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, V course

Educational discipline Industrial practice in Pharmaceutical chemistry
(the name of the educational discipline)

Approved:
The meeting of the department Pharmaceutical chemistry
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Minutes № _ dated _____

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Practical lesson No 1

Topic: Modern methods of pharmaceutical analysis. Classification and characteristics.

Goal: Summarize knowledge about pharmaceutical analysis.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ Basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ Methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ Methods of separation of substances (chemical, chromatographic, extraction);
- ✓ The basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ Safety rules when working in a chemical laboratory;
- ✓ The role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ Main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;

- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Instrumental (physical and physico-chemical) methods of analysis include::
   A. Spectroscopic;
   B. Electrochemical;
   C. Gravimetric;
   D. True options A and B;
   E. There is no correct answer.
2. Physico-chemical methods of analysis include:
   A. Gravimetric;
   B. Titrimetric;
   C. Conductometric;
   D. All options are correct;
   E. There is no correct answer.
3. The methods of calculating the concentration of substances include:
   A. Method of one standard;
   B. Method of two standards;
   C. Method of three standards;

D. True options A and B;

E. There is no correct answer.

4. Electromagnetic radiation with a wavelength of 450 nm corresponds to the region:

   A. UV radiation;

   B. IR radiation;

   C. Visible radiation;

   D. γ-radiation;

   E. There is no correct answer.

5. Groups causing the appearance of absorption bands in molecular spectra are called:

   A. Chromophores;

   B. Auxochromes;

   C. Functional;

   D. Coordinated;

   E. All options are correct.

6. The method of direct conductometry is based on measurement:

   A. voltage in the circuit;

   B. current strength;

   C. specific electrical conductivity of electrolyte solutions;

   D. electrode potential;

   E. all options are correct.

7. In coulometric titration, the titrant:

   A. is added from a burette;

   B. obtained in the process of electrolysis of an auxiliary reagent;

   C. measure with a pipette;

   D. there is no correct answer;

   E. is added in a twofold excess.

8. During the amperometric titration of sodium sulfate with lead salts (electroactive titrant) after the equivalence point, the strength of the diffusion current:

A. increases;

B. decreases;

C. remains constant;

D. first decreases, then increases;

E. first increases, then decreases.

9. During the conductometric titration of acetic acid with an ammonia solution after the equivalence point, the specific electrical conductivity:

A. decreases;

B. increases;

C. increases slightly;

D. there is no correct answer;

E. decreases significantly.

10. The classification of chromatographic methods is based on the following features:

A. The nature of the sorbent;

B. Aggregate state of phases;

C. Sample volume;

D. Concentration of analyzed substances;

E. All the listed answers are correct.

3. Formation of professional skills:

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

The task 1. Determine the volume of 0.1 N perchloric acid solution (KP=0.9835), which will be spent on the titration of 0.1506 g of morphine hydrochloride (M.m. 321.80), if the quantitative content of morphine hydrochloride in the medicinal product is -99 .00%.

The task 2. Determine the mass fraction of chloramphenicol (M.m. 323.13) in the medicinal product, if 16.40 ml of 0.1 N sodium nitrite solution was spent on the titration of a weight of 0.5234 g of chloramphenicol (KP = 0.9928).

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Classification of methods of quantitative determination of medicinal substances.	Principles of constructing graphs during potentiometric titration.	Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 161 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, the students summarized their knowledge of pharmaceutical analysis.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.

8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 2

Topic: General pharmacopoeial methods of analysis. General provisions on chemical methods of drug analysis.

Goal: Summarize knowledge about qualitative methods of analysis of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;

- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The laboratory for quality control of medicinal products received a mucolytic drug containing ambroxol hydrochloride. To identify chloride ions, a solution must be used for its identification:
   A. silver nitrate;
   B. barium sulfate;
   C. glyoxalhydroxyanil;
   D. potassium ferrocyanide;
   E. diphenylamine.
2. Dexamethasone is a hormonal agent, the structure of which contains covalently bound fluorine. This allows, after mineralization of the substance, to identify fluoride ions using a solution:
   A. Calcium chloride;
   B. Sodium chloride;
   C. Ammonium oxalate;
   D. Silver nitrate;
   E. Sodium acetate.
3. The pharmacist-analyst identifies the antimicrobial agent "Ciprofloxacin hydrochloride". To detect the chloride ion, he conducts a reaction in the presence of concentrated sulfuric acid with such a reagent:
   A. Potassium dichromate;
   B. Sodium hydroxide;
   C. Magnesium sulfate;
   D. Potassium chloride;
   E. Zinc oxide.

4. 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 such a reagent:
    A. Barium chloride;
    B. Copper (II) sulfate;
    C. Potassium iodide;
    D. Sodium bicarbonate;
    E. Ammonium chloride.
5. During the pharmaceutical analysis, the drug substance was reacted with antipyrine (phenazone) in the presence of dilute hydrochloric acid. The appearance of green color allows identification:
    A. Nitrites;
    B. Sulfates;
    C. Fluorides;
    D. Bromides;
    E. Iodides.
6. 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 identification:
    A. Carbonates;
    B. Fluorides;
    C. Nitrites;
    D. Sulfates;
    E. Chlorides.
7. An anti-ulcer drug containing bismuth subcitrate has arrived at the drug quality control laboratory. During the reaction on the bismuth cation, the formation of a yellowish-orange color was observed. What reagent was used in this test??
    A. Thiourea;

B. Glyoxalhydroxyanil;

C. Hydrochloric acid;

D. Sodium hydroxide;

E. Potassium acetate.

8. As a result of the reaction of the analgesic "Metamisole sodium monohydrate" with a solution of potassium pyroantimonate, a white precipitate was formed. This confirms the presence of a medicinal substance in the structure:

A. Sodium ions;

B. Covalently bound sulfur;

C. Methyl groups;

D. Phenyl radical;

E. Keto groups.

9. 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 makes it possible to identify such a cation:

A. Calcium;

B. Sodium;

C. Potassium;

D. Ammonia;

E. Barium.

10. A laboratory specialist of the pharmaceutical product certification center prepares reagents. A solution is used to identify medicinal products containing potassium ions:

A. Sodium cobalt nitrite;

B. Ammonium oxalate;

C. Barium chloride;

D. Sodium hydroxide;

E. Magnesium sulfate.

3. Formation of professional skills:

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

The task 1. Choose reagents that give well-soluble compounds with cadmium sulfide, bismuth iodide (II), aluminum hydroxide.

The task 2. Choose reagents that form complex compounds with cobalt (II), nickel and copper (II) cations.

- Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Classification of chromatographic methods of analysis.	Use of chromatographic methods in qualitative analysis.	Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 222 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, the students summarized their knowledge of qualitative methods of analysis of medicinal substances.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.

3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 3

Topic: Testing for the limit content of impurities. Pharmacopoeial reactions for the detection of impurities in medicinal products.

Goal: Summarize knowledge about quantitative methods of analysis of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;

- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Levothyroxine sodium is a drug used for hypofunction of the thyroid gland. To detect chloride impurities when testing this agent, a solution must be used:
   A. Silver nitrate;
   B. Barium chloride;
   C. Magnesium sulfate;
   D. Copper (II) sulfate;
   E. Iron (III) chloride.
2. Furosemide is a drug from the group of loop diuretics. When testing this tool, a reaction was carried out with silver nitrate in the medium of dilute nitric acid. The appearance of white opalescence indicates the presence of an impurity:
   A. Chlorides;
   B. Calcium;
   C. Magnesium;
   D. Heavy metals;
   E. Ammonium salts.

3. A pharmacist-analyst conducts research on the substance of anhydrous glucose. To determine the calcium admixture, he conducts a reaction with the solution:
    A. Ammonium oxalate;
    B. Potassium pyroantimonate;
    C. Barium chloride;
    D. Sodium hydroxide;
    E. Sodium nitrite.
4. When testing the analgesic agent "Goalmizol sodium monohydrate", a reaction was carried out with a solution of barium chloride in the medium of diluted acetic acid. The appearance of white opalescence indicates the presence of an impurity:
    A. Sulfates;
    B. Chlorides;
    C. Calcium;
    D. Heavy metals;
    E. Ammonium salts.
5. Testing the calcium lactate substance involves a reaction with a solution of thioglycolic acid in the presence of citric acid and an ammonia solution. This reaction is used to determine such an impurity:
    A. Iron;
    B. Potassium;
    C. Chlorides;
    D. Sulfates;
    E. Ammonium salts.
6. A pharmacist-analyst conducts an analysis of the substance sodium benzoate. The presence of which impurity in the substance is indicated by the formation of white opalescence after the addition of diluted acetic acid and barium chloride solution?
    A. Sulfates;

B. Zinc;

C. Phosphates;

D. Ammonia;

E. Magnesium.

7. The pharmacist-analyst of the laboratory of the State Inspection for Quality Control of Medicinal Products conducts tests on the purity of the substance "Procaine hydrochloride" with the thioacetamide reagent. The formation of a brown color indicates the presence of an impurity?

   A. Heavy metals;

   B. Potassium;

   C. Aluminum

   D. Magnesium;

   E. Calcium.

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

   A. Calcium chloride;

   B. Sodium sulfate;

   C. Sodium chloride;

   D. Sodium bicarbonate;

   E. Sodium thiosulfate.

9. To determine fluoride admixture in medicinal compounds, the provisional analyst conducts steam distillation and then determines the presence of sodium fluoride by reacting with the reagent:

   A. Aminomethylalizaric acid;

   B. Methoxyphenylacetic acid;

   C. Thioacetamide;

   D. Rhodanbromide;

   E. Sulfuric iodine.

10. The pharmacist-analyst determines the iron impurity in the medicinal product in accordance with the requirements of the SPhU. The presence of this impurity is indicated by the appearance of such a color:

A. Pink;

B. Green;

C. Blue;

D. Storm;

E. Black.

3. Formation of professional skills:

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

The task 1. Determine the weight of papaverine hydrochloride (M.m. 375.86), if 8.55 ml of 0.1 N perchloric acid solution (CP = 0.9886) was spent on its titration. The percentage content of papaverine hydrochloride in the medicinal product is 99.60%.

The task 2. Determine the mass of sodium bromide test (M.m 102.90), if 19.23 ml of 0.1 N solution of argentum(I) nitrate (KP = 0.9870) was spent on its titration. The mass fraction of sodium bromide in the medicinal product is 99.40%.

− Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Chiral impurities.	Give examples of possible chiral impurities in medicinal products.	Analytical chemistry and instrumental methods of analysis / A.I. Gab, D.B. Shakhnin, V.V. Malyshev -Ukraine University, 2018- 69 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, students summarize their knowledge of quantitative methods of analysis of medicinal substances.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.

3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 4

Topic: Testing for the limit content of impurities. Analysis of purified water. Physical and chemical properties of water.

Goal: Summarize knowledge about the analysis of the maximum content of impurities in purified water.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;

- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Water for injections is sterile according to the SPhU and should not contain oxidizing substances. What reagent (solution) does the pharmacist-analyst use to detect this impurity:
   A. Potassium permanganate;
   B. Ammonium oxalate;

C. Iron (III) chloride;

D. Barium chloride;

E. Dilute sodium hydroxide

2. A pharmacist-analyst conducts an analysis of purified water. He uses a reagent to determine the admixture of ammonium salts in water purified according to the requirements of the SPhU:

   A. Nessler's reagent;

   B. Thioacetamide;

   C. Fehling;

   D. Sulfomolybdenum;

   E. Fisher.

3. The pharmacist-analyst determines impurities of ammonium salts (method A) in sodium tetraborate according to SPhU using a solution:

   A. Potassium tetraiodomercurate;

   B. Potassium ferrocyanide;

   C. Sodium tetraborate;

   D. Barium chloride;

   E. Silver nitrate.

4. As the main reagent when testing for the limit content of zinc impurities, the analytical chemist uses a solution:

   A. Potassium ferrocyanide;

   B. Ammonium thiocyanate;

   C. Sodium sulfide;

   D. Silver nitrate;

   E. Barium chloride.

5. To determine the impurity of potassium in medicinal compounds, the pharmacist-analyst conducts a reaction with:

   A. Sodium tetraphenylborate;

   B. Sodium nitrate;

   C. Sodium tetraborate;

D. Sodium sulfate;

E. Sodium salicylate.

6. The chemist of the PTC of the pharmaceutical enterprise determines the quality of purified water. What reagent should he used to detect impurities of nitrates and nitrites?

   A. diphenylamine solution;

   B. ammonium oxalate solution;

   C. solution of sulfosalicylic acid;

   D. silver nitrate solution;

   E. barium chloride solution.

7. Determination of impurities of aluminum salts in medicinal products is carried out with a solution:

   A. 8-hydroxyquinoline;

   B. Pyridine;

   C. β-naphthol;

   D. ethanol;

   E. hydroxylamine.

8. To determine the admixture of fluorides in medicinal compounds, the provisional analyst conducts distillation with steam and then determines the presence of sodium fluoride by reacting with the reagent:

   A. Aminomethylalizaric acid;

   B. Methoxyphenylacetic acid;

   C. Thioacetamide;

   D. Rhodanbromide;

   E. Sulfuric iodine.

9. The pharmacist-analyst determines the iron impurity in the medicinal product in accordance with the requirements of the Federal Drug Administration. The presence of this impurity is indicated by the appearance of such a color:

   A. Pink;

   B. Green;

C. Blue;

D. Storm;

E. Black.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of magnesium sulfate heptahydrate (refractometric method), if the refractive index of purified water is 0.3330, the refractive index of magnesium sulfate heptahydrate solution is 0.3394, the refractive index factor is 0.00093.

