Evaluation tools for certification in the discipline "Special pharmaceutical chemistry" for students for students in 2020, 2021 admission according to the educational program specialist degree in the specialty of training 33.05.01 Pharmacy direction (profile) Pharmacy, form of study full-time (face to face) for the 2024-2025 academic year

1. ***Assessment tools for conducting current discipline assessment***

1.1. Evaluation tools for conducting certification in seminar-type classes

The current certification includes the following types of tasks: testing, situational task solving, control work, interview on control issues, assessment of the development of practical skills, preparation of essays.

1.1.1. Examples of test tasks

Verifiable indicators of competence achievement: UC-8.1.1, GPC-1.1.1, PC-10.1.1, PC-10.2.1. PC-11.1.1, PC-12.1.1, PC-4.1.1.

1. The quantitative content of drotaverine hydrochloride is determined by:

a) nitritometrically
b) argentometrically
c) by neutralization method
d) cerimetrically

2. When papaverine hydrochloride interacts with the Frede reagent,:

a) Red coloring
b) Green coloring
c) Blue coloring
d) Yellow-orange coloring

3. The products of aprofen hydrolysis are:

a) Diphenylacetic acid, 2-diethylaminoethanol
b) 2,2-diphenylpropionic acid, 2-diethylaminoethanol
c) 2,2-Diphenylpropionic acid, 2-(di-n-propylamino)-ethyl mercaptan
d) Diphenylacetic acid, 2-(diethylamino)ethyl mercaptan

4. The Sobolev reaction is used for identification:

a) Quinine hydrochloride
b) Aprofen
c) Dibazole
d) Papaverine hydrochloride

5. The thaleoquine test is based on the sequential action of quinine salts:

a) ammonia solution, bromine water
b) bromine water, ammonia solution
c) sulfuric acid, sodium hydroxide
d) potassium bichromate, sodium nitroprusside

6. *The pharmacopoeial method for determining the authenticity of drotaverine hydrochloride is:*

a) Interaction with concentrated sulfuric acid and formaldehyde
b) Interaction with concentrated sulfuric acid in the presence of iron (III) chloride
c) Interaction with Frede reagent
e) Interaction with iodine solution

7. *When papaverine hydrochloride reacts with concentrated sulfuric acid, it forms:*

a) White sediment
b) Purple coloration
c) Orange coloration that changes over the course of the udder
d) Yellow coloring, turning into orange

8. *The pharmacopoeial method of quantitative determination of drotaverine hydrochloride is:*

a) Argentometry
b) Neutralization method in an aqueous alcohol medium
c) Non-aqueous titration method
d) Gravimetric method

9. *The indicator in the mercurimetric method for the determination of dibazole is:*

a) Crystalline Purple
b) Phenolphthalein
c) Methyl Orange
d) Diphenylcarbazone

10. *A specific impurity in bendazole hydrochloride is:*

a) Diphenylamine
b) o-Phenylenediamine
c) Diphenylacetic acid
d) Veratrol

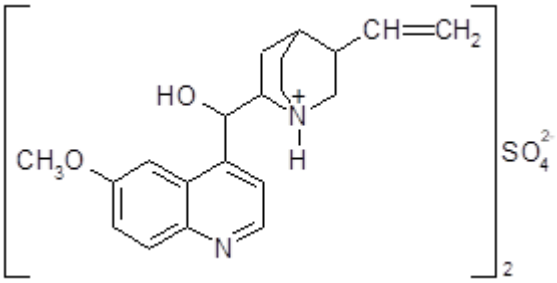
11. *In the case of reverse argentometric titration of dibazole, the indicator is:*

a) Ammonium rhodanide
b) Phenolphthalein
c) Iron-ammonium alum
d) Potassium chromate

1.1.2. Examples of situational tasks

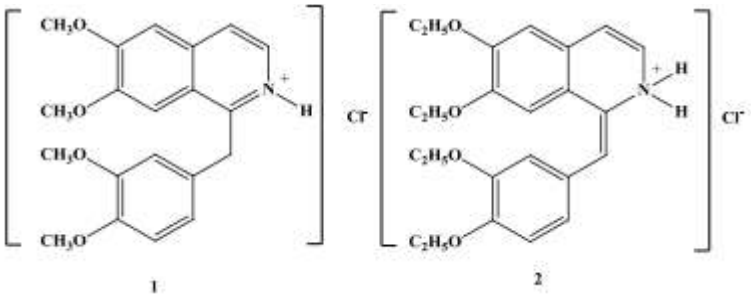
Verifiable indicators of competence achievement: UC-8.1.1, UC-8.2.1, GPC-1.1.1, GPC-1.2.1, GPC -1.3.1, PC-10.1.1, PC-10.2.1, PC-11.1.1, PC-12.1.1, PC-12.3.1, PC-4.1.1, PC-4.2.1, PC-4.3.1.

