

MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY

Faculty of Pharmacy

Department of Pharmaceutical Chemistry and Drug Technology

APPROVED by

Vice-rector for scientific and pedagogical work

_____ Eduard BURYACHKIVSKY

_____, 202_

METHODOLOGICAL DEVELOPMENT

TO PRACTICAL LESSONS FROM THE EDUCATIONAL DISCIPLINE

Faculty, course _____ Pharmaceutical, IV course

Academic discipline _____ Pharmaceutical chemistry

(name of academic discipline)

Approved:

Department meeting _____ Pharmaceutical chemistry _____

Odessa National Medical University

Minutes № _ dated _____

Head of Department (_____) Volodymyr GELMBOLDT

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Developers:

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Practical lesson No. 1

*Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year,
Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page2*

Topic: Means that stimulate receptors of afferent nerve fibers.

Antacid, enveloping and astringent agents: Aluminum hydroxide, Magnesium oxide, Basic magnesium carbonate, Basic bismuth nitrate.

Adsorbents: Activated charcoal.

The purpose: to acquaint students with the pharmaceutical analysis of drugs that stimulate receptors of afferent nerve fibers.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ General characteristics of means that stimulate receptors of afferent nerve fibers;
- ✓ Peculiarities of pharmaceutical analysis of substances that protect sensitive nerve endings from external irritations;
- ✓ Peculiarities of pharmaceutical analysis of substances that irritate sensitive nerve endings.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;

- ✓ Use general methods of drug analysis and determination of the good quality of drugs based on their appearance, solubility, and reaction to the environment in accordance with the requirements of the Federal Drug Administration.

List of didactic units:

- ✓ the text of textbooks;
 - ✓ a bank of test tasks.
- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:
- 1.The provider-analyst determines the presence of disturbance ion according to AND. Which of the given reagents does he use?
A *Potassium iodide solution
B Phenolphthalein solution
C Diethyldithiocarbamate solution
D Starch solution
E Dimethylglyoxime solution
 2. Identification of the medicinal product "Bismuthi subnitras" is carried out after dissolving it in acid with a reagent
A Potassium chlorate
B Sodium chloride
C Sodium sulfate
D Potassium iodide
E Potassium nitrate
 3. The quantitative determination of the medicinal product "Bismuthi subnitras" is carried out by the following method:
A Iodometry
B Alkalimetry
C Bromatometry
D Complexonometry
E Permanganatometry

4.The substance of magnesium carbonate of the lung was received for analysis.

Which reagent can be used to confirm the presence of a magnesium cation in it?

A Disodium hydrogen phosphate

B Potassium hydrosulfate

C Potassium hydrophthalate

D Ammonium thiocyanate

E Sodium tetraphenylborate

5.Under the action of acetic acid diluted as a medicinal substance, a violent release of gas bubbles is observed, which causes turbidity of the barium hydroxide solution.

This test allows you to identify:

A. Carbonates

B. Fluorides

C. Nitrite

D. Sulfates

E. Chlorides

6.Chemical incompatibility of drugs is one of the reasons for their ineffectiveness.

Medicines from the group:

A. antacids

B. cardiac glycosides

C. antihypertensive

D. antifungal

E. Antitussives

7.To establish the authenticity of the substance of the medicinal substance containing the carbonate ion, according to the requirements of the Federal Drug Administration, the pharmacist-analyst must use the following reagent:

A Dilute acetic acid

B Nesler's reagent

C Potassium iodide solution

D Sodium hydroxide solution

E Sodium chloride solution

8. The pharmacist-analyst examines the benign quality of light magnesium oxide in accordance with the requirements of the Federal State of Ukraine. With the help of which reagent did he determine the presence of impurities of calcium salts in it?

A Ammonium oxalate

B Barium sulfate

C Silver nitrate

D Potassium ferrocyanide

E Sodium sulfide

3. Formation of professional skills and abilities:

– Content of tasks (tasks, clinical situations, etc.).

1. Calculate the volume of a 0.1M solution of sodium edetate (KP=1.0000), which will be spent on the titration of 0.9516 g of alkaline bismuth nitrate, if the percentage content of bismuth oxide (M.m. 465.66) in the substance is 80.0%.

2. Calculate the percentage content of magnesium oxide (M.m. 40.31) in alkaline magnesium carbonate, if 16.82 ml of 0.1M sodium edetate solution (KP=1.0002) was spent on the titration of a weight of 0.6782 g; the volume of the measuring flask is 100 ml, the volume of the pipette is 10 ml.

3. Calculate the volume of a 0.1 M solution of sodium edetate (KP = 1.0000) that will be used to titrate 0.5145 g of magnesium oxide (M.m. 40.31), if its percentage content in the substance is 96.8%; the volume of the measuring flask is 100 ml, the volume of the pipette is 10 ml.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education

			institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

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4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.

4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 2

Topic: Means that stimulate receptors of afferent nerve fibers.

Expectorants:Terpine hydrate, Sodium benzoate, Acetylcysteine

Irritants:Racemic menthol, Validol

Lab: Analysis of the substance Sodium benzoate.

The purpose: to acquaint students with the pharmaceutical analysis of drugs that stimulate receptors of afferent nerve fibers.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector, laboratory equipment, chemical reagents.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, the purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;

- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks;
- ✓ laboratory work methodology.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. The pharmacist-analyst conducts a quantitative analysis of sodium benzoate and uses a solution of hydrochloric acid as a titrant. Name this method of quantification.

- A. acidimetry
- B. complexometry
- S. nitritometry
- D. bromatometry
- E. iodometry

2. The CZL conducts the certification of the drug expectorant - the substance sodium benzoate. To identify the benzoate ion, a reaction is carried out with the solution:

- A. iron (III) chloride
- B. sodium nitrite
- S. potassium chloride
- D. sodium carbonate
- E. ammonium thiocyanate

3. The CZL is analyzing a drug with an expectorant effect - sodium benzoate. The presence of the sodium cation is identified by the reaction of the formation of a white precipitate with the solution:

- AND. potassium pyroantimonate
- IN. sodium nitrite
- WITH. ammonium oxalate
- D. iron (III) chloride
- IS. zinc sulfate

4.The pharmacist-analyst conducts an express analysis of the extemporaneous mixture. He identifies sodium benzoate in the composition of the mixture by the reaction with the solution:

- A.iron (III) chloride
- B.sodium bicarbonate
- C.ammonium oxalate
- D.sodium acetate
- E. magnesium sulfate

5.The pharmacist-analyst determines the quantitative determination of the expectorant "Sodium benzoate" by the method of acidimetry. In order to eliminate the effect of benzoic acid on the indicator, the titration should be carried out in the presence of:

- A.diethyl ether
- B.mannitol
- C.mercury (II) acetate
- D.hydrochloric acid
- E. sodium hydroxide

6.Quantitative determination of the expectorant "Sodium benzoate" is carried out by the method of acidimetry in a non-aqueous medium. What reagent is used as a solvent?

- A.acetic acid anhydrous
- B.pyridine
- C.benzene
- D.dimethylformamide
- E. Dimethylsulfoxide

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the percentage content of sodium benzoate (M.m. 144.11) in the substance, weighing 1.4963 g, 20.06 ml of a 0.5 M solution of hydrochloric acid (KP = 1.0000) was used, and the loss in weight during drying was 2 .5%.

Task 2. Suggest possible methods for the identification of terpine hydrate. Where possible, give equations for chemical reactions.

Task 3. Describe the quantitative determination of menthol by the acetylation method. Give the reaction equations, the formula for calculating the quantitative content, indicate the molar mass of the equivalent.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
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6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

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Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 3

Topic:Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia.

Esters of p-aminobenzoic acid: Benzocaine, Procaine hydrochloride

Acetanilide derivatives: Lidocaine hydrochloride.

Arylamides of piperidinecarboxylic acids: Bupivacaine hydrochloride, Articaine hydrochloride.

The purpose: to acquaint students with the pharmaceutical analysis of drugs that stimulate receptors of afferent nerve fibers.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Ethanol is formed as a result of alkaline hydrolysis of the local anesthetic "Benzocaine" (anesthesin). The pharmacist-analyst confirms the breakdown reaction product:

- A. iodoform
- B. murexide
- C. thiochrome

D. ninhydrin

E. hydroxamic acid

2. The local anesthetic "Benzocaine" (anesthesin) is identified by the reaction of the formation of an azo dye. What functional group determines the possibility of carrying out this reaction?

A. primary aromatic amino group

B. aldehyde group

C. ester group

D. aromatic nitro group

E. sulfamide group

3. Local anesthetic "Benzocaine" (anesthesin) is identified by the reaction of formation of iron (III) hydroxamate. What functional group determines the possibility of carrying out this reaction?

A. esters

B. carboxylic

C. ketone

D. aldehyde

E. sulfamide

4. The quantitative content of the local anesthetic "Lidocaine hydrochloride" is determined by the reverse argentometry method. What indicator is used for titration?

A. *iron (III) ammonium sulfate

B. phenolphthalein

C. methylene blue

D. starch

E. neutral red

5. Quantitative determination of the local anesthetic Procaine hydrochloride is carried out in the quality control laboratory. The method of its alkalimetric titration is based on the presence in the structure of:

A. bound hydrochloric acid

B. diethylamino group

- C. ester bond
- D. unsubstituted aromatic cycle
- E. of *p*-aminobenzoic acid residue

6. Procaine hydrochloride (novocaine) is a local anesthetic. According to its chemical structure, it is a derivative of:

AND. *p*-aminobenzoic acid

IN. salicylic acid

WITH. chromotropic acid

D. sulfanilic acid

IS. nicotinic acid

7. The structure of benzocaine (anesthetic) contains a primary aromatic amino group. The quantitative content of the substance is determined by the analytical chemist by the method:

AND. nitritometry

IN. alkalimetry

WITH. complexonometry

D. acidimetry

IS. argentometry

8. The quantitative content of lidocaine hydrochloride is determined by the pharmacist-analyst by the method of alkalimetry with potentiometric setting of the end point of the titration. As a titrant, he uses a solution:

AND. sodium hydroxide

IN. hydrochloric acid

WITH. potassium bromate

D. sodium nitrite

IS. cerium sulfate

9. One of the stages of the pharmacokinetics of drugs is biotransformation. Procaine hydrochloride (novocaine) is hydrolyzed by esterase to form:

AND. *p*-aminobenzoic acid

IN. sulfanilic acid

WITH. phthalic acid

D. *p*-aminosalicylic acid

IS. mefenamic acid

10. Procaine hydrochloride (novocaine) belongs to local anesthetic agents. One of the products of its metabolism is:

AND. diethylaminoethanol

IN. propanol

WITH. butanol

D. octanol

IS. acetone

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the percentage content of novocaine (M.m. 272.78) in the substance, if 11.52 ml of 0.1 M sodium nitrite solution (KP = 1.0000) was used for the titration of a weight of 0.3015 g; the volume of the titrant in the control experiment is 0.50 ml.

Task 2. Calculate the percentage content of novocainamide (M.m. 271.79) in the substance, if 11.91 ml of 0.1 M sodium nitrite solution (KP = 1.0000) was used for the titration of a weight of 0.3120 g; the volume of the titrant in the control experiment is 0.52 ml.

Task 3. Calculate the mass of anesthesin measurement (M.m 165.19), if 12.54 ml of 0.1 M sodium nitrite solution (KP = 1.0000) was used for its titration; the volume of the titrant in the control experiment is 0.48 ml, the percentage content of anesthesin is 99.6%.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4

1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

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2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.

Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page19

3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 4

Topic:Means affecting the efferent nervous system. Means acting on cholinergic processes. Means acting on cholinergic receptors.

Cholinomimetics:Pilocarpine hydrochloride

Reversible anticholinesterase drugs:Neostigmine methyl sulfate

Irreversible anticholinesterase drugs:Armin

The purpose:to acquaint students with the pharmaceutical analysis of medicinesaffecting the efferent nervous system.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.
 - Questions (test tasks, tasks, clinical situations) to check basic

knowledge on the subject of the lesson:

1. According to the chemical structure, lactones are intramolecular esters. The lactone cycle in the structure of the cholinergic agent pilocarpine hydrochloride is determined by the formation reaction:

- A. hydroxamate
- B. azo dye
- C. indophenol
- D. murexide
- E. thiochrome

2. As a result of alkaline hydrolysis of the anticholinesterase agent, neostigmine methyl sulfate is formed 3-dimethylaminophenol. It is further identified by the formation reaction:

- A. azo dye
- B. indophenol
- C. hydroxamate
- D. murexide
- E. thiochrome

3. Quantitative determination of the antiglaucoma drug pilocarpine hydrochloride is carried out by a chemical analyst using the method of acidimetry in non-aqueous solvents. As a titrated solution, he uses:

- A. perchloric acid
- B. sodium hydroxide
- C. sodium nitrite
- D. sodium edetate
- E. potassium bromate

4. At the chemical and pharmaceutical enterprise, they receive an anti-glaucoma drug - aceclidine. The starting substance in the synthesis is:

- A. 3-hydroxyquinuclidine
- B. *p*-aminophenol
- C. diethyl malonate
- D. triethylamine
- E. benzhydrol

5. Medicinal preparations from the group of alkaloids are quantitatively determined by the method of non-aqueous titration. The titrant is:

AND Chloric acid

B Sodium thiosulfate

WITH Sulfuric acid

D Dimethylformamide

E Nitric acid silver

6. To identify alkaloids, DFU requires the use of a reaction with the following precipitating reagent:

AND. potassium iodobismuthate solution

IN. solution of phosphoromolybdic acid

WITH. tannin solution

D. solution of phosphotungstic acid

IS. potassium iodide solution iodized

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Write a scheme for the synthesis of pilocarpine hydrochloride, name the compounds of the synthesis, give characteristics of individual stages.

Task 2. Quantitative determination of pilocarpine hydrochloride by FC. Name the method, explain the titration conditions, write the chemistry of reactions, indicator formulas, calculation of the equivalent and quantitative content in %.

Task 3. Write the structural formula, Latin and chemical names of pilocarpine hydrochloride, name the heterocycles that make up the molecule, write the chemistry of the butyrolactone detection reaction.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.

7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 5

Topic:Means affecting the efferent nervous system. Means acting on cholinergic processes. Cholinergic blockers (cholinolytics).

m-Cholinoblockers: Atropine sulfate, Scopolamine hydrobromide, Platifylline hydrotartrate

n-Cholinoblockers: Pachycarpine hydroiodide, Hexamethonium benzosulfonate

The purpose:to acquaint students with the pharmaceutical analysis of drugs that stimulate receptors of afferent nerve fibers.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Atropine sulfate is a drug that exhibits a cholinolytic effect. Quantitative determination of atropine sulfate by the method of acidimetry in a non-aqueous environment is possible due to the presence in the structure of the substance:

- A. tertiary nitrogen atom
- B. alcohol hydroxyl
- C. phenyl radical
- D. ester group
- E. of bound sulfuric acid

2. Atropine sulfate is a drug that exhibits a cholinolytic effect. Quantitative determination of atropine sulfate by the method of alkalimetry in an alcohol-chloroform environment is possible due to the presence in the structure of the substance:

- A. of bound sulfuric acid
- B. tertiary nitrogen atom
- C. alcohol hydroxyl
- D. phenyl radical
- E. ester group

3. In the central analytical laboratory of the pharmaceutical enterprise, the quality control of 0.1% injection solution of atropine sulfate is carried out. Due to sulfate ions, the active substance can be identified when interacting with the following reagent:

- A. Barium chloride
- B. Copper (II) sulfate
- C. Potassium iodide
- D. Sodium bicarbonate
- E. Ammonium chloride

4. One of the products of atropine metabolism in the body is noratropin. What biotransformation reaction leads to the formation of this metabolite?

- A. demethylation
- B. acetylation

- C. hydroxylation
- D. hydrolysis
- E. glucuronidation

5. In the process of metabolism of medicines, their biochemical transformation takes place under the action of enzymes. One of the directions of atropine metabolism is the reaction:

- A. N- demethylation
- B. restoration
- C. dehalogenation
- D. deamination
- E. S- oxidation

6. Atropine sulfate is a tropane alkaloid with cholinergic action. The remaining tropic acid in the structure of the substance is identified by the formation reaction:

- A. polynitro compounds
- B. indophenol
- C. hydroxamate
- D. murexide
- E. azo dye

7. The ester bond in the structure of the cholinergic agent platyphyllin hydrotartrate determines the formation reaction colored hydroxamate. Which of the listed reagents is used in this reaction?

- A. ferric chloride
- B. sodium chloride
- C. potassium iodide
- D. sodium nitrite
- E. ammonium chloride

8. In the control and analytical laboratory, the analysis of medicinal substances from the group of alkaloids is performed. Which of the following medicinal products gives a positive reaction to Vitaly-Moren?

AND. Skopolaminu hydrobromide

B. PlatypusIlin hydrotartrate

WITH. Quinine sulfate

D. Papaverine hydrochloride

E. Morphine hydrochloride

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the percentage content of atropine sulfate (M.m. 676.8) in the substance, if the weight of the test piece is 0.4983 g, the volume of a 0.1 M perchloric acid solution (KP = 0.9892) in the working experiment is 7.42 ml, in the control - 0.21 ml, and the weight loss during drying - 2.3%.

Task 2. Calculate the volume of 0.1 M perchloric acid solution (KP = 1.0000), which is spent on the titration of 0.2014 g of scopolamine hydrobromide (M.m. 384.3), if the volume of the titrant in the control experiment is 0, 12 ml, the weight loss during drying is 12.6%, and the content of the active substance in the substance is 98.7%.

Task 3. Calculate the percentage content of tropacin (M.m. 371.91) in the substance, if the weight of the test piece is 0.1976 g, the volume of a 0.1 M perchloric acid solution (KP = 1.0014) in the working experiment is 5.43 ml, in the control - 0.18 ml, and the weight loss during drying is 0.4%.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of

2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
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– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy *Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry"* page31

education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.

5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.

6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.

7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 6

Topic:Means acting mainly on adrenergic processes.