The task 2. Determine the volume of 0.1 M sodium nitrite solution (KP=0.9684), which will be spent on the titration of 0.2916 g of dicaine (M.m. 300.83), if its mass fraction in the medicinal product is 99.80 %.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Determination of the mass percentages of calcium and magnesium ions in their simultaneous presence.	Work performance methodology.	Analytical chemistry: Education. manual for pharmacies universities and universities of III - IV accreditation level / V.V. Bolotov, O.M. Svechnikova, S.V. Kolisnyk, T.V. Zhukova and others. – X.: Publication of the National Institute of Scientific Research; Original, 2004. – 275 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, the students summarized their knowledge on the analysis of the maximum content of impurities in purified water.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. :

Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.

4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 5

Topic: General principles of identification of medicinal substances.

Goal: Summarize knowledge about methods of qualitative analysis of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);

- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. According to the requirements of SPhU, a reaction with potassium permanganate in a diluted sulfuric acid environment is used to identify ethanol. What is the oxidation product of ethanol?
   A. Acetaldehyde;
   B. Acetone;
   C. Acetylene;
   D. Diethyl ether;
   E. Acetate-ethyl ether.

2. For the purpose of identification, the pharmacist-analyst heated the ethanol substance with acetic acid diluted in the presence of concentrated sulfuric acid; a pleasant fruity smell appears. This indicates the formation of which substance?
    A. Ethyl acetate;
    B. Acetone;
    C. Acetylene;
    D. Ethylene;
    E. Acetaldehyde.
3. The presence of phenolic hydroxyl in the paracetamol molecule can be confirmed by the complexation reaction with:
    A. $FeCl_3$;
    B. HCl;
    C. $K_2Cr_2O_7$;
    D. $K[BiI_4]$;
    E. NH_2OH.
4. In order to identify the phenol substance in accordance with the requirements of the SPhU, a specialist of the State Inspection for Quality Control of Medicinal Products conducts an oxidation reaction in an ammonia environment. Name the compound formed:
    A. Indophenol dye;
    B. Azo dye;
    C. Azomethyl dye;
    D. Aurine dye;
    E. Complex salt.
5. The drug thymol has a phenolic hydroxyl in its structure and is therefore easily oxidized. An indophenol test can be used to identify thymol. Select the reagents for this reaction:
    A. Chloramine solution and ammonia solution;
    B. Hydrochloric acid solution;

C. A solution of sulfuric acid and formaldehyde;

D. Iodine solution and sodium hydroxide solution;

E. Sulfuric acid solution and bromine solution.

6. Medicinal products that have a phenolic hydroxyl in their structure undergo an electrophilic substitution reaction. Name a reaction that can be used to both identify resorcinol and quantify it:

A. Bromination;

B. Sulfation;

C. Nitration;

D. Alkylation;

E. Hydroxymethylation.

7. The identification of pyridoxine hydrochloride (SPhU) is carried out by a specialist of the State Inspection for Quality Control of Medicinal Products using thin-layer chromatography. To develop a chromatogram, he uses the reactions of the formation of an indophenol dye. Name the required reagent:

A. Dichloroquinone chloramide;

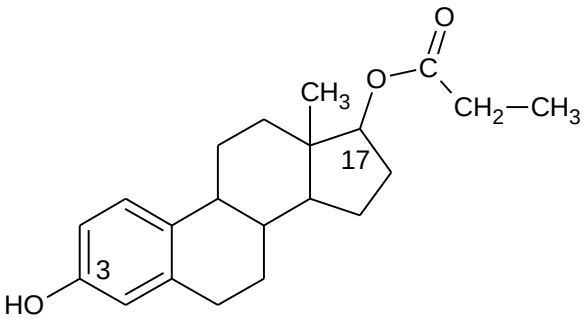
B. Potassium iodobismuthate;

C. Potassium nitrate;

D. Dinitrobenzaldehyde;

E. Sodium cobaltinitrite.

8. Name the functional groups in the estradiol propionate molecule:



A. Phenolic hydroxyl, ester group;

B. Alcohol hydroxyl, keto group;

C. Enol hydroxyl, carboxyl group;

D. Phenolic hydroxyl, ethoxy group;

E. Alcoholic hydroxyl, ester group.

9. The structure of the drug molecule contains an ester group. To confirm its presence in the medicinal product, the pharmacist-analyst uses:

A. Hydroxam sample;

B. Le Rosen test;

C. Murexide sample;

D. Beilstein's test;

E. Indophenol test.

10. The pharmacist-analyst conducts tests on the purity of the ether substance for anesthesia. One of the unacceptable impurities in the substance are aldehydes. To detect the content of aldehyde impurities in accordance with the requirements of the SPhU, he conducts a reaction with reagents:

A. Potassium tetraiodomercurate alkaline solution;

B. Ammonium oxalate, ammonium chloride;

C. Hydrochloric acid, chloroform;

D. Sodium hydrogen phosphate, hydrochloric acid;

E. Sodium hydroxide, sodium carbonate.

3. Formation of professional skills:

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

The task 1. Detection reactions of iron (III) and iron (II) ions.

The task 2. Identification of ions in copper (II) sulfate.

The task 3. Identification of ions in silver nitrate.

The task 4. Choose reagents that form complex compounds with manganese (II), iron (III) and iron (II) cations.

− Recommendations (instructions) for performing tasks.

No	Main tasks	Instructions	Answers

1	2	3	4
1.	Classification of methods of qualitative analysis.	Give examples of reactions.	Analytical chemistry: Education. manual for pharmacies universities and universities of III - IV accreditation level / V.V. Bolotov, O.M. Svechnikova, S.V. Kolisnyk, T.V. Zhukova and others. – X.: Publication of the National Institute of Scientific Research; Original, 2004. – 7 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, the students summarized their knowledge of the methods of qualitative analysis of medicinal substances.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.

7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 6

Topic: Peculiarities of using pharmaceutical analysis in quality control of medicines.

Goal: Summarize knowledge about the use of quantitative and qualitative methods of analysis of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;

- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Levothyroxine sodium is a drug used for hypofunction of the thyroid gland. To detect chloride impurities when testing this agent, a solution must be used:
   A. Silver nitrate;
   B. Barium chloride;
   C. Magnesium sulfate;
   D. Copper (II) sulfate;
   E. Iron (III) chloride.
2. Furosemide is a drug from the group of loop diuretics. When testing this tool, a reaction was carried out with silver nitrate in the medium of dilute nitric acid. The appearance of white opalescence indicates the presence of an impurity:
   A. Chlorides;
   B. Calcium;
   C. Magnesium;
   D. Heavy metals;
   E. Ammonium salts.
3. The substance diltiazem hydrochloride has arrived at the laboratory of the pharmaceutical company. When testing it for the presence of an admixture of heavy metals, it is necessary to use such a reagent:
   A. thioacetamide;
   B. copper-tartrate;
   C. molybdenum-vanadium;

D. sulfomolybdenum;

E. cyanobromide.

4. The pharmacist-analyst conducts an express analysis of a 2% boric acid solution. Quantitative determination of the active substance is carried out by the method:

   A. alkalimetry;

   B. argentometry;

   C. complexonometry;

   D. nitritometry;

   E. acidimetry.

5. The pharmacist-analyst conducts an express analysis of the sedative mixture with sodium bromide. Quantitative determination of sodium bromide is carried out by the method:

   A. argentometry;

   B. complexonometry;

   C. alkalimetry;

   D. acidimetry;

   E. nitritometry.

6. Dosage forms containing potassium bromide are used to treat insomnia. Potassium cation can be identified by reaction with the solution:

   A. sodium cobaltinitrite;

   B. potassium pyroantimonate;

   C. silver nitrate;

   D. barium chloride;

   E. potassium ferrocyanide.

7. The pharmacist-analyst conducts a quantitative determination of calcium chloride in the composition of the extemporaneous mixture. What titrated solution does he use?

   A. sodium edetate;

   B. potassium bromate;

C. hydrochloric acid;

D. potassium permanganate;

E. sodium hydroxide.

8. An infusional 0.9% sodium chloride solution is used as a physiological solution. What method can be used to quantitatively determine the active substance?

A. argentometry;

B. nitritometry;

C. complexonometry;

D. acidimetry;

E. alkalimetry.

9. The expectorant mixture includes sodium bicarbonate, potassium iodide and ammonium chloride. During the rapid analysis of this dosage form, the quantitative determination of sodium bicarbonate can be determined by the following method:

A. acidimetry;

B. alkalimetry;

C. argentometry;

D. complexonometry;

E. nitritometry.

10. Paracetamol is a drug that has an analgesic, antipyretic and anti-inflammatory effect. In the quantitative determination of the active substance by the cerimetric method, it is used as an indicator:

A. feroin;

B. sodium eosinate;

C. phenolphthalein;

D. starch;

E. potassium chromate.

3. Formation of professional skills:

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

The task 1. Determine the volume of 0.1 N perchloric acid solution (KP=0.9835), which will be spent on the titration of 0.1506 g of morphine hydrochloride (M.m. 321.80), if the quantitative content of morphine hydrochloride in the medicinal product is -99 .00%.

The task 2. Determine the mass fraction of isoniazid (M.m. 137.14), if the excess of 0.1 N iodine solution (KP = 0.9858) after the reaction with 0.2246 g of isoniazid was titrated with 17.60 ml of 0.1 M sodium thiosulfate solution (CP = 1.1442), the volume of the iodine solution is 50.00 ml.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Functional analysis.	Give examples of identification reactions by functional groups.	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. - 66 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, the students summarized their knowledge of the use of quantitative and qualitative methods of analysis of medicinal substances.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.

5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 7

Topic: Analysis of concentration of solutions.

Goal: Summarize knowledge about methods of expressing the concentration of solutions.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;

- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Basic ways of expressing the concentration of a substance in a solution:
   A. molar concentration of the substance equivalent in the solution;
   B. solution titer;
   C. standard concentration;
   D. all Answers are correct;
   E. options A and B are correct.
2. The titer of the solution is:
   A. number of grams of dissolved substance per 1 ml of solution;
   B. number of grams of dissolved substance in 1 liter of solution;
   C. number of moles of solute per 1 ml of solution;
   D. number of moles of solute in 1 liter of solution;

E. Number of moles of solute in 1 g of solution.

3. Dilution factor:
   A. the ratio of the volume of the flask to the volume of the pipette;
   B. ratio of mass concentration to molar concentration;
   C. the ratio of the volume of the titrant to the volume of the analyzed solution;
   D. all options are correct;
   E. there is no correct answers.
4. The main techniques (methods) of titration include:
   A. direct titration;
   B. repeated titration;
   C. Fisher titration;
   D. titration according to Howard;
   E. Scheibler titration.
5. During titration, a substitute is used:
   A. an auxiliary reagent that interacts with the specified substance;
   B. two titrants;
   C. a reagent that interacts with the titrant and the specified substance;
   D. one titrant;
   E. all Answers are correct.
6. The following methods are distinguished according to the type of the main reaction occurring during titration:
   A. methods of acid-base interaction;
   B. direct methods;
   C. indirect methods;
   D. reverse methods;
   E. directed methods.
7. Titration curves depict graphical dependence:
   A. all the specified options;
   B. the concentration of the substance to be determined from the titrant volume;
   C. the concentration of the determined substance from the degree of titration;

D. optical density of the solution from the volume of added titrant;

E. there is no correct Answers.

8. Titration is carried out:

A. by means of separate measurements;

B. by way of Bouguer;

C. by the pipetting method;

D. in a measuring cup;

E. by way of Burr.

9. Determinations are made by the reverse titration method:

A. nitrites;

B. nitrates;

C. chlorides;

D. carbonates;

E. phosphates.

10. Titrimetric methods use indicators:

A. acid-base;

B. potassium bromide;

C. acetic acid;

D. potassium acetate;

E. metamizol.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of potassium chloride (M.m. 74.56) in the medicinal product, if 13.02 ml of a 0.1 M solution of argentum(I) nitrate was spent on the titration of a 0.9850 g sample (KP=1.0100); the volume of the measuring flask is 50.00 ml, the volume of the pipette is 5 ml.

The task 2. Determine the volume of a 0.1 M solution of argentum(I) nitrate (KP = 0.9968), which will be used for the titration of 10.00 ml of a diluted mixture

of 3% sodium bromide solution (M.m 102.90), the volume volumetric flask - 50.00 ml, pipette volume - 5.00 ml.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Methods of determining the concentration of solutions.	Give calculation formulas for determining the concentration of solutions.	Analytical chemistry: Education. manual for pharmacies universities and universities of III - IV accreditation level / V.V. Bolotov, O.M. Svechnikova, S.V. Kolisnyk, T.V. Zhukova and others. – X.: Publication of the National Institute of Scientific Research; Original, 2004. – 254 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, the students summarized their knowledge of methods of expressing the concentration of solutions.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.

4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 8

Topic: Peculiarities of the use of pharmaceutical analysis in the quality control of medicines manufactured in a pharmacy.

Goal: Summarize knowledge about pharmaceutical analysis in a pharmacy.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.

- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. 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 benzoic acid:
   A. diethyl ether;
   B. mannitol;
   C. mercury (II) acetate;
   D. hydrochloric acid;
   E. sodium hydroxide.
2. The pharmacist-analyst conducts quantitative determination of the antihistamine "Diphenhydramine hydrochloride" by the method of acidimetry in a non-aqueous environment. For what purpose does he add a solution of mercury (II) acetate?
   A. to bind chloride ions into a slightly dissociated compound;
   B. to enhance the hydrolysis of diphenhydramine hydrochloride;
   C. to change the density of the solution;
   D. to create the optimal pH value of the solution;
   E. to accelerate precipitation of diphenhydramine base.