1. In industrial production conditions, suppositories containing a medicinal substance with the following chemical structure are obtained:



- ✓ When assessing the quality of this medicinal substance in samples of one batch, the indicator "Content of other alkaloids of the bark of the cinchona tree" did not meet the requirements of regulatory documentation. Specify and explain the method of determining this impurity and suggest other tests that characterize its quality.
- ✓ Please provide the Russian, Latin, and rational name of the drug. Describe the physico-chemical properties (appearance, solubility, spectral and optical characteristics) and their use for quality assessment.
- ✓ Based on the chemical properties, suggest identification reactions and quantification methods. Write the reaction equations.

2. The analytical laboratory of the chemical pharmaceutical enterprise received substances of medicinal substances with the following structures for analysis:



- ✓ When assessing the quality of substance 1 in samples of the same series, the pH value of the solution did not meet the requirements of the GF – it was less than 3.0. Provide a justification for the reasons for changing its quality according to this indicator in accordance with its properties. Suggest other tests that characterize its quality..
- ✓ Please provide the Russian, Latin, and rational name of the medicinal product. Describe the physico-chemical properties (appearance, solubility, spectral and optical characteristics) and their use for quality assessment.
- ✓ According to the chemical properties, suggest identification reactions and quantification methods. Suggest group-wide and differentiating reactions to their detection. Write the reaction equations.
- ✓ Suggest methods of quantitative determination, provide formulas for calculating the content of the medicinal substance. What environmental factors affect the stability of drugs? Suggest rational storage conditions and ways to stabilize the dosage form..

3. The head of the analytical department of the pharmacy analyzed the obtained substances quinine sulfate and quinine hydrochloride. He noted that both substances are slightly

soluble in water, the pH of their aqueous extracts is 5.5. To verify the authenticity, he used a thaleohine test, as a result of which the solution turned green. The quantitative determination of both drugs was carried out by the method of alkalimetry.

- ✓ Do the obtained substances comply with the requirements of regulatory documentation on solubility in water and pH values? If not, please explain the possible reasons for changing the values..
- ✓ Justify the choice of a reaction to establish authenticity and specify the conditions for its implementation, write a reaction diagram. What additional reactions and physico-chemical tests can you suggest?
- ✓ Is the quantification method correct? If so, please explain why and describe the conditions of the event. What other methods can be used for this purpose?

1.1.3. Examples of test options

Verifiable indicators of competence achievement: UC-8.1.1, UC-8.2.1, GPC-1.1.1, GPC -1.2.1, GPC -1.3.1, PC-10.1.1, PC-10.2.1, PC-11.1.1, PC-12.1.1, PC-12.3.1, PC-4.1.1, PC-4.2.1, PC-4.3.1.

Option 1

1. Write the formulas and specify the pharmacological action of the drugs: lobelin hydrochloride, quinine, spherophysine benzoate, pentoxifylline, aprofen, troventol.
2. Write a scheme for the synthesis of pilocarpine hydrochloride
3. Write the methods for authenticating atropine sulfate. Write reaction diagrams.
4. What methods are used to quantify caffeine? Characterize them, write down the equations of reactions.

Option 2

1. Write the formulas and specify the pharmacological action of the drugs: atropine sulfate, morphine, proserin, theobromine, strychnine nitrate, xanthinol nicotinate
2. Give a description of the method of obtaining caffeine
3. Write methods for authenticating quinine. Write the reaction diagrams.
4. What methods are used to quantify lobelin hydrochloride? Characterize them, write down the equations of reactions.

