LIST OF THEMES OF CHEMISTRY FOR FOREIGN STUDENTS.

1. Biogenic s- and p-elements; biological role, application in medicine.
2. Biogenic d-elements, biological role, application in medicine.
3. Complex formation in biological systems.
4. Acid-base equilibrium in biological liquids. Quantitative composition of solutions. Preparation of solutions.
5. Fundamentals of titrimetric analysis.
6. Acid-base equilibrium in human organism. The value of pH of biological liquids.
7. Buffer systems, classification and mechanism of action.
8. Determination of buffer capacity. Role of buffers in biological systems.
9. Colligative properties of solutions.
10. Thermodynamics and kinetic regularities of motion of processes and electrokinetic phenomena in biological systems.
11. Thermal effects of chemical reactions.
12. Kinetics of biochemical reactions.
13. Chemical equilibrium. The role of solubility in chemical equilibrium.
14. Determination of redox potential.
15. Physical and chemical surface phenomena.
16. Lyophilic and lyophobic disperse systems.
17. Sorption of biologically active substances on the surface of phase section.
18. Ionic exchange. Chromatography.
19. Methods of purification of colloid solutions. Properties of colloid solutions.
20. Coagulation of colloid solutions and protection from it.
21. Properties of solutions of biopolymers. Isoelectric point of albumen.

QUESTIONS FOR FINAL TESTING.

1. Biogenic elements: their electronic structure; typical chemical properties of elements and their connections – acid – basic, oxidation – reduction, complex formation. The relationshipn between the location of s-, p-, d-elements in the periodic system and their maintenance in human organism. Macro-, micro- and admixture of elements in human organism. Application in medicine.

2. Complex compoumds: theory of Werner, nature of chemical compounds, classification. Complex compounds in biological systems. Complex ions and their application in medicine.

3. The role of solutions in living matter.

4. Solubility of gases in liquids and its dependence on different factors. Law of

Henry – Dalton. Solubility of gases in blood.

5. The dependence of solubility of solid substances in liquids on different factors. Distribution of the substance between two liquids that do not mix. Distributing law of Nernst and its value in the phenomenon of permeability of biological membranes.

6. Solutions of electrolytes. The Ostwald's dilution law. Properties of solutions of strong electrolytes, activity and activity coefficient. The ionic strength of the solution. Water-electrolyte balance as a necessary state of homeostasis

7. Dissociation of water. Ionic product of water. The value of pH of solutions of strong and weak electrolytes. pH of biological liquids in a norm and pathology.

8. Acid-base theory. Types of protolitic reactions. Hydrolysis of salts, the degree of hydrolysis, dependence of hydrolysis on concentration and temperature, hydrolysis constant. The role of hydrolysis in biochemical processes.

9. Methods of titrimetric analysis. Method of acid–base titration: alkali- and acidimetry, their description. Acid-base indicators.

10. The buffer systems, their classification, mechanism of action, basic equations. Henderson-Hasselbalch equation. Experimental determination of buffer capacity. Buffer capacity of blood. Buffer systems of human organism and their mechanism of action. Acid-base equilibrium and alkaline reserve of blood.

11. Colligative properties of solutions. The decline of temperature of freezing and increasing of temperature of boiling of solutions. Raul's laws. Cryometry and ebuliometry, their application in biomedical investigations.

12. Osmosis, semi-permeable membranes, osmolality. Law of Shrouds - Gofa and its interpretation for nonelectrolytes and electrolytes. Isotonic coefficient. Types of solutions: hyper-, hypo-, isotonic solutions. Plasmolysis, hemolysis, turgor.

13. A role of osmosis in biological systems. Osmolality of blood plasma. Gallers equalization. Oncotic pressure. Application of osmometry in biomedical researches.

14. First law of thermodynamics. Internal energy. Enthalpy. Warmth of isobaric and isochoric processes.

15. Thermochemistry. Law of Hess. Thermo-chemical transformations. Standard heat of formation and combustion of matters.

16. Second law of thermodynamics. Entropy. Energy of Gibbs.

17. Chemical equilibrium. Thermodynamic equilibrium conditions. The direction of arbitrary processes. Exergonic and endergonic processes that occur in the body. Heterogeneous balance in the oral cavity.

18. Constant of chemical equilibrium. Methods of expression. Le Chatelier principle. The displacement of chemical equilibrium.

19. The rate of chemical reactions. The law of mass action for rate of chemical reactions. The rate constant of the reaction.

