

## Examination from Medical Chemistry - Autumn 2007

Examination from Medical chemistry is only written. The test consists from two parts.

**The first part** comprises 25 questions (time limit 45 min):

- 4-5 calculations (concentration, pH, buffers, osmotic pressure) – see seminars
- 16 simple questions (multiple choice or free answer)
- 5 structural formulas (essential organic and inorganic compounds)

Each correct answer counts for 1 point, maximal acquisition = 25 points

### Examples of simple questions from the first part

- ✓ Write the Latin name of the compound XY.
- ✓ Which period does the element X occur in?
- ✓ Write the valence electrons of the element Y.
- ✓ Which compound from the following hydrolyzes?
- ✓ Select weak electrolytes from the following compounds.
- ✓ Select conjugate pairs from the following species.
- ✓ Complete the reaction.
- ✓ Complete the structural formula.
- ✓ Give the name of compound which is formed by dehydrogenation/dehydration/.....
- ✓ What heterocycle is contained in the compound X?
- ✓ Draw the ionic structure of amino acid at pH ....
- ✓ Give the name of the compound.
- ✓ Structures of fatty acids, monosaccharides etc. – give the name or describe the structure.
- ✓ Structures of biopolymers – types of bonds, building units, non-covalent interactions etc.

**The second part** (time limit 45 min) comprises  $3 \times 5$  problems, as active answers, from the three blocks (general + inorganic chemistry, organic chemistry, bioorganic chemistry). One block contains five parts (a-e), each part a-e is donated by 2 points. Maximal acquisition = 30 points ( $3 \times 5 \times 2$ ).

Answers have to be very explicit. Write very legibly, illegible answers will not be assessed.

### Example of the second part

#### I. Halogens

- a) Give the names and the symbols of halogens .....
- Put them in the order according to decreasing electronegativity .....
- Write the configuration of valence electrons of chlorine atom ..... and chloride ion .....
- Complete the reaction  $\text{Cl}_2 + 2 \text{X}^- \rightarrow \dots + \dots$ , where  $\text{X}^-$  is a halogenide ion.
- Which halogenides  $\text{X}^-$  can react this way? .....

b) Complete the table:

Compound	Practical usage in everyday life and/or human medicine
Lugol's solution	
Sodium chloride	
Sodium iodate	
Potassium fluoride	

2 p.

c) What is the concentration of chlorides in blood plasma? .....mmol/l

What is the function of chlorides in blood plasma? .....

The loss of chlorides from the body will cause the elevated plasma concentration of .....

What is the concentration of NaCl solution isotonic with blood plasma? .....mmol/l

2 p.

d) Complete the table:

Halogen	Compounds in human body (at least one)	The consequences of halogen deficit
Fluorine		
Iodine		

2 p.

e) Give at least **two** best food sources of **three** halogenides. Select from the following foodstuffs:

tea, milk, coffee, cocoa, coconut, sea products, tomatoes, beef, butter, potatoes, tap water, Vincentka, poppy seed, bacon, cheese, table salt, sugar, vinegar, legumes, spinach, liver, mushrooms, mineral waters, chocolate, mustard.

Halogenide	Food source

2 p.

## II. Amines

- a) Draw structural formulas and determine the type of compound (primary, secondary, tertiary amine, quaternary ammonium salt, amide).

	Cyclohexylamine	Benzylamine	Ethylenediamine	Urea
Formula				
Type of compound				

2 p.

- b) Give a general reaction of an amine with water: .....
- Explain acid-base properties of amines .....
- Write the reaction of methylamine with HCl .....
- Give the name of the product .....

2 p.

- c) Complete the table, encircle the correct possibility:

Feature	Amines	Amides
General formula		
Basicity	YES / NO	YES / NO
Salt formation	YES / NO	YES / NO
The pH of aqueous solutions	acidic / neutral / alkaline	acidic / neutral / alkaline

2 p.

- d) Complete the sentence: Biogenic amines are formed by .....
- Give the formulas and the names of **three** biogenic amines:

2 p.

- e) Give the names of **all** compounds called catecholamines: .....
- Complete: Decarboxylation of DOPA provides .....
- Write this reaction in structural formulas:

2 p.

### III. Monosaccharides

a) Draw D-glucose in acyclic form.

Show the groups which react to make pyranose.

What general type of product is formed in such reaction?

2 p.

b) Draw Haworth formula of  $\beta$ -D-glucopyranose.

Show the anomeric carbon atom.

What is the relation between  $\alpha$ - and  $\beta$ -anomer of glucose? Encircle the best answer from the following:

enantiomer, epimer, diastereomer, tautomer.

What type of conformation prevails in pyranoses?

2 p.

c) In Haworth projection, draw the formula of product formed by the C-6 oxygenation of D-glucose.

Give the name.

This compound binds e.g. to bilirubin, catecholamines. What is this reaction good for in human body?

Great amount of this compound occurs in proteoglycans. What is the general name of saccharide component?

2 p.

d) What is the product of the hydrogenation of ribose? Give the name and draw the structural formula.

Which vitamin contains this compound?

2 p.

e) Complete the table:

Disaccharide	Monosaccharide units
Sucrose	
Maltose	
Lactose	
Cellobiose	

2 p.