1.1.4. Examples of security questions for an interview

Verifiable indicators of competence achievement: UC-8.1.1, GPC-1.1.1, PC-10.1.1, PC-10.2.1. PC-11.1.1, PC-12.1.1, PC-4.1.1.

1. Synthetic drugs – pyridine and piperidine derivatives. Synthesis, complete pharmaceutical analysis, storage, application of nicotinic acid, nicotinamide, nicotinic acid diethylamide, picamilon, isoniazid, ftivazid, prothionamide, nialamide, phenigidine and cyclodol.
2. Quinoline derivatives. Synthesis, complete pharmaceutical analysis, storage, application of quinozol, cinhophene, enteroseptol, nitroxoline, sovcaine, plasmocide, quinocide, hingamine.
3. Uracil derivatives. Synthesis, qualitative and quantitative analysis, storage, use of methyluracil, methylthiouracil, pentoxyl, fluorouracil, fluorofur, hexamidine, cytarabine, azidothymidine, iodoxuridine, lamivudine.
4. Barbituric acid derivatives. Synthesis, complete pharmaceutical analysis, storage, application of barbital, phenobarbital, ethaminal sodium, hexenal, thiopentalnatrium, benzonal.

5. Benzothiadiazine and phenothiazine derivatives. Synthesis, qualitative and quantitative analysis, storage conditions, medical use of chlortiazide, dichlothiazide, aminazine, propazine, triphthazine, etacizine, etmosine.
6. Benzodiazepine derivatives. Synthesis, complete pharmaceutical analysis, storage, application of chlordiazepoxide, diazepam, oxazepam, nitrazepam, phenazepam.
7. Derivatives of benzothiazine and chlorobenzenesulfonic acid. Synthesis and pharmaceutical analysis, storage, application of piroxicam, furosemide, oxodoline.

1.1.5. Examples of tasks for assessing the development of practical skills

Verifiable indicators of competence achievement: UC.2.1, PC-4.3.1.

1. Determine the authenticity of nicotinic acid using decarboxylation and complexation reactions in accordance with regulatory documentation. Write reaction diagrams. Write down the results of the analysis in the logbook.
2. Determine the authenticity of methyluracil using bromination and salt formation reactions in accordance with regulatory documentation. Write reaction diagrams. Write down the results of the analysis in the logbook.

1.1.6. Examples of topics for research papers.

Verifiable indicators of competence achievement: GPC-1.1.1., PC-10.1.1, PC-10.2.1, PC-10.3.1, PC-11.1.1, PC-11.2.1, PC-12.1.1, PC-4.2.1.

1. Alkaloids. Classification. Phenanthrenisoquinoline derivatives. Social significance.
2. Steroid compounds, their classification. Modification of steroid compounds to produce drugs.

1.2. Assessment tools for students' independent work

The assessment of independent work includes testing and solving situational problems.

1.2.1. Examples of test tasks

Verifiable indicators of competence achievement: UC-8.1.1, GPC-1.1.1, PC-10.1.1, PC-10.2.1. PC-11.1.1, PC-12.1.1, PC-4.1.1.

1. *Deoxycorticosterone acetate in water*
   а) practically insoluble
   б) moderately soluble
   в) soluble
   г) easily soluble

2. *The UV spectrum of deoxycorticosterone acetate has a characteristic absorption band with a maximum at*
   a) 240 nm
   b) 250 nm
   c) 230 nm
   d) 260 nm

3. *A reagent that makes it possible to distinguish between corticosteroid preparations*
   a) concentrated sulfuric acid
   b) Fehling's reagent
   c) phenylhydrazine
   d) hydroxylamine

4. *Deoxycorticosterone acetate with concentrated sulfuric acid gives*

а) cherry coloring with green-brown fluorescence
б) orange coloring with yellow fluorescence
в) yellow coloring, turning into red with yellow-green fluorescence after 5 minutes
г) green color, turning into red

5. *Reagent for the steroid cycle in corticosteroidx*
   а) concentrated sulfuric acid
   б) Fehling's reagent
   в) phenylhydrazine
   г) hydroxylamine

6. *Reagent for the detection of the α-ketol group in corticosteroids*
   a) 2,3,5-triphenyltetrazolium chloride
   b) phenylnidrazine
   c) concentrated sulfuric acid
   d) hydroxylamine

