

## THERMODYNAMICS

1. What systems can a biological system (alive organism) that **exchanges substance and energy with the environment** be referred to?

- A. **Open, heterogeneous**      D. Isolated, heterogeneous  
 B. Closed, homogeneous      E. Closed, heterogeneous  
 C. Open, homogeneous

2. **Standard conditions** are determined by the following values of pressure and temperature (parameters of state):

- A. **101.3 kPa, 298 K**      D. 101.3 kPa, 273 K  
 B. 101.3 kPa, 0 K      E. 50 kPa, 273 K  
 C. 50 kPa, 298 K

3. The calculation of heat effects of chemical reactions at the pharmaceutical manufacture is based on the **Hess law**, which states that the reaction's heat effect is determined by:

- A. **The initial and final state of the system**  
 B. The course of the reaction  
 C. The pathway of the reaction  
 D. The number of the intermediate stages  
 E. The process duration

In the pharmaceutical company, without setting up an experiment, the researcher calculated the expected thermal effects of the chemical reaction. What properties determine the possibility of such calculation in accordance with the **Hess law**?

- A. **Initial and final state of system**  
 B. Mechanism by which the chemical change occurs  
 C. Process duration  
 D. Route by which the chemical change occurs  
 E. Number of intermediate stages

4. The main law of thermochemistry (**the Hess law**) states that the thermal effect of a chemical reaction

- A. **Does not depend on the reaction's pathway**  
 B. Depends on the nature of the initial substances  
 C. Depends on the nature of the reaction products  
 D. Does not depend on the nature of the reaction products  
 E. Does not depend on the nature of reactants

5. Chemical processes are accompanied by thermal effects that are submitted to the following law: "The thermal effect of a reaction **does not depend on the pathway of the process**, and it is determined by the initial and the final state of the system". It is the formulation of the:

- A. **Hess law**      C. Henry law  
 B. Raoult law      D. Nernst law      E. Avogadro law

6. **Hess law** can be applied under such conditions:

- A. **isochoric and isobaric**      D. any  
 B. at constant temperature      E. at constant volume  
 C. at constant pressure

7. Which of the given values belong to a state function, its change **doesn't on the reaction pathway**?

- A. **Enthalpy**      C. Work      E. Heat  
 B. Pressure      D. Volume

8. **The thermal effect** of the reaction of neutralization of acids HCl, HNO<sub>3</sub>:

- A. Identical      E. Depends on their basicity  
 B. is determined by their oxidation properties  
 C. Depends on the nature of acidic residue  
 D. Depends on the consequence of pouring of acid-base components

9. What substance does **enthalpy of formation equal zero** for?

- A. **O<sub>2</sub>**      C. H<sub>2</sub>O<sub>2</sub>      E. H<sub>2</sub>SO<sub>4</sub>  
 B. CaCO<sub>3</sub>      D. CO<sub>2</sub>

10. The **decrease** in the **temperature** of which process **increases** the **output** the reactions products (accelerates this process)?

- A. **Exothermal**      C. Endothermal  
 B. Isochoric      D. Isobaric      E. Adiabatic

11. In the technology of pharmaceuticals the main role play pressure, temperature, concentration. What process does **temperature increase** affect **accelerating** it?

- A. **Endothermic**      C. Exothermal  
 B. Adiabatic      D. Isochoric      E. Isobaric

12. For calculation of **thermal effects** of the reactions of the synthesis of medicines at **high temperature** the following equation is applied:

- A. **Kirchhoff equation**      D. Boltzmann equation  
 B. isobar equation      E. isochor equation  
 C. isotherm equation

13. The kinetics of thermal decomposition of a medicinal substance is studied in a **bomb calorimetre**. Determine the type of this process?

- A. **Isochoric**      C. Isobaric  
 B. Isothermal      D. Equilibrium      E. Cyclical

14. Yield of medical products can be enhanced by proper choice of temperature conditions during their production. What equation determines dependence of equilibrium constant from the temperature **under constant pressure**?

- A. **Isobaric lines of chemical reaction**  
 B. Isotherms of chemical reaction  
 C. Kirchhoff equation      E. Isochores of chemical reaction  
 D. Gibbs-Helmholtz equation

15. Which equation establishes the dependence of the equilibrium constant on temperature **at constant pressure**?

- A. **Chemical reaction isobar**  
 B. Chemical reaction isotherm  
 C. Kirchhoff equation      E. Chemical reaction isochor  
 D. Gibbs-Helmholtz equation

16. In the technology of medicinal preparation **temperature and pressure** are sustained **constant** very often. What is this process called?