20. The types of reactions: simple and complex (successive, parallel, conjunction, circulating, chain).

21. Reaction order. Reactions of zero, 1st and 2nd order. Half – transformation period.

22. The dependence of reaction rate on temperature. Temperature coefficient. The Rule of Vant - Goff.

23. Arrhenius equation. The energy of activation. The concept of the theory of active collisions and the theory of the transition state.

24. Homogeneous and heterogeneous catalysis. Features of action of a catalyst. Mechanism of catalysis and its role in metabolic processes.

25. Enzymes as catalysts of biochemical reactions. The dependence of enzyme activity on temperature, enzyme and substrate concentration and pH.

26. Macroergic substances. ATP as universal energy source for biochemical reaction. Types of macroergic substances. Reactions of precipitation and dissolutions. Solubility equilibrium.

27. Electrode potentials and mechanism of their origin. Nernst's equation. Normal (standard) electrode potential.

LIST OF PRACTICAL WORKS AND TASKS FOR FINAL CONTROL.

1. To explain the chemical properties of s, p, d-elements and their bonds.

2. To interpret quality reactions on s, p, d-elements.

3. To explain the structure of complex bonds, determine the charge of complex formation, coordinating number.

4. Interpret the principles of formation of complex bonds and explain their constants of stability and instability.

5. Calculate the mass part of the substance in solution, molar concentration and molar concentration of equivalent solutions.

6. To calculate the pH of solutions of strong and weak electrolytes.

7. To determine the pH solutions by means of calorimetery.

8. To calculate the pH of the buffer systems, correlation of volumes of components and change of pH of the buffer systems as a result of addition of acids and bases.

9. To explain the principles of preparation of buffer solutions with the set of solutions with different values of pH.

10. To calculate the buffer capacity of acid and base solutions.

11. To interpret principles of determination of buffer capacity by way of blood acid and base and explain the results.

12. To explain the meaning of the osmolality of solutions, osmotic concentration, depression of solutions.

13. To analyse the ways of reception of semi-permeable membranes.

14. To explain osmotic processes in blood cells.

15. To explain the meaning of thermal effects of reactions, entropy, Gibbs energy.

16. Determine the direction of the chemical reaction.

17. Interpret the principle of determining the thermal effect of the neutralization reaction.

18. To determine the rate of chemical reactions, temperature coefficient, solubility and equilibrium constant.

19. To determine the direction of displacement of chemical equilibrium in chemical reactions.

20. To estimate the influence of concentration of substrate and temperature on the rate of chemical reactions.

21. To determine the value of pH by means of pH –meter.

22. To calculate redox potential by Peters equation.

23. To identify the substance by means of the value of Rf .

24. To explain the structure of micelle of colloid solutions.

25. To estimate the threshold of coagulation.

26. To determine the isoelectric point of HMC.

27. To analyse the influence of electrolytes, pH and temperature on stability of

HMC and swelling degree.

THEMATIC PLAN OF INDEPENGENT WORK OF STUDENTS.

1. To interpret conformities to law and explain the mechanisms of physical and chemical processes which take place in solutions and on the verge of division of phases, analyse intercommunications between these processes(by the phenomena) and their biological significance and use in practical medicine, to explain principles of certain methods of quantitative determinations bioactive matters.
2. To be able to determine quantitative maintenance of acids and

   bases in solution.

1. To execute potentiometric research, to determine the solution size of adsorption, to clear colloidal solution by the method of dialysis, to determine the isoelectric point of albumen, conduct express analysis of solutions by the method of TLC.
2. To execute potentiometric research, to determine the solution size of adsorption, to clear colloidal solution by the method of dialysis, to determine the isoelectric point of albumen, conduct express analysis of solutions by the method of TLC.
3. Biogeochemical provinces. Problems of contamination of biosphere.

4. Biological value of elements and their connections.
5. Methods of expression of concentration of solutions.
6. Theory of indicators.
7. Acid-base equilibrium in the organism of man and its maintenance.
8. Cryometry, application in medicine.
9. Potentiometric titration.
10. Catalysis and catalysts.
11. Deposition and dissolution reactions. The solubility of substances.
12. Chromatography, application in medicine.
13. Diagram of Donnan equilibrium

TYPES OF TASKS.

1. Calculation of Gibbs free energy.

2. Thermochemical calculation of solubility.

3. Calculation of chemical reaction rate.

4. Calculations of equilibrium and equilibrium displacement constants.

5. Calculations of the product solubility.

6. Calculations of redox-potential.

7. Calculations of Rf values.

8. The structure of the micelles. The threshold of coagulation.

OBLIGATORY MINIMUM OF THEORETICAL ISSUES.