7. *When corticosteroids interact with 2,3,5-triphenyl tetrazolium chloride,*
   а) red coloring
   б) yellow coloration
   в) white precipitate
   г) yellow precipitate

8. *A positive hydroxamine reaction gives*
   а) cortisone acetate
   б) prednisone
   в) deoxycorticosterone
   г) dexamethasone

9. *Reagent for the carbonyl group in the 3rd position*
   a) phenylhydrazine
   b) 2,3,5-triphenyltetrazolium chloride
   c) silver nitrate ammonia solution
   d) concentrated sulfuric acid

10. *The formation of ethyl acetate is typical for*
    a) corticosterone acetate
    b) prednisone
    c) cortisone
    d) hydrocortisone

11. *Solasodine is used to obtain*
    a) cortisone
    b) prednisone
    c) dexamethasone
    d) hydrocortisone

11. *When cortisone acetate interacts with phenylhydrazine, it forms*
    а) yellow coloring
    б) green coloration
    в) white precipitate
    г) orange-red precipitate

12. Fluorinated derivatives of corticosteroids include

a) dexamethasone
b) prednisone
c) cortisone
d) hydrocortisone

13. When interacting with concentrated sulfuric acid, there is no fluorescence in

a) prednisone
b) deoxycorticosterone acetate
c) cortisone acetate
d) hydrocortisone

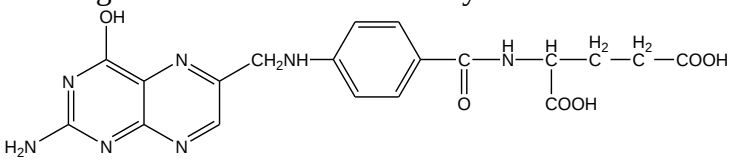
14. Negative reaction to dexamethasone

a) Hydroxamic acid
b) with Fehling's reagent
c) phenylhydrazine
d) with 2,3,5-triphenyltetrazolium chloride

1.2.2. Examples of situational tasks

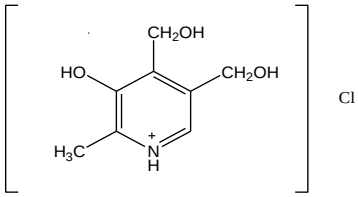
Verifiable indicators of competence achievement: UC-8.1.1, UC-8.2.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-10.1.1, PC-10.2.1, PC-11.1.1, PC-12.1.1, PC-12.3.1, PC-4.1.1, PC-4.2.1, PC-4.3.1.

1. The pharmaceutical company's quality control department has received a pharmaceutical substance with the following chemical structure for analysis:



- ✓ Name this substance and describe the chemical structure, name the functional groups.
- ✓ When evaluating the quality of this medicinal product in samples of the same batch, the appearance did not meet the requirements of the "Description" section - the powder was wet and dirty green in color. Provide a justification for the reasons for the change in its quality according to this indicator in accordance with the methods of production and properties.
- ✓ Based on the chemical structure, suggest identification reactions. Write the reaction equations to identify the phenolic hydroxyl, aromatic, and aliphatic amino groups.
- ✓ List the methods of quantification of this substance, explain the essence of one of them.

2. A pharmaceutical substance with the following chemical structure has been delivered to the Testing Center:



- ✓ Name this substance and describe its chemical structure, name the functional groups.

- ✓ When determining the impurity "methyl ether ...", a blue stain appeared in the samples of one series. Provide a justification for the reasons for the change in its quality according to this indicator in accordance with the methods of production and properties..
- ✓ In accordance with the chemical structure, suggest identification reactions and methods of quantitative determination. Write the reaction equations.
- ✓ Explain how the chemical properties affect the nature of the spectra of this in various solvents? What medications of this substance are known to you?

3. The pharmaceutical company's quality control department received the substance “Cortisone Acetate”.

- ✓ Please provide the structural formula of the drug. What class of steroid compounds does cortisone acetate belong to?
- ✓ When analyzing the “specific rotation” indicator, it was found that this indicator has a value of +170 ° (0.5% in acetone). Explain what could be the reason for the deviation of this parameter from the indicators provided for in the pharmacopoeia article?
- ✓ What reactions can confirm the presence of ester and alpha-ketol groups in the composition of this substance? Write the equations of chemical reactions.
- ✓ During TLC analysis of the substance, spots of cortisone acetate, cortisone and one extraneous spot were found on the chromatogram. What conclusion can be drawn from the results of this analysis? Which system is used for chromatography?