Adrenomimetics:Epinephrine, Norepinephrine, Phenylephrine hydrochloride, Ephedrine hydrochloride, Naphazoline nitrate, Clonidine hydrochloride, Salbutamol.

Adrenoblockers (adrenolytics):Propranolol hydrochloride, Atenolol.

The purpose:to acquaint students with the pharmaceutical analysis of medicinal products,acting mainly on adrenergic processes.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

✓ the text of textbooks;

✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Quantitative determination of the substance "Adrenaline Tartrate" is carried out by the method of acidimetry in a non-aqueous medium. A solution is used as a titrant:

A. perchloric acid

B. sodium hydroxide

C. potassium bromate

D. iodine

E. sodium nitrite

2. Quantitative determination of the substance "Adrenaline Tartrate" is carried out by the method of acidimetry in a non-aqueous medium. What indicator is used in this method?

A. crystal violet

B. methyl orange

C. phenolphthalein

D. chalcone carboxylic acid

E. cryochrome black

3. An antihypertensive drug containing clonidine hydrochloride (Clonidine) was received by the laboratory for quality control of medicinal products. For its identification, chloride ions are determined by the reaction of silver with nitrate in the medium:

A. Diluted nitric acid

B. Concentrated sulfuric acid

C. Sodium hydroxide

D. Diethyl ether

E. Formaldehyde

4. Adrenaline tartrate chemically belongs to catecholamines. The starting compound

for the synthesis of the substance is:

- A. pyrocatechin
- B. nitrotoluene
- C. aminophenol
- D. cresol
- E. xylene

5. Adrenaline contains two phenolic hydroxyls in its structure, which causes the chemical instability of the compound. What chemical process occurs when a substance is improperly stored:

- A. oxidation
- B. restoration
- C. polymerization
- D. hydrolysis
- E. weathering

6. To identify adrenaline tartrate, react with a solution of iron (III) chloride. The emerald-green color formed as a result of the reaction is caused by the presence of the substance in the molecule:

- A. phenolic hydroxyls
- B. aldehyde group
- C. aromatic amino group
- D. keto groups
- E. carboxyl group

7. The adrenergic drug adrenaline tartrate contains phenolic hydroxyls in its structure. To detect them, it is necessary to carry out a reaction with a solution:

- A. iron (III) chloride
- B. potassium bromide
- C. magnesium sulfate
- D. sodium nitrate
- E. copper (II) sulfate

8. According to the DFU monograph, the quantitative determination of adrenaline tartrate is carried out by a chemist-analyst using the method of acidimetry in a non-aqueous environment. As a titrant, he uses a solution:

- A. * perchloric acid
- B. sodium edetate
- C. silver nitrate
- D. sodium hydroxide
- E. potassium permanganate

9. Epinephrine (adrenaline) is a direct-acting adrenomimetic and stimulates α - and β -adrenoceptors. According to its chemical structure, it belongs to:

- A. catecholamines
- B. tannins
- C. proteins
- D. lipids
- E. carbohydrates

10. α_1 - The adrenomimetic phenylephrine hydrochloride (Mesaton) is a salt of hydrochloric acid. The presence of chloride ion is established using a solution:

- A. silver nitrate
- B. potassium bromide
- C. magnesium sulfate
- D. sodium nitrate
- E. ammonium hydrochloride

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the weight of a test of norepinephrine hydrotartrate (M.m. 337.29), if 4.95 ml of a 0.1 M perchloric acid solution (CP = 1.0030) was spent on its titration, its percentage content in the substance is 99.5%, the percentage of water is 5% and the volume of the titrant in the control experiment is 0.30 ml.

Task 2. Calculate the percentage content of mesatone (M.m. 203.67) in the substance, if 16.10 ml of 0.1 M sodium thiosulfate solution (CP = 1.0000) was used for the titration of a weight of 0.1120 g when determined by the method of inverse bromatometry, weight loss during drying - 0.5% and the titrant volume in the control experiment - 48.50 ml.

Task 3. Write the structural formula, Latin and chemical name of ephedrine hydrochloride, properties, chemistry of pharmacopoeial identification reactions.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical

University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 7

Topic:Thematic control work on the topic:"Agents that stimulate receptors of afferent nerve fibers. Means affecting the efferent nervous system. Means acting mainly on adrenergic processes. Cardiotonic means".

The purpose:check the assimilation of knowledge of higher education studentsby topics:"Agents that stimulate receptors of afferent nerve fibers. Means affecting the efferent nervous system. Means acting mainly on adrenergic processes. Cardiotonic means".

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. The quality control of 0.1% injection solution of atropine sulfate is carried out in the central analytical laboratory of the pharmaceutical enterprise. Due to sulfate ions, the active substance can be identified when interacting with the following reagent:

A. Sodium bicarbonate

B. Copper (II) sulfate

C. Potassium iodide

D. Barium chloride

E. Ammonium chloride

2. An antihypertensive drug containing clonidine hydrochloride (Clonidine) was received by the laboratory for quality control of medicinal products. For its identification, chloride ions are determined by the reaction of silver with nitrate in the medium:

A. Sodium hydroxide

B. Concentrated sulfuric acid

C. Diluted nitric acid

D. Diethyl ether

E. Formaldehyde

3. Under the action of acetic acid diluted as a medicinal substance, a violent release of gas bubbles is observed, which causes cloudiness of the barium hydroxide solution. This test allows you to identify:

A. Nitrite

B. Fluorides

C. Carbonates

D. Sulfates

E. Chlorides

4. The pharmacist-analyst conducts an express analysis of the extemporaneous mixture. He identifies sodium benzoate in the composition of the mixture by the reaction with the solution:

A. iron (III) chloride

B. sodium bicarbonate

C. ammonium oxalate

D. sodium acetate

E. magnesium sulfate

5. An express analysis of the liquid dosage form containing sodium salicylate and sodium benzoate is carried out. To detect salicylate and benzoate ions in their simultaneous presence, it is necessary to use a solution:

A. iron (III) chloride

B. potassium iodide

C. sodium nitrite

D. ammonium chloride

E. aluminum sulfate

6. The pharmacist-analyst determines the quantitative determination of the expectorant "Sodium benzoate" by the method of acidimetry. In order to eliminate the effect of benzoic acid on the indicator, the titration should be carried out in the presence of:

A. mannitol

B. diethyl ether

C. mercury (II) acetate

D. hydrochloric acid

E. sodium hydroxide

7. Quantitative determination of the local anesthetic Procaine hydrochloride is carried out in the quality control laboratory. The method of its alkalimetric titration is based on the presence in the structure of:

A. of p-aminobenzoic acid residue

B. diethylamino group

C. ester bond

D. unsubstituted aromatic cycle

E. bound hydrochloric acid

8. Quantitative determination of the substance "Adrenaline Tartrate" is carried out by the method of acidimetry in a non-aqueous environment. A solution is used as a titrant:

A. sodium hydroxide

B. perchloric acid

C. potassium bromate

D. iodine

E. sodium nitrite

9. Quantitative determination of the substance "Adrenaline Tartrate" is carried out by the method of acidimetry in a non-aqueous environment. What indicator is used in this method?

A. methyl orange

B. crystal violet

C. phenolphthalein

D. chalcone carboxylic acid

E. cryochrome black

10. Quantitative determination of the expectorant "Sodium benzoate" is carried out by the method of acidimetry in a non-aqueous environment. What reagent is used as a solvent?

A. Dimethylsulfoxide

B. pyridine

C. benzene

D. dimethylformamide

E. acetic acid anhydrous

11. The quantitative content of the local anesthetic "Lidocaine hydrochloride" is determined by the reverse argentometry method. What indicator is used for titration?

A. methylene blue

B. phenolphthalein

C. iron (III) ammonium sulfate

D. starch

E. neutral red

12. Local anesthetic "Benzocaine" (anesthesin) is identified by the reaction of formation of iron (III) hydroxamate. What functional group determines the possibility of carrying out this reaction?

A. ketone

B. carboxylic

C. estera

D. aldehyde

E. sulfamide

13. The local anesthetic "Benzocaine" (anesthesin) is identified by the reaction of the formation of an azo dye. What functional group determines the possibility of carrying out this reaction?

A. primary aromatic amino group

B. aldehyde group

C. ester group

D. aromatic nitro group

E. sulfamide group

14. Ethanol is formed as a result of alkaline hydrolysis of the local anesthetic "Benzocaine" (anesthesin). The pharmacist-analyst confirms the breakdown reaction product:

A. iodoform

B. murexide

C. thiochrome

D. ninhydrin

E. hydroxamic acid

15. Atropine sulfate is a drug that exhibits a cholinolytic effect. Quantitative determination of atropine sulfate by the method of acidimetry in a non-aqueous environment is possible due to the presence in the structure of the substance:

A. tertiary nitrogen atom

B. alcohol hydroxyl

C. phenyl radical

D. ester group

E. of bound sulfuric acid

16. Atropine sulfate is a drug that has a cholinolytic effect. Quantitative determination of atropine sulfate by the method of alkalimetry in an alcohol-

chloroform environment is possible due to the presence in the structure of the substance:

- A. alcohol hydroxyl
- B. tertiary nitrogen atom
- C. of bound sulfuric acid
- D. phenyl radical
- E. ester group

17. When analyzing nitroglycerin tablets, the pharmacist-analyst identifies the nitrate ion by the appearance of a blue color after interaction with the solution:

- A silver nitrate
- B cyanobromide
- C diphenylamine
- D barium chloride
- E calcium chloride

18. Identification of the medicinal product "Bismuthi subnitras" is carried out after dissolving it in acid with a reagent

- A Potassium chlorate
- B Sodium chloride
- C Sodium sulfate
- D Potassium iodide
- E Potassium nitrate

19. Quantitative determination of the medicinal product "Bismuthi subnitras" is carried out by the method:

- A Iodometry
- B Alkalimetry
- C Bromatometry
- D Complexonometry
- E Permanganatometry

20. The substance of magnesium carbonate of the lung was received for analysis.

Which reagent can be used to confirm the presence of a magnesium cation in it?

A Disodium hydrogen phosphate

B Potassium hydrosulfate

C Potassium hydrophthalate

D Ammonium thiocyanate

E Sodium tetraphenylborate

21. The substance of procaine hydrochloride was sent to the control and analytical laboratory for analysis. The limit content of heavy metals in accordance with the Federal Financial Regulation is determined with the help of:

A Methoxyphenylacetic acid reagent

B Thioacetamide reagent

C Hypophosphate reagent

D Aminomethylalzarinoacetic acid reagent

E Sulfomolybdenum reagent

22. Which solution of the presented medicines is optically active?

A Protargol

B Chloroform

C Menthol

D Magnesium sulfate

E Iodine

23. When adding sulfuric acid conc. to a hot solution of terpine hydrate. Liquid

A yellow precipitate falls out

B a white precipitate falls out

C precipitates a brown precipitate

D becomes cloudy and acquires an aromatic smell

E hydrogen gas is released

24. Quantitative determination of which medicinal substance can be performed by a pharmacist-analyst using the alkalimetry method

A resorcinol

B sodium benzoate

C anesthesin

D calcium gluconate

E ephedrine hydrochloride

25. In the control and analytical laboratory, an analysis of a medicinal substance from the group of alkaloids is performed. Indicate which of the following medicines gives a positive reaction to Vitaly-Morena

A papaverine hydrochloride

B platyphyllin hydrotartrate

C quinine sulfate

D scopolamine hydrobromide

E morphine hydrochloride

26. The pharmacist-analyst performs the identification reaction of ephedrine hydrochloride in an alkaline medium by the action of the solution:

A sodium chloride

B bromine water

C of copper (II) sulfate

D hydrochloric acid

E ammonium chloride

27. When ephedrine is heated with a crystal of potassium ferricyanide, the smell of bitter almonds appears. What substance is formed at the same time?

A nitrobenzene

B benzaldehyde

C chlorobenzene

D aniline

E toluene

28. To identify alkaloids, DFU requires the use of a reaction with the following precipitating reagent:

A potassium iodobismuthate solution

B solution of phosphoromolybdic acid

C tannin solution

D solution of phosphotungstic acid

E solution of potassium iodide iodized

29. To identify drugs derived from tropane, the Vitali-Moren reaction is used. To do this, the drugs, after interaction with nitric acid, are treated with an alcoholic solution of potassium hydroxide in the presence of acetone. At the same time, it is formed:

A green color

B purple color

C release of gas bubbles

D precipitation of black sediment

E precipitation of a white precipitate

30. Pharmacist-analyst KAL conducts identification of medicinal substance

"Atropine sulfate". For what purpose does he use diluted hydrochloric acid and barium chloride solution?

A definition of benzoates

B determination of sulfates

C definition of alkaloids

D determination of salicylates

E determination of sulfites

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Give a scheme for the synthesis of terpine hydrate, indicating the chemical names of the initial, intermediate and final products; its pharmacological action.

Task 2. Suggest possible methods for the identification of terpine hydrate. Where possible, give equations for chemical reactions.

Task 3. Suggest possible methods of identification of sodium benzoate. Where possible, give the corresponding reaction equations.

Task 4. Describe the acidimetric method for the quantitative determination of sodium benzoate. Give the reaction equations, the formula for calculating the quantitative content, indicate the molar mass of the equivalent.

Task 5. Provide a scheme for the synthesis of menthol from n-cymol, indicating the chemical names of the intermediate and final products; its pharmacological action.

Task 6. Describe the means of obtaining menthol from vegetable raw materials; its pharmacological action.

Task 7. Suggest possible methods for the identification of menthol. Where possible, give equations for chemical reactions.

Task 8. Describe the alkalimetric method of quantitative determination of validol. Give the reaction equations, the formula for calculating the quantitative content, indicate the molar mass of the equivalent.

Task 9. Write a scheme for the synthesis of pilocarpine hydrochloride, name the compounds of the synthesis, give characteristics of individual stages.

Task 10. Suggest possible methods of identification of atropine sulfate. Where possible, give equations for chemical reactions.

Task 11. Give a scheme for the synthesis of adrenaline hydrotartrate, norepinephrine hydrotartrate, indicating the chemical names of the starting compounds, intermediate and final products; its pharmacological action.

Task 12. Suggest possible methods of identification of epinephrine hydrotartrate, norepinephrine hydrotartrate. Where possible, give chemical equations reactions. Specify its pharmacologic effect.

Task 13. Give a scheme for the synthesis of mesatone, norepinephrine hydrotartrate, indicating the chemical names of the starting compounds, intermediate and final products; its pharmacological action.

Task 14. Suggest possible methods of mesatone identification. Where possible, give chemical equations reactions. Specify its pharmacologic effect.

Task 15. Write the structural formula, Latin and chemical name of ephedrine hydrochloride, properties, chemistry of pharmacopoeial identification reactions.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4

1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the lesson, mastering of the studied topics, the ability to choose methods of determining the quality of medicinal products in accordance with the requirements of the Federal Medical University and the Ministry of Health according to the methods used in pharmaceutical analysis are checked.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.

3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 8

Topic:Antiarrhythmic drugs. Procainamide hydrochloride, Amiodarone

The purpose:to acquaint students with the pharmaceutical analysis of medicines they own antiarrhythmic properties.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;

- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Procaine hydrochloride is quantitatively determined in the quality control laboratory. The method of its alkalimetric titration is based on the presence in the structure of:

- A. *bound hydrochloric acid
- B. diethylamino groups
- C. ester bond
- D. unsubstituted aromatic ring
- E. p-aminobenzoic acid residue

2. Quantitative content of Lidocaine hydrochloride is determined by reverse argentometry. What indicator is used for titration?

- A. * iron (III) ammonium sulfate
- B. phenolphthalein
- C. methylene blue
- D. starch
- E. neutral red

3. Benzocaine (anesthesin) is identified by the reaction of formation of iron (III) hydroxamate. What functional group determines the possibility of carrying out this reaction?

- A. *esterna
- B. carboxylic

C. ketone

D. aldehyde

E. sulfamide

4. Benzocaine (anesthesin) is identified by the reaction of the formation of an azo dye. What functional group determines the possibility of carrying out this reaction?

A. *primary aromatic amino group

B. aldehyde group

C. ester group

D. aromatic nitro group

E. sulfamide group

5. Benzocaine" (anesthesin) is identified by the reaction of the formation of an azo dye. What functional group determines the possibility of carrying out this reaction?

A. *primary aromatic amino group

B. aldehyde group

C. ester group

D. aromatic nitro group

E. sulfamide group

6. Ethanol is formed as a result of alkaline hydrolysis of Benzocaine (anesthesin).

The pharmacist-analyst confirms the breakdown reaction product:

A. *iodoform

B. murexidna

C. thiochrome

D. ninhydrin

E. hydroxamov

7. To identify the chloride ion in hydrochloric acid, the Pharmacopoeia suggests conducting a reaction with the following reagent:

A * Manganese dioxide

B Potassium chromate

CPotassium pyrochromate

DPotassium permanganate

E Ammonium molybdate

8. Chloride ions are detected by a solution of argentum nitrate in an acidic medium in the presence of the following acid:

A * Nitrate

B Sulfate

C Phosphate

D Vinegar

E Sulfite

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Give a scheme for the synthesis of novocainamide (procainamide hydrochloride), indicate the chemical names of starting, intermediate and final products; its pharmacological action.

Task 2. Suggest possible methods of identification of novocainamide (procainamide hydrochloride). Where possible, give the corresponding chemical reaction equations.

Task 3. Describe the nitritometric method for quantitative determination of novocainamide (procainamide hydrochloride). Give the reaction equations, the formula for calculating the quantitative content, indicate the molar mass of the equivalent.

Task 4. Calculate the percentage content of novocainamide (M.m. 271.79) in the substance, if 11.91 ml of 0.1 M sodium nitrite solution (KP = 1.0000) was used for the titration of a weight of 0.3120 g; the volume of the titrant in the control experiment is 0.52 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4

1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.

3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
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6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 9

Topic: Means that improve blood supply to organs and tissues.