As a result of the discipline, students must know:

- the basic provisions of thermodynamics, kinetics and catalysis,

- fundamentals of the doctrine of solutions that are necessary for proper understanding of biochemical processes;

- the main provisions of electrochemistry, physics and chemistry of surface phenomena and disperse systems necessary for understanding the structures and properties of biological membranes, and methods of medical practice: dialysis, electrophoresis, electroosmosis and others.;

- the structure of the major classes of natural organic compounds, macromolecules and structural elements of cells and metabolic processes in the body;

- predicting chemical behavior of natural organic compounds in certain environments;

- possible ways and conditions of conversion of functional groups in important classes of natural organic compounds and the basis of their genetic connectivity in biochemistry;

and be able to:

- practice safety in the chemical laboratory (treatment of caustic, toxic, volatile organic compounds, as well as heating appliances)

- to be able to determine the pH of solutions and biological substances with pH-meter (ionomer)

- analyze amino acids using paper chromatography;

- to separate mixtures of substances by thin layer chromatography;

- to determine the structure of the molecules in the presence of reaction centers, to determine their nature: acidic, basic, electrophilic or nucleophilic and qualitatively assess the possibility of reactive organic compound

- to conduct qualitative response in unsaturation, the patency diol fragment number of amino acids, glucose, fruit products, alkaloids;

- to use quantitative and qualitative analysis of organic substances;

- to analyze and process the results of the experiment. Correct skills in documentation - abstracts, registration records, prototypes, laboratory journal.

PRACTICAL SKILLS.

- Learning to work with educational and scientific literature, chemical reference books, using the special terminology;

- learn safety in the chemical laboratory (properties of caustic, toxic, volatile organic compounds, as well as heating appliances);

- treatment of chemical vessels and product of chemical experiment;

- to be able to determine the pH of solutions and biological substances by means of pH-meter (ionomer);

- learn the techniques of purification of colloidal systems by dialysis - an analysis of amino acids by paper chromatography;

- to separate mixtures of substances by thin layer chromatography - classify organic compounds on the structure of the carbon skeleton and functional groups in nature - to use the rules of chemical nomenclature.

- identify the chiral center of the molecule;

- learn about the special structure of biologically important organic compounds, make models of organic compounds.

- to determine the structure of the reaction centers of molecule, determine their nature: acidic, basic, electrophilic or nucleophilic and qualitatively assess their reactivity;

- to conduct qualitative response in unsaturation, the patency diol fragment number of amino acids, glucose, fructose, alkaloids ;

- qualitative analysis of diethyl ether and acetylsalicylic acid;

- qualitative analysis of acetone and glucose in biological fluids;

- to analyze and process the results of the experiment. Correct skills in documentation - abstracts, registration records, prototypes, laboratory journal.

RECOMMENDED LITERATURE.

1. Kenneth W. Raymond. General organic and biological chemistry: an integrated approach. Wiley & Sons, 2014.
2. Organic chemistry: problems and solutions. Bansal, Raj.K. New Age International, 2013. ISBN 978-81-224-3415-6.
3. Inorganic chemistry. Chakrabarty, D.K. New Age International, 2012. ISBN 978-81-224-3193-3.
4. W. Roch, T. Lemke, S. Zifo, D. Williams. Foye's principles of medicinal chemistry. Lippincott, 2012. ISBN/ISSN 9781609133450.
5. Chemistry: Principles and Reactions, Seventh Edition**.** William L. Masterton, Cecile N. Hurley, and Edward J. Neth. © 2012, 2009 Brooks/Cole, Cengage Learning. ISBN-13: 978-1-111-42710-8, ISBN-10: 1-111-42710-0
6. Organic chemistry. David R. Klein. Copyright © 2012 John Wiley & Sons, Inc. ISBN 978-0-471-75614-9 (hardback) Binder-ready version 978-0-470-91780
7. General, Organic, and Biological Chemistry, Fifth Edition.H. Stephen Stoker. © 2010 Brooks/Cole, Cengage Learning.
8. Smith, Janice G. Principles of general, organic, and biological chemistry / Janice Gorzynski Smith. -- 1st ed. Copyright © 2012 by The McGraw-Hill Companies, Inc. ISBN 978–0–07–351115–3 — ISBN 0–07–351115–3.