3. The pharmacist-analyst determines the quantitative content of the substance "Ascorbic acid" by the iodometric method. He uses a solution as an indicator:
    A. starch;
    B. methyl orange;
    C. bromophenol blue;
    D. phenolphthalein;
    E. murexide.
4. The pharmacist-analyst conducts quantitative determination of the antibacterial agent "Sulfatiazole" by the nitritometry method. The presence of which functional group determines the choice of method?
    A. primary aromatic amino group;
    B. aldehyde group;
    C. carboxyl group;
    D. sulfogroups;
    E. hydroxyl group.
5. A pharmacist-analyst analyzes phenol in the composition of an antiseptic medicinal product. Phenolic hydroxyl is identified by reaction with the solution:
    A. iron (III) chloride;
    B. ninhydrin;
    C. barium chloride;
    D. potassium permanganate;
    E. silver nitrate.
6. The antihistamine "Diphenhydramine hydrochloride" is an ether. The pharmacist-analyst identifies the compound by the reaction of the formation of an oxonium salt when added:
    A. concentrated sulfuric acid;
    B. solution of hydroxylamine hydrochloride;
    C. iron (III) chloride solution;
    D. dilute nitric acid;

E. potassium pyroantimonate solution.

7. The pharmacist-analyst identifies the antihistamine "Diphenhydramine hydrochloride" by the reaction of the formation of an oxonium salt with concentrated sulfuric acid. What functional group determines the possibility of carrying out this reaction?
   A. ethereal;
   B. aldehyde;
   C. sulfamide;
   D. amide;
   E. carboxylic.
8. 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. thiourea;
   D. chloramine;
   E. glyoxalhydroxyanil.
9. 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. murexidna;
   C. thiochrome;
   D. ninhydrin;
   E. hydroxamomic.
10. The pharmacist-analyst identifies the aromatic nitro group in the structure of the antibacterial agent "Nitrofural" (furacilin). What reagent does he use in this case?
   A. sodium hydroxide;

B. magnesium sulfate;

C. ammonium oxalate;

D. calcium chloride;

E. iron(III) chloride.

3. Formation of professional skills:

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

The task 1. 250 ml of sodium caffeine benzoate solution was prepared. Analyzes showed that the solution contains 19 and 21% of the drug. How much caffeine sodium benzoate or solvent should be added to obtain a 20% solution?

The task 2. 500 l of glucose was obtained. Analyzes showed that the concentration of glucose is 39.5 and 42% of the drug. Calculate up to 40% (ρ40%=1.1498; humidity 10%).

− Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Internal pharmacy quality control of medicinal forms.	Give examples of internal pharmacy quality control.	Drug technology / By editor. A.I. Tikhonov. - Kh., 2002; Encyclopedic dictionary of a pharmacy worker/Ed. V.P. Kalashnikov and others. - M., 1960; Pivnenko H.P. Pharmacy technology of drugs. - K., 1962

− 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, the students summarized their knowledge of pharmaceutical analysis in the conditions of a pharmacy.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. :

Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.

4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 9

Topic: Analysis of unstable medicinal products, as well as perishable medicinal products.

Goal: Summarize knowledge about the pharmaceutical analysis of perishable medicinal substances and their storage conditions.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;

- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Adrenaline contains two phenolic hydroxyls in its structure, which determines the chemical instability of the compound. What chemical process occurs when a substance is stored improperly?
   A. oxidation;
   B. recovery;
   C. polymerization;
   D. hydrolysis;

E. weathering.

2. If the conditions of storage of the substance "Calcium lactate pentahydrate" are violated, the loss of crystallization water may occur. What is this process called?
   A. weathering;
   B. oxidation;
   C. restoration;
   D. hydrolysis;
   E. polymerization.
3. 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. oxidation;
   B. weathering;
   C. recovery;
   D. hydrolysis;
   E. polymerization.
4. A pharmacist-analyst performs an express analysis of a liquid dosage form containing calcium chloride. He identifies the chloride ion by reaction with the solution:
   A. silver nitrate;
   B. potassium pyroantimonate;
   C. sodium tetraphenylborate;
   D. ammonium oxalate;
   E. barium chloride.
5. An express analysis of the antitussive mixture, which includes sodium bicarbonate and thermopsis grass extract, is carried out. The quantitative content of sodium bicarbonate in this mixture can be determined by the method:
   A. acidimetry;

B. nitritometry;

C. cerimetry;

D. permanganatometry;

E. argentometry.

6. Express analysis of the mixture containing calcium chloride and sodium bromide is carried out. The summary definition of the ingredients of this dosage form can be determined:

   A. argentometrically;

   B. complexonometrically;

   C. alkalimetrically;

   D. polarimetrically;

   E. nitritometrically.

7. The pharmacist-analyst performs an express analysis of powders containing ascorbic acid. The acidic properties of this substance allow for its quantitative determination by the method:

   A. alkalimetry;

   B. iodometry;

   C. cerimetry;

   D. iodometry;

   E. complexonometry.

8. 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 benzoic acid:

   A. diethyl ether;

   B. mannitol;

   C. mercury (II) acetate;

   D. hydrochloric acid;

   E. sodium hydroxide.

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 for the purpose of prevention:
   A. hydrolysis of the ester group;
   B. recovery of medicinal substance;
   C. oxidation of medicinal substance;
   D. decarboxylation of the medicinal substance;
   E. precipitation of the resulting salt.
10. To prevent crystalluria, the pharmacist advised the patient to use an alkaline drink while taking the medicine. This medicine belongs to the group:
   A. sulfonamides;
   B. barbiturates;
   C. benzodiazepines;
   D. penicillins;
   E. catecholamines.

3. Formation of professional skills:

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

The task 1. Determine the mass of calcium chloride hexahydrate (M.m. 219.0V), if 19.50 ml of 0.05 N trilon B solution (KP=1.1245) was spent on its titration. The percentage content of zinc sulfate heptahydrate in the medicinal product is 100.35%.

The task 2. Determine the weight of benzoic acid (M.m. 122.12), if 17.05 ml of 0.1 N sodium hydroxide solution (KP = 0.9954) was spent on its titration, and its percentage content in the medicinal product is 99.80 %.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers

1	2	3	4
1.	Storage conditions of various medicinal substances.	Storage conditions of oxidizable compounds.	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. - 560 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, the students summarized their knowledge of pharmaceutical analysis of perishable medicinal substances and their storage conditions.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.

7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 10

Topic: Analysis of 5% alcohol iodine solution.

Goal: Summarize the qualitative and quantitative analysis of the 5% alcohol iodine solution.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;

- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The pharmacist-analyst conducts quantitative determination of the 0.02% nitrofural solution using the iodometric method. What indicator does it use?
   A. Starch;
   B. Potassium chromate;
   C. Methyl red;
   D. Phenolphthalein;
   E. Crystal violet.
2. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:
   A. argentometry;
   B. complexonometry;
   C. nitritometry;
   D. acidimetry;
   E. alkalimetry.
3. The expectorant mixture includes sodium bicarbonate, potassium iodide and ammonium chloride. During the rapid analysis of this dosage form, the quantitative determination of sodium bicarbonate can be determined by the following method:
   A. acidimetry;
   B. alkalimetry;
   C. argentometry;
   D. complexonometry;
   E. nitritometry.

4. The pharmacist-analyst determines the quantitative content of the substance "Ascorbic acid" by the iodometric method. He uses a solution as an indicator:
    A. starch;
    B. methyl orange;
    C. bromophenol blue
    D. phenolphthalein;
    E. murexide.
5. Quantitative determination of the vitamin product "Ascorbic acid" is carried out by the method of iodometry. On what properties of the substance is the method based?
    A. restorative;
    B. oxidizing;
    C. acidic;
    D. basic;
    E. amphoteric.
6. 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. murexidna;
    C. thiochrome;
    D. ninhydrin;
    E. hydroxamic.
7. An analytical chemist conducts a qualitative reaction of nitrazepam with potassium tetraiodobismutate and obtains an orange-red precipitate. What fragment of the molecule determines this reaction?
    A. tertiary nitrogen;
    B. phenolic hydroxyl;
    C. carboxyl group;
    D. ester group;

E. benzene nucleus.

8. The formation of a colored precipitate with potassium tetraiodobismuthate is a characteristic reaction for substances containing tertiary nitrogen. This reaction can be used for identification:
   A. nitrazepam;
   B. chloral hydrate;
   C. camphor;
   D. phenyl salicylate;
   E. phenol.
9. The pharmacist-analyst of the control and analytical laboratory carries out quantitative determination of Goalmizol sodium by the method of iodometry. What indicator does it use:
   A. starch;
   B. murexide;
   C. phenolphthalein;
   D. feroin;
   E. tropeolin 00.
10. An analytical chemist performs quantitative determination of caffeine by iodometry. He uses a solution as an indicator:
   A. starch;
   B. murexide;
   C. phenolphthalein;
   D. ferroin;
   E. tropeolin 00.

3. Formation of professional skills:

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

The task 1. Determine the volume of 0.1 N of potassium iodate solution (KP = 1.0010), which will be spent on the titration of a weight of 0.4520 g of ascorbic acid (M.m. 176.13), if the percentage content of ascorbic acid in the medicinal

product is 98.70%. The volume of the measuring flask is 50.00 ml, the volume of the pipette is 10.00 ml.

The task 2. Determine the mass fraction of isoniazid (M.m. 137.14), if the excess of 0.1 N iodine solution (KP = 0.9858) after the reaction with 0.2246 g of isoniazid was titrated with 17.60 ml of 0.1 M sodium thiosulfate solution (CP = 1.1442), the volume of the iodine solution is 50.00 ml.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of alcohol iodine solution.	Calculate the equivalence factor of iodine in its quantitative determination.	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. - 560 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, the students summarized the qualitative and quantitative analysis of the 5% alcohol iodine solution.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.

2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття.

Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 11

Topic: Analysis of unstable drugs, as well as oxidizing drugs.

Goal: Summarize knowledge about the pharmaceutical analysis of perishable medicinal substances and their storage conditions.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Adrenaline contains two phenolic hydroxyls in its structure, which determines the chemical instability of the compound. What chemical process occurs when a substance is stored improperly?
   A. oxidation;
   B. recovery;
   C. polymerization;
   D. hydrolysis;
   E. weathering.
2. If the conditions of storage of the substance "Calcium lactate pentahydrate" are violated, the loss of crystallization water may occur. What is this process called??
   A. weathering;
   B. oxidation;
   C. restoration;

D. hydrolysis;

E. polymerization.

3. 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. oxidation;

   B. weathering;

   C. recovery;

   D. hydrolysis;

   E. polymerization.

4. A pharmacist-analyst performs an express analysis of a liquid dosage form containing calcium chloride. He identifies the chloride ion by reaction with the solution:

   A. silver nitrate;

   B. potassium pyroantimonate;

   C. sodium tetraphenylborate;

   D. ammonium oxalate;

   E. barium chloride.

5. An express analysis of the antitussive mixture, which includes sodium bicarbonate and thermopsis grass extract, is carried out. The quantitative content of sodium bicarbonate in this mixture can be determined by the method:

   A. acidimetry;

   B. nitritometry;

   C. cerimetry;

   D. permanganatometry;

   E. argentometry.

6. Express analysis of the mixture containing calcium chloride and sodium bromide is carried out. The summary definition of the ingredients of this dosage form can be determined:

A. argentometrically;

B. complexonometrically;

C. alkalimetrically;

D. polarimetrically;

E. nitritometrically.

7. The pharmacist-analyst performs an express analysis of powders containing ascorbic acid. The acidic properties of this substance allow for its quantitative determination by the method:

A. alkalimetry;

B. iodometry;

C. cerimetry;

D. iodometry;

E. complexonometry.

8. 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 benzoic acid:

A. diethyl ether;

B. mannitol;

C. mercury (II) acetate;

D. hydrochloric acid;

E. sodium hydroxide.

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 for the purpose of prevention:

A. hydrolysis of the ester group;

B. recovery of medicinal substance;

C. oxidation of medicinal substance;

D. decarboxylation of the medicinal substance;

E. precipitation of the resulting salt.

10. To prevent crystalluria, the pharmacist advised the patient to use an alkaline drink while taking the medicine. This medicine belongs to the group:

A. sulfonamides;

B. barbiturates;

C. benzodiazepines;

D. penicillins;

E. catecholamines.

3. Formation of professional skills:

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

The task 1. Determine the mass of calcium chloride hexahydrate (M.m. 219.0V), if 19.50 ml of 0.05 N trilon B solution (KP=1.1245) was spent on its titration. The percentage content of zinc sulfate heptahydrate in the medicinal product is 100.35%.

The task 2. Determine the weight of benzoic acid (M.m. 122.12), if 17.05 ml of 0.1 N sodium hydroxide solution (KP = 0.9954) was spent on its titration, and its percentage content in the medicinal product is 99.80 %.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Storage conditions of various medicinal substances.	Storage conditions of oxidizable compounds.	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. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of medicinal substances that are oxidized.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.

2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 12

Topic: Analysis of ammonia-anise drops.

Goal: Summarize the qualitative and quantitative analysis of ammonia-anise drops.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. A pharmacist-analyst conducts an analysis of chloramphenicol eye drops. To detect the active pharmaceutical ingredient, he adds sodium hydroxide

solution; at the same time, a yellow color appeared, turning into red-orange. On which functional group was the reaction carried out?

A. nitro group;
B. phenyl radical;
C. aldehyde group;
D. imino group;
E. alcohol hydroxyl.

2. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:

A. argentometry;
B. complexonometry;
C. nitritometry;
D. acidimetry;
E. alkalimetry.

3. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies the zinc cation by reacting it with a solution:

A. potassium ferrocyanide;
B. sodium chloride;
C. potassium permanganate;
D. sodium nitrite;
E. ammonium oxalate.

4. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies sulfates by reacting with a solution:

A. barium chloride;
B. ammonium oxalate;
C. potassium nitrate;
D. sodium nitrite;
E. iron (III) chloride.

5. An express analysis of eye drops containing zinc sulfate and boric acid is carried out. The quantitative content of zinc sulfate in this dosage form can be determined by the method:
    A. complexonometry;
    B. alkalimetry;
    C. cerimetry;
    D. polarimetry;
    E. nitritometry.
6. 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.
7. The pharmacist-analyst conducts a quantitative determination of calcium chloride in the composition of the extemporaneous mixture. What titrated solution does he use?
    A. sodium edetate;
    B. potassium bromate;
    C. hydrochloric acid;
    D. potassium permanganate;
    E. sodium hydroxide.
8. An infusional 0.9% sodium chloride solution is used as a physiological solution. What method can be used to quantitatively determine the active substance?
    A. argentometry;
    B. nitritometry;
    C. complexonometry;

D. acidimetry;

E. alkalimetry.

9. The quantitative content of the antihistamine "Diphenhydramine hydrochloride" is determined by the method of alkalimetry. A solution is used as a titrant:

A. sodium hydroxide;

B. potassium bromate;

C. sodium thiosulfate;

D. potassium permanganate;

E. hydrochloric acid.

10. 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 for the purpose of prevention:

A. hydrolysis of the ester group;

B. recovery of medicinal substance;

C. oxidation of medicinal substance;

D. decarboxylation of the medicinal substance;

E. precipitation of the resulting salt.

3. Formation of professional skills:

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

The task 1. Determine the volume of 0.1 N sodium hydroxide solution (KP = 0.8973), which will be spent on the titration of 0.2037 g of benzoic acid (M.m. 122.12), and its percentage content in the medicinal product is 99, 20%.