Nitrovasodilators: Glycerin trinitrate solution, Pentaerythritol tetranitrate, Eritrit

The purpose: to acquaint students with the pharmaceutical analysis of medicinal products, which improve blood supply to organs and tissues.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;

- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Glycerin trinitrate (nitroglycerin), an antianginal agent, chemically belongs to the esters of nitric acid. Identify the substance by nitrate ions after carrying out:

A. *hydrolysis

B. pyrolysis

C. oxidation

D. decarboxylation

E. dehydration

2. A pharmacist-analyst analyzes the antianginal agent glycerin trinitrate (nitroglycerin). To identify the nitrate ions formed after hydrolysis, he uses a solution:

A. *diphenylamine

B. lanthanum (III) nitrate

C. thioureas

D. chloramine

E. glyoxalhydroxyanil

3. The pharmacist-analyst analyzes the anti-anginal agent glycerol trinitrate (nitroglycerin). To identify the nitrate ions formed after hydrolysis, he uses a solution:

A. *diphenylamine

B. lanthanum (III) nitrate

C. thioureas

D. chloramine

E. glyoxalhydroxyanil

4. A refractometer is used to identify and test the purity of the glycerol substance.

What indicator is being measured?

A. *refractive index

B. melting point

C. dynamic viscosity

D. optical density

E. rotation angle

5. The pharmacist-analyst performs the analysis of the glycerin substance according to the DFU. To determine the unacceptable admixture of sugars, he uses a freshly prepared solution:

AND * Copper (II) sulfate

B Iron (II) sulfate

WITH Cobalt (II) chloride

D Mercury (II) nitrate

E Sodium thiosulfate

6. Nitroglycerin is used in acute heart failure. When taken sublingually, it quickly penetrates into the blood, where it undergoes recovery with the formation of:

And *nitrogen (II) oxide

B sulfur (VI) oxide

C carbon (IV) oxide

D carbon (II) oxide

E sulfur (IV) oxide

7. Nitroglycerin (glycerol trinitrate) drugs are prescribed for the treatment of angina pectoris. According to its chemical structure, nitroglycerin belongs to:

A * esters

B polyphenols

C polyalcohols

D of nitroalkanes

E of nitroarenes

8. Certification of a series of nitroglycerin tablets is carried out in the laboratory for quality control of medicinal products. After hydrolysis of nitroglycerin, the remaining nitric acid can be identified by reaction with the solution:

A *diphenylamine

B cyanobromide

C silver nitrate

D potassium pyroantimonate

E sodium nitroprusside

9. In order to identify nitroglycerin, the pharmacist-analyst conducts a reaction with potassium hydrosulfate when heated, as a result of which a substance with a sharp smell is formed. Name this compound.

A *acrolein

B benzene

C methylamine

D ethanol

E chloroform

10. When conducting a quantitative analysis of glycerol trinitrate solution by absorption spectrophotometry, the analytical chemist determines on the spectrophotometer:

A * optical density

B refractive index

C boiling point

D angle of rotation

E pH of the solution

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Suggest possible methods for the identification of glycerol. Where possible, give equations for chemical reactions.

Task 2. Describe possible physical and chemical methods for the quantitative determination of glycerol. Give the equations of the reactions, the formulas for calculating the quantitative content, indicate the molar masses of the equivalents.

Task 3. Methods of quantitative determination of nitroglycerin. Write reaction equations, formulas for calculating equivalents, quantitative content.

Task 4. Give a scheme for the synthesis of nitroglycerin, indicating the chemical names of the initial, intermediate and final products; its pharmacological action.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of

medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
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6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 10

Topic:Antagonists of calcium ions: Nifedipine, Verapamil hydrochloride, Amlodipine.

Activators of potassium channels: Minoxidil, Diazoxide.

The purpose:to acquaint students with the pharmaceutical analysis of medicinesantagonists of calcium ions, activators of potassium channels.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. At the pharmaceutical plant, the production technology of nifedipine substance is being introduced. One of the starting substances in the synthesis of this medicinal substance is:

A * nitrobenzaldehyde

B aniline

C phenol

D malonic ether

E chloroacetic acid

2. An analytical chemist identifies nifedipine after reduction of the nitro group to the primary aromatic amino group. The reduction product is determined by the formation reaction:

A * azo dye

B murexide

C thiochrome

D fluorescein

E of thalleioquinine

3. One of the directions of biotransformation of nifedipine is hydrolysis. At the expense of which functional group does this transformation take place:

A * ester group

B nitro groups

C of the dihydropyridine cycle

D carboxyl group

E of phenolic hydroxyl

4. A sample of nifedipine substance was received in the laboratory for quality control of medicinal products. What method can be used to quantitatively determine this substance?

A * cerimetry

B thiocyanatometry

C argentometry

D complexometry

E alkalimetry

5. The pharmacist-analyst performs quantitative determination of nifedipine by the cerimetry method. Specify the indicator used in this method?

And *feroin

In potassium chromate

C phenolphthalein

D tropeolin 00

E methyl orange

6. Quality control of nifedipine preparations is carried out in the control and analytical laboratory. Which method of quantitative determination of the active substance requires preliminary reduction of the nitro group to the amino group?

A *nitritometry

B complexometry

C acidimetry

D argentometry

E alkalimetry

7. Nifedipine is a synthetic drug belonging to the group of calcium channel blockers. According to DFU, the substance is reduced with zinc in the presence of hydrochloric acid, a solution of sodium nitrite and naphthylethylenediamine dihydrochloride is added. At the same time, an intense red color appears, which indicates the presence of:

A. *aromatic nitro group

B. aldehyde group

C. aliphatic amino group

D. lactone cycle

E. ester group

8. The calcium channel blocker verapamil hydrochloride is metabolized in the liver to form norverapamil. What reaction is the basis of this transformation:

A *N-demethylation

B acetylation

C hydroxylation

D glucuronidation

E demining

9. The substance verapamil hydrochloride is examined in the control and analytical laboratory. Which of the following reagents can be used for its identification?

A * silver nitrate

B sodium chloride

C ammonium oxalate

D potassium bromide

E copper sulfate

10. The patient was prescribed the antihypertensive drug Verapamil, tablets. The active substance – verapamil hydrochloride – according to its chemical structure belongs to the derivatives:

A *phenylalkylamine

B phenothiazine

C benzothiazepine

D of dihydropyridine

E of pyrimidine

11. The pharmacist of the control and analytical laboratory examines the substance of verapamil hydrochloride by the method of acidimetry in a non-aqueous medium.

As a titrant, he uses a solution:

A * perchloric acid

B potassium bromate

C sodium nitrite

D sodium edetate

E zinc sulfate

12. One of the methods of quantitative determination of verapamil hydrochloride is the method of acidimetric titration in a non-aqueous medium. For what purpose titration is carried out in the presence mercury(II) acetate:

A * for binding chloride ions into a slightly dissociated compound

B for precipitation of a nitrogen-containing base

C to change the density of the solution

D to create the optimal pH value of the solution

E to accelerate the hydrolysis of the substance

3. Formation of professional skills and abilities:

Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page68

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Antagonists of calcium ions. Activators of potassium channels. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.

Task 2. Calculate the weight of the weight Nifedipinein (M.m. 165.40), if 16.53 ml of a 0.1 M solution of hydrochloric acid (KP=1.0018) was spent on the titration, and its percentage content in the substance was 99.8%; volume of titrant in the control experiment - 34.60 ml.

Task 3. Calculate the volume of 0.1 M sodium hydroxide solution (KP=1.0000), which will be used for the titration of 0.1196 g Verapamil hydrochloridein (M.m. 140.19) by the reverse acidimeria method, if its percentage content in the substance is 99.2%; volume of titrant in the control experiment - 49.85 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.

7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFAU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 11

Topic: Agents affecting the renin-angiotensin system. Hypotensive (antihypertensive) drugs.

Angiotensin-converting enzyme (ACE) inhibitors: Captopril, Enalapril maleate
 Antispasmodic means: Papaverine hydrochloride, Drotaverine hydrochloride,
 Dibazol

The purpose: to acquaint students with the pharmaceutical analysis of medicinal products, affecting the renin-angiotensin system, as well as with hypotensive (antihypertensive) agents.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Inbound control of the enalapril maleate substance is carried out in the CZL of the pharmaceutical enterprise. What method can be used to quantify a substance?

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A * alkalimetry

B complexometry

C thiocyanometry

D argentometry

E acidimetry

2. The pharmacist-analyst conducts quantitative determination of enalapril maleate by the alkalimetric method. He determines the end point of the titration using:

A * potentiometer

B refractometer

C polarimeter

D polarograph

E fluorimeter

3. The doctor prescribed the antispasmodic agent bendazol hydrochloride (dibazol) to the patient. According to the chemical structure, this substance is a derivative of:

A.* benzimidazole

V. indole

S. acridine

D. purine

E. phenothiazine

4. A technological scheme for obtaining bendazole hydrochloride (dibazole) has been implemented at the chemical and pharmaceutical plant. The synthesis of the compound is based on the condensation reaction of o-phenylenediamine with:

A.* phenylacetic acid

B. anthranilic acid

S. acetic acid

D. malonic acid

E. mefenamic acid

5. The pharmacist-analyst conducts the analysis of the substance bendazole hydrochloride (dibazole) by the UV spectrophotometry method, using the device:

A.* spectrophotometer

IN. fluorimeter

S. polarimeter

D. refractometer

E. potentiometer

6. In the laboratory for quality control of medicinal products, a sample of the substance bendazole hydrochloride (dibazole) is tested. The quantitative determination of the substance is carried out by the method of acidimetry in a non-aqueous environment, using as a titrant the following solution:

A.* perchloric acid

B. sodium hydroxide

S. potassium iodide

D. silver nitrate

E. sodium thiosulfate

7. A chemist-analyst of the CZL carries out quantitative determination of bendazole hydrochloride (dibazole) by the method of acidimetry in a non-aqueous environment. Titration is carried out in the presence of:

A.*mercury (II) acetate

B. copper (II) sulfate

S. of iron (III) chloride

D. potassium tetraiodomercurate

E. zinc sulfate

8. Inbound control of the enalapril maleate substance is carried out at the CZL of the pharmaceutical enterprise. What method can be used to quantify a substance?

A * alkalimetry

B complexometry

C thiocyanatometry

D argentometry

E acidimetry

9. The pharmacist-analyst performs the quantitative determination of enalapril maleate by the alkalimetric method. He determines the end point of the titration using:

A * potentiometer

B refractometer

C polarimeter

D polarograph

E fluorimeter

10. Papaverine hydrochloride is a drug of plant origin from the group of alkaloids, used in medicine as an antispasmodic. According to the chemical structure, papaverine is a derivative of:

A.* isoquinoline

V. furan

S. Indole

D. tropane

E. purine

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Write the structural formula, Latin and chemical name of dibazole, name and indicate the heterocycles and analytical functional groups that are in the molecule.

Task 2. Write and explain the chemistry of the identification reactions of papaverine hydrochloride with picrate acid, Dragendorff, Wagner-Buchard, Mayer, Marchi reagents, bromine water.

Task 3. Methods of quantitative determination of no-shpa (drotaverine hydrochloride).

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
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1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

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- 7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
- 9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 12

Topic: Hypertensive drugs. Adrenaline tartrate, norepinephrine hydrotartrate, mesaton.

The purpose: to acquaint students with the pharmaceutical analysis of medicinal products, showing hypertensive properties.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Quantitative determination of the substance "Adrenaline Tartrate" is carried out by the method of acidimetry in a non-aqueous medium. A solution is used as a titrant:

- A. *chloric acid
- B. sodium hydroxide
- C. potassium bromate
- D. iodine
- E. sodium nitrite

2. Quantitative determination of the substance "Adrenaline Tartrate" is carried out by the method of acidimetry in a non-aqueous medium. What indicator is used in this method?

- A. *crystal violet
- B. methyl orange
- C. phenolphthalein
- D. chalcone carboxylic acid
- E. cryochrome black

3. A pharmacist-analyst conducts an express analysis of eye drops containing adrenaline hydrotartrate. After adding a solution of iron (III) chloride, an emerald-green color appeared, which indicates the presence of adrenaline in the molecule:

A * Phenolic hydroxyl groups

B Aldehyde groups

C Aromatic amino groups

D Complex ether groups

E Carboxylic groups

4. The pharmacist-analyst determines the quantitative content of norepinephrine hydrotartrate in accordance with the requirements of the DFU by the method of acid-base titration in non-aqueous media. As a solvent, he used a solution:

A. * acetic acid anhydrous

B. sodium hydroxide

S. potassium bromate

D. iodine

E. sodium nitrite

5. One of the reactions that makes it possible to distinguish adrenaline from norepinephrine. is an oxidation reaction with a 0.05 M solution of iodine in buffer solutions with different pH values. At the same time, adrenaline forms:

A. * Adrenochrome is red-violet in color

B. Noradrenochrome is red-violet in color

S. Adrenochrome is light purple in color

D. Noradrenochrome is red

E. Purple adrenochrome

6. The pharmacist-analyst determines the quantitative content of phenylephrine hydrochloride (Mesatone) according to the DFU method:

A. * alkalimetry

B. complexometry

S. nitritometry

D. permanganometry

E. thiocyanometry

7. A pharmacist-analyst performs a quantitative determination of mesatone (phenylephrine hydrochloride). Which of the listed methods can he use?

A. * bromatometry

V. nitritometry

S. acidimetry

D. complexometry

E. gravimetry

8. The pharmacist-analyst performs the identification of phenylephrine hydrochloride (mesaton) in accordance with the requirements of the Federal Drug Administration by the formation of a purple color when interacting with the solution:

A. * copper sulfate

B. potassium bromide

S. magnesium sulfate

D. sodium nitrite

E. ammonium hydrochloride

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the weight of a test of norepinephrine hydrotartrate (M.m. 337.29), if 4.95 ml of a 0.1 M perchloric acid solution (CP = 1.0030) was spent on its titration, its percentage content in the substance is 99.5%, the percentage of water is 5% and the volume of the titrant in the control experiment is 0.30 ml.

Task 2. Calculate the percentage content of mesatone (M.m. 203.67) in the substance, if 16.10 ml of 0.1 M sodium thiosulfate solution (CP = 1.0000) was used for the titration of a weight of 0.1120 g when determined by the method of inverse bromatometry, weight loss during drying - 0.5% and the titrant volume in the control experiment - 48.50 ml.

Task 3. Give a scheme for the synthesis of adrenaline hydrotartrate, indicating the chemical names of the starting compounds, intermediate and final products; its pharmacological action.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
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1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition.

- Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
- 3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
- 4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
- 5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
- 6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
- 7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
- 9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 13

Topic: Angioprotectors. Antioxidants. Ascorbic acid, Rutin, Nicotinic acid, Tocopherol acetate, Retinol acetate.

The purpose: to acquaint students with the pharmaceutical analysis of medicinal products, showing angioprotective and antioxidant properties.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. After hydrolysis of rutin in an acidic environment, the substance can be detected:

- A. * glucose
- B. lactose
- S. sucrose
- D. starch
- E. dextrin

2. A pharmacist-analyst examines a medicinal substance from the group of vitamins.

What substance is called vitamin C?

- A. * ascorbic acid
- B. barbituric acid
- C. nicotinic acid
- D. folic acid
- E. salicylic acid

3. The identification of ascorbic acid according to DFU is carried out by a pharmacist-analyst using the following reagent:

- A. * silver nitrate
- B. zinc sulfate
- C. ammonium oxalate
- D. calcium chloride

E. barium nitrate

4. In the practice of control and analytical laboratories, a solution of 2,6-dichlorophenolindophenol is used, the blue color of which is discolored under the action of reducing agents. Name the medicinal product that can be identified by a solution of 2,6-dichlorophenolindophenol:

A. ascorbic acid

B. salicylic acid

C. nicotinic acid

D. benzoic acid

E. acetylsalicylic acid

5. The pharmacist-analyst performs the analysis of the substance of ascorbic acid in accordance with the requirements of the DFU. To determine the admixture of oxalic acid, he uses a solution:

A. * calcium chloride

B. sodium chloride

C. sodium bicarbonate

D. sodium sulfate

E. sodium thiosulfate

6. The substance of ascorbic acid was sent to the control and analytical laboratory for analysis. In accordance with the requirements of the DFU, the quantitative content of ascorbic acid is determined by the method:

A. * iodometry

B. nitritometry

C. acidimetry

D. acidimetry in the above environments

E. compleconometry

7. The analyst carries out quality control of nicotinic acid in accordance with the requirements of the Federal State Administration of Ukraine. Which reagent can be used to confirm the presence of a pyridine cycle in its structure?

A. *cyanobromide solution

- B. sodium nitroprusside solution
- C. potassium ferrocyanide solution
- D. ninhydrin solution
- E. benzaldehyde solution

8. Quantitative content of nicotinic acid according to DFU is determined by the method:

- A. * alkalimetry
- B. argentometry
- C. nitritometry
- D. permanganometry
- E. bromatometry

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the volume of 0.1 M potassium iodate solution (KP = 1.0010), which will be used for the titration of 0.4520 g of ascorbic acid (M.m. 176.13), if its percentage content in the substance is 98.7% ; the volume of the measuring flask is 50 ml, the volume of the pipette is 10 ml.

Task 2. Calculate the volume of 0.1 M sodium hydroxide solution (KP = 1.0030), which will be spent on the titration of 0.3010 g of nicotinic acid (M.m. 123.11), if its percentage content in the substance is 99.5 % and weight loss during drying - 0.4%.

Task 3. Calculate the weight of the tocopherol acetate sample (M.m. 472.8), if 19.20 ml of a 0.1 M solution of cerium sulfate (KP = 1.0000) was spent on its titration, its percentage content in the substance was 94.9% and volume of titrant in the control experiment - 0.4 ml; the volume of the measuring flask is 50 ml, the volume of the pipette is 20 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
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1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
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- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
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- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 14

Topic:*Thematic control work on the topic:*"Antiarrhythmic drugs. Means that improve blood supply to organs and tissues. Antagonists of calcium ions. Agents affecting the renin-angiotensin system. Hypotensive (antihypertensive) drugs. Hypertensive drugs. Angioprotectors. Antioxidants".