4. The pharmaceutical company's quality control department received the substance “Methyltestosterone”.

- ✓ Give the chemical formula of the compound and characterize it according to the indicators “Description” and “Solubility".
- ✓ When determining the specific absorption index of the substance, it was found that this parameter at a wavelength of 240 nm (for a 0.001% solution in 95% ethanol) was equal to 570. What is the range of specific absorption index indicated in the pharmacopoeia monograph? What could be the reason for the discrepancy between the received and required values?
- ✓ What functional group can be established using hydroxylamine hydrochloride? How is the resulting product identified? Write the reaction equation.
- ✓ Which functional group can be identified using the acetylation reaction? How is the resulting product identified? Write the reaction equation.

2. Assessment tools for conducting intermediate certification in the discipline

The intermediate certification is conducted in the form of an exam.

The list of questions for preparation for intermediate certification:

№	Questions for the Intermediate assessment	Verifiable indicators of competence achievement
1.	Heterocyclic drugs are pyridine and piperidine derivatives. Pyridine-3-carboxylic acid derivatives: nicotinic acid, nicotinamide, nicotinic acid diethylamide, picamilon.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
2.	Pyridine-4-carboxylic acid derivatives: anti-tuberculosis drugs (isoniazid, ftivazid,	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1

	prothionamide), antidepressants (nialamide). Derivatives of dihydropyridine: nifedipine (phenigidine). Piperidine derivatives: cyclodol.	
3.	Quinoline derivatives. Characteristics of quinoline derivatives. A general method for the synthesis of a heterocyclic quinoline system. Quinosol, cinhophene, enteroseptol, nitroxoline, sovcaine	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
4.	Synthetic antimalarial drugs are quinine analogues. Plasmocide, quinocide, hingamine.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
5.	Pyrimidine derivatives. The relationship between structure and action in a number of pyrimidine derivatives. Uracil and its derivatives - methylthiouracil, methyluracil. Uracil derivatives - pentoxyl, fluorouracil, fluorafur, hexamidine.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
6.	Synthetic drugs of nucleoside nature: cytarabine, azidothymidine, iodoxuridine, lamivudine.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
7.	Derivatives of barbituric acid. The relationship between the chemical structure, narcotic and anticonvulsant effects of barbiturates. General methods of obtaining barbiturates. Barbital, phenobarbital, ethaminaldium, hexenal, thiopental-sodium, benzonal.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
8.	Benzothiazine derivatives. A non-steroidal anti-inflammatory drug is piroxicam. Benzothiazine derivatives are diuretics: chlortiazide and dichlothiazide. Derivatives of chlorobenzenesulfonic acid amide. Analogues in action are derivatives of chlorobenzenesulfonic acid amide: furosemide, bufenox. Oxodoline.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
9.	Neuroleptics are phenothiazine derivatives. Alkylamino derivatives - aminazine, propazine, triphthazine	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
10.	Acyl derivatives of phenothiazine are etacizine and etmosine. The relationship between structure and action depends on the nature of the substituents and the nature of the bonds	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
11.	Benzodiazepine derivatives as targeted drugs. General methods of obtaining. The effect of the structure of drugs on the direction of their pharmacological action is	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1

