Assessment tools for conducting attestation
in discipline «Organic chemistry»
for students of 2025 year of admission
under the educational programme
33.05.01 Pharmacy,
specialisation (profile) Pharmacy
(Specialist's degree),
form of study full-time correspondence
for the 2025 - 2026 academic year

1. Assessment tools for conducting current attestation in discipline «Organic chemistry».

The current attestation includes the following types of tasks: control work, interview on control questions

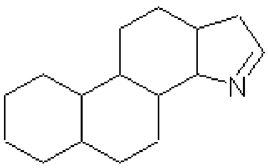
1.1. Examples of test

Verifiable indicators of competence achievement: UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3.

Choose just one correct answer

1. Choose the formula of sterane

1.



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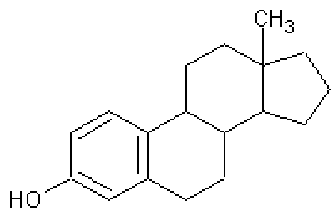

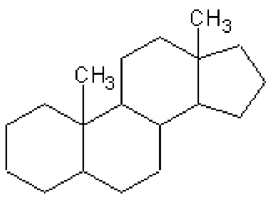

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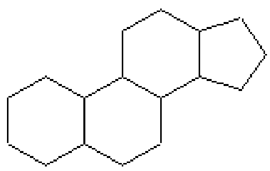


4.

2. What is the type of interaction between toluene and bromine in the presence of UV-radiation?

$$C_6H_5\text{-}CH_3 + Br_2 \rightarrow C_6H_5\text{-}CH_2Br + HBr$$

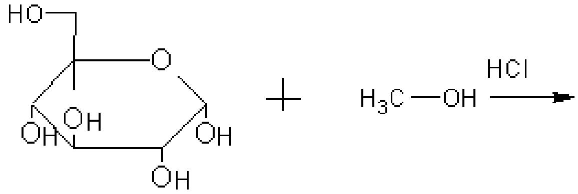
1. nucleophilic substitution S_N
2. electrophilic addition A_E
3. free-radical addition A_R
4. free-radical substitution S_R
5. electrophilic substitution S_E

3. Which compound is a product of aldol reaction?

1. $CH_2(OH)CH_2CH(CH_3)CH=O$

2. $CH_3CH(OH)CH(CH_3)CH{=}O$
3. $CH_3C(O)CH_2CH{=}O$
4. $CH_3CH(CH_3)CH(OH)CH{=}O$
5. $CH_2(OH)C(CH_3)CH(OH)CH_2OH$
   |
   OH

4. What compound is formed in the following conditions from the initial compound?

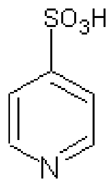


1. methyl-α,D-glucopyranoside
2. methyl-2,3,4,6-tetra-O-methyl- α,D-glucopyranoside
3. methyl-α(and β),D-glucopyranoside.

5. Define the type of hybridization of each carbon in 2-hexenal:

1. sp
2. sp^2
3. sp^3

6. Which compound is a product of pyridine sulphonation?

1.

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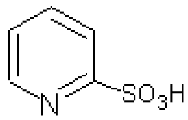
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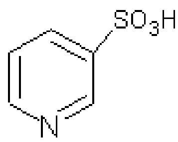
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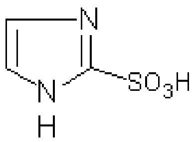
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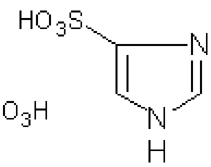
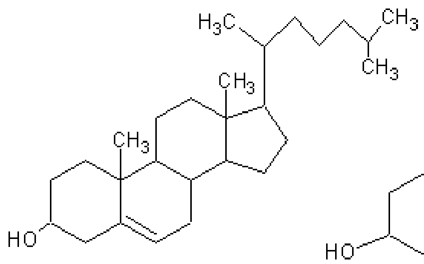


7. Which is cholesterol?

1.