The task 2. Determine the weight of benzoic acid (M.m. 122.12), if 17.05 ml of 0.1M sodium hydroxide solution (KP = 0.9954) was spent on its titration, and its percentage content in the medicinal product is 99.80%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Storage conditions of various medicinal substances.	Storage conditions of weathering compounds.	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. - 560 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, the students summarized the qualitative and quantitative analysis of ammonia-anise drops.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.

7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 13

Topic: Peculiarities of the use of pharmaceutical analysis in the quality control of medicines manufactured in a pharmacy. Preparation and analysis of dosage forms for injections.

Goal: Summarize knowledge about pharmaceutical analysis of extemporaneous dosage forms. Pharmaceutical analysis of injectable dosage forms.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;

- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The quantitative content of the antibacterial agent "Phthalylsulfathiazole" (phthalazole) is determined by the method of alkalimetry. The titrant in this method is a solution:
   A. sodium hydroxide;
   B. perchloric acid;
   C. potassium bromate;
   D. ammonium thiocyanate;
   E. silver nitrate.
2. The pharmacist-analyst conducts quantitative determination of the antihistamine "Diphenhydramine hydrochloride" by the method of acidimetry in a non-aqueous medium. For what purpose does he add a solution of mercury (II) acetate?
   A. to bind chloride ions into a slightly dissociated compound;
   B. to enhance the hydrolysis of diphenhydramine hydrochloride;
   C. to change the density of the solution;
   D. to create the optimal pH value of the solution;
   E. to accelerate precipitation of diphenhydramine base.
3. Paracetamol is a drug that has an analgesic, antipyretic and anti-inflammatory effect. The reaction of identification with a solution of iron (III) chloride is due to its presence in its structure:
   A. phenolic hydroxyl;
   B. aromatic nitro group;

C. ester group;

D. aldehyde group;

E. carboxyl group.

4. The pharmacist-analyst determines the quantitative content of the drug "Hydrocortisone Acetate" using an instrumental method. He measures the optical density of the solution using:

   A. spectrophotometer;

   B. polarograph;

   C. polarimeter;

   D. pH meter;

   E. refractometer.

5. The pharmacist-analyst conducts photocolorimetric quantitative determination of 0.02% nitrofural solution. For this he measures:

   A. optical density of the solution;

   B. pH of the studied solution;

   C. refractive index of the solution;

   D. angle of rotation of the solution;

   E. boiling point of the solution.

6. For the express analysis of a 10% glucose solution, it is necessary to determine its refractive index. What device should the pharmacist-analyst use in this case?

   A. refractometer;

   B. photocolorimeter;

   C. potentiometer;

   D. polarimeter;

   E. spectrophotometer.

7. Quality control of substances for pharmaceutical use involves determining the content of residual amounts of volatile organic solvents. For this purpose, it is most rational to apply this type of chromatography:

   A. gas;

B. paper;

C. liquid;

D. ion exchange;

E. thin layer.

8. Chromatographic methods are used in pharmaceutical analysis. What chromatographic method is based on reversible chemisorption of ions of the analyzed solution by ionogenic groups of the sorbent:

A. ion exchange;

B. paper;

C. adsorption;

D. thin layer;

E. gas.

9. A specialist in the ampoule shop of a pharmaceutical enterprise carries out quality control of injection solutions. To determine the pH of the solution, he must use it:

A. potentiometer;

B. refractometer;

C. spectrophotometer;

D. polarimeter;

E. viscometer.

10. A pharmacist-analyst analyzes the medicinal substance nicotinamide. When carrying out a pharmacopoeial reaction with a solution of cyanobromide and aniline, a yellow color appears. What functional group does it react with?

A. pyridine cycle;

B. amide group;

C. carboxyl group;

D. phenolic hydroxyl group;

E. ester group.

3. Formation of professional skills:

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

The task 1. Determine the volume of 0.1 M sodium nitrite solution (KP = 1.0000), which will be spent on the titration of 0.5025 g of chloramphenicol (M.m. 323.13), if its percentage content in the medicinal product is 98.55 %.

The task 2. Determine the mass fraction of isoniazid (M.m. 137.14), if the excess of 0.1 M iodine solution (KP = 0.9858) after the reaction with 0.2246 g of isoniazid was titrated with 17.60 ml of 0.1 M sodium thiosulfate solution (CP = 1.1442), the volume of the iodine solution is 50.00 ml.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Storage conditions of various injectable dosage forms.	Storage conditions of oxidizing solutions.	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. - 560 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, students generalized their knowledge of pharmaceutical analysis of extemporaneous dosage forms. Pharmaceutical analysis of injectable dosage forms.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.

5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 14

Topic: Processing of auxiliary material, personal hygiene of aseptic block workers.

Goal: Summarize knowledge about the requirements for personnel in an aseptic unit.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;

- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The pharmacy has a license to manufacture medicinal forms in aseptic conditions. Which premises do not belong to the aseptic block:
   A. Premises for receiving purified water;
   B. Gateway;
   C. Sterilization;
   D. Aseptic assistant;
   E. Premises for receiving water for injections.
2. The pharmacy has a license to manufacture sterile medicinal products. Who is responsible for organizing the operation of the aseptic block and preparation of sterile medicinal products?
   A. The head of the pharmacy;

B. Analyst analyst;

C. Pharmacist for taking prescriptions and dispensing medical products;

D. Authorized person;

E. Pharmacist.

3. Indicate which of the listed objects require aseptic preparation conditions followed by thermal sterilization with saturated steam under pressure:

   A. Solutions for injections with thermostable substances;

   B. Solutions for injections with thermolabile substances;

   C. Concentrated solutions for the burette system;

   D. Liquid medicines with antibiotics for internal use;

   E. 2% solutions of kolargol for newborns.

4. The pharmacist during pharmaceutical care gave the patient a recommendation not to drink the medicine with milk due to possible deterioration of bioavailability. Choose this medicine from the following:

   A. tetracycline;

   B. sulfanilamide;

   C. phenobarbital;

   D. nifuroxazide;

   E. Metamizol sodium.

5. Prodrugs are drugs that exert their pharmacological action due to the formation of an active metabolite. Choose a medicine from the following:

   A. phthalylsulfathiazole;

   B. chloramphenicol;

   C. diphenhydramine;

   D. metronidazole;

   E. ciprofloxacin.

6. The second phase of Goalbolism of drugs (conjugation phase) includes reactions of interaction of xenobiotics or their Goalbolites, which have active functional groups, with hydrophilic endogenous molecules. This phase includes the process:

A. glucuronidation;

B. S-oxidation;

C. hydroxylation;

D. restoration;

E. hydrolysis.

7. 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. with isopropanol and hexane;

   D. ethanol and benzene;

   E. ethyl acetate and dichloroethane.

8. 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.

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

   A. n-octanol-water;

   B. water-chloroform;

   C. chloroform-glycerol;

   D. acetonitrile-water;

   E. ethanol-paraffin.

10. Medicines are metabolized in several stages. The Metabolism phase, 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. Formation of professional skills:

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

The task 1. Determine the mass fraction of chloramphenicol (M.m. 323.13) in the medicinal product, if 16.40 ml of 0.1 N sodium nitrite solution was spent on the titration of 0.5234 g of chloramphenicol (KP = 0.9928).

The task 2. Determine the mass of the theobromine sample (M.m. 180.17), if 16.50 ml of 0.1 N sodium hydroxide solution (KP=0.9903) was spent on its titration by the method of indirect neutralization. The mass fraction of theobromine in the medicinal product is 99.33%.

− Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Conditions for the analysis of aseptic medicinal forms.	Conditions for analysis of injectable dosage forms.	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. - 560 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, the students summarized their knowledge of the requirements for personnel in the aseptic block.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.

2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 15

Topic: Topical control work on Topics: "Modern methods of pharmaceutical analysis. Classification and characteristics; General pharmacopoeial methods of analysis. General provisions on chemical methods of drug analysis; Testing for the maximum content of impurities; General principles of identification of medicinal substances».

Goal: Generalize knowledge about modern methods of pharmaceutical analysis, general pharmacopoeial methods of analysis, general provisions on chemical methods of analysis of medicinal products, tests for the limit content of impurities and general principles of identification of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;

- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Adrenaline contains two phenolic hydroxyls in its structure, which determines the chemical instability of the compound. What chemical process occurs when a substance is stored improperly?
   A. oxidation;
   B. recovery;
   C. polymerization;
   D. hydrolysis;
   E. weathering.
2. If the conditions of storage of the substance "Calcium lactate pentahydrate" are violated, the loss of crystallization water may occur. What is this process called?
   A. weathering;
   B. oxidation;
   C. restoration;
   D. hydrolysis;
   E. polymerization.
3. 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. oxidation;
   B. weathering;
   C. recovery;
   D. hydrolysis;
   E. polymerization.

4. A pharmacist-analyst performs an express analysis of a liquid dosage form containing calcium chloride. He identifies the chloride ion by reaction with the solution:
    A. silver nitrate;
    B. potassium pyroantimonate;
    C. sodium tetraphenylborate;
    D. ammonium oxalate;
    E. barium chloride.
5. An express analysis of the antitussive mixture, which includes sodium bicarbonate and thermopsis grass extract, is carried out. The quantitative content of sodium bicarbonate in this mixture can be determined by the method:
    A. acidimetry;
    B. nitritometry;
    C. cerimetry;
    D. permanganatometry;
    E. argentometry.
6. Express analysis of the mixture containing calcium chloride and sodium bromide is carried out. The summary definition of the ingredients of this dosage form can be determined:
    A. argentometrically;
    B. complexonometrically;
    C. alkalimetrically;
    D. polarimetrically;
    E. nitritometrically.
7. The pharmacist-analyst performs an express analysis of powders containing ascorbic acid. The acidic properties of this substance allow for its quantitative determination by the method:
    A. alkalimetry;
    B. iodometry;

C. cerimetry;

D. iodometry;

E. complexonometry.

8. 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 benzoic acid:

A. diethyl ether;

B. mannitol;

C. mercury (II) acetate;

D. hydrochloric acid;

E. sodium hydroxide.

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 for the purpose of prevention:

A. hydrolysis of the ester group;

B. recovery of medicinal substance;

C. oxidation of medicinal substance;

D. decarboxylation of the medicinal substance;

E. precipitation of the resulting salt.

10. To prevent crystalluria, the pharmacist advised the patient to use an alkaline drink while taking the medicine. This medicine belongs to the group:

A. sulfonamides;

B. barbiturates;

C. benzodiazepines;

D. penicillins;

E. catecholamines.

3. Formation of professional skills:

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

The task 1. Determine the mass of calcium chloride hexahydrate (M.m. 219.0V), if 19.50 ml of 0.05 N trilon B solution (KP=1.1245) was spent on its titration. The percentage content of zinc sulfate heptahydrate in the medicinal product is 100.35%.

The task 2. Determine the weight of benzoic acid (M.m. 122.12), if 17.05 ml of 0.1 N sodium hydroxide solution (KP = 0.9954) was spent on its titration, and its percentage content in the medicinal product is 99.80 %.

The task 3. Determine the mass of the theobromine sample (M.m. 180.17), if 16.50 ml of 0.1 N sodium hydroxide solution (KP=0.9903) was spent on its titration by the method of indirect neutralization. The mass fraction of theobromine in the medicinal product is 99.33%.

The task 4. Determine the volume of 0.1 N potassium iodate solution (KP=1.0010), which will be used for the titration of 0.4520 g of ascorbic acid (M.m. 176.13). The percentage content of ascorbic acid in the medicinal product is 98.70%.

The task 5. Determine the volume of a 0.1 M solution of perchloric acid (KP - 0.9985), which will be used for the titration of a weight of 0.1518 g of morphine hydrochloride M.m. 321.80). The percentage content of morphine hydrochloride in the medicinal product is 99.50%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Storage conditions of various medicinal substances.	Storage conditions of oxidizable compounds.	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. - 560 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 summarized their knowledge of modern methods of pharmaceutical analysis, general pharmacopoeial methods of analysis, general provisions on chemical methods of analysis of medicinal products, tests for the limit content of impurities and general principles of identification of medicinal substances.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 16

Topic: Chemical analysis of 50% analgin solution for injections.

Goal: Summarize knowledge about the pharmaceutical analysis of Goalmizol sodium salt 50% for injections.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;

✓ bank of test tasks.

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

1. The pharmacist-analyst conducts quantitative determination of the 0.02% nitrofural solution using the iodometric method. What indicator does it use?
   A. Starch;
   B. Potassium chromate;
   C. Methyl red;
   D. Phenolphthalein;
   E. Crystal violet.
2. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:
   A. argentometry;
   B. complexonometry;
   C. nitritometry;
   D. acidimetry;
   E. alkalimetry.
3. The expectorant mixture includes sodium bicarbonate, potassium iodide and ammonium chloride. During the rapid analysis of this dosage form, the quantitative determination of sodium bicarbonate can be determined by the following method:
   A. acidimetry;
   B. alkalimetry;
   C. argentometry;
   D. complexonometry;
   E. nitritometry.
4. The pharmacist-analyst determines the quantitative content of the substance "Ascorbic acid" by the iodometric method. He uses a solution as an indicator:
   A. starch;

B. methyl orange;

C. bromophenol blue

D. phenolphthalein;

E. murexide.

5. Quantitative determination of the vitamin product "Ascorbic acid" is carried out by the method of iodometry. On what properties of the substance is the method based?