The purpose:check the assimilation of knowledge of higher education students by topics:"Antiarrhythmic drugs. Means that improve blood supply to organs and tissues. Antagonists of calcium ions. Agents affecting the renin-angiotensin system. Hypotensive (antihypertensive) drugs. Hypertensive drugs. Angioprotectors. Antioxidants".

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;

- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Procaine hydrochloride is quantitatively determined in the quality control laboratory. The method of its alkalimetric titration is based on the presence in the structure of:

- A. *bound hydrochloric acid
- B. diethylamino groups
- C. ester bond
- D. unsubstituted aromatic ring
- E. p-aminobenzoic acid residue

2. Quantitative content of Lidocaine hydrochloride is determined by reverse argentometry. What indicator is used for titration?

- A. * iron (III) ammonium sulfate
- B. phenolphthalein
- C. methylene blue
- D. starch
- E. neutral red

3. Benzocaine (anesthesin) is identified by the reaction of formation of iron (III) hydroxamate. What functional group determines the possibility of carrying out this reaction?

- A. *esterna
- B. carboxylic
- C. ketone
- D. aldehyde
- E. sulfamide

4. Benzocaine (anesthesin) is identified by the reaction of the formation of an azo dye. What functional group determines the possibility of carrying out this reaction?

- A. *primary aromatic amino group
- B. aldehyde group
- C. ester group
- D. aromatic nitro group
- E. sulfamide group

5. Benzocaine" (anesthesin) is identified by the reaction of the formation of an azo dye. What functional group determines the possibility of carrying out this reaction?

- A. *primary aromatic amino group
- B. aldehyde group
- C. ester group
- D. aromatic nitro group
- E. sulfamide group

6. A pharmacist-analyst analyzes the anti-anginal agent glycerol trinitrate (nitroglycerin). To identify the nitrate ions formed after hydrolysis, he uses a solution:

- A. *diphenylamine
- B. lanthanum (III) nitrate
- C. thioureas
- D. chloramine
- E. glyoxalhydroxyanil

7. A refractometer is used to identify and test the purity of the glycerol substance. What indicator is being measured?
- A. *refractive index
 - B. melting point
 - C. dynamic viscosity
 - D. optical density
 - E. rotation angle
8. The pharmacist-analyst performs the analysis of the glycerin substance according to the DFU. To determine the unacceptable admixture of sugars, he uses a freshly prepared solution:
- AND * Copper (II) sulfate
 - B Iron (II) sulfate
 - WITH Cobalt (II) chloride
 - D Mercury (II) nitrate
 - E Sodium thiosulfate
9. Nitroglycerin is used in acute heart failure. When taken sublingually, it quickly penetrates into the blood, where it undergoes recovery with the formation of:
- And *nitrogen (II) oxide
 - B sulfur (VI) oxide
 - C carbon (IV) oxide
 - D carbon (II) oxide
 - E sulfur (IV) oxide
10. Nitroglycerin (glycerol trinitrate) preparations are prescribed for the treatment of angina pectoris. According to its chemical structure, nitroglycerin belongs to:
- A * esters
 - B polyphenols
 - C polyalcohols
 - D of nitroalkanes
 - E of nitroarenes

11. At the pharmaceutical plant, the technology for the production of the nifedipine substance is being implemented. One of the starting substances in the synthesis of this medicinal substance is:

A * nitrobenzaldehyde

B aniline

C phenol

D malonic ether

E chloroacetic acid

12. An analytical chemist identifies nifedipine after reduction of the nitro group to the primary aromatic amino group. The reduction product is determined by the formation reaction:

A * azo dye

B murexide

C thiochrome

D fluorescein

E of thalleioquinine

13. One of the directions of biotransformation of nifedipine is hydrolysis. At the expense of which functional group does this transformation take place:

A * ester group

B nitro groups

C of the dihydropyridine cycle

D carboxyl group

E of phenolic hydroxyl

14. A sample of nifedipine substance was received in the laboratory for quality control of medicinal products. What method can be used to quantitatively determine this substance?

A * cerimetry

B thiocyanatometry

C argentometry

D complexometry

E alkalimetry

15. The pharmacist-analyst performs the quantitative determination of nifedipine by the cerimetry method. Specify the indicator used in this method?

And *feroin

In potassium chromate

C phenolphthalein

D tropeolin 00

E methyl orange

16. The pharmacist-analyst determines the quantitative content of norepinephrine hydrotartrate in accordance with the requirements of the DFU by the method of acid-base titration in non-aqueous media. As a solvent, he used a solution:

A. * acetic acid anhydrous

B. sodium hydroxide

S. potassium bromate

D. iodine

E. sodium nitrite

17. One of the reactions that makes it possible to distinguish adrenaline from norepinephrine. is an oxidation reaction with a 0.05 M solution of iodine in buffer solutions with different pH values. At the same time, adrenaline forms:

A. * Adrenochrome is red-violet in color

B. Noradrenochrome is red-violet in color

S. Adrenochrome is light purple in color

D. Noradrenochrome is red

E. Purple adrenochrome

18. The pharmacist-analyst determines the quantitative content of phenylephrine hydrochloride (Mesatone) according to the DFU method:

A. * alkalimetry

B. complexometry

S. nitritometry

D. permanganometry

E. thiocyanatometry

19. A pharmacist-analyst performs a quantitative determination of mesatone (phenylephrine hydrochloride). Which of the listed methods can he use?

A. * bromatometry

V. nitritometry

S. acidimetry

D. complexonometry

E. gravimetry

20. The pharmacist-analyst performs the identification of phenylephrine hydrochloride (mesaton) in accordance with the requirements of the Federal Drug Administration by the formation of a purple color when interacting with the solution:

A. * copper sulfate

B. potassium bromide

S. magnesium sulfate

D. sodium nitrite

E. ammonium hydrochloride

21. A pharmacist-analyst examines a medicinal substance from the group of vitamins. What substance is called vitamin C?

A. * ascorbic acid

B. barbituric acid

C. nicotinic acid

D. folic acid

E. salicylic acid

22. The identification of ascorbic acid according to DFU is carried out by a pharmacist-analyst using the following reagent:

A. * silver nitrate

B. zinc sulfate

C. ammonium oxalate

D. calcium chloride

E. barium nitrate

23. In the practice of control and analytical laboratories, a solution of 2,6-dichlorophenolindophenol is used, the blue color of which is discolored under the action of reducing agents. Name the medicinal product that can be identified by a solution of 2,6-dichlorophenolindophenol:

- A. ascorbic acid
- B. salicylic acid
- C. nicotinic acid
- D. benzoic acid
- E. acetylsalicylic acid

24. The pharmacist-analyst performs the analysis of the substance of ascorbic acid in accordance with the requirements of the DFU. To determine the admixture of oxalic acid, he uses a solution:

- A. * calcium chloride
- B. sodium chloride
- C. sodium bicarbonate
- D. sodium sulfate
- E. sodium thiosulfate

25. The substance of ascorbic acid was sent to the control and analytical laboratory for analysis. In accordance with the requirements of the DFU, the quantitative content of ascorbic acid is determined by the method:

- A. * iodometry
- B. nitritometry
- C. acidimetry
- D. acidimetry in the above environments
- E. compleconometry

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Suggest possible methods for the identification of glycerol. Where possible, give equations for chemical reactions.

Task 2. Describe possible physical and chemical methods for the quantitative determination of glycerol. Give the equations of the reactions, the formulas for calculating the quantitative content, indicate the molar masses of the equivalents.

Task 3. Methods of quantitative determination of nitroglycerin. Write reaction equations, formulas for calculating equivalents, quantitative content.

Task 4. Give a scheme for the synthesis of nitroglycerin, indicating the chemical names of the initial, intermediate and final products; its pharmacological action.

Task 5. Calculate the weight of the weight Nifedipinein (M.m. 165.40), if 16.53 ml of a 0.1 M solution of hydrochloric acid (KP=1.0018) was spent on the titration, and its percentage content in the substance was 99.8%; volume of titrant in the control experiment - 34.60 ml.

Problem 6. Calculate the volume of 0.1 M sodium hydroxide solution (KP=1.0000), which will be used for the titration of 0.1196 g Verapamil hydrochloridein (M.m. 140.19) by the reverse acidimeria method, if its percentage content in the substance is 99.2%; volume of titrant in the control experiment - 49.85 ml.

Task 7. Calculate the weight of a test of norepinephrine hydrotartrate (M.m. 337.29), if 4.95 ml of a 0.1 M perchloric acid solution (CP = 1.0030) was spent on its titration, its percentage content in the substance is 99.5%, the percentage of water is 5% and the volume of the titrant in the control experiment is 0.30 ml.

Task 8. Calculate the percentage content of mesatone (M.m. 203.67) in the substance, if 16.10 ml of 0.1 M sodium thiosulfate solution (CP = 1.0000) was used for the titration of a weight of 0.1120 g when determined by the method of inverse bromatometry, weight loss during drying - 0.5% and the titrant volume in the control experiment - 48.50 ml.

Problem 9. Give a scheme for the synthesis of adrenaline hydrotartrate, indicating the chemical names of the starting compounds, intermediate and final products; its pharmacological action.

Task 10. Calculate the volume of 0.1 M potassium iodate solution (KP = 1.0010), which will be used for the titration of 0.4520 g of ascorbic acid (M.m. 176.13), if its

percentage content in the substance is 98.7% ; the volume of the measuring flask is 50 ml, the volume of the pipette is 10 ml.

Task 11. Calculate the volume of 0.1 M sodium hydroxide solution (KP = 1.0030), which will be spent on the titration of 0.3010 g of nicotinic acid (M.m. 123.11), if its percentage content in the substance is 99.5 % and weight loss during drying - 0.4%.

Problem 12. Calculate the weight of the tocopherol acetate sample (M.m. 472.8), if 19.20 ml of a 0.1 M solution of cerium sulfate (KP = 1.0000) was spent on its titration, its percentage content in the substance was 94.9% and volume of titrant in the control experiment - 0.4 ml; the volume of the measuring flask is 50 ml, the volume of the pipette is 20 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the lesson, mastering of the studied topics, the ability to choose methods of determining the quality of medicinal products in accordance with the requirements of the Federal Medical University and the Ministry of Health according to the methods used in pharmaceutical analysis are checked.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 15

Topic:Hypolipidemic agents. Antiatherosclerotic drugs.

Lovastatin, Simvastatin, Atorvastatin.

The purpose:to acquaint students with pharmaceutical analysishypolipidemic and antiatheroscleroticmedicines.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. During the pharmaceutical analysis of the medicinal substance, a reaction with antipyrine was carried out (phenazone) in the presence of dilute hydrochloric acid.

The appearance of green color allows you to identify:

- A. *Nitrite
- B. Sulfates
- C. Fluorides
- D. Bromides
- E. Iodides

2. Under the action of acetic acid diluted as a medicinal substance, a violent release of gas bubbles is observed, which causes cloudiness of the barium hydroxide solution. This test allows you to identify:

- A.* Carbonates
- B. Fluorides
- C. Nitrites
- D. Sulfates
- E. Chlorides

3. When conducting a pharmaceutical analysis of a medicinal substance, a reaction was performed with sodium hydroxide solution during heating. As a result of this reaction, a gas with a characteristic smell was released, under the influence of which a wet red litmus paper turned blue. What cations were identified in the composition of the medicinal substance?

- A. *Ammonia
- B. Magnesium
- C. Calcium
- D. Sodium
- E. Potassium

4. When conducting a pharmaceutical analysis, a sample of a medicinal substance moistened with dilute hydrochloric acid was introduced into a colorless flame. The appearance of an orange-red color allows you to identify the following cation:

- A. *Calcium
- B. Sodium
- C. Potassium
- D. Ammonia
- E. Barium

5. A laboratory specialist of the pharmaceutical product certification center prepares reagents. To identify medicines containing potassium ions, use a solution:

- A. *Sodium cobaltinitrite
- B. Ammonium oxalate

- C. Barium chloride
- D. Sodium hydroxide
- E. Magnesium sulfate
6. To confirm the presence of covalently bound chlorine in the structure of the diuretic "Furosemide", the substance under investigation is sintered with a mixture of potassium carbonate and potassium nitrate. The formed chloride ions are identified by the solution:
- A. *silver nitrate
- B. ammonium oxalate
- C. potassium iodide
- D. sodium sulfide
- E. calcium chloride
7. A sample of purified water from a pharmacy was sent for analysis. Which reagent can be used to detect the presence of heavy metals in it?
- A* Thiocetamid
- B 2,6-dichlorophenylinphenol
- C Sodium nitroprusside
- D Ninhydrin
- E Thiosemicarbazide
8. According to the requirements of the State Pharmacopoeia of Ukraine, which ions are identified with a disodium hydrogen phosphate solution in the presence of a dilute ammonia solution and an ammonium chloride solution?
- AND* Magnesium
- B Calcium
- WITH Argentum
- D Potassium
- E to Arsen (III)

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Write a synthesis scheme lovastatin, simvastatin, atorvastatin, name analytical functional groups in molecules, write reactions for their detection. Application in medicine.

Task 2. Write and explain the chemistry of identification reactions lovastatin, simvastatin, atorvastatin.

Task 3. Quantitative definition lovastatin, simvastatin, atorvastatin. Name the method, explain the titration conditions, write the chemistry of the reactions, formulas for calculating the equivalent and content in %.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of

medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 16

Topic:Diuretics.Saluretics: chlorothiazide, hydrochlorothiazide, furosemide, indapamide, ethacrynic acid

Aldosterone antagonists (potassium sparing):Spironolactone

The purpose:to acquaint students with pharmaceutical analysisdiuretics.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. To confirm the presence of covalently bound chlorine in the structure of the diuretic "Furosemide", the substance under study is sintered with a mixture of potassium carbonate and potassium nitrate. The formed chloride ions are identified by the solution:

A. *silver nitrate

B. ammonium oxalate

C. potassium iodide

D. sodium sulfide

E. calcium chloride

2. As a result of acid hydrolysis of the diuretic "Furosemide", a product containing a primary aromatic amino group is formed. This makes it possible to carry out the formation reaction further:

A. *azo dye

B. thiochrome

C. iodoform

D. thaleoquinine

E. murexide

3. The pharmacist-analyst performs the analysis of furosemide solution for injections using the instrumental method. To calculate the quantitative content of a substance, he uses the value of the optical density, which is measured using:

* spectrophotometer

B refractometer

C potentiometer

D polarimeter

E chromatograph

4

* sodium hydroxide

B potassium permanganate

C cerium sulfate

D zinc sulfate

E perchloric acid

5. A furosemide metabolite was found in the biological material in the laboratory for chemical and toxicological analysis (4-chloro-(2-furfurylamino)-5-sulfamoylbenzoic acid). Specify this substance.

*4-chloro-5-sulfamoylanthranilic acid

B (5-chloroindol-3-yl)acetic acid

C p-hydroxyaminophenol

D 2-amino-5-nitrobenzophenone

E 4-hydroxyphenazone

6. The patient was prescribed a diuretic - hydrochlorothiazide (hypothiazide) tablets.

The structure of the active substance is based on a condensed system:

* benzothiadiazine

B isoquinoline

C xanthine

D indole

E quinoline

7. The pharmacist-analyst identifies the hydrochlorothiazide substance. After mineralization of the substance, he determines the formed sulfate ion by reaction with the solution:

* barium chloride

B of copper (II) sulfate

C of sodium hydroxide

D cobalt nitrate

E silver nitrate

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Write the structural formula, Latin and chemical names of furosemide, pharmacopoeial and non-pharmacopoeial identification reactions.

Task 2. Calculate the percentage content of furosemide, if the specific absorption index of the standard solution is 750, the optical density of the standard solution is 0.463, and the exact weight is 0.1011 g. The determination was made by FH.

Task 3. Calculate the exact weight of hydrochlorothiazide for quantitative determination by the spectrophotometric method, if the optical density is 0.434, the specific absorption index of the standard solution is 74.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
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1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. *Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry"* page111

- Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
- 3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
- 4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
- 5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
- 6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
- 7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
- 9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 17

Topic: Diuretics. Osmotic diuretics: Potassium acetate, Mannitol, Urea, Ammonium chloride.

Diuretics - xanthine derivatives: Euphylin, Theophylin, Theobromine

The purpose: to acquaint students with pharmaceutical analysis diuretics.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.
 - Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. For the purpose of quantitative determination of ethylenediamine in the theophylline-ethylenediamine substance, the following method is used in the CZL of the pharmaceutical enterprise:

*acidimetry

B alkalimetry

C iodometry

D nitritometry

E complexometry

2. The laboratory analyzes the theophylline-ethylenediamine substance. Theophylline, as a derivative of xanthine, is identified by the formation reaction:

*Murexide

B thaleoquinine

C thiochrome

D indophenol

E of azo dye

3. In the control and analytical laboratory, it is necessary to confirm the presence of ethylenediamine in the composition of euphilin. Which of the listed reagents can be used to determine ethylenediamine?

A* copper (II) sulfate

B sodium hydroxide

C concentrated sulfuric acid

D argentum nitrate

It is barium chloride

4. During the transportation of the theobromine and theophylline substances, the labeling on the package was damaged. What solution can be used to separate theobromine and theophylline?

AND * cobalt chloride

B sodium chloride

WITH copper nitrate

D potassium permanganate

E potassium dichromate

5. Medicinal preparations from the group of alkaloids are quantitatively determined by the method of non-aqueous titration. The titrant is:

AND * Chloric acid

B Sodium thiosulfate

WITH Sulfuric acid

D Dimethylformamide

E Nitric acid silver

6. Quantitative content of theophylline in accordance with the requirements of the DFU is determined by the method of alkalimetry by substitute. The titrant in this method is a solution:

AND * Sodium hydroxide

B Potassium bromide

WITH Sodium edetate

D Hydrochloric acids

E Ammonium thiocyanate

7. Theobromine and theophylline are quantitatively determined by the method of alkalimetry by substitution. What acid is titrated with sodium hydroxide?

AND * Nitrate

B Chloride

WITH Sulfate

D Acetate

E Phosphate

8. The pharmacist-analyst identifies the substance potassium acetate. With the help of which reagent does he confirm the presence of potassium cation in the studied solution?

