Composition, properties and function of biological membranes</li> <li>- Basic structure of steroids, classification of steroids (cholesterol, steroid hormones, bile acids)</li> </ul> <p style="text-align: right;"><i>prof. Mareková</i></p>	<p><b><u>Chemical properties of saccharides</u></b></p> <ol style="list-style-type: none"> <li>1. Chromatic reactions of monosaccharides (11.1.1)</li> <li>2. Reducing reactions of monosaccharides (11.1.2)</li> <li>3. Reducing properties of disaccharides (11.2)</li> <li>4. Hydrolysis of sucrose (11.3)</li> <li>5. Starch color reaction (11.4)</li> <li>6. Analysis of unknown sample (11.5)</li> </ol> <p><b>Seminar – saccharides</b></p> <p style="text-align: right;"><i>Mgr. Urban</i></p>
11	<p><b>PEPTIDES</b></p> <ul style="list-style-type: none"> <li>- Composition, classification and properties of peptide</li> <li>- Physico-chemical characteristic of peptides and their usage in biochemistry</li> <li>- Biochemically important peptides (glutathione)</li> <li>- Method of isolation and purification of peptides</li> </ul> <p style="text-align: right;"><i>prof. Mareková</i></p>	<p><b><u>Basic properties of lipids</u></b></p> <ol style="list-style-type: none"> <li>1. Hydrolysis of neutral lipids by lipase</li> <li>2. Saponification of fats (12.6)</li> <li>3. Detection of cholesterol (12.3)</li> <li>4. Solubility and lipid emulsification (12.2)</li> </ol> <p><b>Seminar – lipids</b></p> <p style="text-align: right;"><i>RNDr. Stupák</i></p>
12	<p><b>PROTEINS</b></p> <ul style="list-style-type: none"> <li>- Three dimensional structure of proteins, classification, physico-chemical properties, biological and biomedical importance (elastine, collagen)</li> <li>- Proteins in solution</li> <li>- Preparation of proteins (isolation, solubility, chromatography, electrophoresis, ultracentrifugation)</li> <li>- Complex proteins and their usage in medicinal practice</li> </ul> <p style="text-align: right;"><i>prof. Mareková</i></p>	<p><b><u>Characteristic reactions of amino acid and peptides</u></b></p> <ol style="list-style-type: none"> <li>1. Determination of total amino acids content (13.1) Ninhydrin reaction, amino acids detection by fluorescence</li> <li>2. Detection of individual amino acids (13.2)</li> <li>3. Detection of peptide bond by biuret reaction (13.3)</li> <li>4. Determination of amino acid according to Sørensen (13.1.1)</li> </ol> <p><b>Seminar – amino acids</b></p> <p style="text-align: right;"><i>Mgr. Urban</i></p>
13	<p><b>NUCLEIC ACIDS</b></p> <ul style="list-style-type: none"> <li>- Nucleosides and nucleotides – biochem. importance</li> <li>- Classification, structure and properties of nucleic acids</li> <li>- Biochemically important nucleotides with high energy of hydrolysis</li> <li>- DNA, structure, conformation, properties</li> <li>- RNA, structure, function, classification</li> <li>- Method of analysis of nucleic acids, usage in medicinal practice (restriction enzymes, PCR)</li> </ul> <p style="text-align: right;"><i>prof. Mareková</i></p>	<p><b><u>Chemical properties of proteins</u></b></p> <ol style="list-style-type: none"> <li>1. Reversible precipitation of protein (14.1)</li> <li>2. Irreversible precipitation of proteins (14.2)</li> <li>3. Hydrolysis of proteins (14.3)</li> <li>4. Determination of proteins according to Biureta (instruction)</li> </ol> <p><b>Repeating test from organic chemistry (9<sup>th</sup> to 12<sup>th</sup> week)</b></p> <p style="text-align: right;"><i>RNDr. Stupák</i></p>
14	<p><b>NATURAL COMPOUNDS</b></p> <ul style="list-style-type: none"> <li>- Terpenes, alkaloids, flavonoids, their structure, physicochemical characteristic, biological importance and usage in medicine</li> <li>- General properties of vitamins, structure and importance in biochemistry (coenzymes) and in medicine</li> <li>- Vitamins as coenzymes</li> </ul> <p style="text-align: right;"><i>prof. Mareková</i></p>	<ol style="list-style-type: none"> <li>1. Summary and evaluation of student work</li> <li>2. Credit tests</li> </ol>