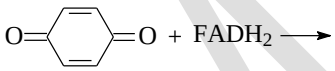
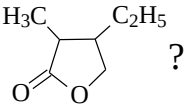
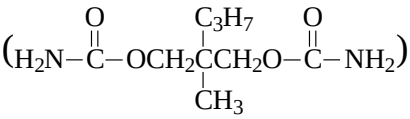
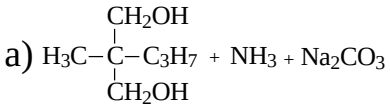
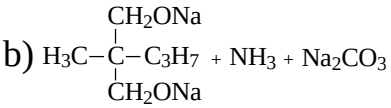
Unit IV.
Online test (typical questions)

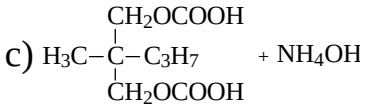
1. Which of the following compounds can act only as oxidants in biological redox processes?
   a) thiol; b) FAD; c) O_2; d) pyrocatechol.
2. The reaction cysteine (2R–SH) – 2ē → cystine (R–S–S–R) + $2H^+$ is:
   a) reduction process b) neither reduction nor oxidation c) oxidation
3. How will an increase in pH affect the value of the reduction potential for the system $NAD^+ + H^+ + 2ē \rightarrow NADH$?
   a) potential will increase b) potential will decrease c) potential will not change.
4. Determine whether the reaction
   $^-OOCCH_2C(O)COO^- + NADH + H^+ \rightarrow {}^-OOCCH_2CH(OH)COO^- + NAD^+$
   is spontaneous under standard biological conditions if
   $E°'$(oxalacetate, $2H^+$/malate) = – 0.17 V and $E°'$(NAD^+, H^+/NADH) = – 0.32 V.
   a) spontaneous b) impossible to say c) nonspontaneous
5. Name the product of the following reaction:

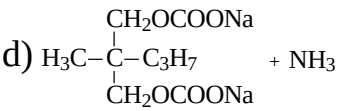


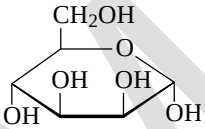
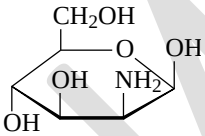
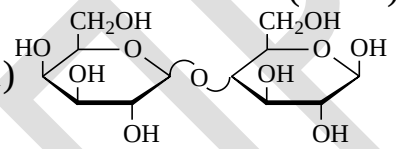
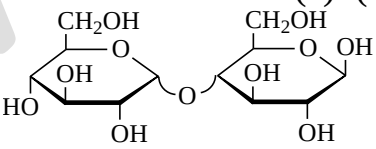
   a) *para*-benzoquinone b) pyrocatechol c) hydroquinone d) *ortho*-benzoquinone
6. Which reaction (intermolecular or intramolecular esterification) can occur for each of the following compounds upon heating?
   a) $CH_3CH(OH)CH(CH_3)COOH$ b) $HOOCCH_2CH(OH)CH(CH_3)COOH$
   c) $(CH_3)_2C(OH)COOH$ d) $HOOCCH(CH_3)CH(OH)CH(CH_3)COOH$
   e) $CH_3CH(OH)CH_2CH(CH_3)COOH$
7. Which product (lactam or lactone) will form upon heating of the following compounds?
   a) 4-hydroxy-2-methoxyhexanoic acid b) 3-hydroxycyclohexanecarboxylic acid
   c) 2-hydroxy-4-methoxypentanoic acid d) 2-amino-3-hydroxypentanoic acid
   e) 3-hydroxypentanedioic acid
8. Which type of tautomerism is possible for the compound  ?
   a) lactim-lactam b) keto-enol c) ring-chain d) none
9. Crotonic acid is the product of:
   a) elimination of γ-aminobutyric acid b) hydration of 3-butenoic acid
   c) elimination of β-aminobutyric acid d) dehydrogenation of γ-aminobutyric acid
10. The products of the hydrolysis of meprotan () in excess aqueous NaOH are:

a) 

b) 

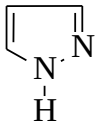
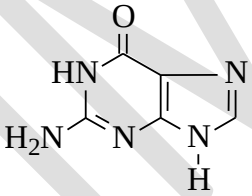
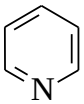
c) 

d) 