AND * The acid is tartaric

B Sodium hydroxide

WITH Potassium permanganate

D Iron (III) chloride

E Zinc oxide

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the weight of potassium acetate (M.m. 98.15), if 8.54 ml of 0.1 M perchloric acid solution (KP=1.0020) was spent on its titration; the volume of the titrant in the control experiment was 0.40 ml, and the percentage content of potassium acetate was 99.7%.

Task 2. How to distinguish caffeine from theophylline and theobromine, theophylline from theobromine? Write the chemistry of the reaction.

Task 3. Write a scheme for the synthesis of theobromine, name the starting and intermediate compounds, give a description of the individual stages of the synthesis.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv

	medicinal products.		higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. *Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry"* page117

- Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
- 4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
- 5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
- 6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
- 7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
- 9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
- 4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 18

Topic: Agents affecting platelet aggregation and blood coagulation. Antiplatelet agents: Acetylsalicylic acid. Anticoagulants: Neodicumarin, Heparin.

The purpose: to acquaint students with pharmaceutical analysis drugs affecting platelet aggregation and blood coagulation.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;

- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Acetylsalicylic acid (aspirin) belongs to the group of nonsteroidal anti-inflammatory drugs. Its quantitative determination by the method of direct alkalimetry is recommended to be carried out at a temperature not higher than 20 °C in order to prevent:

- A. *ester group hydrolysis
- B. Recovery of medicinal substance
- C. oxidation of the medicinal substance
- Decarboxylation of the medicinal substance
- precipitation of the formed salt

2. When identifying the substance of acetylsalicylic acid (aspirin), its hydrolysis is carried out. What reagent is used to detect one of the hydrolysis products?

- A. *iron (III) chloride
- B. sodium hydrotartrate
- C. magnesium sulfate
- D. ammonium oxalate
- E. sodium bicarbonate

3. The principle of salol was formed by Nentsky and is widely used in the development of medicines that form two active ingredients in the process of biotransformation. As a result of metabolism, salol forms phenol and salicylic acid.

Its international name is:

- A. *phenyl salicylate
- B. acetaminophen
- C. chloramphenicol
- D. diphenhydramine

E. phthalylsulfathiazole

4. The second phase of drug metabolism (conjugation phase) includes reactions of interaction of xenobiotics or their metabolites, which have active functional groups, with hydrophilic endogenous molecules. This phase includes the process of:

A. *glucuronidation

B. S-oxidation

C. hydroxylation

D. restoration

E. hydrolysis

5. An important characteristic of the medicinal product is its lipophilicity. To experimentally determine the lipophilicity coefficient of substances, its distribution between:

A. *water and octanol

B. ethanol and acetone

C. isopropanol and hexane

D. methanol and benzene

E. ethyl acetate and dichloroethane

6. In medical practice, optically active medicinal compounds are used in the form of levorotatory, dextrorotatory isomers and their racemic mixtures. The study of the optical activity of substances is carried out by the method:

A. *polarimetry

B. refractometry

C. conductometry

D. spectrometry

E. amperometry

7. Lipophilicity affects the bioavailability of medicines. This indicator characterizes the ability of a substance to dissolve in:

A. * lipids

B. water

C. acetone

D. acids

E. basics

8. Lipophilicity is one of the factors affecting the bioavailability of medicines. Experimentally, it can be determined by the nature of the substance distribution in the system:

A. *n-octanol-water

B. water-chloroform

C. chloroform-glycerol

D. acetonitrile-water

E. ethanol-paraffin

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the volume of 0.1 M sodium hydroxide solution (KP=1.0000), which will be spent on the titration of 0.5120 g of acetylsalicylic acid (M.m. 180.16), if its percentage content in the substance is 99.6%.

Task 2. Calculate the percentage content of phenylsalicylate (M.m. 214.22) in the substance, if 15.60 ml of a 0.5M solution of hydrochloric acid (KP=1.0000) was spent on the titration of a weight of 0.9864g; the volume of the titrant in the control experiment is 24.76 ml.

Task 3. Write and explain the identification reactions of neodicumarin by analytical and functional groups.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education

			institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.

4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 19

Topic: Agents affecting platelet aggregation and blood coagulation.

Hemostatic agents: Vikasol Antifibrinolytics: Aminocaproic acid

Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page124

The purpose:to acquaint students with pharmaceutical analysismedicines,affecting platelet aggregation and blood coagulation.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

✓ the text of textbooks;

✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. A solution of Vikasol for injections was sent to the control and analytical laboratory for analysis. One of the drug identification reactions is the reaction with sulfuric acid (conc.). What is observed at the same time:

A. * the smell of sulfur (IV) oxide is felt

B. change in the color of the solution

S. smells of ammonia

D. the smell of benzaldehyde is felt

E. the smell of acetaldehyde is felt

2. Medicines are metabolized in several stages. The phase of metabolism, during which the functional groups in the molecule of the medicinal substance undergo biochemical transformation, is called:

A. * functionalization phase

B. conjugation phase

C. secretion phase

D. phase of mitosis

E. depolarization phase

3. Medicines are metabolized in several stages. The phase of drug metabolism, during which the biochemical conjugation of functional groups of the molecule with acid residues, such as glucuronic and sulfate, or glycine, occurs, is called:

A. * conjugation phase

B. functionalization phase

C. secretion phase

D. phase of mitosis

E. depolarization phase

4. Drug metabolism is one of the stages of pharmacokinetics. Means that are metabolically transformed into biologically active substances are called:

A. *prodrugs

B. vitamins

C. hormones

D. enzymes

E. conjugate

5. Medicinal products can undergo biotransformation in the body. The metabolic functionalization phase is aimed at:

A. *increasing hydrophilicity

B. binding to endogenous molecules

C. mineralization of matter

D. formation of polymers

E. deactivation of enzymes

6. Lipophilicity is one of the factors affecting the distribution of molecules of biologically active substances in the body. The numerical indicator of this factor is:

A. *distribution coefficient

B. angle of rotation

C. optical density

D. melting point

E. refractive index

7. Lipophilicity is very important for the bioavailability of the substance. The numerical indicator that characterizes lipophilicity is called:

A. *distribution coefficient

B. stoichiometric coefficient

C. correction factor

D. viscosity coefficient

E. surface tension coefficient

8. In the laboratory for quality control of medicinal products, when quantitative determination of the furosemide substance was carried out by the method of alkalimetry, a solution was used as a titrant:

AND* sodium hydroxide

B potassium permanganate

C cerium sulfate

D zinc sulfate

E perchloric acid

9. A furosemide metabolite was found in the biological material in the laboratory for chemical and toxicological analysis (4-chloro-(2-furfurylamino)-5-sulfamoylbenzoic acid). Specify this substance.

AND* 4-chloro-5-sulfamoylanthranilic acid

B (5-chloroindol-3-yl)acetic acid

C p-hydroxyaminophenol

D 2-amino-5-nitrobenzophenone

E 4-hydroxyphenazone

10. The patient was prescribed a diuretic - hydrochlorothiazide (hypothiazide) tablets. The structure of the active substance is based on a condensed system:

AND* benzothiadiazine

B isoquinoline

C xanthine

D indole

E quinoline

11. The pharmacist-analyst identifies the hydrochlorothiazide substance. After mineralization of the substance, he determines the formed sulfate ion by reaction with the solution:

AND* barium chloride B copper (II) sulfate

C of sodium hydroxide

D cobalt nitrate

E silver nitrate

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Give a scheme for the synthesis of vikasol with an indication of the chemical names of the starting solk, intermediate and final productstives; specify their pharmacological action.

Task 2. Suggest possible methods of identification of vikasol. Where possible, give the equation of ximic reactions. Point to her headlightsmacological action.

Task 3. Describe the cerimetric method of quantitative determination of vikasol.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 20

Topic: Thematic control work on the topic: "Hypolipidemic agents. Antiatherosclerotic drugs. Diuretics. Agents affecting platelet aggregation and blood coagulation."

The purpose: check the assimilation of knowledge of higher education students by topics: "Hypolipidemic agents. Antiatherosclerotic drugs. Diuretics. Agents affecting platelet aggregation and blood coagulation."

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

- 1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).**
- 2. Control of basic knowledge (written work, written test, frontal survey, etc.):**
 - Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. When conducting a pharmaceutical analysis of a medicinal substance, a reaction was performed with sodium hydroxide solution when heated. As a result of this reaction, a gas with a characteristic smell was released, under the influence of which a wet red litmus paper turned blue. What cations were identified in the composition of the medicinal substance?

- A. *Ammonia
- B. Magnesium
- C. Calcium
- D. Sodium

E. Potassium

2. When conducting a pharmaceutical analysis, a sample of a medicinal substance moistened with dilute hydrochloric acid was introduced into a colorless flame. The appearance of an orange-red color allows you to identify the following cation:

A. *Calcium

B. Sodium

C. Potassium

D. Ammonia

E. Barium

3. A laboratory specialist of the pharmaceutical product certification center prepares reagents. To identify medicines containing potassium ions, use a solution:

A. *Sodium cobaltinitrite

B. Ammonium oxalate

C. Barium chloride

D. Sodium hydroxide

E. Magnesium sulfate

4. To confirm the presence of covalently bound chlorine in the structure of the diuretic "Furosemide", the substance under study is sintered with a mixture of potassium carbonate and potassium nitrate. The formed chloride ions are identified by the solution:

A. *silver nitrate

B. ammonium oxalate

C. potassium iodide

D. sodium sulfide

E. calcium chloride

5. For the purpose of quantitative determination of ethylenediamine in the theophylline-ethylenediamine substance, the following method is used in the CZL of the pharmaceutical enterprise:

*acidimetry

B alkalimetry

C iodometry

D nitritometry

E complexometry

6. The laboratory analyzes the theophylline-ethylenediamine substance.

Theophylline, as a derivative of xanthine, is identified by the formation reaction:

*Murexide

B thaleoquinine

C thiochrome

D indophenol

E of azo dye

7. In the control and analytical laboratory, it is necessary to confirm the presence of ethylenediamine in the composition of ephedrine. Which of the listed reagents can be used to determine ethylenediamine?

A* copper (II) sulfate

B sodium hydroxide

C concentrated sulfuric acid

D argentic nitrate

It is barium chloride

8. During the transportation of the theobromine and theophylline substances, the labeling on the package was damaged. What solution can be used to separate theobromine and theophylline?

AND * cobalt chloride

B sodium chloride

WITH copper nitrate

D potassium permanganate

E potassium dichromate

9. Acetylsalicylic acid (aspirin) belongs to the group of nonsteroidal anti-inflammatory drugs. Its quantitative determination by the method of direct alkalimetry is recommended to be carried out at a temperature not higher than 20 °C in order to prevent:

- A. *ester group hydrolysis
- B. Recovery of medicinal substance
- C. oxidation of the medicinal substance
- Decarboxylation of the medicinal substance
- precipitation of the formed salt

10. When identifying the substance of acetylsalicylic acid (aspirin), its hydrolysis is carried out. What reagent is used to detect one of the hydrolysis products?

- A. *iron (III) chloride
- B. sodium hydrotartrate
- C. magnesium sulfate
- D. ammonium oxalate
- E. sodium bicarbonate

11. The principle of salol was formed by Nentsky and is widely used in the development of medicines that form two active ingredients in the process of biotransformation. As a result of metabolism, salol forms phenol and salicylic acid. Its international name is:

- A. *phenyl salicylate
- B. acetaminophen
- C. chloramphenicol
- D. diphenhydramine
- E. phthalylsulfathiazole

12. The second phase of drug metabolism (conjugation phase) includes interactions of xenobiotics or their metabolites, which have active functional groups, with hydrophilic endogenous molecules. This phase includes the process of:

- A. *glucuronidation
- B. S-oxidation
- C. hydroxylation
- D. restoration
- E. hydrolysis

13. A solution of Vikasol for injections was sent to the control and analytical
Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page135

laboratory for analysis. One of the drug identification reactions is the reaction with sulfuric acid (conc.). What is observed at the same time:

- A. * the smell of sulfur (IV) oxide is felt
- B. change in the color of the solution
- S. smells of ammonia
- D. the smell of benzaldehyde is felt
- E. the smell of acetaldehyde is felt

14. Medicines are metabolized in several stages. The phase of metabolism, during which the functional groups in the molecule of the medicinal substance undergo biochemical transformation, is called:

- A. * functionalization phase
- B. conjugation phase
- C. secretion phase
- D. phase of mitosis
- E. depolarization phase

15. Medicines are metabolized in several stages. The phase of drug metabolism, during which the biochemical conjugation of functional groups of the molecule with acid residues, such as glucuronic and sulfate, or glycine, occurs, is called:

- A. * conjugation phase
- B. functionalization phase
- C. secretion phase
- D. phase of mitosis
- E. depolarization phase

16. Drug metabolism is one of the stages of pharmacokinetics. Means that are metabolically transformed into biologically active substances are called:

- A. * prodrugs
- B. vitamins
- C. hormones
- D. enzymes
- E. conjugates

17. The patient was prescribed a diuretic - hydrochlorothiazide (hypothiazide) tablets. The structure of the active substance is based on a condensed system:

* benzothiadiazine

B isoquinoline

C xanthine

D indole

E quinoline

18. The pharmacist-analyst identifies the hydrochlorothiazide substance. After mineralization of the substance, he determines the formed sulfate ion by reaction with the solution:

* barium chloride

B of copper (II) sulfate

C of sodium hydroxide

D cobalt nitrate

E silver nitrate

19. For the purpose of quantitative determination of ethylenediamine in the theophylline-ethylenediamine substance, the following method is used in the CZL of the pharmaceutical enterprise:

* acidimetry

B alkalimetry

C iodometry

D nitritometry

E complexometry

20. The laboratory analyzes the theophylline-ethylenediamine substance. Theophylline, as a derivative of xanthine, is identified by the formation reaction:

* Murexide

B thaleoquinine

C thiochrome

D indophenol

E of azo dye

21. In the control and analytical laboratory, it is necessary to confirm the presence of ethylenediamine in the composition of ephedrine. Which of the listed reagents can be used to determine ethylenediamine?

A* copper (II) sulfate

B sodium hydroxide

C concentrated sulfuric acid

D argentic nitrate

E barium chloride

22. During the transportation of the theobromine and theophylline substances, the labeling on the package was damaged. What solution can be used to separate theobromine and theophylline?

A* cobalt chloride

B sodium chloride

C WITH copper nitrate

D potassium permanganate

E potassium dichromate

23. Medicinal preparations from the group of alkaloids are quantitatively determined by the method of non-aqueous titration. The titrant is:

A* Chloric acid

B Sodium thiosulfate

C WITH Sulfuric acid

D Dimethylformamide

E Nitric acid silver

24. Quantitative content of theophylline in accordance with the requirements of the DFU is determined by the method of alkalimetry by substitute. The titrant in this method is a solution:

A* Sodium hydroxide

B Potassium bromide

C WITH Sodium edetate

D Hydrochloric acids

E Ammonium thiocyanate

25. Theobromine and theophylline are quantitatively determined by the method of alkalimetry by substitution. What acid is titrated with sodium hydroxide?

AND * Nitrate

B Chloride

WITH Sulfate

D Acetate

E Phosphate

26. The pharmacist-analyst identifies the substance potassium acetate. With the help of which reagent does he confirm the presence of potassium cation in the studied solution?

AND * The acid is tartaric

B Sodium hydroxide

WITH Potassium permanganate

D Iron (III) chloride

E Zinc oxide

3. Formation of professional skills and abilities:

Task 1. Write the structural formula, Latin and chemical names of furosemide, pharmacopoeial and non-pharmacopoeial identification reactions.

Task 2. Calculate the percentage content of furosemide, if the specific absorption index of the standard solution is 750, the optical density of the standard solution is 0.463, and the exact weight is 0.1011 g. The determination was made by FH.

Task 3. Calculate the exact weight hydrochlorothiazide for quantitative determination by the spectrophotometric method, if the optical density is 0.434, the specific absorption index of the standard solution is 74.

Task 4. Calculate the weight of potassium acetate (M.m. 98.15), if 8.54 ml of 0.1 M perchloric acid solution (KP=1.0020) was spent on its titration; the volume of the titrant in the control experiment was 0.40 ml, and the percentage content of potassium acetate was 99.7%.

Task 5. Calculate the weight of potassium acetate (M.m. 98.15), if 8.54 ml of 0.1 M perchloric acid solution (KP=1.0020) was spent on its titration; the volume of the titrant in the control experiment was 0.40 ml, and the percentage content of potassium acetate was 99.7%.

Task 6. Calculate the volume of 0.1 M sodium hydroxide solution (KP=1.0000), which will be spent on the titration of 0.5120 g of acetylsalicylic acid (M.m. 180.16), if its percentage content in the substance is 99.6%.

Task 7. Calculate the percentage content of phenylsalicylate (M.m. 214.22) in the substance, if 15.60 ml of a 0.5M solution of hydrochloric acid (KP=1.0000) was spent on the titration of a weight of 0.9864g; the volume of the titrant in the control experiment is 24.76 ml.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the lesson, mastering of the studied topics, the ability to choose methods of determining the quality of medicinal products in accordance with the requirements of the Federal Medical University and the Ministry of Health according to the methods used in pharmaceutical analysis are checked.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 21

Topic:Antiseptic and disinfectants.

Halogens and halogen-containing products:Chloramine, Iodine, Alcohol iodine solution 5, 10%, Triiodomethane (Iodoform).

