

**Thematic plan of seminar-type classes
in discipline « Physical and colloidal chemistry »
for students of 2024 year of admission
under the educational programme
cipher 33.05.01 Pharmacy,
specialisation (profile) Pharmacy
(Specialist's),
form of study full-time
for the 2025-2026 academic year**

| № | Thematic blocks | Practical training (PT) ³ | Hours (academic) ⁴ |
|-------------------|--|--------------------------------------|-------------------------------|
| 3 Semester | | | |
| 1. | Introduction to physical and colloidal chemistry. ¹ The main sections of physical and colloidal chemistry, goals, and objectives. ² | PT | 4 |
| 2. | Chemical thermodynamics. 1 Problems and methods of physical and colloidal chemistry. The first law of thermodynamics. Heat capacity. Calculations of thermal effects. ² | PT | 4 |
| 3. | Chemical Thermodynamics. Determination of Heat Effects. ¹ Laboratory Practice "Determination of the Heat of Neutralization of a Strong Acid by a Strong Base". Problem Solving. ² | PT | 4 |
| 4. | Second law of thermodynamics. Chemical equilibrium. 1 Chemical equilibrium. Study of the equilibrium of a homogeneous reaction in a solution. ² | PT | 4 |
| 5. | Thermodynamic potentials. Determining the direction of the process. ¹ Determining the direction of the process using thermodynamic data in isobaric, isochoric, and thermal processes. Laboratory practice "Determination of the integral heat of salt dissolution." ² | PT | 4 |
| 6. | Concluding test № 1 ¹ | PT | 4 |
| 7. | Colligative properties of solutions. Raoult's law, consequences of Raoult's law. Osmosis. The role of osmosis in biological systems. Solving problems. ² | PT | 4 |
| 8. | Heterogeneous equilibria. 1 Conditions for dissolution and precipitation. Laboratory practice "Conditions for precipitation and dissolution". Solving problems. ² | PT | 4 |
| 9. | Buffer systems. 1 The mechanism of action of buffer systems. Protholytic reactions. Henderson-Hasselbalch equations. Calculation of pH of protholytic systems. Solving problems. Zone of buffer action and buffer capacity. Buffer systems of blood. The concept of acid-base state of the body. Laboratory practice "Properties of buffer solutions". ² | PT | 4 |
| 10. | Concluding test № 2 ¹ | PT | 4 |
| 11. | Thermodynamics of phase equilibria. ¹ Conditions of phase equilibrium. Gibbs' phase rule. Problem solving. Analysis of one- and two-component systems Construction of a melting diagram of a binary system with simple | PT | 4 |