A. restorative;

B. oxidizing;

C. acidic;

D. basic;

E. amphoteric.

6. 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. murexidna;

C. thiochrome;

D. ninhydrin;

E. hydroxamov.

7. An analytical chemist conducts a qualitative reaction of nitrazepam with potassium tetraiodobismutate and obtains an orange-red precipitate. What fragment of the molecule determines this reaction?

A. tertiary nitrogen;

B. phenolic hydroxyl;

C. carboxyl group;

D. ester group;

E. benzene nucleus.

8. The formation of a colored precipitate with potassium tetraiodobismuthate is a characteristic reaction for substances containing tertiary nitrogen. This reaction can be used for identification:
    A. nitrazepam;
    B. chloral hydrate;
    C. camphor;
    D. phenyl salicylate;
    E. phenol.
9. The pharmacist-analyst of the control and analytical laboratory carries out the quantitative determination of Metamizol sodium by the method of iodometry. What indicator does it use?
    A. starch;
    B. murexide;
    C. phenolphthalein;
    D. feroin;
    E. tropeolin 00.
10. An analytical chemist performs quantitative determination of caffeine by iodometry. He uses a solution as an indicator:
    A. starch;
    B. murexide;
    C. phenolphthalein;
    D. ferroin;
    E. tropeolin 00.

3. Formation of professional skills:

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

The task 1. Determine the weight of the measurement of Goalmizol sodium salt ((M.m. (b/v) = 333.36, M.m. (v)=351.36)), if 11.95 ml of 0.1 N will be spent on its titration iodine solution (CP = 0.9956), the percentage content of Goalmizol sodium salt in the medicinal product is 99.00%.

The task 2. Determine the mass fraction of norsulfazole (M.m. 255.32) in the medicinal product, if 11.12 ml of 0.1 M sodium nitrite solution (CP = 1.0546) was spent on the titration of a weight of 0.3025 g.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of Metamizol sodium salt solution.	Calculate the equivalency factor of analgin in its quantitative determination.	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. - 560 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, students summarized their knowledge of the pharmaceutical analysis of Goalmizol sodium salt 50% for injections.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.

3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 17

Topic: Features of preparation and analysis of dosage forms for injections.

Goal: Summarize knowledge about pharmaceutical analysis of injectable dosage forms.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;

- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Adrenaline contains two phenolic hydroxyls in its structure, which determines the chemical instability of the compound. What chemical process occurs when a substance is stored improperly?
   A. oxidation;
   B. recovery;
   C. polymerization;
   D. hydrolysis;
   E. weathering.
2. If the conditions of storage of the substance "Calcium lactate pentahydrate" are violated, the loss of crystallization water may occur. What is this process called?
   A. weathering;
   B. oxidation;
   C. recovery;
   D. hydrolysis;
   E. polymerization.

3. 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. oxidation;
    B. weathering;
    C. recovery;
    D. hydrolysis;
    E. polymerization.
4. A pharmacist-analyst performs an express analysis of a liquid dosage form containing calcium chloride. He identifies the chloride ion by reaction with the solution:
    A. silver nitrate;
    B. potassium pyroantimonate;
    C. sodium tetraphenylborate;
    D. ammonium oxalate;
    E. barium chloride.
5. An express analysis of the antitussive mixture, which includes sodium bicarbonate and thermopsis grass extract, is carried out. The quantitative content of sodium bicarbonate in this mixture can be determined by the method:
    A. acidimetry;
    B. nitritometry;
    C. cerimetry;
    D. permanganatometry;
    E. argentometry.
6. Express analysis of the mixture containing calcium chloride and sodium bromide is carried out. The summary definition of the ingredients of this dosage form can be determined:
    A. argentometrically;
    B. complexonometrically;

C. alkalimetrically;

D. polarimetrically;

E. nitritometrically.

7. The pharmacist-analyst performs an express analysis of powders containing ascorbic acid. The acidic properties of this substance allow for its quantitative determination by the method:

   A. alkalimetry;

   B. iodometry;

   C. cerimetry;

   D. iodometry;

   E. complexonometry.

8. 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 benzoic acid:

   A. diethyl ether;

   B. mannitol;

   C. mercury (II) acetate;

   D. hydrochloric acid;

   E. sodium hydroxide.

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 for the purpose of prevention:

   A. hydrolysis of the ester group;

   B. recovery of medicinal substance;

   C. oxidation of medicinal substance;

   D. decarboxylation of the medicinal substance;

   E. precipitation of the resulting salt.

10. To prevent crystalluria, the pharmacist advised the patient to use an alkaline drink while taking the medicine. This medicine belongs to the group:

A. sulfonamides;

B. barbiturates;

C. benzodiazepines;

D. penicillins;

E. catecholamines.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction of atropine sulfate (M.m. 676.8) in the medicinal product, if 7.42 ml of 0.1 M perchloric acid solution was spent on the titration of 0.4990 g of atropine sulfate (KP = 0.9982).

The task 2. Determine the weight of papaverine hydrochloride (M.m. 375.86), if 8.55 ml of 0.1 M perchloric acid solution (CP = 0.9886) was spent on its titration. The percentage content of papaverine hydrochloride in the medicinal product is 99.60%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Storage conditions of various medicinal substances.	Storage conditions of infusion dosage forms.	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. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of injectable dosage forms.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. :

Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.

3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 18

Topic: Chemical analysis of 5% aminocaproic acid solution.

Goal: Summarize knowledge about the pharmaceutical analysis of a 5% aminocaproic acid solution.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;

- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The pharmacist-analyst conducts quantitative determination of the 0.02% nitrofural solution using the iodometric method. What indicator does it use?

A. Starch;

B. Potassium chromate;

C. Methyl red;

D. Phenolphthalein;

E. Crystal violet.

2. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:

A. argentometry;

B. complexonometry;

C. nitritometry;

D. acidimetry;

E. alkalimetry.

3. The expectorant mixture includes sodium bicarbonate, potassium iodide and ammonium chloride. During the rapid analysis of this dosage form, the quantitative determination of sodium bicarbonate can be determined by the following method:

A. acidimetry;

B. alkalimetry;

C. argentometry;

D. complexonometry;

E. nitritometry.

4. The pharmacist-analyst determines the quantitative content of the substance "Ascorbic acid" by the iodometric method. He uses a solution as an indicator:

A. starch;

B. methyl orange;

C. bromophenol blue

D. phenolphthalein;

E. murexide.

5. Quantitative determination of the vitamin product "Ascorbic acid" is carried out by the method of iodometry. On what properties of the substance is the method based?
    A. restorative;
    B. oxidizing;
    C. acidic;
    D. basic;
    E. amphoteric.
6. 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. murexidna;
    C. thiochrome;
    D. ninhydrin;
    E. hydroxamic.
7. An analytical chemist conducts a qualitative reaction of nitrazepam with potassium tetraiodobismutate and obtains an orange-red precipitate. What fragment of the molecule determines this reaction?
    A. tertiary nitrogen;
    B. phenolic hydroxyl;
    C. carboxyl group;
    D. ester group;
    E. benzene nucleus.
8. The formation of a colored precipitate with potassium tetraiodobismuthate is a characteristic reaction for substances containing tertiary nitrogen. This reaction can be used for identification:
    A. nitrazepam;
    B. chloral hydrate;
    C. camphor;

D. phenyl salicylate;

E. phenol.

9. The pharmacist-analyst of the control and analytical laboratory carries out quantitative determination of Goalmizol sodium by the method of iodometry. What indicator does it use:

A. starch;

B. murexide;

C. phenolphthalein;

D. feroin;

E. tropeolin 00.

10. An analytical chemist performs quantitative determination of caffeine by iodometry. He uses a solution as an indicator:

A. starch;

B. murexide;

C. phenolphthalein;

D. ferroin;

E. tropeolin 00.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of glutamic acid (M.m. 147.13) in the medicinal product, if ml of 0.1 N sodium hydroxide solution (KP = 1.0150) was spent on the titration of a weight of 0.3024 g of glutamic acid.

The task 2. Determine the weight of glutamic acid (M.m. 147.13), if 22.42 ml of 0.1 M sodium hydroxide solution (KP = 1.1148) was spent on its titration by the method of direct alkalimetry, and its mass percentage in the medicinal product is 99.70%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of aminocaproic acid solution.	Calculate the equivalence factor of aminocaproic acid in its quantitative determination.	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. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of a 5% aminocaproic acid solution.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.

7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 19

Topic: Peculiarities of preparation, analysis and storage of children's medicines.

Goal: Summarize knowledge about pharmaceutical analysis of children's dosage forms.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;

- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Paracetamol is a drug that has an analgesic, antipyretic and anti-inflammatory effect. In the quantitative determination of the active substance by the cerimetric method, it is used as an indicator:
   A. Feroin;
   B. Sodium eosinate;
   C. Phenolphthalein;
   D. Starch;
   E. Potassium chromate.
2. Paracetamol is a drug that has an analgesic, antipyretic and anti-inflammatory effect. The reaction of identification with a solution of iron (III) chloride is due to its presence in its structure:
   A. Phenolic hydroxyl;
   B. Aromatic nitro group;
   C. Ester group;
   D. Aldehyde group;
   E. Carboxyl group.
3. 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 for the purpose of prevention:
   A. Hydrolysis of the ester group;
   B. Recovery of medicinal substance;

C. Oxidation of medicinal substance;

D. Decarboxylation of medicinal substance;

E. Precipitation of the resulting salt.

4. Specify the product of the interaction of paracetamol with hydrochloric acid and the subsequent addition of potassium dichromate:

   A. Indophenol dye;

   B. Aurine dye;

   C. Triphenylmethyl dye;

   D. Azo dye;

   E. Schiff base.

5. Quantitative determination of which medicinal product by nitritometry method requires preliminary hydrolysis:

   A. Paracetamol;

   B. Anesthesin;

   C. Procaine hydrochloride;

   D. Sodium paraaminosalicylate;

   E. Dikain.

6. Analgin substance was received for analysis. Choose a method by which you can determine the quantitative content of analgin:

   A. Iodometry;

   B. Acidimetry;

   C. Alkalimetry;

   D. Complex ionometry;

   E. Permanganatometry.

7. An acidic environment is optimal for the absorption of the main metabolite of acetylsalicylic acid. Name this metabolite:

   A. Salicylic acid;

   B. Barbituric acid;

   C. Phenylacetic acid;

   D. Uric acid;

E. Valproic acid.

8. One of the directions of biotransformation of paracetamol in the liver is oxidation by microsomal enzymes. As a result, a toxic metabolite is formed:
   A. Quinonimin;
   B. Phenol;
   C. o-xylene;
   D. Phthalic anhydride;
   E. m-dioxybenzene.
9. A chemical analyst identifies the reaction of paracetamol with phenolic hydroxyl, which results in the formation of a blue-violet color. What reagent did he use?
   A. Iron (III) chloride;
   B. Sodium chloride;
   C. Potassium pyroantimonate;
   D. Barium chloride;
   E. Silver nitrate.
10. Paracetamol belongs to non-steroidal anti-inflammatory drugs and is biotransformed in the body by deacetylation. What metabolite is formed?
   A. p-aminophenol;
   B. Aminobenzene;
   C. o-xylene;
   D. Nitrobenzene;
   E. m-dioxybenzene.

3. Formation of professional skills:

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

The task 1. Calculate the volume of 0.1 N sodium nitrite solution (KP = 1.0000), which will be spent on the titration of 0.2525 g of paracetamol (M. 151.17), if its content in the substance is 98.6%.

The task 2. Determine the mass fraction of acetylsalicylic acid (M.m. 180.16) in the medicinal product, if 20.50 ml of 0.1 M sodium hydroxide solution (KP = 1.0520) was spent on the titration of a weight of 0.5184 g of acetylsalicylic acid.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of paracetamol.	Calculate the equivalence factor of paracetamol in its quantitative determination.	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. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of children's dosage forms.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.

3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 20

Topic: Peculiarities of preparation, analysis and storage of children's medicines, including for newborns.

Goal: Summarize knowledge about pharmaceutical analysis of children's dosage forms, including for newborns.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;

- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Paracetamol is a drug that has an analgesic, antipyretic and anti-inflammatory effect. In the quantitative determination of the active substance by the cerimetric method, it is used as an indicator:
   A. Feroin;
   B. Sodium eosinate;
   C. Phenolphthalein;
   D. Starch;
   E. Potassium chromate.
2. Paracetamol is a drug that has an analgesic, antipyretic and anti-inflammatory effect. The reaction of identification with a solution of iron (III) chloride is due to its presence in its structure:
   A. Phenolic hydroxyl;
   B. Aromatic nitro group;
   C. Ester group;
   D. Aldehyde group;
   E. Carboxyl group.

3. 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 for the purpose of prevention:
    A. Hydrolysis of the ester group;
    B. Recovery of medicinal substance;
    C. Oxidation of medicinal substance;
    D. Decarboxylation of medicinal substance;
    E. Precipitation of the resulting salt.
4. Specify the product of the interaction of paracetamol with hydrochloric acid and the subsequent addition of potassium dichromate:
    A. Indophenol dye;
    B. Aurine dye;
    C. Triphenylmethyl dye;
    D. Azo dye;
    E. Schiff base.
5. Quantitative determination of which medicinal product by nitritometry method requires preliminary hydrolysis:
    A. Paracetamol;
    B. Anesthesin;
    C. Procaine hydrochloride;
    D. Sodium paraaminosalicylate;
    E. Dikain.
6. Analgin substance was received for analysis. Choose a method by which you can determine the quantitative content of analgin:
    A. Iodometry;
    B. Acidimetry;
    C. Alkalimetry;
    D. Complex ionometry;
    E. Permanganatometry.