Oxidizers:Hydrogen peroxide solution 3, 30%, Potassium permanganate

The purpose:to acquaint students with pharmaceutical analysisantiseptic and disinfectants.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. In the laboratory for quality control of medicinal products, when performing quantitative determination of the substance chloramine (sodium tosylchloramide) by the method of iodometry with a substitute, a solution was used as a titrant:

A. *sodium thiosulfate

B. potassium permanganate

- C. cerium sulfate
 - D. zinc sulfate
 - E. perchloric acid
2. Sodium tosylchloramide (chloramine) exhibits a strong disinfecting effect due to the release of active chlorine in an acidic environment. What method should be used to quantify it?
- A. *iodometry
 - B. nitritometry
 - C. complexometry
 - D. permanganometry
 - E. iodine chlorometry
3. The disinfectant sodium tosylchloramide (chloramine) was sent to the quality control laboratory for analysis. What ion is determined by adding a solution of potassium pyroantimonate after calcination of the substance?
- A. * sodium
 - B. magnesium
 - C. calcium
 - D. zinc
 - E. potassium
4. When identifying the disinfectant sodium tosylchloramide (chloramine), the substance is calcined for the purpose of mineralization. What ion is further determined by adding a solution of barium chloride?
- A. * sulfate
 - B. carbonate
 - C. phosphate
 - D. chloride
 - E. nitrate
5. The disinfectant sodium tosylchloramide (chloramine) was sent to the quality control laboratory for analysis. After roasting the substance, the determination is

carried out with a solution of silver nitrate. What ion is formed during mineralization?

- A. *chloride
- B. sulfate
- C. carbonate
- D. phosphate
- E. nitrate

6. According to the requirements of the State Pharmacopoeia of Ukraine, to identify potassium permanganate, dissolve 50 mg of the substance in 5 ml of water and add 0.3 ml of sodium hydroxide solution. What is the analytical effect of this reaction?

- A Discoloration of the solution
- B Red precipitate
- C*Green color
- DBrown sediment
- E Violet color

7. According to AND, quantitative determination of hydrogen peroxide solution is carried out by the following method:

- AAkalimetry
- B Argentometry
- CComplexonometry
- D Acidimetry
- E *Permanganatometry

8. Quantitative determination of hydrogen peroxide is carried out by the permanganatometric method. Before the appearance of what color of the solution is the titration carried out?

- A*Pink
- B green
- Cyellow
- Dblue

E Colorless

9. A pharmacist-analyst examines a 3% hydrogen peroxide solution. What reagent does the DFU recommend for its identification?

- A. Magnesium sulfate
- B. Sodium chloride
- C. *Potassium chromate
- D. Calcium chloride
- E. Zinc oxide

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the percentage content of hydrogen peroxide (M.m. 34.01) in the solution, if 18.40 ml of 0.1 M potassium permanganate solution (KP=1.0018) was spent on the preparation of 10.00 ml of the drug; the volume of the measuring flask is 100 ml, the volume of the pipette is 10 ml.

Task 2. Calculate the volume of 0.1 M sodium thiosulfate solution (KP = 1.0012), which will be spent on the titration of 0.2016 g of iodine (atm. 126.90), if its percentage content in the substance is 99.6%.

Task 3. Calculate the percentage content of potassium iodide (M.m. 166.01) in a 5% alcoholic solution of iodine, if 8.04 ml of a 0.1M solution of argentum nitrate (KP = 1.0000) was spent on the titration of 2.00 ml of the drug; volume of 0.1 M sodium thiosulfate solution (CP = 1.0000), spent on iodine titration - 5.68 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv

	medicinal products.		higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition.

- Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
- 4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
- 5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
- 6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
- 7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
- 9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
- 4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 22

Topic:Antiseptic and disinfectants.

Acids and bases:Benzoic acid, Salicylic acid, Boric acid, Sodium tetraborate.

Aldehydes:Formaldehyde solution 35% Alcohols: Ethanol 96%

The purpose:to acquaint students with pharmaceutical analysisantiseptic and disinfectants.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;

- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. The substance sodium tetraborate was sent to the control and analytical laboratory for analysis. Which method can be used to determine the quantitative content of sodium tetraborate, in accordance with the requirements of the Federal State of Ukraine?

A Bromatometry

B Iodometry

C Nitritometry

D* Alkalimetry

E Iodine chlorometry

2. The pharmacist-analyst identifies salicylic acid by the formation of red auric dye. What reagent does he add at the same time:

A. Tolens reagent

B. Fisher's reagent

C. Alkaline solution of potassium tetraiodomercurate (Nessler's reagent)

D. *Solution of formaldehyde in concentrated H₂SO₄ (Markey's reagent)

E. Fehling's reagent

3. The pharmacist of the control and analytical laboratory examines the substance of benzoic acid in accordance with the requirements of the DFU. What method does the DFU recommend to determine the quantitative content of this drug?

A. Complexonometry

B. Bromatometry

C. Acidimetry

D. Nitritometry

E. *Alkalimetry

4. Salicylates are widely used in medicine as anti-inflammatory agents.

Identification of salicylic acid is carried out using a solution:

A. Sodium hydroxide

B. *Iron (III) chloride

C. Magnesium sulfate

D. Sodium nitrate

E. Potassium sulfate

5. Benzoic acid is used in medicine as an antiseptic. Which of the following reagents forms a pale yellow precipitate with benzoic acid?

A.* solution of iron (III) chloride

B. sodium bicarbonate solution

C. potassium permanganate solution

D. magnesium sulfate solution

E. sodium nitrate solution

6. A pharmacist-analyst analyzes phenol in the composition of an antiseptic medicinal product. Phenolic hydroxyl is identified by reaction with a solution:

A. potassium permanganate

B. ninhydrin

C. barium chloride

D.*iron (III) chloride

E. silver nitrate

7. To identify ethanol, the pharmacist-analyst must conduct:

A. Hydroxamate sample

B. *Iodoform test

S. Taleiochinnu test

D. Murexide test

E. Ninhydrin reaction

8. Formaldehyde solution was received for analysis. Which reagent is used to identify it?

- A. Sulfuric acid
- B. Tartaric acid
- S. Benzoic acid
- D. *Chromotropic acid
- E. Acetic acid

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the volume of 0.1M sodium hydroxide solution (KP=1.0000) that will be spent on the titration of 0.2462 g of salicylic acid (M.m. 138.12), if its percentage content in the substance is 99.6% .

Task 2. Calculate the volume of a 0.1M solution of hydrochloric acid (KP=0.9880), which will be spent on the titration of 0.5050 g of sodium tetraborate (M.m. 381.37), if its percentage content in the substance is 100.1% .

Task 3. Calculate the weight of boric acid (M.m. 61.83), if 32.30 ml of 0.1M sodium hydroxide solution (KP=1.0000) was spent on its titration, and its percentage content in the substance is 99.8%.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of

2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
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– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy *Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry"* page153

education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.

5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.

6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.

7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 23

Topic:Antiseptic and disinfectants.

Salts of heavy metals:Argentum nitrate, Copper sulfate pentahydrate, Zinc oxide, Zinc sulfate heptahydrate

Phenols:Phenol, Resorcinol, Phenylsalicylate

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Dyes: Ethacridine lactate

The purpose: to acquaint students with pharmaceutical analysis antiseptic and disinfectants.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Phenylsalicylate (Phenylisalicilas) can be identified by the smell of phenol, which will be released when added to the drug:

A. AgN03

B. NaCl

S. CuSO4

D.*H2SO4

E. CoC12

2. Redox methods are widely used in pharmaceutical analysis. For the quantitative determination of phenol, thymol and resorcinol, the following method is used:

A. Argentomeria

B. Nitrometry

C. Permanganatometry

D. Alkalimetry

E. *Bromatometry

3. For which medicinal substance from the group of phenol derivatives is a specific fusion reaction with phthalic anhydride in the presence of concentrated sulfuric acid with the formation of fluorescein?

A. Phenol

B. Thymol

C. * Resorcinol

D. Phenolphthalein

E. Xeroform

4. The substance resorcinol is studied in the control and analytical laboratory.

Which of the listed methods is used to determine its quantitative content?

A. Nitritometric

- B. Argentometric
 - C. Complexometric
 - D. Mercurimetric
 - E. * Bromatometric
5. The pharmacist-analyst added sodium sulfide solution to identify zinc sulfate. What is observed at the same time?
- A. *Precipitation of a white precipitate
 - B. Precipitation of black sediment
 - C. Appearance of green fluorescence
 - D. Release of gas bubbles
 - E. Appearance of yellow color
6. Quantitative determination of Argentum nitrate is carried out by the method of thiocyanatometry. Specify which indicator is used in this case.
- A. Misty blue
 - B. Phenolphthalein
 - C. Potassium chromate
 - D. *Iron (III) ammonium sulfate
 - E. Fluorescein
7. Phenylsalicylate is a classic representative of prodrugs. It is hydrolyzed in the intestines and forms the following compounds:
- A. benzoic acid and methanol
 - B. aminobenzoic acid and ethanol
 - C. *salicylic acid and phenol
 - D. isovaleric acid and menthol
 - E. nicotinic acid and diethylamine
8. The pharmacist-analyst of the quality control department analyzes the phenol substance. Suggest a method for its quantitative determination:
- A. mercurimetry
 - B. complexonometry
 - C. argentometry

D. permanganometry

E. * bromatometry

3. Formation of professional skills and abilities:

– Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the weight of zinc sulfate (M.m. 287.54), if 20.72 ml of 0.1M sodium edetate solution (KP=1.0000) was spent on its titration, and its percentage content in the substance is 99.8%.

Task 2. Calculate the volume of a 0.1 M solution of ammonium rhodanide (KP = 0.9950), which will be used to titrate 0.2876 g of argentum nitrate (M.m. 169.87), if its percentage content in the substance is 99.8 %.

Task 3. Calculate the percentage content of phenylsalicylate (M.m. 214.22) in the substance, if 15.60 ml of a 0.5M solution of hydrochloric acid (KP=1.0000) was spent on the titration of a weight of 0.9864g; the volume of the titrant in the control experiment is 24.76 ml.

– Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.

6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFAU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.
4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 24

Topic: Thematic control work on the topic: "Antiseptic and disinfectants."

The purpose: check the assimilation of knowledge of higher education students by topics: "Antiseptic and disinfectants."

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

– Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. According to the requirements of the State Pharmacopoeia of Ukraine, to

identify potassium permanganate, dissolve 50 mg of the substance in 5 ml of water
Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page161

and add 0.3 ml of sodium hydroxide solution. What is the analytical effect of this reaction?

A Discoloration of the solution

B Red precipitate

C*Green color

DBrown sediment

E Violet color

2. According to AND, quantitative determination of hydrogen peroxide solution is carried out by the following method:

AAlkalimetry

B Argentometry

CComplexonometry

D Acidimetry

E *Permanganatometry

3. Choose a medicinal substance that can be determined by the permanganatometry method:

A Nicotinic acid

B Magnesium sulfate

C*Hydrogen peroxide

DParacetamol

E Novocaine

4. The analyst of the control and analytical laboratory conducts quality control of boric acid. The authenticity is confirmed by the reaction of the formation of boroethyl (boromethyl) ether, which burns with a flame surrounded by:

A In red color

B In blue color

C*Green color

DIn yellow color

E In purple color

5. Quantitative determination of hydrogen peroxide is carried out by the permanganometric method. Before the appearance of what color of the solution is the titration carried out?

A*Pink

B green

Cyellow

Dblue

E Colorless

6. The pharmacist-analyst determines the admixture of sulfates in boric acid. As the main reagent, he added:

A Sodium sulfide

B*Barium chloride

CPotassium ferrocyanide

DArgentum nitrate

E Ammonium oxalate

7. The substance sodium tetraborate was sent to the control and analytical laboratory for analysis. Which method can be used to determine the quantitative content of sodium tetraborate, in accordance with the requirements of the Federal State of Ukraine?

A Bromatometry

B Iodometry

CNitritometry

D* Alkalimetry

E Iodine chlorometry

8. Quantitative detection of boric acid is carried out by the analyst by alkalimetric titration in the presence of:

A. Mercury (II) acetate

B. Ethyl alcohol

C. Ammonia buffer

D. *Manitu

E. Nitric acid

9. A pharmacist-analyst examines a 3% hydrogen peroxide solution. What reagent does the DFU recommend for its identification?

A. Magnesium sulfate

B. Sodium chloride

C. *Potassium chromate

D. Calcium chloride

E. Zinc oxide

10. The pharmacist-analyst identifies salicylic acid by the formation of red auric dye. What reagent does he add at the same time:

A. Tolens reagent

B. Fisher's reagent

C. Alkaline solution of potassium tetraiodomercurate (Nessler's reagent)

D. *Solution of formaldehyde in concentrated H₂SO₄ (Markey's reagent)

E. Fehling's reagent

11. The pharmacist of the control and analytical laboratory examines the substance of benzoic acid in accordance with the requirements of the DFU. What method does the DFU recommend to determine the quantitative content of this drug?

A. Complexometry

B. Bromatometry

C. Acidimetry

D. Nitritometry

E. *Alkalimetry

12. Salicylates are widely used in medicine as anti-inflammatory agents.

Identification of salicylic acid is carried out using a solution:

A. Sodium hydroxide

B. *Iron (III) chloride

C. Magnesium sulfate

D. Sodium nitrate

E. Potassium sulfate

13. Benzoic acid is used in medicine as an antiseptic. Which of the following reagents forms a pale yellow precipitate with benzoic acid?

- A. * solution of iron (III) chloride
- B. sodium bicarbonate solution
- C. potassium permanganate solution
- D. magnesium sulfate solution
- E. sodium nitrate solution

14. When stored in improper conditions, the antiseptic substance "Phenol" changes its color under the influence of moisture and light. The appearance of color is a consequence of the process:

- A. weathering
- B. *oxidation
- C. restoration
- D. hydrolysis
- E. polymerization

15. A pharmacist-analyst analyzes phenol in the composition of an antiseptic medicinal product. Phenolic hydroxyl is identified by reaction with a solution:

- A. potassium permanganate
- B. ninhydrin
- C. barium chloride
- D. *iron (III) chloride
- E. silver nitrate

16. In order to identify phenol, the pharmacist-analyst conducts a reaction with a solution of sodium hypochlorite in an ammonia medium, as a result of which a blue-colored substance is formed. Name this compound.

- A. acrolein
- B. azo dye
- C. murexid
- D. thiochrome
- E. *indophenol

- A. murexide
- B. phenolphthalein
- C. *starch
- D. eosinate
- E. tropeolin 00

18. The pharmacist-analyst of the quality control department analyzes the substance phenol. Suggest a method for its quantitative determination:

- A. mercurimetry
- B. complexometry
- C. argentometry
- D. permanganometry
- E. *bromatometry

19. The principle of salol was formed by Nentsky and is widely used in the development of medicines that form two active ingredients in the process of biotransformation. As a result of metabolism, salol forms phenol and salicylic acid. Its international name is:

- A. acetaminophen
- B. *phenyl salicylate
- C. chloramphenicol
- D. diphenhydramine
- E. phthalylsulfathiazole

20. Phenylsalicylate is a classic representative of prodrugs. It is hydrolyzed in the intestines and forms the following compounds:

- A. benzoic acid and methanol
- B. aminobenzoic acid and ethanol
- C. *salicylic acid and phenol
- D. isovaleric acid and menthol
- E. nicotinic acid and diethylamine

21. Quantitative determination of argentum nitrate is carried out by the method of thiocyanatometry. What indicator is used in this case?

A Phenolphthalein

B*Ferrum (III) ammonium sulfate

CPotassium chromate

DMethylene blue

E Sodium eosinate

22. Quantitative determination of Argentum nitrate is carried out by the method of thiocyanatometry. Specify which indicator is used in this case.

A. Misty blue

B. Phenolphthalein

C. Potassium chromate

D. *Iron (III) ammonium sulfate

E. Fluorescein

23. A pharmacist-analyst added sodium sulfide solution to identify zinc sulfate.

What is observed at the same time?

A. *Precipitation of a white precipitate

B. Precipitation of black sediment

C. Appearance of green fluorescence

D. Release of gas bubbles

E. Appearance of yellow color

24. The substance resorcinol is being studied in the control and analytical laboratory. Which of the listed methods is used to determine its quantitative content?

A. Nitritometric

B. Argentometric

C. Complexometric

D. Mercurimetric

E. * Bromatometric

25. For which medicinal substance from the group of phenol derivatives is a specific fusion reaction with phthalic anhydride in the presence of concentrated sulfuric acid with the formation of fluorescein?

- A. Phenol
- B. Thymol
- C. * Resorcinol
- D. Phenolphthalein
- E. Xeroform

26. Redox methods are widely used in pharmaceutical analysis. For the quantitative determination of phenol, thymol and resorcinol, the following method is used:

- A. Argentomeria
- B. Nitrometry
- C. Permanganatometry
- D. Alkalimetry
- E. *Bromatometry

27. Phenylsalicylate (Phenylisalicilas) can be identified by the smell of phenol, which will be released when added to the drug:

- A. AgNO₃
- B. NaCl
- S. CuSO₄
- D. *H₂SO₄
- E. CoCl₂

28. To identify ethanol, the pharmacist-analyst must conduct:

- A. Hydroxamate sample
- B. *Iodoform test
- S. Taleiochinnu test
- D. Murexide test
- E. Ninhydrin reaction

29. A solution of formaldehyde was received for analysis. Which reagent is used to identify it?

- A. Sulfuric acid
- B. Tartaric acid
- S. Benzoic acid
- D. *Chromotropic acid
- E. Acetic acid

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the weight of zinc sulfate (M.m. 287.54), if 20.72 ml of 0.1M sodium edetate solution (KP=1.0000) was spent on its titration, and its percentage content in the substance is 99.8%.

Task 2. Calculate the volume of 0.1 M ammonium rhodanide solution (CP = 0.9950), which will be used for the titration of 0.2876 g of argentum nitrate (M.m. Calculate the percentage content of zinc oxide (M.m. 81.37), if 10.54 ml of 0.1 M sodium edetate solution (KP = 1.0010) was used for the titration of a weight of 0.8617 g, the volume of the volumetric flask is 100 ml, the volume of the pipette is 10 ml.

Task 3. Calculate the weight of copper sulfate (M.m. 249.68), if 20.42 ml of 0.1 M sodium thiosulfate solution (KP = 1.0000) was used for its titration, and its percentage content in the substance is 96.6% .

Task 4. Calculate the volume of a 0.1 M titrant solution that will be used for the alkalimetric titration of boric acid (M.m. 61.83) in 1% boric ointment, if the amount of the dosage form obtained for analysis is 1.0 g (KP = 0.9908).