	as follows: chlordiazeproxide, diazepam, oxazepam, nitrazepam, phenazepam.	
12.	Classification of vitamins. Vitamins of the aliphatic series. Ascorbic acid (vitamin C). Production methods, causes of instability, redox and acid-base properties.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
13.	Vitamins of the aliphatic series. Pantothenic acid (calcium pantothenate), pangamic acid (calcium pangamate - vitamin B15).	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
14.	Vitamins of the alicyclic series. Retinols (vitamins of group A). Retinol acetate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
15.	Calciferols (vitamins of group D) as products of sterol conversion. The mechanism of formation of ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Oxidevite, dioxydevite.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
16.	Aromatic vitamins are derivatives of naphthoquinones (vitamins of group K). Vikasol.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
17.	Antivitamins K. Dicumarin, neodicumarin, fepromarone, phenylline.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
18.	Vitamins of the heterocyclic series. Chromane vitamins - tocopherols (vitamins of group E) as medicinal and preventive agents. Tocopherol acetate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
19.	Phenylchromanic vitamins are bioflavanoids (vitamins of group P). Rutin, quercetin.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
20.	Vitamins are pyridine derivatives. Nicotinic acid, nicotinamide (vitamin B5 or PP).	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
21.	Oxymethylpyridine vitamins (B6 vitamins). Pyridoxine hydrochloride, pyridoxal phosphate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
22.	Pyrimidino-thiazole vitamins (vitamins of group B1). Thiamine chloride and bromide, cocarboxylase, phosphothiamine, benfotiamine. Biotransformation of vitamins. Biotransformation of vitamins of group B1, stability, quality requirements, methods of analysis.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
23.	Pteric vitamins (vitamins of the folic acid group). Folic acid and its analogues. The relationship between structure and biological action. Methotrexate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
24.	Isoalloxazine derivatives (B2 vitamins) as	UC-8.1.1, GPC-1.2.1, GPC-1.3.1,

	medicinal and preventive agents. Riboflavin, riboflavin mononucleotide.	PC-11.1.1, PC-4.1.1
25.	Pyrrole derivatives (B12 vitamins). Cyancobalamin, oxycobalamin, cobamide. Features of the structure of vitamins B12. Quality requirements, methods of analysis.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
26.	Alkaloids. Classification. General methods of isolation, purification and separation of alkaloids. Qualitative determination of alkaloids. General (group) reactions. Methods of quantitative determination of alkaloids.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
27.	Pyridine and piperidine derivatives. Lobeline hydrochloride, cytisine, pachycarpine	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
28.	Derivatives of tropane. Atropine sulfate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
29.	Synthetic analogues of atropine. Homatropin hydrobromide, scopolamine hydrobromide, tropacin, aprofen, troventol. Ecgonine derivatives. Cocaine hydrochloride. Characteristics of the drug.Social significance.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
30.	Quinoline derivatives. Quinine, quinidine, isodibut.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
31.	Benzylisoquinoline derivatives. Papaverine hydrochloride and drotaverine hydrochloride (no-shpa). Papaverine analogues in action: typhen, diprofen, aprofen.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
32.	Phenanthrenisoquinoline derivatives. Morphine, codeine. Sources of morphine production. Semi-synthetic morphine derivatives. Apomorphine hydrochloride, ethylmorphine hydrochloride. The problem of creating morphine-type analgesics and its social significance. Promedol, fentanyl.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
33.	Indole derivatives (raufolfia alkaloids). Reserpine.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
34.	Physostegmine salicylate and its semi-synthetic analog proserin. Features of the quality requirements and methods of analysis depending on the redox properties and the ability to isomerize. Strychnine nitrate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-12.1.1, PC-4.1.1
35.	Imidazole derivatives. Pilocarpine hydrochloride. Benzimidazole derivatives.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1

	Dibazole, omeprozole.	
36.	Purine derivatives. Caffeine, theophylline, theobromine. General methods of synthesis and analysis based on oxidation reactions and hydrolytic cleavage of pyrimidine and imidazole cycles.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
37.	Salts of purine derivatives. Diprophyllin, xanthinol nicotinate, pentoxifylline.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
38.	Synthetic medicines are purine derivatives. Allopurinol, etymizole, fopurin, riboxin.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
39.	Guanine derivatives. Acyclovir, ganciclovir.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
40.	Alkaloids, derivatives of phenylalkylamines. Ephedrine hydrochloride, defedrine. Derivatives of guanidine. Spherophysin benzoate.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
41.	Hormones. The concept, biological role and classification of hormones.	
42.	Iodized derivatives of aromatic amino acids. Thyroid hormones: thyroxine, triiodothyronine. The complex preparation is thyroidin. Antithyroid drugs: diiodothyrosine.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
43.	Hydroxyphenylkylamines. Hormones of the adrenal medulla (dopamine, adrenaline, norepinephrine and their salts). Synthetic analogues of catecholamines. Isoprenaline hydrochloride (isadrine). The mezzaton.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
44.	Derivatives of substituted hydroxypropanolamines (beta-adrenoblockers). Anaprilin, atenolol	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
45.	The biochemical role of steroids in the body. Classification and nomenclature. Cardenolides (cardiac glycosides). Compounds of the digitoxigenin series: digitoxin, acetyldigitoxin, digoxin. Strophanthine. Lily of the valley glycosides: corglicon.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
46.	Corticosteroids. The relationship between structure and biological activity. Mineralcorticosteroids, glucocorticosteroids.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
47.	Deoxycorticosterone acetate, cortisone acetate, hydrocortisone and prednisone, fluoro-substituted compounds:	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1