7. An acidic environment is optimal for absorption of the main metabolit of acetylsalicylic acid. Name the metabolite:
    A. Salicylic acid;
    B. Barbituric acid;
    C. Phenylacetic acid;
    D. Uric acid;
    E. Valproic acid.
8. One of the directions of biotransformation of paracetamol in the liver is oxidation by microsomal enzymes. As a result, a toxic metabolite is formed:
    A. Quinonimin;
    B. Phenol;
    C. o-xylene;
    D. Phthalic anhydride;
    E. m-dioxybenzene.
9. A chemical analyst identifies the reaction of paracetamol with phenolic hydroxyl, which results in the formation of a blue-violet color. What reagent did he use?
    A. Iron (III) chloride;
    B. Sodium chloride;
    C. Potassium pyroantimonate;
    D. Barium chloride;
    E. Silver nitrate.
10. Paracetamol belongs to non-steroidal anti-inflammatory drugs and is biotransformed in the body by deacetylation. What Goalbolite is formed?
    A. p-aminophenol;
    B. Aminobenzene;
    C. o-xylene;
    D. Nitrobenzene;
    E. m-dioxybenzene.

3. Formation of professional skills:

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

The task 1. Calculate the volume of 0.1 N sodium nitrite solution (KP = 1.0000), which will be spent on the titration of 0.2525 g of paracetamol (M. 151.17), if its content in the substance is 98.6%.

The task 2. Determine the mass fraction of acetylsalicylic acid (M.m. 180.16) in the medicinal product, if 20.50 ml of 0.1 N sodium hydroxide solution (CP = 1.0520) was spent on the titration of a weight of 0.5184 g of acetylsalicylic acid.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of acetylsalicylic acid.	Calculate the equivalence factor of acetylsalicylic acid in its quantitative determination.	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. - 560 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, students summarized their knowledge of pharmaceutical analysis of children's dosage forms, including those for newborns.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.

5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 21

Topic: Analysis of 1% glutamic acid solution.

Goal: Summarize knowledge about pharmaceutical analysis of 1% glutamic acid solution.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;

- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The pharmacist-analyst performs the identification of glutamic acid by the method of thin-layer chromatography. In order to detect spots on the chromatogram, he must treat it with a solution of the following substance:
   A. Ninhydrin;
   B. Aniline;
   C. Pyridine;
   D. Benzaldehyde;
   E. Diphenylamine.
2. Procaine hydrochloride is used as a local anesthetic and is a derivative:
   A. p-aminobenzoic acid;
   B. Acetylsalicylic acid;

C. Sulfanilic acid;

D. Benzoic acid;

E. Nicotinic acid.

3. Anesthesin refers to substances with local anesthetic activity and is a derivative:

A. p - aminobenzoic acid;

B. p - aminosalicylic acid;

C. p - aminobenzene sulfonic acids;

D. p - chlorobenzoic acid;

E. p - aminophthalic acid.

4. The presence of an ester group in the structure of benzocaine can be proven by the formation reaction:

A. Salts of hydroxamic acids;

B. Indophenol;

C. Azo dye;

D. Aurine dye;

E. Azomethine dye.

5. Glutamic acid, according to its chemical structure, belongs to the amino acids of the aliphatic series. What method is used for its quantitative determination?

A. alkalimetry;

B. nitritometry;

C. bromatometry;

D. argentometry;

E. complexonometry.

6. Quantitative analysis of glutamic acid is carried out in the laboratory of the pharmaceutical product certification center by the method of nitrogen determination after mineralization with sulfuric acid. The use of this method is connected with the presence of atoms in the structure of the medicinal substance:

A. nitrogen;

B. carbon;

C. oxygen;

D. phosphorus;

E. sulfur.

7. Pharmaceutical analysis of glutamic acid involves the determination of nitrogen after mineralization with concentrated sulfuric acid. Ammonia formed during the test is driven off into the receiving flask, which should contain:

   A. titrated solution of hydrochloric acid;

   B. saturated sodium chloride solution;

   C. titrated sodium edetate solution;

   D. freshly prepared tannin solution;

   E. potassium iodide solution iodized.

8. When conducting quality control of the substance "Glutamic acid", the specific optical rotation is determined. To calculate this value, it is necessary to measure:

   A. rotation angle;

   B. melting point;

   C. optical density;

   D. dynamic viscosity;

   E. refractive index.

9. The chemical laboratory checks the quality of medicines. Specify the substance whose quantitative analysis can be carried out by the method of nitrogen determination after mineralization:

   A. glutamic acid;

   B. salicylic acid;

   C. calcium gluconate;

   D. ascorbic acid;

   E. sodium benzoate.

10. Alkalimetric titration is used as a method of quantitative determination at the pharmaceutical enterprise during the input control of glutamic acid substance. What indicator is used?

A. bromothymol blue;

B. starch;

C. feroin;

D. potassium chromate;

E. tropeolin 00.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of glutamic acid (M.m. 147.13) in the medicinal product, if 20.01 ml of 0.1 N sodium hydroxide solution (CP = 1.0150) was spent on the titration of a weight of 0.3024 g of glutamic acid.

The task 2. Determine the weight of glutamic acid (M.m. 147.13), if 22.42 ml of 0.1 N sodium hydroxide solution (CP = 1.1148) was spent on its titration by the method of direct alkalimetry, and its mass percentage in the medicinal product is 99.70%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of glutamic acid.	Calculate the equivalence factor of glutamic acid in its quantitative determination.	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. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of a 1% glutamic acid solution.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.

2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 22

Topic: Peculiarities of using pharmaceutical analysis in quality control of medicines. Soft dosage forms.

Goal: Summarize knowledge about the pharmaceutical analysis of medicinal substances that are part of soft dosage forms.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The pharmacist-analyst performs the analysis of chloramphenicol (levomycetin). Which reagent solution does he used to identify this substance?
    A. sodium hydroxide;
    B. barium chloride;
    C. sodium cobaltinitrite;
    D. ammonium oxalate;
    E. sodium sulfide.
2. Representatives of broad-spectrum antibiotics are aminoglycoside antibiotics. Which of the following antibiotics belongs to aminoglycosides?
    A. kanamycin;
    B. chloramphenicol;
    C. doxorubicin;
    D. phenoxymethylpenicillin;
    E. methacycline.
3. In the control and analytical laboratory, it is necessary to conduct an analysis of drugs from the group of sulfonamides. Choose the general reaction for the identification of this group of substances:
    A. formation of azo dye;
    B. formation of indophenol;
    C. formation of thiochrome;
    D. formation of iodoform;
    E. formation of quinonimine.
4. Sulfathiazole (norsulfazole) is a representative of drugs from the group of sulfonamides. What heterocycle is included in the structure of a molecule of a substance:
    A. thiazole;
    B. pyrimidine;
    C. pyridine;
    D. thiadiazole;

E. oxazole.

5. Norfloxacin is a representative of drugs from the group of fluoroquinolones. Name the heterocycle that is part of the substance:
   A. piperazine;
   B. pyrimidine;
   C. pyridine;
   D. thiazole;
   E. morpholine.
6. Chloramphenicol is an antibiotic with an aromatic structure, which is obtained synthetically. The starting compound in the synthesis of the substance is:
   A. p-nitroacetophenone;
   B. m-aminobenzoic acid;
   C. acetic acid;
   D. salicylic acid;
   E. ascorbic acid.
7. 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.
8. Chloramphenicol contains a covalently bonded 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.

9. The structure of ciprofloxacin contains a free carboxyl group. When used together with which drugs, the substance can form chelate complexes?
   A. magnesium oxide;
   B. sodium benzoate;
   C. potassium orotate;
   D. sodium tetraborate;
   E. resorcinol.
10. Some medicines are not recommended to be used at the same time due to possible interaction between them. Antacids that contain divalent and trivalent metal cations can form chelate compounds with:
   A. ofloxacin;
   B. benzocaine;
   C. metronidazole;
   D. potassium acetate;
   E. chloral hydrate.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction of chloramphenicol (M.m. 323.13) in the medicinal product, if 16.40 ml of 0.1 N sodium nitrite solution was spent on the titration of a weight of 0.5234 g of chloramphenicol (KP = 0.9928).

The task 2. Determine the volume of a 0.1 M solution of sodium nitrite (KP = 0.9875), which will be used for the titration of a weight of 0.4995 g of chloramphenicol (M.m. 323.13). The percentage content of chloramphenicol in the medicinal product is 98.60%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4

1.	Quantitative determination of chloramphenicol.	Calculate the equivalence factor of chloramphenicol in its quantitative determination.	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. - 560 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, students summarized their knowledge of pharmaceutical analysis of medicinal substances that are part of soft dosage forms.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.

7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 23

Topic: Analysis of dibazole 0.005, glucose 0.2.

Goal: Summarize knowledge about the pharmaceutical analysis of dibazol 0.005, glucose 0.2.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;

- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The doctor prescribed the antispasmodic agent bendazol hydrochloride (dibazol) to the patient. According to the chemical structure, this substance is a derivative:
   A. benzimidazole;
   B. indole;
   C. acridine;
   D. purine;
   E. phenothiazine.
2. A technological scheme for obtaining bendazole hydrochloride (dibazole) was 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;
   C. acetic acid;
   D. malonic acid;
   E. mefenamic acid.
3. The pharmacist-analyst conducts the analysis of the substance bendazole hydrochloride (dibazole) by the method of UV spectrophotometry, using the device:
   A. spectrophotometer;
   B. fluorimeter;
   C. polarimeter;
   D. refractometer;
   E. potentiometer.

4. In the laboratory for quality control of medicinal products, a sample of the substance bendazole hydrochloride (dibazole) is checked. The quantitative determination of the substance is carried out by the method of acidimetry in a non-aqueous environment, using a solution as a titrant:
    A. perchloric acid;
    B. sodium hydroxide;
    C. potassium iodide;
    D. silver nitrate;
    E. sodium thiosulfate.
5. A chemist-analyst of the CZL carries out quantitative determination of bendazole hydrochloride (dibazole) by the method of acidimetry in a non-aqueous medium. Titration is carried out in the presence of:
    A. mercury (II) acetate;
    B. copper (II) sulfate;
    C. iron (III) chloride;
    D. potassium tetraiodomercurate;
    E. zinc sulfate.
6. Glucose is an optically active substance, the research of which is carried out by the method of polarimetry. To identify and confirm the purity of optically active medicinal products, the value of the specific optical rotation is used, which is calculated using:
    A. angle of rotation;
    B. optical density;
    C. refractive index;
    D. retention time;
    E. distribution coefficient.
7. A pharmacist-analyst conducts research on the substance of anhydrous glucose. To determine the calcium admixture, he conducts a reaction with the solution:
    A. Ammonium oxalate;

B. Potassium pyroantimonate;

C. Barium chloride;

D. Sodium hydroxide;

E. Sodium nitrite.

8. For the express analysis of a 10% glucose solution, it is necessary to determine its refractive index. What device should the pharmacist-analyst use in this case?

A. refractometer;

B. photocolorimeter;

C. potentiometer;

D. polarimeter;

E. spectrophotometer.

9. The quantitative content of calcium gluconate in accordance with the requirements of the SPhU is determined by the method of complexonometry. A solution is used as a titrant:

A. Sodium edetate;

B. Iodine monochloride;

C. Argentum nitrate;

D. Potassium permanganate;

E. Hydrochloric acids.

10. The presence of which group in glucose is indicated by the formation of a brick-red precipitate when heated with a copper-tartrate reagent (Fehling's reagent)?

A. Aldehydna;

B. Ketone;

C. Carboxylic;

D. Esterna;

E. Amidna.

3. Formation of professional skills:

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

The task 1. Calcium gluconate tablets of 0.5 g No. 10 in the amount of 900 packages, the average weight of the tablet is 0.53 g, if Krozr=1.06. (Tablets include starch, talc, calcium stearate).

The task 2. 500 l of glucose was obtained. Analyzes showed that the concentration of glucose is 39.5 and 42% of the drug.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of dibazole.	Calculate the equivalence factor of dibazol in its quantitative determination.	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. - 560 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, students summarized their knowledge of the pharmaceutical analysis of dibazole 0.005, glucose 0.2.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.

2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття.

Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 24

Topic: Peculiarities of using pharmaceutical analysis in quality control of medicines. Analysis of eye drops.

Goal: Summarize knowledge about the pharmaceutical analysis of medicinal substances that are part of eye drops.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;

- ✓ main literary sources, reference literature.

  The student should be able to:
- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

  List of didactic units:
- ✓ textbook text;
- ✓ bank of test tasks.

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

1. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:
   A. argentometry;
   B. complexonometry;
   C. nitritometry;
   D. acidimetry;
   E. alkalimetry.
2. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies the zinc cation by reacting it with a solution:
   A. potassium ferrocyanide;
   B. sodium chloride;
   C. potassium permanganate;

D. sodium nitrite;

E. ammonium oxalate.

3. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies sulfates by reaction with a solution:

   A. barium chloride;

   B. ammonium oxalate;

   C. potassium nitrate;

   D. sodium nitrite;

   E. iron (III) chloride.

4. An express analysis of eye drops containing zinc sulfate and boric acid is carried out. The quantitative content of zinc sulfate in this dosage form can be determined by the method:

   A. complexonometry;

   B. alkalimetry;

   C. cerimetry;

   D. polarimetry;

   E. nitritometry.

5. The pharmacist-analyst needs to perform a quantitative determination of chloramphenicol (levomycetin) in eye drops. For this he uses a method:

   A. nitritometry;

   B. complexonometry;

   C. gravimetry;

   D. cerimetry;

   E. permanganatometry.

6. A pharmacist-analyst conducts an analysis of chloramphenicol eye drops. To detect the active pharmaceutical ingredient, he adds sodium hydroxide solution; at the same time, a yellow color appeared, turning into red-orange. On which functional group was the reaction carried out?