Task 5. Calculate the mass of a test of benzoic acid (M.m. 122.12), if 16.35 ml of a 0.1 M sodium hydroxide solution (1.0000) was spent on its titration, and its percentage content in the substance is 99.7%.

Task 6. Calculate the volume of 0.1M sodium hydroxide solution (KP=1.0000) that will be spent on the titration of 0.2462 g of salicylic acid (M.m. 138.12), if its percentage content in the substance is 99.6% .

Task 7. Calculate the percentage content of formaldehyde (M.m. 30.03) in the solution, if 7.54 ml of 0.1 M sodium thiosulfate solution (KP=0.9980) was spent on the titration of 1.0216 g of the drug; volume of 0.1 M iodine solution (KP=1.0000) - 20 ml; the volume of the measuring flask is 100 ml, the volume of the pipette is 5 ml.

Task 8. Calculate the percentage content of phenylsalicylate (M.m. 214.22) in the substance, if 15.60 ml of a 0.5M solution of hydrochloric acid (KP=1.0000) was spent on the titration of a weight of 0.9864g; the volume of the titrant in the control experiment is 24.76 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the lesson, mastering of the studied topics, the ability to choose methods of determining the quality of medicinal products in accordance with the

requirements of the Federal Medical University and the Ministry of Health according to the methods used in pharmaceutical analysis are checked.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.

8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.

9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.

2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 25

Topic:Antibiotics of heterocyclic structure. β -lactamase inhibitors.

Penicillins. Cephalosporins.

The purpose:to acquaint students with pharmaceutical analysisantibiotics of heterocyclic structure, β -lactamase inhibitors.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

- Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Which of the cephalosporin antibiotics includes the tetrazole cycle?

- A.* cefazolin
- B. cephalixin
- C. cephaloridine
- D. cefuroxime
- E. cephalothin

2. Which of the cephalosporin antibiotics contains a furan nucleus in its composition:

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AND.* Cefuroxime

B. cephalothin

C. cephalexin;

D. Cephapirin

E. cefazolin

3. The CZL specialist conducts an analysis of the sodium benzylpenicillin substance. What reagent solution does he use to identify the sodium cation?

A. *potassium pyroantimonate

B. potassium chloride

C. barium chloride

D. silver nitrate

E. ammonium oxalate

4. Representatives of β -lactam antibiotics are penicillins. Name the structural fragment that is part of penicillin molecules:

A. *thiazole cycle

B. pyridine cycle

C. piperazine cycle

D. furan cycle

E. morpholine cycle

5. Penicillin antibiotics started a new stage in the fight against infectious diseases. Indicate which of the following medicines is of natural origin.

A. *benzylpenicillin

B. ampicillin

C. amoxicillin

D. oxacillin

E. clavulanic acid

6. Antibiotics certification is carried out in the drug quality control laboratory. In which of the listed antibiotics can the alpha-amino acid residue be determined using the ninhydrin reaction?

A. *ampicillin

- B. oxacillin
- C. cephalixin
- D. cefazolin
- E. lincomycin

7. β -lactam antibiotics started a new stage in the fight against infectious diseases

Indicate which of the following groups you belong to β -lactams:

- A. *penicillins
- B. aminoglycosides
- C. macrolides
- D. polyene antibiotics
- E. anthracyclines

8. Semi-synthetic antibiotics of the penicillin series are obtained by combining microbiological and chemical synthesis. The starting compound in the synthesis of ampicillin is:

- A. *6-aminopenicillanic acid
- B. 7-aminocephalosporanic acid
- C. acetic acid
- D. salicylic acid
- E. ascorbic acid

9. Ampicillin sodium salt belongs to the semi-synthetic antibiotics of the penicillin series. Identification of the substance by reaction with an alkaline solution of hydroxylamine with the subsequent formation of a green color when adding a solution of copper (II) nitrate occurs due to the presence in the structure:

- A. * β -lactam cycle
- B. pyridine cycle
- C. quinoline cycle
- D. furan cycle
- E. phenothiazine cycle

10. Oxacillin sodium salt belongs to the semi-synthetic β -lactam antibiotics of the penicillin series. The sodium cation in the structure of the substance is identified by the action of the solution:

- A. *potassium pyroantimonate
- B. barium chloride
- C. silver nitrate
- D. copper sulfate
- E. lead acetate

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the exact weight of oxacillin-sodium (M.m. 441.4), if 38.5 ml of 0.1 n was used for its titration according to FH. solution of hydrochloric acid (Kp 0.9973). The volume of the titrant in the control experiment. The content of the amount of penicillins is 94.5%.

Task 2. Calculate the percentage content of the amount of penicillins in phenoxymethylpenicillin when determining the amount of penicillins by the iodometric method, if the weight of the substance is 0.0685 g; volume of 0.01 M sodium thiosulfate solution (CP = 1.0000) in the main experiment - 11.48 ml; in the control experiment - 19.80 ml; the value of the equivalent is 0.0004100; the volume of the measuring flask is 100 ml, the volume of the pipette is 5 ml.

Task 3. Calculate the weight of the weight of benzylpenicillin sodium salt, if 5.00 ml of 0.01 M sodium thiosulfate solution (KP = 1.0000) was spent on the titration of an excess of 0.01 M iodine solution (KP = 1.0000), the percentage content of the amount of penicillins is 99, 0%, titrant volume in the control experiment - 20.00 ml; the value of the equivalent is 0.0004000; the volume of the measuring flask is 100 ml, the volume of the pipette is 5 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
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1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

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2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition.

- Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
- 3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
- 4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
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- 7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
- 8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
- 9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

- 1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
- 2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
- 3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 26

Topic: Tetracycline and macrolide antibiotics, aromatic series. Tetracyclines.
Macrolides: Erythromycin.

Antibiotics of the aromatic series: Levomycetin, Levomycetin stearate, Levomycetin succinate soluble.

The purpose: to acquaint students with pharmaceutical analysis antibiotics of the tetracycline series, aromatic series and macrolides.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Certification of tetracycline antibiotics is carried out in the laboratory for quality control of medicinal products. Suggest a reaction for the identification of methacycline hydrochloride:

- A. *reaction to chlorides
- B. reaction to xanthines
- C. reaction to nitrates
- D. reaction to sulfates
- E. reaction to barbiturates

2. The pharmacist-analyst performs the analysis of the substance doxycycline monohydrate. What reagent solution does he use to identify the phenolic hydroxyl in this substance?

- A. *iron (III) chloride
- B. barium chloride
- C. chloramine
- D. ammonium oxalate
- E. potassium pyroantimonate

3. The pharmacist-analyst performs the analysis of chloramphenicol (levomycetin). What reagent solution does he use to identify this substance?

- A. *sodium hydroxide
 - B. barium chloride
 - C. sodium cobalt nitrite
 - D. ammonium oxalate
 - E. sodium sulfide
4. The pharmacist-analyst needs to perform a quantitative determination of chloramphenicol (levomycetin) in eye drops. For this he uses the method:
- A. *nitritometry
 - B. complexometry
 - C. gravimetry
 - D. cerimetry
 - E. permanganometry
5. Chloramphenicol is an antibiotic with an aromatic structure, which is obtained synthetically. The starting compound in the synthesis of a substance is:
- A. **p*-nitroacetophenone
 - B. *m*-aminobenzoic acid
 - C. acetic acid
 - D. salicylic acid
 - E. ascorbic acid
6. The quantitative content of chloramphenicol - an antibiotic with an aromatic structure - is determined by the nitritometry method. A solution is used as a titrant:
- A. * sodium nitrite
 - B. hydrochloric acid
 - C. potassium bromate
 - D. sodium hydroxide
 - E. silver nitrate
7. Chloramphenicol contains a covalently bound halogen in its structure. To determine it, after mineralization, the substance is reacted with a solution:
- A. *silver nitrate
 - B. barium chloride

C. ammonium oxalate

D. sodium hydroxide

E. potassium bromide

8. The presence of phenolic and alcoholic hydroxyls in the molecule of doxycycline hydrochloride contributes to the formation of complexes with salts of alkaline earth and heavy metals. Choose a medicine that should not be used simultaneously with this antibiotic:

A. *almagel

B. paracetamol

C. phenazone

D. analgin

E. phenol

9. The quantitative content of doxycycline hydrochloride is determined by the method of acidimetry in a non-aqueous environment. A solution is used as a titrant:

A. *chloric acid

B. potassium permanganate

C. potassium bromate

D. sodium nitrite

E. sodium hydroxide

10. Chloramphenicol (levomycetin) is subject to the process of metabolism in the intestinal walls. Its main metabolite is formed as a result of:

A. *glucuronation

B. nitration

C. hydroxylation

D. bromination

E. decarboxylation

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the volume of 0.1 M sodium nitrite solution (KP = 1.0000), which is used for the titration of 0.5025 g of chloramphenicol (M.m. 323.13), if its content in the substance is 98.5%.

Task 2. Calculate the percentage content of chloramphenicol (M.m. 323.13) in the substance, if 14.02 ml of 0.1 M sodium nitrite solution (CP = 1.0020) was spent on the titration of a weight of 0.4590 g.

Task 3. Write and explain the identification reactions of tetracyclines.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical

University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

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4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 27

Topic:Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics. Lincomycins. Antibiotics - aminoglycosides: Streptomycin sulfate, Kanamycin monosulfate, Gentamicin sulfate.

Derivatives of 8-oxyquinoline and nitrofuran.

Derivatives of 8-hydroxyquinoline:Nitroxoline.

Nitrofuran derivatives:Nitrofural, Nitrofurantoin, Furazolidone.

The purpose:to acquaint students with pharmaceutical analysisantibiotics of the aminoglycoside structure, amphenicols, antibiotics - aminoglycosides. With pharmaceutical analysis of 8-oxyquinoline and nitrofuran derivatives.

Basic concepts:State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment:visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

– Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Which of the listed antibiotics can be identified by the maltol formation reaction?

A * Streptomycin sulfate

Methodical development of practical classes, EPP "Pharmacy, Industrial Pharmacy", 4th year, Faculty of Pharmacy, Discipline: "Pharmaceutical Chemistry" page186

B Doxycycline hydrochloride

C Amoxicillin

D Lincomycin hydrochloride

E Kanamycin monosulfate

2. Quantitative determination of kanamycin monosulfate DFU recommends to determine by the method:

A. * microbiological

B. spectrophotometrically

S. liquid chromatography

D. alkalimetry

E. gravimetry

3. For the quantitative determination of gentamicin sulfate in accordance with the requirements of the DFU, the following are used:

A. *microbiological method

B. method of spectrophotometry in the UV region

S. liquid chromatography

D. alkalimetry

E. gravimetric method

3. Nitroloxline belongs to antibacterial agents. The structure of this medicinal substance is based on a condensed heterocyclic system. What cycles does it consist of?

A *Benzene and pyridine

B Pyrrole and benzene (indole derivatives)

C Benzene and seven-membered - 1,4-diazepine

D Pyrimidine and imidazole

E Two 4-oxycoumarin residues

4. During the identification of nitroxolin, a reaction was carried out, as a result of which a black-green color appears. What reagent is used in this case?

AND * Iron (III) chloride solution

B Sodium hydroxide solution

WITH Copper (II) sulfate solution

D Rhodanbromide reagent

E Nesler's reagent

5. The analyst of the control and analytical laboratory determines the quantitative content of Nitrofur. What titrimetric method of quantitative determination can he use?

AND *Iodometry

B Permanganometry

WITH Alkalimetry

D Argentometry

E Nitritometry

6. Quantitative determination of the substance nitrofur (furacilin) is carried out by the spectrophotometric method. A provisional analyst can calculate the quantitative content by measuring:

AND *Optical density

B Refractive index

WITH Angle of rotation

D pH of the solution

E Melting points

7. With sodium hydroxide solution, nitroxoline forms:

A. * Red-orange color

B. White sediment

C. Yellow precipitate

D. Black-green color

E. Violet color

8. The pharmacist-analyst must conduct an analysis of the nitroxolin substance.

For quantitative determination, he uses the method:

A. *alkalimetry in a non-aqueous environment

B. reverse complexometry

C. permanganometry

D. argentometry

E. direct argentometry

9. A pharmacist-analyst conducts an analysis of the substance nitrofurantoin (furacilin).

For its quantitative determination, he uses the method:

A. *spectrophotometry

B. complexometry

C. refractometry

D. argentometry

E. polarimetry

10. A substance with antimicrobial activity is obtained at a chemical and pharmaceutical enterprise. As a result of the condensation of 5-nitrofurfural with semicarbazide, the following is synthesized:

A. * nitrofurantoin

B. metronidazole

C. nitrofurantoin

D. norfloxacin

E. phthalazole

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the exact dosage of furacilin (nitrofurantoin)(M. m. 198.14), if 2.84 ml of 0.01 M solution of sodium thiosulfate (Kp 0.9800) was used for its titration by FC. The volume of the titrant in the control experiment is 4.8 ml.

Task 2. Calculate the percentage content of furazolidone, if the specific absorption index of the standard solution is 750, the optical density of the standard solution is 0.463, and the exact weight is 0.1011 g. The determination was carried out according to FH.

Task 3. Calculate the content of sodium chloride (M.m. 58.44) in furacilin tablets (nitrofurantoin), if 13.5 ml of 0.1 n. silver nitrate solution (Kp 0.9996). The average weight of the tablet is 0.85 g.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

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3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
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3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 28

Topic: Derivatives of sulfanilic acid amides. General characteristics.

Sulfanilamides: Sulfanilamide, Sulfacetamide sodium (Albucid), Sulphathiazole (Norsulfazol), Phthalylsulfathiazole (Fthalazol).

The purpose: to acquaint students with the pharmaceutical analysis of medicines derivatives of sulfanilic acid amides.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;

- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Phthalylsulfathiazole (phthalazole), as a representative of prodrugs, forms an active metabolite as a result of metabolism. Select this metabolite from the following:

A. *norsulfasol

B. norepinephrine

C. desloratadine

sulfonamide

methylxanthine

2. Antimicrobial agents from the group of amidated sulfanilic acid derivatives contain a primary aromatic amino group in the structure. What reaction is used to identify sulfadimethoxine:

A. *reaction of diazotization and azo compound

B. reaction of formation of indophenol

C. the reaction of the formation of an auric dye

D. Schiff base formation reaction

E. reaction of oxidation and condensation

3. Sulfanilamides are broad-spectrum antibacterial agents. The presence of a sulfamide group in the structure of sulfathiazole (norsulfazole) is detected by reaction with a solution:

- A. *copper sulfate
- B. potassium bromide
- S. sodium carbonate
- D. ammonium chloride
- E. potassium bromate

4. A pharmacist-analyst analyzes sulfadimethoxine tablets. When adding a solution of sodium nitrite in the presence of hydrochloric acid followed by the addition of an alkaline β -naphthol solution, an orange-red color appeared. What functional group of the substance did he react to?

- A. *primary aromatic amino group
- B. acetyl group
- C. residual sulfonic acid
- D. phenyl radical
- E. pyrimidine cycle

5. Sulfadimethoxine is a sulfonamide preparation with antibacterial action, containing a primary aromatic amino group. What method does the DFU recommend for its quantification?

- A. *nitritometry
- B. iodometry
- C. acidimetry
- D. argentometry
- E. permanganatometry

6. In the laboratory for chemical and toxicological analysis, an active metabolite was found in the biological material phthalylsulfathiazole (phthalazol). Specify this substance.

- A. *norsulfazol
- V. Sulgin

S. urosulfan

D. Phtasin

E. sulfonamide

7. The use of sulfonamide drugs can be accompanied by a side effect - crystalluria.

What metabolic process contributes to the formation of inactive metabolites that precipitate in an acidic environment?

A. *acetylation

B. demethylation

S. oxidation

D. demining

E. recovery

8. Quantitative determination of sulfonamide substance (streptocide) is carried out in the laboratory for quality control of medicinal products using a method based on the properties of the primary aromatic amino group. Name this method:

A. *nitritometry

B. alkalimetry

S. permanganatometry

D. acidimetry

E. iodometry

9. The pharmacist-analyst identifies the substance sulfathiazole (norsulfazole). He confirms the presence of a primary aromatic amino group in its structure by the formation reaction:

A.*azo dye

B. fluorescein

S. mureksid

D. indophenol

E. iodoform

10. Sulfanilamide (streptocide) is a medicinal substance with an antimicrobial effect. As a starting compound for its synthesis, the following is used:

A.*N-carbomethoxyaniline

- B. acetanilide
- S. 5-nitrofurfurol
- D. p-dimethylaminobenzaldehyde
- E. 8-hydroxyquinoline

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Give a scheme for the synthesis of streptocide from acetanilide, indicating the chemical names of the initial, intermediate and final products; its pharmacological action.

Task 2. Specify the reasons for the contamination of soluble streptocide with an admixture of sodium sulfite. Give the reaction equation for the detection of this impurity.

Task 3. Describe possible methods of quantitative determination of soluble streptocide. Give the equations of the reactions, the formulas for calculating the quantitative content, indicate the molar masses of the equivalents.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed.
2.	Chemical methods for the analysis of medicinal substances	Give a quantitative analysis of medicinal substances	Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.

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– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

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Practical lesson No. 29

Topic:Antituberculosis drugs

Isonicotinic acid hydrazide derivatives:Isoniazid, Phtivazid

Derivatives of p-aminosalicylic acid:Sodium paraaminosalicylate

The purpose:to acquaint students with the pharmaceutical analysis of anti-tuberculosis drugs.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;
- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Ftivazid is an anti-tuberculosis drug belonging to isonicotinic acid derivatives.

Choose the reagents, the condensation of which carries out the synthesis of ftivazid?

- A. *isoniazid and vanillin
- B. isonicotinic acid and hydrazine
- C. nicotinic acid and hydrazine
- D. nicotinamide and formaldehyde
- E. isonicotinic acid and vanillin

2. At a chemical and pharmaceutical enterprise, the substance ftivazid is obtained by the interaction of isoniazid and vanillin. What type of reaction is underlying of this interaction?