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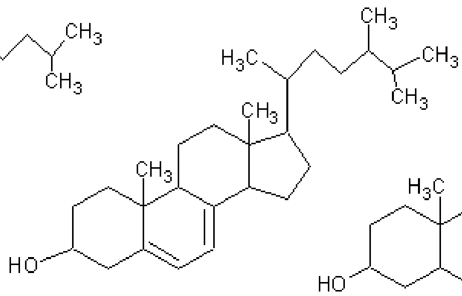
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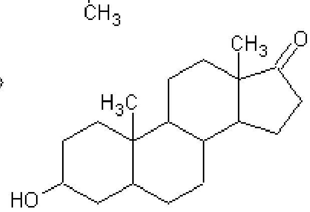


8. What pairs are wrong?

a) propyl $CH_3-CH_2-CH_2-$

b) butyl $CH_3-CH_2-CH_2-CH_2-$

c) sec-butyl $H_3C-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-$

d) isopropyl $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-$

e) tert-butyl $CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-$

9. Choose the naming according to the radicofunctional nomenclature of IUPAC from the column № 2 for the following compounds from the column № 1:

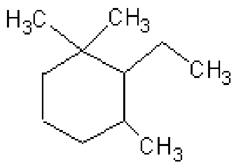
Column 1

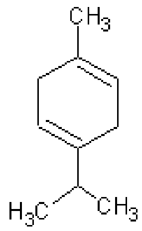
1) $HO-CH_2-CH_2-CH_2-SH$ 2) $HS-CH_2-CH_2-CH_2-COOH$

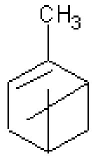
Column 2

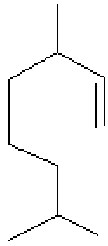
a) 4-mercaptobutanoic acid
b) 3-hydroxypropanthiol-1
c) 3-carboxypropanthiol
d) 3-mercaptopropanol-1
e) 1-hydroxy-3-mercaptopropane

10. Which formula is α-pinen

1. 

2. 

3. 

4. 

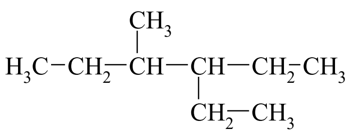
11. Complete and give the name: Delta Sleep Inducing Peptide , DSIP
Trp-Ala-Gly-Gly-Asp-Ala-Ser-Gly-Glu

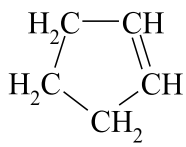
12. Complete primary structure of tetranucleotide of a nucleic acid: dA-T-dG-dC. Name nucleosides and nucleotides in the structure.

1.2. An example of a test case.

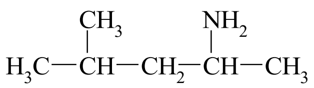
Verifiable indicators of competence achievement: UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3.

1. Name the following compounds:

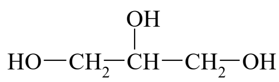
1. 

2. 

3. $H_3C-CH_2-CH_2-CH_2-OH$

4. 

5. $H_2C{=}CH-CH_2-Cl$

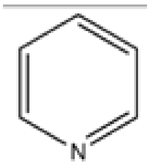
6. 

2. Write the structure of the following compounds:

a) 3-methylbutene-1
b) 2,4-dinitro-1-pentanol
c) 2-ethylbutanedial

3. Draw structural formulas for all possible isomers having the following molecular formula $C_5H_{10}O$ and name them

4. Is this compound aromatic? Explain your answer using four criteria of aromaticity



1.3. Examples of control questions for the interview.

Verifiable indicators of competence achievement: UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1

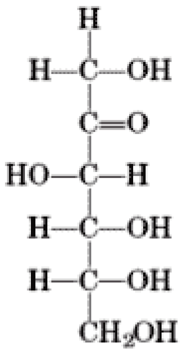
1. Structural theory of organic chemistry of A.Butlerov; sp, sp^2, sp^3 carbon atoms (draw them)/
2. Isomerism and isomers. Types of structural isomerism (with examples).
3. Theories which explain acidic and basic properties of organic substances. Give examples of organic acids and bases, explain why they are acidic/basic.
4. Configurations: absolute and relative. D,L- and R,S-stereonomenclatures. Chiral atom and molecules. Configurations of configurational standard (glyceraldehyde), lactic acid, tartaric acid.