   A. nitro group;

   B. phenyl radical;

C. aldehyde group;

D. imino group;

E. alcohol hydroxyl.

7. The 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. Carboxyl groups.

8. The quantitative content of atropine sulfate in eye drops is determined by the pharmacist-analyst using the method:

   A. Alkalimetry;

   B. Nitritomerii;

   C. Bromatometry;

   D. Mercurimetry;

   E. Complexonometry.

9. Riboflavin concentrate solution (1:5000) is used to make eye drops. Specify how much of the solution must be measured if the recipe says 0.001 riboflavin:

   A. 5 ml;

   B. 3 ml;

   C. 4 ml;

   D. 2 ml;

   E. 1 ml.

10. When conducting a qualitative chemical analysis of eye drops containing zinc sulfate, a reaction was carried out in the pharmacy to identify the zinc cation, which resulted in the formation of a white precipitate. What reagent was used in this case?

A. solution of potassium hexacyanoferrate (III);

B. sodium chloride solution;

C. potassium nitrate solution;

D. tartaric acid solution;

E. sulfuric acid solution.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction of atropine sulfate (M.m. 676.8) in the medicinal product, if the weight of the test piece is 0.4983 g, the volume of 0.1 N perchloric acid solution (KP=0.9892) spent on titration is 7 ,42 ml.

The task 2. Determine the mass fraction (%) of potassium iodide (M.m. 166.01) in the mixture, if 2.86 ml of 0.1 N argentum (I) nitrate solution (CP= 1, 0532); volumetric flask volume 50.00 ml, pipette volume 5.00 ml.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of pilocarpine hydrochloride.	Calculate the equivalence factor of pilocarpine hydrochloride in its quantitative determination.	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. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of medicinal substances included in eye drops.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.

3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 25

Topic: Analysis of 0.25% zinc sulfate solution.

Goal: Summarize knowledge about pharmaceutical analysis of zinc sulfate heptahydrate solution.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;

- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. A pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies the zinc cation by reacting it with a solution:
   A. potassium ferrocyanide;
   B. sodium chloride;
   C. potassium permanganate;

D. sodium nitrite;

E. ammonium oxalate.

2. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies sulfates by reaction with a solution:

   A. barium chloride;

   B. ammonium oxalate;

   C. potassium nitrate;

   D. sodium nitrite;

   E. iron (III) chloride.

3. An express analysis of eye drops containing zinc sulfate and boric acid is carried out. The quantitative content of zinc sulfate in this dosage form can be determined by the method:

   A. complexonometry;

   B. alkalimetry;

   C. cerimetry;

   D. polarimetry;

   E. nitritometry.

4. The pharmacist-analyst performs the identification of zinc sulfate with a solution of potassium ferrocyanide. At the same time, a precipitate is formed:

   A. white color;

   B. pink color;

   C. red color;

   D. blue color;

   E. orange-red color.

5. The analyst determines the presence of a zinc cation in the zinc sulfate substance. To do this, he conducted a reaction with sodium sulfide, which resulted in the formation of a precipitate:

   A. white;

   B. black;

   C. brown;

D. blue;

E. gray.

6. A pharmacist-analyst analyzes a dosage form containing zinc sulfate. With the help of which reagent can he confirm the presence of zinc cation in the studied dosage form?

   A. sodium sulfide;

   B. ammonium chloride;

   C. potassium ferricyanide;

   D. silver nitrate;

   E. sodium tetraphenylborate.

7. Preparations of calcium chloride, magnesium sulfate, zinc sulfate, bismuth nitrate basic can be quantitatively determined:

   A. complexonometrically;

   B. iodometrically;

   C. nitritometrically;

   D. acidimetrically;

   E. alkalimetrically.

8. For the quantitative determination of calcium, magnesium, and zinc salts, the method is used:

   A. Complexonometry;

   B. Alkalimetry;

   C. Acidimetry;

   D. Gravimetry;

   E. Argentometry.

9. The pharmacist-analyst determines the quantitative content of mercury dichloride by the complexonometry method. What titrated solution can be used to titrate sodium edetate solution?

   A. zinc sulfate;

   B. sodium hydroxide;

   C. sodium thiosulfate;

D. potassium bromate;

E. sodium methylate

10. The substance zinc sulfate heptahydrate was sent to the control and analytical laboratory for analysis. What method does the SPhU recommend for its quantitative determination?

A. Complexonometry;

B. Alkalimetry;

C. Acidimetry;

D. Permanganatometry;

E. Cerimetry.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of zinc sulfate heptahydrate (M.m. 287.54) in eye drops, if 0.34 ml of 0.05 N trilon B solution was spent on the titration of 2.00 ml of zinc sulfate heptahydrate solution (KP = 1, 0308).

The task 2. Determine the volume of 0.05 N of Trilon B solution (KP=1.1245), which will be spent on the titration of a weight of 0.2152 g of zinc sulfate heptahydrate (M.m. 287.54), if its percentage content in the medicinal product is 99.85%.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of zinc sulfate heptahydrate.	Calculate the equivalence factor of zinc sulfate heptahydrate in	Pharmaceutical chemistry: Textbook for students. higher pharmacy education closing and pharmacy Faculty of Medical Sciences for students higher pharmacy education

		its quantitative determination.	closing / In general ed. P.O. Bezuglio - Kind. 3rd edition, revised. – Vinnytsia, NOVA KNYGA, 2017. - 560 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, the students summarized their knowledge of the pharmaceutical analysis of zinc sulfate heptahydrate solution.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. :

Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.

2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 26

Topic: Peculiarities of using pharmaceutical analysis in quality control of medicines. Analysis of alcohol solutions.

Goal: Summarize knowledge about pharmaceutical analysis of medicinal substances. Analysis of alcohol solutions.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Ethyl alcohol (Spirityus aethylicus), which is used in medicine for rubs, compresses, preparation of extracts and solutions, should not contain ethanol impurities. Name the reagent used to determine this impurity:
   A. Ammonia solution of argentum nitrate;
   B. Alcohol solution of potassium hydroxide;
   C. Hydrochloric acid solution;
   D. Furfural solution;
   E. Acetamide solution.
2. For the identification of ethanol, it is necessary to carry out preliminary analysis:
   A. Iodoform sample;
   B. Murexide sample;
   C. Hydroxamate sample;
   D. Ninhydrin reaction;
   E. Thaleiochin sample.
3. As a result of the reduction of alcoholic solutions of 5-nitrofuran derivatives with zinc in the presence of dilute hydrochloric acid:
   A. discoloration of the solution;
   B. release of ammonia;
   C. precipitation and gas release;
   D. precipitation;
   E. change of yellow color to red.
4. To determine the identity of drugs derived from tropane, the Vitali-Moren reaction is used. For this purpose, after decomposition with nitric acid, the preparations are treated with an alcoholic solution of potassium hydroxide and acetone. At the same time, it happens:
   A. Color of the solution in violet color;
   B. The color of the solution is green;

C. Release of gas bubbles;

D. Falling of black sediment;

E. Precipitation of a white precipitate.

5. By what method, according to the SPhU, is the admixture of methyl alcohol in ethyl alcohol discovered:

   A. By the method of gas chromatography;

   B. Redox method;

   C. By the method of neutralization;

   D. By the deposition method;

   E. Complexonometry.

6. To identify the polyatomic alcohol of glycerol, the pharmacist-analyst conducts a dehydration reaction with potassium hydrosulfate. The resulting product has a characteristic pungent odor and causes a blue coloration of the filter paper moistened with a 1% solution of sodium nitroprusside and piperidine. Name this product:

   A. acrolein;

   B. diethyl ether;

   C. acetic acid;

   D. ethanol;

   E. chloroform.

7. When determining the identity of Phenylsalicylate [Phenylii salicilas], its alcohol solution gave a purple color. The identification reaction was carried out with the solution of which compound?

   A. $FeCl_3$;

   B. $CuSO_4$;

   C. NaOH;

   D. NaCl;

   E. K_2CO_3.

8. With what solution does the alcoholic solution of phenylsalicylate form a purple color?

A. iron (III) chloride;

B. ammonium oxalate;

C. potassium iodide;

D. potassium sulfate;

E. potassium permanganate.

9. The pharmacist-analyst performs the identification of sodium sulfacetamide. According to SPhU, after heating the substance with alcohol in the presence of sulfuric acid is formed:

A. ethyl acetate;

B. fluorescein;

C. iodoform;

D. thaleoquinine;

E. murexid.

10. The pharmacist-analyst of the laboratory of the State Inspection for Quality Control of Medicinal Products carries out the identification of "Thiamine hydrobromide" with a solution of potassium ferricyanide in an alkaline medium. At the same time, he observes the light blue fluorescence of the alcohol layer in UV light. Indicate which product is formed?

A. thiochrome;

B. murexide;

C. thaleoquinine;

D. ninhydrin;

E. quinonimine.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of potassium iodide (M.m. 166.01) in a 5% alcoholic solution of iodine, if 8.04 ml of 0.1 M argentum nitrate solution was spent on the titration of 2.00 ml of the drug (KP = 1.0000); volume of 0.1 N sodium thiosulfate solution (CP = 1.0000) used for iodine titration - 5.68 ml.

The task 2. Determine the mass fraction (%) of potassium iodide (M.m. 116.01) in a 5% alcohol solution of iodine, if 16.34 ml of 0.05 N argentum(I) nitrate solution (KP) was spent on the titration of 2.00 ml of the drug = 1.0000); and the volume of 0.05 N sodium thiosulfate solution (KP = 1.0000) was spent on iodine titration - 12.11 ml.

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantification of ethanol (96%).	Calculate the equivalence factor of ethanol (96%) in its quantitative determination.	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. - 560 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, students summarized their knowledge of pharmaceutical analysis of medicinal substances. Analysis of alcohol solutions.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.

2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття.

Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 27

Topic: Peculiarities of using pharmaceutical analysis in quality control of medicines. Calculations, examples.

Goal: Summarize knowledge about quantitative methods of analysis of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;

- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. As the main reagent when testing for the limit content of zinc impurities, the analytical chemist uses a solution:
   A. Potassium ferrocyanide;
   B. Ammonium thiocyanate;
   C. Sodium sulfide;
   D. Silver nitrate;
   E. Barium chloride.
2. To determine the impurity of potassium in medicinal compounds, the pharmacist-analyst conducts a reaction with:
   A. Sodium tetraphenylborate;
   B. Sodium nitrate;
   C. Sodium tetraborate;
   D. Sodium sulfate;

E. Sodium salicylate.

3. The chemist of the PCT of the pharmaceutical enterprise determines the quality of purified water. What reagent should he used to detect impurities of nitrates and nitrites?

   A. diphenylamine solution;

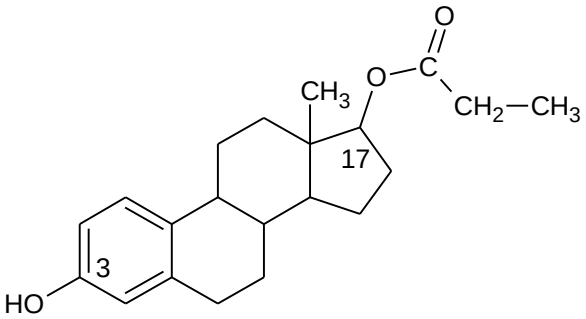
   B. ammonium oxalate solution;

   C. solution of sulfosalicylic acid;

   D. silver nitrate solution;

   E. barium chloride solution.

4. Name the functional groups in the estradiol propionate molecule:



   A. Phenolic hydroxyl, ester group;

   B. Alcohol hydroxyl, keto group;

   C. Enol hydroxyl, carboxyl group;

   D. Phenolic hydroxyl, ethoxy group;

   E. Alcoholic hydroxyl, ester group.

5. The structure of the drug molecule contains an ester group. To confirm its presence in the medicinal product, the pharmacist-analyst uses:

   A. Hydroxam sample;

   B. Le Rosen test;

   C. Murexide sample;

   D. Beilstein's test;

   E. Indophenol test.

6. The pharmacist-analyst conducts tests on the purity of the ether substance for anesthesia. One of the unacceptable impurities in the substance are aldehydes.

To detect the content of aldehyde impurities in accordance with the requirements of the SPhU, he conducts a reaction with reagents:

A. Potassium tetraiodomercurate alkaline solution;
B. Ammonium oxalate, ammonium chloride;
C. Hydrochloric acid, chloroform;
D. Sodium hydrogen phosphate, hydrochloric acid;
E. Sodium hydroxide, sodium carbonate.

7. A pharmacist-analyst performs an express analysis of a liquid dosage form containing calcium chloride. He identifies the chloride ion by reaction with the solution:

A. silver nitrate;
B. potassium pyroantimonate;
C. sodium tetraphenylborate;
D. ammonium oxalate;
E. barium chloride.

8. An express analysis of the antitussive mixture, which includes sodium bicarbonate and thermopsis grass extract, is carried out. The quantitative content of sodium bicarbonate in this mixture can be determined by the method:

A. acidimetry;
B. nitritometry;
C. cerimetry;
D. permanganatometry;
E. argentometry.

9. An express analysis of a mixture containing calcium chloride and sodium bromide is carried out. The summary definition of the ingredients of this dosage form can be determined:

A. argentometrically;
B. complexonometrically;
C. alkalimetrically;

D. polarimetrically;

E. nitritometrically.

10. The pharmacist-analyst performs an express analysis of powders containing ascorbic acid. The acidic properties of this substance allow for its quantitative determination by the method:

A. alkalimetry;

B. iodometry;

C. cerimetry;

D. iodometry;

E. complexonometry.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction (%) of hydrochloric acid (M.m. 36.46) in the medicinal product, if 12.52 ml of 1 N sodium hydroxide solution was used for the titration of 5.4582 g of it (KP = 1.0018).

The task 2. Calculate the mass fraction of zinc sulfate heptahydrate (M.m. 287.54), if 19.50 ml of 0.05 N Trilon B solution was spent on the titration of a weight of 0.3252 g (KP=1.1245).