- A. **Isobaric-isothermal**      C. Isochoric-isothermal  
 B. Isobaric      D. Isochoric      E. Isothermal

17. How is the process of medicines manufacturing at **constant temperature and volume** of the system called?

- A. **isochoric – isothermal**      C. isobaric – isothermal  
 B. isobaric      D. isochoric      E. isothermal

18. An **extensive property** of a thermodynamic system is:

- A. **internal energy**      C. pressure      E. density

B. temperature      D. concentration

19. System is present in an **isobar-isothermal** equilibrium. Which function describes the process?

- A. **Gibbs energy**      C. Helmholtz energy  
 B. Internal energy      D. Enthalpy      E. Entropy

20. What change of thermodynamic potentials is a criterion of the spontaneous chemical process course in conditions of **the pressure and temperature constancy**?

- A. **Gibbs isobar-isothermic potential**

- B. Helmholtz isochoric-isothermal potential  
 C. Gibbs-Helmholtz thermodynamic potential  
 D. chemical potential  
 E. electrochemical potential
21. What expression corresponds with the state of chemical equilibrium under **constant pressure and temperature**?  
 A.  $\Delta G=0$       B.  $\Delta F=0$   
 C.  $\Delta H=0$       D.  $\Delta U=0$       E.  $\Delta S=0$
22. Iodoform is decomposed during storage. Which of thermodynamic functions is a criterion of the process direction at **constant V and T**?  
 A. Helmholtz energy F      D. entropy S  
 B. enthalpy H      E. Gibbs energy G  
 C. internal energy U
23. What thermodynamic value is a criterion of direction of spontaneous processes under conditions of **constant volume and temperature**?  
 A. Helmholtz energy      D. Entropy  
 B. Gibbs energy      E. Chemical potential  
 C. Enthalpy
24. Helmholtz energy is a direction criterion of a spontaneous process at a constant:  
 A. Temperature and pressure  
 B. Entropy and volume  
 C. Internal energy and volume  
 D. Entropy and pressure  
 E. Temperature and volume
25. Work in isochoric process equals:  
 A. Zero      D. change in internal energy  
 B. change in Enthalpy      E. change in capacity  
 C. change in Entropy
26. For isochoric process the thermal effect is equal to:  
 A. internal energy change      D. process enthalpy change  
 B. Zero      E. entropy system change  
 C. Gibbs free energy change
27. Thermodynamic calculations allow to determine the possibility and **direction of spontaneous processes**. In **isolated** system the change in the following thermodynamic function is used:  
 A. Entropy      D. Gibbs energy  
 B. Helmholtz energy      E. Internal energy  
 C. E. Enthalpy
28. Synthesis of a medicinal substance takes place in an **isolated** system. What is the criterion of the **direction** of proceeding spontaneous process?  
 A. entropy change      D. Gibbs energy  
 B. Helmholtz energy  
 C. Internal energy      E. Enthalpy
29. Determine without calculations in which reaction the **entropy** of a system **increases**:  
 A.  $N_2O_4 = 2NO_2$       D.  $2CO + O_2 = 2CO_2$   
 B.  $H_2 + Cl_2 = 2HCl$       E.  $3H_2 + N_2 = 2NH_3$   
 C.  $2SO_2 + O_2 = 2SO_3$
30. Entropy of a system **decreases** during the process of:  
 A. Polymerisation      D. Melting  
 B. Evaporation      E. Sublimation  
 C. Dissociation
31. In **isolated** systems only such processes can take place spontaneously where **entropy**:  
 A. Increases      C. Decreases      E.  $S = 0$   
 B. Is a constant value      D.  $S = S_{min}$
32. In the pharmaceutical production processes of drug

synthesis take place under different conditions. **Entropy** stays **unchanged** in the following process:

- A. Adiabatic      C. Isothermal      E. Isochoric  
 B. Isobaric      D. Polytopic
33. Entropy is a value of:  
 A. free energy      E. internal energy of the system  
 B. full energy of the system  
 C. energy that can be used to perform a work  
 D. enthalpy
34. The **state** of the system which **does not change in time** at constant external factors is called:  
 A. Equilibrium      C. Nonequilibrium  
 B. Isothermal      D. Isobaric      E. Isochoric
35. Determine which **factor** can **increase output** of the reaction products of  $N_2+3H_2=2NH_3$ :  
 A. increase of pressure      D. addition of inert gas  
 B. increase in volume      E. decrease in pressure  
 C. addition of catalyst
36. While **increasing** the **pressure** chemical equilibrium will be **shifted into the side of reagents**. Determine such a system:  
 A.  $N_2O_4(g) \leftrightarrow 2NO_2(g)$   
 B.  $C(s) + O_2(g) \leftrightarrow CO_2(g)$   
 C.  $4HCl(g) + O_2 \leftrightarrow 2H_2O(g) + 2Cl_2(g)$   
 D.  $N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g)$   
 E.  $CO_2(g) + H_2(g) \leftrightarrow CO(g) + H_2O(g)$
37. Theory of chemical equilibrium allows to predict ways of maximal output of the medicinal substances. Which of the factors **doesn't influence the replacement of the chemical equilibrium**?  
 A. addition of catalyst  
 B. initial substances concentration change  
 C. products concentration change  
 D. temperature change      E. pressure change
37. What is the type of a thermodynamic process where system **turns into the initial state**?  
 A. Circle
38. Thermodynamic state of the system is characterized with such **state parameters**:  
 A. Extensive and intensive
39. Which parameter of a **thermodynamic** system belongs to **extensive**:  
 A. Volume
40. Chose the reaction where the equilibrium state **does not depend on pressure change**  
 A. reaction where number of gaseous is the same
41. The **equilibrium** state of chemical reaction belongs to certain processes that take place in chemical-pharmaceutical production. For reverse reactions it is described by:  
 A. Guldberg and Waage mass action law
- PHASE EQUILIBRIA**
1. Estimation of temperature of **phase transition** at different pressures is of great practical importance for modern pharmaceutical industry and can be done by applying:  
 A. Clapeyron-Clausius equation      D. Trutone rule  
 B. Gibbs phase rule      E. Mendelejev-Clapeyron equation  
 C. Konovalov laws

2. The following process belong to **phase transformation**:

- A. **Evaporation** C. polymerization  
B. Decomposition D. burning E. oxidation

3. Under which phase transformation **entropy increases**?

- A. **melting and evaporation**  
B. melting and crystallization  
C. boiling and condensation  
D. sublimation and crystallization  
E. crystallization and condensation

4. Which rule is used to characterize heterogeneous systems where **phase equilibrium** is established?

- A. **Gibbs phase rule** C. Van't-Hoff  
B. Nernst D. Staudinger E. Peters

5. How many **phases** are present in the equilibrium system?  $\text{NH}_4\text{HCO}_3(\text{s}) = \text{NH}_3(\text{g}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ .

- A. **3** B. 1 C. 4 D. 5 E. 2

6. Does the **number of the degrees of freedom** in equilibrium heterogeneous system depend on the number of components of system?

- A. **Depends** E. Does not depend  
B. Depends in condensed systems  
C. Depends in liquid twocomponent systems  
D. Depends in biochemical systems

7. Iodine used for medical purposes is purified by sublimation. The process that takes place is:  $\text{I}_{2(\text{cr})} \rightleftharpoons \text{I}_{2(\text{g})}$ . Point out the number of **phases, the number of components and the number of freedom** degrees for this equivalent system if  $n = 2$ :

- A.  **$P = 2; C = 1; F = 1$**   
B.  $P = 3; C = 1; F = 0$   
C.  $P = 1; C = 1; F = 2$   
D.  $P = 2; C = 2; F = 2$   
E.  $P = 3; C = 2; F = 1$

8. What is the kind of the given system, if in test tube limestone is heated  $\text{CaCO}_3(\text{s}) \xrightarrow{i^0} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

- A. **Heterogeneous, three -phased**  
B. Homogeneous, two-phased  
C. Homogeneous, one-phased  
D. Heterogeneous, two -phased  
E. Heterogeneous, four-phased

9. **Condensed** system is the system in which:

- A. **Gas phase is absent** E. Solid phase is absent  
B. Liquid phase is absent  
C. Components are present in a liquid state  
D. More than two components are present