1.4 Assessment tools for students' independent work

The evaluation of independent work includes testing.

1.4.1. Examples of test tasks with a single answer

1. Carbohydrates are produced in the green leaves of plants by the process of
    1. photosynthesis
    2. metabolism
    3. hydrolysis
    4. respiration
2. Carbohydrates may contain the functional groups
    1. of an aldehyde
    2. of a ketone
    3. hydroxyl groups
    4. all of the above
3. The carbohydrate pictured above is a



1. ketopentose
2. aldohexose
3. ketopentose
4. aldopentose

1.4.2. Examples of multiple choice test tasks and/or matching and/or sequencing

1. Glycine is the one of the simple building blocks of proteins. What functional groups are present in glycine?

1. carboxylic group
2. amino group
3. hydroxy group
4. mercapto group

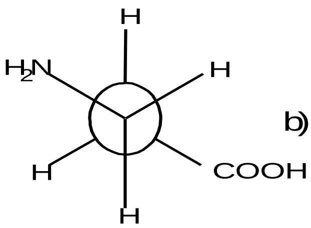
2. Choose correct names from the column 1 for the projection formulas from the column 2.

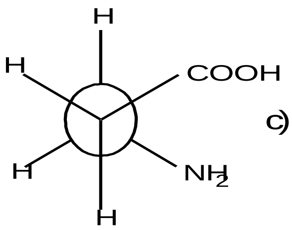
Column 1

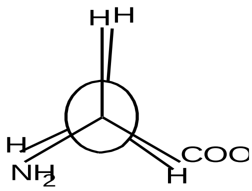
1) anti-conformation of the 3-aminopropanoic acid

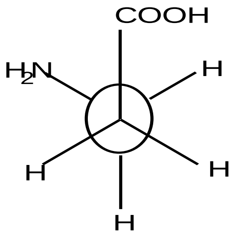
2) structure isomer of the 3-aminopropanoic acid

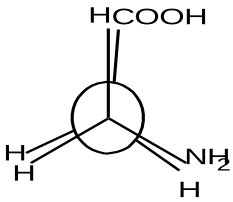
Column 2

a) 

b) 

c) 

d) 

e) 

2. Assessment tools for conducting intermediate attestation in a discipline « Organic chemistry ».

Intermediate attestation is carried out in the form of an exam. The intermediate attestation includes the following type of tasks: interview on control issues.

List of questions to prepare for the intermediate attestation:

№	EXAMINATION QUESTIONS	Verifiable general professional competencies
1.	The Butlerov`s theory of organic compounds structure. Electronic structure of the carbon atom and types hybridizations (sp, sp2, sp3).	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
2.	Classification of organic compounds. Classification of organic compounds according to molecular framework and according to the nature of functional group.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
3.	Nomenclature of organic compounds. Trivial name, IUPAC, radical-functional names for organic molecules. Homologous	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1,