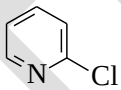
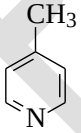
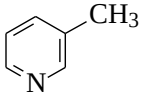
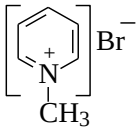
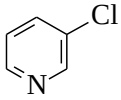
11. Decide whether the following statements are true or false:
    a) α-hydroxyacids do not form lactones on heating
    b) the decarboxylation of acetoacetic acid proceeds more readily than that of propionic acid
    c) colamine is weaker as a base than ethylamine
    d) *para*-aminobenzoic acid is stronger than salicylic acid
12. Classify the type (enantiomers, epimers, anomers) of isomers in each pair of compounds:
    a) D-glucose and D-mannose b) D-arabinose and L-arabinose
    c) D-ribose and D-xylose d) D-glucose and D-fructose
    e) α-D-glucopyranose and β-D-fructofuranose
13. Name the following compound: 
    a) β-D-mannopyranose b) α-D-mannofuranose
    c) β-D-mannofuranose d) α-D-mannopyranose
14. The compound  is the cyclic form of:
    a) 2-amino-2-deoxy-L-mannose b) 2-amino-2-deoxy-L-glucose
    c) 2-amino-2-deoxy-D-glucose d) 2-amino-2-deoxy-D-mannose
15. Match the formulae (1 or 2) with the chemical names (a)–(f):
    1) 
    2) 
    a) β-D-glucopyranosyl-(1→4)-α-D-glucopyranose
    b) α-D-glucopyranosyl-(1→4)-β-D-glucopyranose
    c) β-D-glucopyranosyl-(1→4)-β-D-glucopyranoside
    d) β-D-galactopyranosyl-(1→4)-α-D-glucopyranose
    e) α-D-galactopyranosyl-(1→4)-α-D-glucopyranose
    f) β-D-galactopyranosyl-(1→4)-β-D-glucopyranose
16. Which statements are true for: a) amylose; b) amylopectin?
    1) it consists of the residues of α-D-glucopyranose
    2) it belongs to branched polysaccharides
    3) it is soluble in water
    4) it forms methyl ethers
    5) it undergoes acid hydrolysis
    6) it forms coloured compound with iodine
17. Choose the true statements about glycogen:

a) it is a branched polysaccharide b) it is a linear polysaccharide
c) it contains β-D-glucopyranose units d) it is a reducing disaccharide

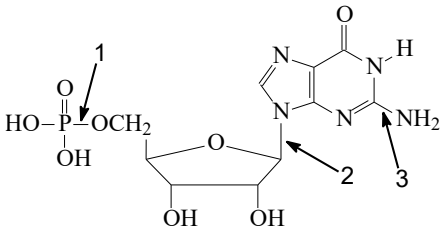
18. The reaction of a monosaccharide with an alcohol under acid conditions produces:
a) glycosides b) polyol c) uronic acids d) aldonic acids
19. Name the reaction product(s) of D-glucose and methanol:
a) *O*-methyl-α-D-galactopyranoside b) *O*-methyl-α-D-glucopyranoside
c) a mixture of *O*-methyl-α-D-glucopyranoside and *O*-methyl-β-D-glucopyranoside
d) *O*-methyl-β-D-glucopyranoside
20. The reduction of D-xylose produces:
a) D-mannitol b) xylitol c) sorbitol d) D-glucitol
21. Oxidation of a primary hydroxyl group in aldoses produces:
a) uronic acids b) aldaric acids c) aldonic acids d) glycosides
22. The equilibrium mixture that forms after isomerisation of D-glucose under alkaline conditions consists of:
a) D-mannose and D-fructose b) D-glucose, D-mannose and D-fructose
c) D-glucose and D-mannose d) D-glucose and D-fructose
23. Match the names of heterocycles (1–4) with their formulae (a–d):
1) pyridine 2) furan 3) guanine 4) pyrazole

a)  b)  c)  d) 

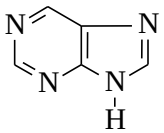
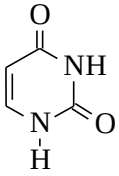
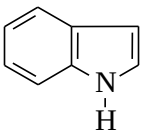
24. Match the formulae of the reagents (1 or 2) with the products of their reactions with pyridine (a)–(e):
1) CH_3Br 2) Cl_2, $AlCl_3$

a)  b)  c)  d)  e) 