	dexamethasone. Esters of steroids.	
48.	Androgens and anabolics. Androgenic hormones as drugs: testosterone propionate, methyltestosterone.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
49.	Biological prerequisites for the production of semi-synthetic medicinal substances with anabolic effects. Methandrostenolone, methylandrostenediol, phenoboline. Quality requirements, methods of analysis.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
50.	Progestogens and their synthetic analogues. Progesterone, pregnin.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
51.	Estrogens. Estrone and estradiol as medicinal substances.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
52.	Estrogenic hormones. Ethinyl Estradiol, mestranol, estradiol esters.	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
53.	Synthetic analogues of estrogens of nonsteroidal structure.1 Synestrol, diethylstilbestrol. Synthetic antiestrogenic agents are tamoxifen citrate (nolvadex).	UC-8.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
54.	Antibiotics as medicines. Classification of antibiotics. Standardization of antibiotics.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
55.	Penicillins. The general chemical structure and its features. The relationship between structure and biological action. Benzylpenicillin, its salts (sodium, potassium, novocaine). Phenoxymethylpenicillin. Semi-synthetic penicillins: carbenicillin disodium salt, amoxicillin.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
56.	Cephalosporins. Partial targeted synthesis of cephalosporin antibiotics. Cephalexin, cephalotin. Quality requirements and methods of analysis.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
57.	Aromatic antibiotics. Nitrophenylalkylamines. Levomycetin (chloramphenicol). Syntomycin and its esters are stearate and succinate.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
58.	Antibiotics aminoglycosides Streptomycin sulfate, kanamycin sulfate, gentamicin sulfate. Semi-synthetic aminoglycosides. Amikacin. General quality requirements and methods of analysis.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
59.	Tetracyclines (partially hydrogenated naphthacene derivatives). The relationship	UC-8.1.1, GPC-1.1.1, GPC-1.2.1,

	between structure and biological action. Tetracycline, oxytetracycline and their semi-synthetic derivatives: metacycline and doxycycline. Quality requirements, methods of analysis.	GPC-1.3.1, PC-11.1.1, PC-4.1.1
60.	Antitumor antibiotics of various chemical groups. Anthracycline antibiotics – rubomycin hydrochloride. Aurelic acid derivatives are olivomycin.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1
61.	Quinoline-5,8-dione derivatives. Bruneomycin, rheumycin. Actinomycins: dactinomycin.	UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1

2.1. Examples of interview questions

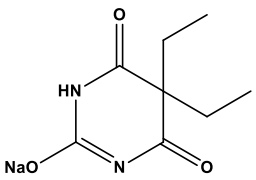
Проверяемые индикаторы достижения компетенции: UC-8.1.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-11.1.1, PC-4.1.1

1. Heterocyclic medicinal products - pyridine and piperidine derivatives. Pyridine-3-carboxylic acid derivatives: nicotinic acid, nicotinamide, nicotinic acid diethylamide, picamilon.
2. Pyridine-4-carboxylic acid derivatives: anti-tuberculosis drugs (isoniazid, ftivazid, prothionamide), antidepressants (nialamide). Derivatives of dihydropyridine: nifedipine (phenigidine). Piperidine derivatives: cyclodol.
3. Quinoline derivatives. Characteristics of quinoline derivatives. A general method for the synthesis of a heterocyclic quinoline system. Quinosol, cinhophene, enteroseptol, nitroxoline, sovcaine.
4. Synthetic antimalarial drugs – quinine analogues. Plasmocide, quinocide, hingamine.
5. Pyrimidine derivatives. The relationship between structure and action in a number of pyrimidine derivatives. Uracil and its derivatives - methylthiouracil, methyluracil. Uracil derivatives are pentoxyl, fluorouracil, fluorafur, hexamidine.