	series.	GPC-1.2.1, GPC-1.3.1
4.	Isomerism and isomers. Types of isomerism: structural isomerism and stereoisomerism.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
5.	Stereoisomerism. Conformations of alkanes (ethane, butane). Newman projection formulas. Energy of conformers formation. Stereoisomerism. Conformations of cycloalkanes. Conformations of cyclohexane.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
6.	Stereoisomerism. Chirality and enantiomers. Configuration and the R–S transformation. Fischer projection formulas. Diastereomers. Relative and absolute configurations.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
7.	Electronic effects of molecules. Inductive effect. Electronic effects of molecules. Mesomeric effects. Conjugated systems. p,π– and π,π– conjugation.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
8.	Aromaticity of benzoic and nonbenzoic systems. Criteria of aromaticity.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
9.	Acidity and basicity of organic molecules. Effect of substituents on acidity and basicity of organic compounds. pKa and pKb.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
10.	Classification of organic reactions.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
11.	The free-radical chain mechanism of halogenation (S_R). Nucleophilic substitution mechanisms. The SN_2 and SN_1 mechanisms compared.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
12.	Elimination reaction mechanism E_1 and E_2. Substitution and elimination in competition.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
13.	The mechanism of electrophilic aromatic substitution S_E (halogenation, nitration, sulfonation, alkylation and acylation). Ring-activating and ring-deactivating substituents.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
14.	Mechanism of electrophilic addition to alkenes A_E (halogenation, hydration, addition of acids). Addition of unsymmetric reagents to unsymmetric alkenes, Markovnikov`s rule. The Karasch effect.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
15.	Saturated hydrocarbons. Alkanes and cycloalkanes. Classification, nomenclature. Chemical properties of saturated hydrocarbons – alkanes and cycloalkanes: free-radical chain mechanism of halogenation, nitration, sulfonation, sulfohalogenetion reactions, oxidation and isomerization reactions.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
16.	Unsaturated hydrocarbons. Alkenes. Chemical properties of	UC-1.1.1, UC-1.2.1,

	unsaturated hydrocarbons. Addition reactions, halogenation, hydration, addition of acids. Addition of unsymmetric reagents to unsymmetric alkenes, Markovnikov`s rule. Antimarkovnikov`s rule. Oxidation reaction of alkenes. Polymerization reaction.	UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
17.	Alkynes. Structure, classification, nomenclature. Chemical properties of unsaturated hydrocarbons – alkynes. Acidic properties, addition reactions, oxidation.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
18.	Arenes. Classification and nomenclature. Chemical properties of aromatic hydrocarbons: The mechanism of electrophilic aromatic substitution S_E (halogenation, nitration, sulfonation, alkylation and acylation). Ring-activating and ring-deactivating substituents. Addition, isomerization, polymerization of arenes.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
19.	Organic halides: structure, classification, isomerism, and preparation. Chemical properties of halogen derivatives. Substitution and elimination reactions, formation of Grignard reagent.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
20.	Oxygen-containing organic compounds: alcohols – classification, nomenclature and isomerism. Preparation of alcohols. Chemical properties of aliphatic alcohols. Acidic character, substitution (alkylation, acylation, esterification, reaction with Grignard reagent) and elimination (dehydration), oxidation reactions. Chemical properties of ethylene glycol and glycerol and their application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
21.	Oxygen-containing organic compounds: phenols – classification, nomenclature and isomerism. Preparation and chemical properties of phenols. Acidic character, substitution.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
22.	Amines: classification and nomenclature. Preparation, chemical properties of amines: Basic character, substitution reactions, reactions with nitrous acid.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
23.	Classification and nomenclature of aldehydes and ketones. Electronic structure of carbonyl group. Nucleophilic addition to carbonyl group A_N (addition of alcohols, water, hydrogen cyanide). Addition-elimination of nitrogen nucleophiles (reaction with primary amines, hydroxylamine, hydrazine, phenylhydrazine, semicarbazide). The aldol condensation. The Cannizzaro condensation. Reduction, oxidation polymerization of carbonyl compounds.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
24.	Classification and nomenclature of carboxyl acids. Electronic structure of carboxyl group. Acidity of acids. Effect of structure on acidity. Chemical properties of carboxylic acids. The mechanism of esterification. Fats and oils.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
25.	Dicarboxylic acids (oxalic, malonic, succunic, glutaric acids). Methods of preparation. Specific properties.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
26.	Amino alcohols. Colamine, choline, betain, dimedrol. Properties of amino alcohols.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1