- A. *condensation
- B. hydrolysis
- C. acylation
- D. esterification
- E. amidation

3. In order to reduce the toxicity of isoniazid by its condensation with aromatic aldehyde, ftivazid was obtained. For its identification, a heating reaction with hydrochloric acid is used, as a result of which the smell appears:

- A. * vanillin
- B. ammonia
- C. formaldehyde
- D. acetic acid
- E. benzaldehyde

4. According to its chemical structure, isoniazid is pyridine-4-carboxylic acid hydrazide. The presence of a pyridine ring can be confirmed by:

- A. *Cyan bromide reagent
- B. thioacetamide reagent
- C. iodine-sulfur reagent

D. sulfomolybdenum reagent

E. copper-tartrate reagent

5. Isoniazid has regenerative properties. The presence of which functional group allows you to identify it with an ammonia solution of argentum nitrate:

A. *hydrazide

B. amide

C. carboxyl

D. sulfamide

E. esteroi

6. About 50-70% of isoniazid is excreted unchanged by the kidneys, the rest is metabolized in the liver.

The active metabolite of isoniazid is:

A. *isonicotinoylamide

B. succinic aldehyde

C. benzoic acid

D. p-aminophenol

E. ethylmalonic ester

7. According to its chemical structure, isoniazid is a hydrazide of isonicotinic acid. As a starting compound for its synthesis, the following is used:

A. *4-methylpyridine

B. ethyl malonate

C. ethyl acetate

D. furfural

E. urea

8. Isoniazid belongs to the main anti-tuberculosis drugs. According to its chemical structure, it is a derivative of:

A. *isonicotinic acid

B. cyclopentanepiperhydrophenanthrene

C. barbituric acid

D. bis-(β -chloroethyl)amine

E. p-aminobenzoic acid

9. Certification of the antituberculosis agent ftivazid is carried out in the laboratory for quality control of medicinal products. To identify a substance, a reaction with a solution is used:

- A. *2,4-dinitrochlorobenzene
- B. barium chloride
- C. ammonium oxalate
- D. calcium chloride
- E. ammonium chloride

10. The pharmacist-analyst analyzes the isoniazid substance. For the quantitative determination of the substance, he uses the method:

- A. *bromatometry
- B. alkalimetry
- C. acidimetry
- D. argentometry
- E. complexometry

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the percentage content of isoniazid (M. m. 137.14), if for titration the so-called = 0.1173 g according to FC, 18.7 ml of 0.1 M sodium thiosulfate (Kp 1.0018) was used. The volume of the titrant in the control experiment is 50.5 ml.

Task 2. Calculate the volume of perchloric acid (Kp 1.0016), which will be used for titration of the so-called = 0.1828 g of ftivazide (M. m. 271.28) according to FH. The content of ftivazide is 97.15%. For the titration of the control experiment, 0.08 ml was used, the loss of the substance during drying was 6.35%.

Task 3. Calculate the percent content of ftivazide (M. m. 271.28), if 10.2 ml of 0.1 N was used for the titration of an exact weight of 0.2518 g according to FH. perchloric acid solution (Kp 1.0071). The volume of the titrant in the control experiment is 0.12 ml.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

– Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the class, the students of higher education acquired the skills to propose and implement the selection of methods for determining the quality of medicinal products in accordance with the requirements of the State Medical University of Ukraine and the Ministry of Health, according to the methods used in pharmaceutical analysis.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.

2. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 2. - 724 p.
3. State Pharmacopoeia of Ukraine: in 3 volumes / Derzh. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2014. - Vol. 3. - 732 p.5.
4. Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 456 p.
5. Nizhnyk H.P. Pharmaceutical chemistry: a textbook (University I-III years) H.P. Nizhnyk — 2nd ed., ed. - All-Ukrainian specialized publishing house "Medytsina", 2015. - 352 p.
6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
7. Hudoyarova O.S. Pharmaceutical chemistry. - Vinnytsia: "Nilan-LTD" LLC, 2018. - 194 p.
8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.

3. European Pharmacopoeia. Third Edition. Supplement, 2008. Council of Europe Strasbourg.

4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.

Practical lesson No. 30

Topic: Thematic control work on the topic: "Antibiotics. Derivatives of 8-hydroxyquinoline. Nitrofurans derivatives. Sulfanilamides. Antituberculosis drugs."

The purpose: check the assimilation of knowledge of higher education students by topics: "Antibiotics. Derivatives of 8-hydroxyquinoline. Nitrofurans derivatives. Sulfanilamides. Antituberculosis drugs."

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, active substance, substance, monograph.

Equipment: visual material, multimedia projector.

Plan:

1. Organizational moment (greetings, checking those present, announcing the topic, purpose of the lesson, motivating students to study the topic).

2. Control of basic knowledge (written work, written test, frontal survey, etc.):

– Requirements for students' theoretical readiness to perform practical classes.

The student should know:

- ✓ Subject and tasks of pharmaceutical chemistry;
- ✓ General methods of analysis of medicinal products and determination of the benign quality of medicinal products by appearance, solubility and reaction of the environment in accordance with the requirements of the Federal Drug Administration;

- ✓ The structure and main provisions of the State Pharmacopoeia of Ukraine regarding the quality of substances and medicinal forms of industrial production.

The student should be able to:

- ✓ Interpret the general requirements of the SFU regarding the identification of drugs;
- ✓ To propose and carry out a choice of physical, physico-chemical and chemical methods for determining the good quality of medicinal products in accordance with the requirements of the State Medical Center and the Ministry of Health;
- ✓ Environments according to the requirements of the SFU.

List of didactic units:

- ✓ the text of textbooks;
- ✓ a bank of test tasks.

- Questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson:

1. Oxacillin sodium salt belongs to the semi-synthetic β -lactam antibiotics of the penicillin series. The sodium cation in the structure of the substance is identified by the action of the solution:

- A. barium chloride
- B. silver nitrate
- C. potassium pyroantimonate
- D. copper sulfate
- E. lead acetate

2. Instability at elevated temperature and rapid destruction of natural penicillins in alkaline and acidic environments are due to the presence in the structure of:

- A. furan cycle
- B. β -lactam cycle
- C. quinoline cycle
- D. pyridine cycle
- E. phenothiazine cycle

3. Semi-synthetic penicillins, such as ampicillin and amoxicillin, contain fragments of aliphatic acids in their structure. For their identification, the reaction of the formation of a colored product with:

- A. diphenylamine
- B. ninhydrin
- C. benzaldehyde
- D. hexamethylenetetramine
- E. formaldehyde

4. Levomycetin can be identified by the reaction of the formation of an azo dye after the previous one:

- A. recovery
- B. oxidation
- C. hydrolysis
- D. halogenation
- E. alkylation

5. The aromatic nitro group in chloramphenicol can be identified with the solution:

- A. sodium hydroxide
- B. hydrogen peroxide
- C. bromine water
- D. iron (III) chloride
- E. 2,4-dinitrochlorobenzene

6. The structural basis of tetracyclines is a partially hydrogenated core:

- A. phenanthrene
- B. anthracene
- S. naphthalene
- D. naphthacene
- E. acridine

7. Which of the listed antibiotics can be identified by the maltol formation reaction?

- A. Lincomycin hydrochloride

B. Doxycycline hydrochloride

C. Amoxicillin

D. Kanamycin monosulfate

E. Streptomycin sulfate

8. Quantitative determination of kanamycin monosulfate DFU recommends to determine by the method:

A. microbiological

B. spectrophotometrically

S. liquid chromatography

D. alkalimetry

E. gravimetry

9. For the quantitative determination of gentamicin sulfate in accordance with the requirements of the DFU, the following are used:

A. method of spectrophotometry in the UV region

B. gravimetric method

S. liquid chromatography

D. alkalimetry

E. microbiological method

10. The pharmacist-analyst identifies the substance sulfathiazole (norsulfazole). He confirms the presence of a primary aromatic amino group in its structure by the formation reaction:

AND. fluorescein

IN. azo dye

WITH. murexide

D. indophenol

IS. iodoform

11. Sulfanilamide (streptocide) is a medicinal substance with an antimicrobial effect. As a starting compound for its synthesis, the following is used:

AND. 8-hydroxyquinoline

IN. *N*-carbomethoxyaniline

WITH. 5-nitrofurfurol

D. *p*-dimethylaminobenzaldehyde

IS. acetanilide

12. Sulfonamides are used in medical practice as antimicrobial agents. Acid is used as a starting material for their synthesis:

AND. sulfanilic acid

IN. *p*-aminobenzoin

WITH. salicylic

D. quinoline-3-carbonate

IS. nicotine

13. Semi-synthetic antibiotics of the penicillin series are obtained by combining microbiological and chemical synthesis. The starting compound in the synthesis of amoxicillin is:

A. sulfanilic acid

B. *p*-aminobenzoic acid

C. 6-aminopenicillanic acid

D. 7-aminocephalosporanic acid

E. *p*-aminosalicylic acid

14. A semi-synthetic antibiotic is obtained at a chemical and pharmaceutical enterprise. When 6-aminopenicillanic acid reacts with phenylaminoacetic acid chloride, the following is synthesized:

A. cephalexin

B. methacycline

C. ampicillin

D. rifampicin

E. amikacin

15. Which of the following penicillins is natural?

A. amoxicillin

B. phenoxymethylpenicillin

S. ampicillin

D. carbenicillin

E. oxacillin

16. A pharmacist-analyst performs an analysis of the substance doxycycline monohydrate. Which identification reaction can be used for the indicated medicinal product:

A. reaction with barium chloride

B. reaction with concentrated sulfuric acid

C. reaction of formation of thaleoquinine

D. murexide formation reaction

E. reaction with ammonium oxalate

17. Certification of tetracycline antibiotics is carried out in the laboratory for quality control of medicinal products. Suggest a reaction for the identification of methacycline hydrochloride:

A. reaction to xanthenes

B. reaction to sulfates

C. reaction to nitrates

D. reaction to chlorides

E. reaction to barbiturates

18. The pharmacist-analyst performs the analysis of the substance doxycycline monohydrate. What reagent solution does he use to identify the phenolic hydroxyl in this substance?

A. chloramine

B. barium chloride

C. ammonium oxalate

D. iron (III) chloride

E. potassium pyroantimonate

19. Nitroxoline is used for infectious diseases of the urinary tract. The presence of a tertiary nitrogen atom allows you to determine its quantitative content by the method:

AND. reverse alkalimetry

IN. acidimetry in non-aqueous solvents

WITH. complexonometry by substitute

D. reverse bromatometry

IS. reverse argentometry

20. The pharmacist-analyst conducts a reaction for the presence of a nitro group in the structure of nitroxoline, while a red-orange color is observed. What reagent did the pharmacist-analyst use?

A. potassium iodide solution iodized

B. aniline solution

C. sodium hydroxide solution

D. cyanobromide solution

E. hydroxylamine solution

21. The pharmacist-analyst of the department of quality control of medicinal products analyzes the substance nitrofurantoin (furacilin). Quantitative determination according to the DFU is carried out by the spectrophotometric method, measuring for a solution of substances in dimethylformamide:

A. boiling point

B. optical density

C. angle of rotation

D. refractive index

E. dynamic viscosity

22. Phthalylsulfathiazole (phthalazole), as a representative of prodrugs, forms an active metabolite as a result of metabolism. Select this metabolite from the following:

A. norsulfazol

B. norepinephrine

C. Desloratadine

D. sulfonamide

E. methylxanthine

23. Antimicrobial agents from the group of amidated sulfanilic acid derivatives contain a primary aromatic amino group in the structure. What reaction is used to identify sulfadimethoxine:
- A. reaction of diazotization and azo-combination
 - B. the reaction of indophenol formation
 - C. reaction of the formation of an auric dye
 - D. Schiff base formation reaction
 - E. oxidation and condensation reaction
24. Ftivazid is an anti-tuberculosis agent belonging to isonicotinic acid derivatives. Choose the reagents, the condensation of which carries out the synthesis of ftivazid?
- A. nicotinic acid and hydrazine
 - B. isonicotinic acid and hydrazine
 - C. isoniazid and vanillin
 - D. nicotinamide and formaldehyde
 - E. isonicotinic acid and vanillin
25. The CZL specialist conducts an analysis of the sodium benzylpenicillin substance. What reagent solution does he use to identify the sodium cation?
- A. barium chloride
 - B. potassium chloride
 - C. potassium pyroantimonate
 - D. silver nitrate
 - E. ammonium oxalate
26. Representatives of β -lactam antibiotics are penicillins. Name the structural fragment that is part of penicillin molecules:
- A. furan cycle
 - B. thiazole cycle
 - C. piperazine cycle
 - D. pyridine cycle
 - E. morpholine cycle

27. Penicillin antibiotics started a new stage in the fight against infectious diseases. Indicate which of the following medicines is of natural origin.
- A. ampicillin
 - B. clavulanic acid
 - C. amoxicillin
 - D. oxacillin
 - E. benzylpenicillin
28. The quantitative content of doxycycline hydrochloride is determined by the method of acidimetry in a non-aqueous environment. A solution is used as a titrant:
- A. sodium nitrite
 - B. perchloric acid
 - C. potassium bromate
 - D. potassium permanganate
 - E. sodium hydroxide
29. Chloramphenicol (levomycetin) is subject to the process of metabolism in the intestinal walls. Its main metabolite is formed as a result of:
- A. gluronation
 - B. nitration
 - C. hydroxylation
 - D. bromination
 - E. decarboxylation
30. The synthetic antibiotic chloramphenicol was sent to the laboratory for certification. Identification and testing for the purity of the substance is carried out according to the specific optical rotation by measuring with a polarimeter:
- A. viscosity
 - B. optical density
 - C. angle of rotation
 - D. melting point
 - E. refractive index

3. Formation of professional skills and abilities:

- Content of tasks (tasks, clinical situations, etc.).

Task 1. Calculate the content of sodium chloride (M.m. 58.44) in furacilin tablets, if 13.5 ml of 0.1 n was used for the titration of an exact weight of 0.8497 g according to FH. silver nitrate solution (Kp 0.9996). The average weight of the tablet is 0.85 g.

Task 2. Calculate the percentage content of isoniazid (M. m. 137.14), if for titration the so-called = 0.1173 g according to FC, 18.7 ml of 0.1 M sodium thiosulfate (Kp 1.0018) was used. The volume of the titrant in the control experiment is 50.5 ml.

Task 3. Calculate the volume of perchloric acid (Kp 1.0016), which will be used for titration of the so-called = 0.1828 g of ftivazide (M. m. 271.28) according to FH. The content of ftivazide is 97.15%. For the titration of the control experiment, 0.08 ml was used, the loss of the substance during drying was 6.35%.

Task 4. Calculate the exact amount of furacilin (M. m. 198.14), if 2.84 ml of 0.01 M solution of sodium thiosulfate (Kp 0.9800) was used for its titration according to FC. The volume of the titrant in the control experiment is 4.8 ml.

Task 5. Calculate the volume of 0.1 M sodium nitrite solution (KP = 1.0000), which is used for the titration of 0.5025 g of chloramphenicol (M.m. 323.13), if its content in the substance is 98.5%.

Task 6. Calculate the weight of the weight of benzylpenicillin sodium salt, if 5.00 ml of 0.01 M sodium thiosulfate solution (KP = 1.0000) was spent on the titration of an excess of 0.01 M iodine solution (KP = 1.0000), the percentage content of the amount of penicillins is 99, 0%, titrant volume in the control experiment - 20.00 ml; the value of the equivalent is 0.0004000; the volume of the measuring flask is 100 ml, the volume of the pipette is 5 ml.

Task 7. Calculate the exact weight of oxacillin-sodium (M.m. 441.4), if 38.5 ml of 0.1 n was used for its titration according to FH. solution of hydrochloric acid (Kp 0.9973). The volume of the titrant in the control experiment. The content of the amount of penicillins is 94.5%.

Task 8. Calculate the volume of 0.01 n. iodine solution, which will be used for the titration of an accurate measurement of 0.8106 g of furacilin tablets (M.m. 198.14) according to FH, the volume of the titrant in the control experiment is 50 ml. The average weight of the tablet is 0.85 g.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Chemical methods for the analysis of medicinal products.	Give identification reactions of ions that are part of medicinal products.	Pharmaceutical chemistry: textbook for students. of higher pharmacology education institutions and pharmacies. f-tiv higher med. education institutions of III-IV levels of accreditation. / for general ed. Prof. Bezuglio P. O. - Ed. 3rd edition, revised. – Vinnytsia: Nova Kniga, 2017. – 456 p.
2.	Chemical methods for the analysis of medicinal products.	Give a quantitative analysis of medicinal substances	

- Requirements for work results, including for registration: Individual form of answers to test tasks (the form is attached).

4. Summary:

As a result of the lesson, mastering of the studied topics, the ability to choose methods of determining the quality of medicinal products in accordance with the requirements of the Federal Medical University and the Ministry of Health according to the methods used in pharmaceutical analysis are checked.

5. List of recommended literature:

Main:

1. State Pharmacopoeia of Ukraine: in 3 volumes / Derz. medical service of Ukraine funds, Ukr. of science pharmacopoeia medicine quality center means - 2nd edition. - Kh.: Ukr. of science pharmacopoeia medicine quality center means, 2015. - Vol. 1. - 1128 p.
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6. Pharmaceutical chemistry. Analysis of medicinal substances by functional groups: study guide / O.O. Tsurkan, I.V. Nizhenkovska, O.O. Glushachenko. - 3rd edition - All-Ukrainian specialized publishing house "Medytsina", 2019. - 152 p.
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8. Medicinal chemistry: education. manual for students of higher educational institutions / I.S. Hrytsenko, S.G. Taran, L.O. Transition, etc.; for general I.S. Hrytsenko - Kharkiv: NFaU: Golden Pages, 2017. - 552p.
9. Pharmaceutical chemistry. General and special pharmaceutical chemistry. Medicines of an inorganic nature: laboratory-practical classes. Study guide / L.G. Mishina - Vinnytsia: PP "TD "Edelweiss and K"", 2010. - 384 p.

Additional:

1. Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 396 p.
2. British Pharmacopoeia, 2004. - CD-ROM, v. 3.0.
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4. Clarke's Analysis of Drugs and Poisons, London: Pharmaceutical Press, Electronic version, 2005.