2.2. Examples of situational tasks

Verifiable indicators of competence achievement: UC-8.1.1, UC-8.2.1, GPC-1.1.1, GPC-1.2.1, GPC-1.3.1, PC-10.1.1, PC-10.2.1, PC-11.1.1, PC-12.1.1, PC-12.3.1, PC-4.1.1, PC-4.2.1, PC-4.3.1.

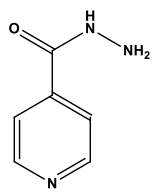
1. An intern quality control analyst at a pharmaceutical company received a substance of the following structure:

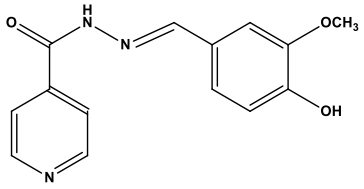


When assessing the quality of the drug, the indicators "Solubility", "Transparency and color", and "Free alkali content" did not meet the requirements of regulatory documentation. The solution of the drug immediately opalesced, and the quantitative content of "free alkali" is significantly higher than indicated in the regulatory documentation. The student needs to:

- ✓ Provide a justification for the reasons for the change in its quality according to this indicator in accordance with the storage conditions and properties.
- ✓ Provide other tests that characterize its quality.
- ✓ Give the Russian and Latin names of this medicinal substance.
- ✓ To characterize its physico-chemical properties.
- ✓ According to the chemical properties, suggest authenticity reactions and quantification methods.

2. A pharmacist-analyst of a pharmaceutical company supplies pharmaceutical substances obtained for the production of tablets of medicinal substances of several series of the following structure:





When determining the admixture of isonicotinic acid hydrazine in sample No. 2 according to the methodology of the State Pharmacopoeia, no stable blue staining was observed on iodine starch paper with a solution of sodium nitrite. The pharmacist-analyst must:

- ✓ To make a conclusion on the compliance of the impurity content with the requirements of the State Pharmacopoeia. Suggest other studies to determine the quality of these drugs.
- ✓ Give the Russian, Latin and rational names of the drug. Describe its physico-chemical properties.
- ✓ For chemical properties, suggest authenticity reactions and methods of quantitative determination. Write the reaction equations.

2.3. Example of an exam card

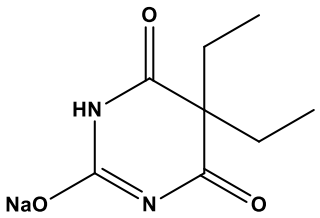
Federal State Budgetary Educational Institution of Higher Education
"Volgograd State Medical University"
Ministry of Health of the Russian Federation

Department: **Pharmaceutical, toxicological chemistry, pharmacognosy and botany.**
Discipline: **Special Pharmaceutical Chemistry**
Speciality at the speciality **33.05.01 Pharmacy**
Academic year: **2025 - 2026**

EXAMINATION CARD № 1

1. Subject and objectives of pharmaceutical chemistry. Basic terminology (biologically active substance, pharmacological agent, drug substance, drug product, drug form). Interrelation with chemical and biomedical disciplines.
2. Antitumor antibiotics. Anthracyclines: rubomycin and its analogs.

3. Situational task. A trainee pharmacist-analyst of quality control of a pharmaceutical company received a substance of the following structure:



When assessing the quality of the preparation, the indicators "Solubility", "Transparency and color", "Free alkali content" did not meet the requirements of the regulatory documentation. The solution of the preparation opalesced immediately and the quantitative content of "free alkali" is significantly higher than specified in the regulatory documentation. The trainee needs to:

- Give a justification of the reasons for the change in its quality by this indicator according to its storage conditions and properties.
- Cite other tests characterizing its quality.
- Give the Russian and Latin names of this medicinal substance.
- Characterize its physical and chemical properties.
- According to its chemical properties, propose identification reactions and methods of quantification.

Seal place Head of department A.A.Ozerov

The full fund of assessment tools for discipline / practice is available in the EIES of VolgSMU at the link:
https://elearning.volgmed.ru/course/view.php?id=11209

Considered at the meeting of the department of Pharmaceutical, Toxicological Chemistry, pharmacognosy and botany "30" May 2025, protocol No1

Head of the Department Ozerov A.A.