The task 3. The mass fraction of nitrofural (M.m. 198.14) during the quantitative determination is equal to 98.92%. What volume of 0.01 N sodium thiosulfate solution (KP=0.9800) will be used for the titration of a weight of 0.0987 g? The volume of the measuring flask is 500.00 ml, the volume of the pipette is 5.00 ml.

The task 4. Determine the volume of 0.1 N of potassium iodate solution (KP = 1.0010), which will be spent on the titration of a weight of 0.4520 g of ascorbic acid (M.m. 176.13), if the percentage content of ascorbic acid in the medicinal product is 98.70%. The volume of the measuring flask is 50.00 ml, the volume of the pipette is 10.00 ml.

- Recommendations (instructions) for performing tasks.

Main tasks	Instructions	Answers
1. Quantification of piracetam. 2. Quantitative determination of potassium orotate. 3. Quantitative determination of sodium benzoate.	1. Calculate the piracetam equivalence factor for its quantitative determination. 2. Calculate the equivalence factor of potassium orotate when it is quantitatively determined. 3. Calculate the equivalence factor of sodium benzoate when it is quantitatively determined.	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. - 560 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, the students summarized their knowledge of quantitative methods of analysis of medicinal substances. Calculations of the percentage content of the active substance in various medicinal products have been improved.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.

5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 28

Topic: Qualitative express analysis of medicines.

Goal: Summarize knowledge about methods of express analysis of medicinal substances.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;

- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. A pharmacist-analyst conducts an express analysis of a 2% boric acid solution. Quantitative determination of the active substance is carried out by the method:
   A. alkalimetry;
   B. argentometry;
   C. complexonometry;
   D. nitritometry;
   E. acidimetry.
2. The pharmacist-analyst conducts an express analysis of the sedative mixture with sodium bromide. Quantitative determination of sodium bromide is carried out by the method:

A. argentometry;

B. complexonometry;

C. alkalimetry;

D. acidimetry;

E. nitritometry.

3. The pharmacist-analyst performs an express analysis of the extemporaneous mixture. He identifies the calcium cation by reacting it with a solution:

A. ammonium oxalate;

B. potassium pyroantimonate;

C. sodium tetraphenylborate;

D. copper (II) sulfate;

E. barium chloride.

4. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:

A. argentometry;

B. complexonometry;

C. nitritometry;

D. acidimetry;

E. alkalimetry.

5. 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.

6. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies the zinc cation by reacting it with a solution:

A. potassium ferrocyanide;

B. sodium chloride;

C. potassium permanganate;

D. sodium nitrite;

E. ammonium oxalate.

7. The pharmacist-analyst performs an express analysis of eye drops containing zinc sulfate. He identifies sulfates by reaction with a solution:

A. barium chloride;

B. ammonium oxalate;

C. potassium nitrate;

D. sodium nitrite;

E. iron (III) chloride.

8. A pharmacist-analyst performs an express analysis of a liquid dosage form containing calcium chloride. He identifies the chloride ion by reaction with the solution:

A. silver nitrate;

B. potassium pyroantimonate;

C. sodium tetraphenylborate;

D. ammonium oxalate;

E. barium chloride.

9. An express analysis of a liquid dosage form containing sodium salicylate and sodium benzoate is carried out. To detect salicylate and benzoate ions when they are present together, it is necessary to use a solution:

A. iron (III) chloride;

B. potassium iodide;

C. sodium nitrite;

D. ammonium chloride;

E. aluminum sulfate.

10. An express analysis of the antitussive mixture, which includes sodium bicarbonate and thermopsis grass extract, is conducted. The quantitative

content of sodium bicarbonate in this mixture can be determined by the method:

A. acidimetry;

B. nitritometry;

C. cerimetry;

D. permanganatometry;

E. argentometry.

3. Formation of professional skills:

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

The task 1. Determine the mass fraction of chloramphenicol (M.m. 323.13) in the medicinal product, if 14.02 ml of 0.1 N sodium nitrite solution was spent on the titration of a weight of 0.4590 g (KP=1.0028).

The task 2. Determine the mass fraction of atropine sulfate (M.m. 676.8) in the medicinal product, if 7.42 ml of 0.1 N perchloric acid solution was spent on the titration of 0.4990 g of atropine sulfate (KP = 0.9982).

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of diazepam.	Calculate the equivalence factor of diazepam in its quantitative determination.	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. - 560 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, the students summarized their knowledge of the methods of express analysis of medicinal substances.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. :

Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.

3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 29

Topic: Quality control and chemical-pharmaceutical examination of plant raw materials.

Goal: Summarize knowledge about pharmaceutical analysis and physico-pharmaceutical examination of medicinal plant raw materials.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

✓ Basic concepts and laws underlying various instrumental methods of analysis;

- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;
- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. 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:

A. isoquinoline;

B. furan;

C. indole;

D. tropana;

E. purine.

2. Chromatographic analysis is widely used in the Department of Agriculture of Ukraine for the identification of plant raw materials and phytopreparations. To identify individual substances in chromatographic analysis, the following value is determined:

   A. value R_f;

   B. melting point;

   C. boiling point;

   D. angle of refraction;

   E. rotation angle.

3. Codeine for medical purposes can be obtained semi-synthetically from a plant alkaloid. Select this alkaloid:

   A. Morphine;

   B. Papaverine;

   C. Protopin;

   D. Helidonin;

   E. Berberine.

4. At a pharmaceutical factory, juice is made from fresh vegetable raw materials. Specify which operation is performed at the stage of juice purification:

   A. Adsorption;

   B. Crystallization;

   C. Advocacy;

   D. Heating followed by sharp cooling;

   E. Filtration.

5. Tincture of which medicinal plant can the pharmacist offer as a tonic?

   A. Rhodiola pink;

B. Digitalis purple;

C. Common cedar;

D. Stamen orthosiphon;

E. White acacia.

6. The pharmacist prepared an infusion of althea roots. In what ratio did he take the amount of medicinal plant material and extractant?

   A. 1:100;

   B. 1:10;

   C. 1:30;

   D. 1:20;

   E. 1:400.

7. Common juniper is used as a diuretic, anti-inflammatory and choleretic agent. The medicinal raw material of this plant is:

   A. Leaves;

   B. Shoots;

   C. Roots;

   D. Seeds;

   E. Fruits.

8. One of the methods of obtaining essential oil is the method of enfleurage or maceration. Indicate from which medicinal plant raw materials essential oil is obtained by this method:

   A. Coriander seeds;

   B. Lemon peels;

   C. Mint leaves;

   D. Chamomile flowers;

   E. Damask rose petals.

9. The celery family is a biennial or perennial plant with a bluish branched stem in the upper part. The leaves are bluish, divided into filiform lobes. The flowers are yellow, collected in inflorescences a complex umbrella. "Dill water" is made from the fruits of this plant. Name the plant:

A. Carum carvi;

B. Conium maculatum;

C. Foeniculum vulgare;

D. Petroselium crispum;

E. Coriandrum sativum.

10. The phytochemical workshop of the enterprise manufactures biogenic stimulants from various types of raw materials. Specify preparations of biogenic stimulants of plant origin:

A. Liquid aloe extract, peloidin, aloe juice, biosed;

B. Liquid aloe extract, aloe liniment, aloe juice, biosed;

C. Peloidin, humizol, peat, FiBS for injections;

D. Vitreous body, suspended placenta for injections, aloe juice, biosed;

E. Peloidin, humizol, peat, plasmol, solcoseryl.

3. Formation of professional skills:

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

The task 1. Determine the mass of the theobromine sample (M.m. 180.17), if 16.50 ml of 0.1 N sodium hydroxide solution (KP=0.9903) was spent on its titration by the method of indirect neutralization. The mass fraction of theobromine in the medicinal product is 99.33%.

The task 2. Determine the mass fraction of atropine sulfate (M.m. 676.8) in the medicinal product, if 7.42 ml of 0.1 N perchloric acid solution was spent on the titration of 0.4990 g of atropine sulfate (KP = 0.9982).

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4

1.	Methods of extracting menthol.	Give methods of extracting menthol.	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. - 560 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, the students summarized their knowledge of pharmaceutical analysis and physico-pharmaceutical examination of medicinal plant raw materials.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.

7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

Practical lesson No 30

Topic: Topical control work by Topics: "Peculiarities of preparation and analysis of medicinal forms for injections, Peculiarities of preparation, analysis and storage of children's medicines, soft medicinal forms, analysis of eye drops, analysis of alcohol solutions, qualitative express analysis of medicines, control quality and chemical-pharmaceutical examination of plant raw materials.

Goal: Summarize knowledge about the peculiarities of preparation and analysis of dosage forms for injections, children's medicines, soft dosage forms,

analysis of eye drops, analysis of alcohol solutions, qualitative express analysis, quality control and chemical-pharmaceutical examination of plant raw materials.

Basic concepts: State Pharmacopoeia of Ukraine, qualitative analysis, quantitative analysis, pharmaceutical analysis, express analysis, 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:

- ✓ Basic concepts and laws underlying various instrumental methods of analysis;
- ✓ basic principles and possibilities of practical application of common instrumental methods of chemical analysis;
- ✓ methods, techniques and methods of physical and chemical analysis to establish qualitative composition and quantitative determinations;
- ✓ methods of separation of substances (chemical, chromatographic, extraction);
- ✓ the basics of mathematical statistics regarding the assessment of correctness and reproducibility of analysis results;
- ✓ safety rules when working in a chemical laboratory;
- ✓ the role and significance of instrumental methods in pharmacy, in the practical activity of a pharmacist;
- ✓ main literary sources, reference literature.

The student should be able to:

- ✓ work with the main types of devices used in the analysis;
- ✓ to choose the optimal instrumental method of qualitative and quantitative analysis of substances when analyzing real objects;

- ✓ separate cations and anions by chromatographic methods.
- ✓ conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;
- ✓ perform initial calculations, final calculations using statistical processing of quantitative analysis results;
- ✓ work independently with educational and reference literature.

List of didactic units:

- ✓ textbook text;
- ✓ bank of test tasks.

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

1. Codeine for medical purposes can be obtained semi-synthetically from a plant alkaloid. Select this alkaloid:
   A. Morphine;
   B. Papaverine;
   C. Protopin;
   D. Helidonin;
   E. Berberine.
2. At a pharmaceutical factory, juice is made from fresh vegetable raw materials. Specify which operation is performed at the stage of juice purification:
   A. Adsorption;
   B. Crystallization;
   C. Advocacy;
   D. Heating followed by sharp cooling;
   E. Filtration.
3. Tincture of which medicinal plant can the pharmacist offer as a tonic?
   A. Rhodiola pink;
   B. Digitalis purple;
   C. Common cedar;

D. Stamen orthosiphon;

E. White acacia.

4. The pharmacist-analyst conducts an express analysis of the sedative mixture with sodium bromide. Quantitative determination of sodium bromide is carried out by the method:

   A. argentometry;

   B. complexonometry;

   C. alkalimetry;

   D. acidimetry;

   E. nitritometry.

5. The pharmacist-analyst performs an express analysis of the extemporaneous mixture. He identifies the calcium cation by reacting it with a solution:

   A. ammonium oxalate;

   B. potassium pyroantimonate;

   C. sodium tetraphenylborate;

   D. copper (II) sulfate;

   E. barium chloride.

6. The pharmacist-analyst performs an express analysis of anti-inflammatory eye drops containing potassium iodide. Quantitative determination of the active substance is carried out by the method:

   A. argentometry;

   B. complexonometry;

   C. nitritometry;

   D. acidimetry;

   E. alkalimetry.

7. When determining the identity of Phenylsalicylate [Phenylii salicilas], its alcohol solution gave a purple color. The identification reaction was carried out with the solution of which compound?

   A. $FeCl_3$;

   B. $CuSO_4$;

C. NaOH;

D. NaCl;

E. K_2CO_3.

8. With what solution does the alcoholic solution of phenylsalicylate form a purple color?

   A. iron (III) chloride;

   B. ammonium oxalate;

   C. potassium iodide;

   D. potassium sulfate;

   E. potassium permanganate.

9. The pharmacist-analyst performs the identification of sodium sulfacetamide. According to SPhU, after heating the substance with alcohol in the presence of sulfuric acid is formed:

   A. ethyl acetate;

   B. fluorescein;

   C. iodoform;

   D. thaleoquinine;

   E. murexid.

10. The pharmacist-analyst of the laboratory of the State Inspection for Quality Control of Medicinal Products carries out the identification of "Thiamine hydrobromide" with a solution of potassium ferricyanide in an alkaline medium. At the same time, he observes the light blue fluorescence of the alcohol layer in UV light. Indicate which product is formed?

    A. thiochrome;

    B. murexide;

    C. thaleoquinine;

    D. ninhydrin;

    E. quinonimine.

3. Formation of professional skills:

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

The task 1. Determine the mass of the theobromine sample (M.m. 180.17), if 16.50 ml of 0.1 N sodium hydroxide solution (KP=0.9903) was spent on its titration by the method of indirect neutralization. The mass fraction of theobromine in the medicinal product is 99.33%.

The task 2. Determine the mass fraction of atropine sulfate (M.m. 676.8) in the medicinal product, if 7.42 ml of 0.1 N perchloric acid solution was spent on the titration of 0.4990 g of atropine sulfate (KP = 0.9982).

- Recommendations (instructions) for performing tasks.

№	Main tasks	Instructions	Answers
1	2	3	4
1.	Quantitative determination of dibazole.	Calculate the equivalence factor of dibazol in its quantitative determination.	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. - 560 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, students summarized their knowledge of the peculiarities of preparation and analysis of dosage forms for injections, children's medicines, soft dosage forms, analysis of eye drops, analysis of alcohol solutions,

qualitative express analysis, quality control and chemical-pharmaceutical examination of plant raw materials.

5. List of recommended literature:

Basic:

1. Handbook of pharmaceutical chemictry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. Europian Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. :

Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.

4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.