| | | | |
|-------------------|--|----|---|
| | eutectic. Laboratory workshop "Construction of a melting diagram of a 2-component system with simple eutectic".2 | | |
| 12. | Analysis of the solubility diagrams of limited-soluble liquids.1 Analysis of the mutual solubility diagram of substances with an upper critical temperature of dissolution using the Fath Gibbs rule. Leverage rule. Problem solving.2 | PT | 4 |
| 13. | Analysis of three-component systems. 1 Gibbs-Roseboom triangle. Extraction Principles of obtaining infusions and decoctions. Laboratory practice "Determination of the distribution coefficient of acetic acid between water and benzene".2 | PT | 4 |
| 14. | Electrochemistry. Electrical conductivity. Electrode potential.1 Electrochemistry conductors of the I and II kind. The concept of an electrode The emergence of a double electric layer. Types of electrical potentials and mechanisms of their occurrence, biological significance. The standard hydrogen electrode. The Nernst equation for calculating the electrode potential. Solving problems.2 | PT | 4 |
| 15. | Oxidation-reduction systems. Galvanic cell.1 Nerist-Petersa equation. Redox systems of the body. Solving problems. Galvanic cell. Types of galvanic cells. Daniel-Jacobi cell. Calculation of the EMF of a galvanic cell. Solving problems. Laboratory practice "Thermodynamics of a galvanic cell".2 | PT | 4 |
| 16. | Потенциометрия. Потенциометрическое титрование. ¹ Потенциометрические методы измерения pH. Электроды сравнения и определения Потенциометрическое титрование. Лабораторный практикум «Определение константы диссоциации слабой кислоты потенциометрическим методом». ² | PT | 4 |
| 17. | Concluding test № 3. ¹ | PT | 4 |
| 4 Semester | | PT | |
| 18. | Kinetics of chemical reactions. 1 The rate of a chemical reaction, the factors that affect it. The effect of temperature on the rate of a chemical reaction Destruction of medicinal substances Calculation of the temperature coefficient and activation energy Methods of calculating the shelf life of medicinal substances. Solving problems. 2 | PT | 4 |
| 19. | Study of the dependence of the decomposition rate of sodium thiosulfate on concentration and temperature.1 Laboratory practice "Study of the dependence of the decomposition rate of sodium thiosulfate".2 | PT | 4 |
| 20. | Molecular kinetics. TAS and TPS. ¹ | PT | 4 |
| 21. | Study of the kinetic patterns of complex reactions. 1 Pharmacokinetics. Problem solving.2 | PT | 4 |
| 22. | Catalysis. 1 Homogeneous catalysis. Heterogeneous catalysis. Enzyme catalysis. Michaelis-Menten equation.2 | PT | 4 |
| 23. | Concluding test № 4. ¹ | PT | 4 |
| 24. | Physical and chemical surface phenomena.1 Surface phenomena on the moving interface of the phase. Basic properties and features of surfactants. Adsorption on the liquid-liquid interface. Shishkovsky equation. Duclos-Traube rule.2 | PT | 4 |
| 25. | Adsorption at the liquid-liquid interface. 1 Laboratory exercise "The effect of chain length on the surface activity of normal aliphatic alcohols".2 | PT | 4 |
| 26. | Adsorption at the liquid-gas interface. | PT | 4 |

| | | | |
|-------|---|----|-----|
| | Analysis of the Gibbs equation. The Gibbs-Rebinder equation. The adsorption isotherm and its explanation. The Langmuir equation. The Freundlich isotherm. Experimental determination of the constants of these equations. ² | | |
| 27. | Adsorption on the solid-gas and solid-liquid interfaces. ¹ Laboratory exercise "Adsorption of acetic acid on activated carbon". Problem solving. ² | PT | 4 |
| 28. | Concluding test № 5. ¹ | PT | 4 |
| 29. | Dispersed systems. ¹ Classification of dispersed systems. Lyophobic colloidal solutions. Electro - kinetic properties of colloidal systems and electrophoretic methods of research in pharmacy. Micella. Properties of lyophobic colloidal solutions. ² | PT | 4 |
| 30. | Methods of purification and preparation of colloidal solutions. Physico-chemical basis of preparation of colloidal solutions. Methods of purification and preparation of colloidal solutions. Structure of colloidal particles. Laboratory practice "Preparation and properties of sols". ² | PT | 4 |
| 31. | Stability of colloidal solutions. Study of the process of sol coagulation by electrolytes. Stability of colloidal solutions. Determination of the coagulation threshold. Confirmation of the Schulze-Hardy rule. Laboratory practice "Determination of the coagulation threshold". ² | PT | 4 |
| 32. | Study of the properties of aerosols, emulsions, and suspensions. ¹ | PT | 4 |
| 33. | Features of the properties of solutions of high-molecular-weight compounds. ¹ Swelling and dissolution of HMC. Viscosity, types of viscosity. The Staudinger equation. Features of the properties of solutions of high-molecular-weight compounds. Osmotic pressure, Donnan membrane equilibrium. The Haller equation. ² | PT | 4 |
| 34. | Stability of solutions of HMC ¹ Determination of the molecular weight of the polymer by the viscometric method. Laboratory practice. «Determination of the molecular weight of the polymer by the viscometric method». ² | PT | 4 |
| 35. | Concluding test № 6. Final testing. ¹ | PT | 4 |
| Total | | | 140 |

1 – Topic

2 – Essential content

3 – PT (Practical training)

4 – one thematic block includes several classes, the duration of one class is 45 minutes, with a break between classes of at least 5 minutes

Considered at the department meeting chemistry protocol of «30»_May 2025 г. № 10.

Head of the Department

A.K.Brel'