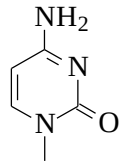
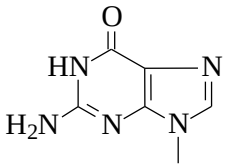
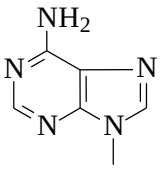
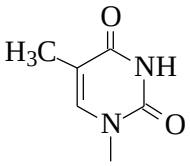
25. Identify the ester bond:



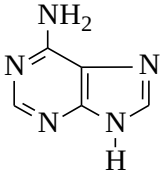
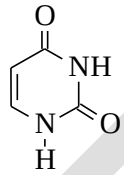
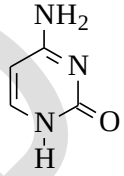
26. Which of the following compounds show only basic properties?

a)  b)  c)  d) 

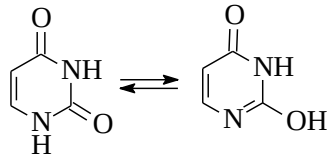
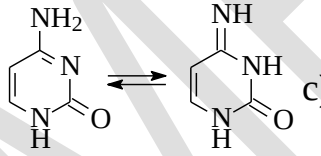
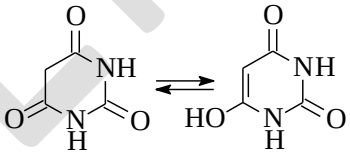
27. The fragment of adenine in RNA or DNA is:

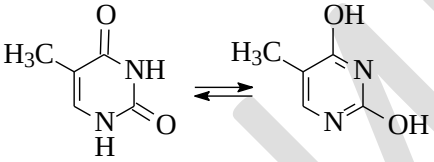
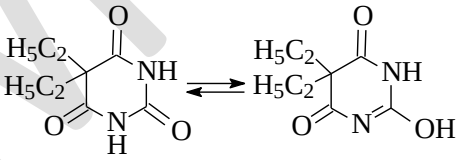
a)  b)  c)  d) 

28. What are the structural units of uridine?
    a) deoxyribose and uracil b) deoxyribose, phosphoric acid and uracil
    c) ribose, phosphoric acid and uracil d) ribose and uracil.
29. Which of the following compounds will undergo deamination in the reaction with nitrous acid?

a)  b)  c)  d) 

30. Match the type of isomerism (1 or 2) with its scheme (a)–(e):
    1) keto-enol 2) lactim-lactam

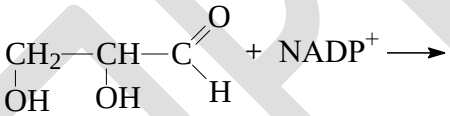
a)  b)  c) 

d)  e) 

Paper test (typical questions)

I. *(6 × 1 = 6 points, 2 points – names of the products)*

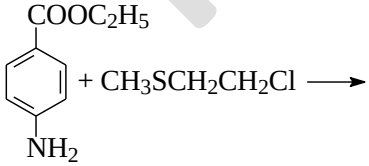
a) Complete the following reactions:

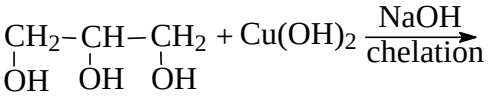
1) 

2) 

3) Choline + 

4) lactic acid + $CH_3C(O)SCoA$ ⟶

5) 

6) 

b) Write systematic and/or class names for the products.

II. *(1,5 × 4 = 6 points)*

a) Draw a scheme of ring-chain tautomerism for D-glucopyranose (two most common cyclic- and one oxo-form). Name the cyclic tautomeric forms. Specify the glycosidic hydroxyl group.

b) Draw the structural formula of glycogen fragment. Name the monosaccharide fragments, identify and state the type of bonds between them. State the type of this polysaccharides (linear, branched, homo- or heteropolysaccharide).

c) Complete the equations and name the products:

1) D-ribose $\xrightarrow{Br_2\ (aq)}$ 2) 5-phospho-α-D-ribofuranosyl 1-diphosphate + 2 H_2O $\xrightarrow{H^+}$

III. *(4 × 1,5 = 6 points)*

a) Draw the structural formula of cytidine-5'-monophosphate. Specify N-glycosidic and ester bonds.

b) Write the reaction scheme of the complete hydrolysis of this nucleotide. Indicate the reaction conditions and name the resulting products.

c) Draw the tautomeric forms of the nucleic base formed.

d) Complete the equations and name the product: adenine $\xrightarrow[\text{(or deaminase)}]{HNO_2\ /\ H_2O}$