27.	Hydroxy acids (malic, lactic, tartaric, citric). Preparation, general and specific properties of α-,β-,γ-hydroxyacids.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
28.	Salicylic acid: preparation, chemical properties. Derivatives in medicine.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
29.	Oxo acids (aldehyde acids and ketone acids). Preparation and general chemical properties of oxoacids. Keto-enol tautomerism of derivatives. Biorole of oxoacids.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
30.	Classification and nomenclature of amino acids. Isomerism of amino acids. The acid-base properties of amino acids. Dipolar ion structure. The isoelectric point. Chemical properties of amino acids.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
31.	Peptides. Structure of peptide bond. The primary, secondary, tertiary, quaternary structure of proteins. Peptide synthesis. Test reactions for aminoacids and proteins.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
32.	Definitions and classification of carbohydrates. Chirality in monosaccharides. Fischer projection formulas and D-, L-sugars. The cyclic hemiacetal structures of monosaccharides. Pyranose and furanose structures. Anomeric carbon atom (α-, β-forms). Mutarotation. Chemical properties of monosaccharides.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
33.	Disaccharides. Reducing and nonreducing sugars. Maltose, cellobiose, lactose, sucrose. Chemical properties of reducing sugars.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
34.	Homopolysaccharides. Starch (amylase and amylopectin), glycogen, cellulose, chitin. Structure and their hydrolysis. Biological importance and medical application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
35.	Heteropolysaccharides. Heparin, chondroitin sulphate, hyaluronic acid. Structure and their hydrolysis. Biological importance and medical application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
36.	Heterocyclic compounds. Their classification and nomenclature.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1
37.	Heterocyclic compounds. Five-membered heterocycles with one heteroatom: Furan, pyrrole, and thiophene. Preparation, aromaticity and chemical properties of pyrrole. Their derivatives: porphine, hemoglobin, chlorophyll.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-

		1.2.1, PC-1.3.1, PC-1.3.3
38.	Five-membered heterocycles with two heteroatoms. Oxazole, imidazole, thiazole. Preparation, aromaticity and chemical properties. Chemical properties of azoles. Their derivatives: thiamin, histidine, histamine.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
39.	Six-membered heterocycles with one heteroatom. Pyridine: preparation, aromaticity and chemical properties. Chemical properties of pyridine. Biorole of its derivatives: nicotine, pyridoxine, nicotinic acid.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
40.	Six-membered heterocycles with two heteroatoms. Pyrimidine: aromaticity and properties. Its derivatives: cytosine, thymine, uracil.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
41.	Fused-ring heterocycles: indole, quinoline and purine. Chemical properties and their derivatives.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
42.	Alkaloids: classification and representatives. Biological role and medical application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
43.	The general structure of nucleic acids. Heterocyclic base: the pyrimidines (cytosine, thymine, uracil) and the purines (adenine and guanine). Their lactim-lactam tautomerism. Nucleosides and their hydrolysis. Nucleotides. The primary structure of nucleic acids. Minor bases.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
44.	Secondary DNA structure. DNA replication. Complementary pairs and the Chargaff's rules. Ribonucleic acids, RNA. Types of RNA. Aniviral and anti cancer pharmaceuticals.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-

		1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
45.	Terpenes and terpenoids. Classification of terpenes. Isoprene rule. Acyclic terpenes and terpenoids. Ocimene, geraniol, geranial, licopene, vit A, β-carotine.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
46.	Terpenes and terpenoids. Classification of terpenes. Isoprene rule. Cyclic terpenes and terpenoids. Limonene, menthol, camphor.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
47.	Unsaponifiable lipids. Bile acids: cholic acid, cholanic acid, deoxycholic acid, glycocholic acid, taurocholic acid. Their structure, biological activity and medical application..	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
48.	Unsaponifiable lipids. Sex-hormones. Estrogens, androgens. Progestines. Biological activity and medical application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
49.	Unsaponifiable lipids. Cholane, cholesterol. Corticoids. Biological activity and medical application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
50.	Unsaponifiable lipids. Cardiac poisons. Biological activity and medical application.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
51.	Vitamins. Classification. Fat soluble vitamins:A, D, K, E: structure and biological activity.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1,

		GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3
52.	Vitamins. Classification. Water soluble group B vitamins, Vit C: structure and biological activity.	UC-1.1.1, UC-1.2.1, UC-1.3.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-1.1.1, PC-1.2.1, PC-1.3.1, PC-1.3.3

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Head of the Department of Chemistry, professor A.K. Brel