10. Water in the **triple point** on the diagram of state is the system called:

- A. **Invariant** C. Monovariant E. Bivariant  
B. Trivariant D. Four-variant

11. At **triple point** of the water phase diagram:

- A.  **$f=0$**  C.  $f=2$  E.  $f=1$   
B.  $p=3; n=1$  D.  $p=3, f=1$

12. Which **phases** are present in equilibrium in the **triple point** on the diagram of state of water?

- A. **liquid water, ice, water vapour**  
B. liquid water, ice D. liquid water, water vapour  
C. ice, water vapour E. ice

13. **Thermal analysis** belongs to physical-chemical analysis, that studies dependence of:

- A. **Crystallization temperatures of binary systems on their composition**

B. Boiling temperatures of the system components

C. Crystallization temperatures of the system components

D. Boiling temperatures of the system mixture on their composition

E. Boiling temperatures of azeotropic mixtures

14. **Thermal analysis** is used in pharmacy to identify drugs and determine drug purity. What coordinates are necessary to build a **cooling curve**?

- A. Temperature-time D. Volume temperature  
B. Temperature-volume E. Pressure-time  
C. Volume-time

15. The line on the diagram of state **above** which the **solid** phase can not exist is called...

- A. **Solidus** C. Eutectic E. Mediana  
B. Liquidus D. Connode

16. What is the **number of components** in the point of intersection of **liquidus** line with **ordinate** axis on the diagram of fusibility?

- A. **1** B. 3 C. 2 D. 0 E. -

17. **Number of freedom degrees** at the point of intersection of liquidus with Y-axis on the fusibility chart of a two component system would equal:

- A. **0** B. 1 C. 2 D. 3 E. 4

18. How **many phases** are present in the mixture of **eutectic** composition at eutectic temperature in two component system?

- A. **3** B. 2 C. 5 D. 4 E. 1

19. Determine which **phases** are present in equilibrium in the **eutectic** point on the diagram of system camphor-chloralhydrate:

- A. **melt of eutectic composition, crystals of chloralhydrate, crystals of camphor**  
B. melt of eutectic composition  
C. crystals of camphor and chloralhydrate  
D. crystalline camphor  
E. melt of eutectic composition and crystalline camphor

20. In the **eutectic** point of twocomponent system with simple eutectic the following phases are present in equilibrium:

- A. **2 solid and the melt of eutectic composition**  
B. 2 liquid and 1 solid E. 3 solid phases  
C. 1 solid, 1 liquid and 1 gaseous  
D. 1 liquid and 1 solid

21. What is the **number of degrees of freedom** in system salol-camphor if the crystals of both components are formed simultaneously from the melt?

- A. **0** B. 1 C. 2 D. 3 E. -1

22. Determine the **number of the degrees of freedom** in the point of intersection of liquidus line with ordinate axis on the diagram of fusibility of twocomponent system:

- A.  **$F=0$**  C.  $F=2$  E.  $F=1$   
B.  $F=-1$  D.  $F=3$

23. **Mixture of crystals** of both components that is formed under the melt cooling is called:

- A. **Eutectic** C. isomorphic E. suspension  
B. Emulsion D. paste

24. Thermal analysis is widely used in pharmacy. How **many points** are present on diagram of fusibility salol-camphor that form a **simple eutectic** correspond to **invariant**?

- A. **3** B. 1 C. 2 D. 0 E. 4

25. Thermal analysis is widely used in pharmacy. Point out a **number of points** on the diagram of fusibility for *n*-toluidine–phenol, which components **form one chemical compound** where the number of **freedom degrees equals 0**:

A. 5 B. 1 C. 2 D. 4 E. 3

26. The **maximum point** on the fusibility diagram when the substances **form a stable compound** is called:

A. Singular C. Eutectic E. Equilibrium  
B. Maximum D. Critical

27. Thermal analysis is widely used in pharmacy. Point out a **number of points** on the diagram of fusibility for (**isomorphic substances**) NaBr–KBr, where the system is invariant.

A. 2 B. 0 C. 1 D. 3 E. 4

28. The correlation between the **masses of equilibrium phases** in the system on the diagram of fusibility at given temperature can be determined by the rule:

A. Lever rule D. Gibbs phase rule  
B. Duclot—Traube rule E. Schultze—Hardy rule  
C. Vant—Hoff rule

29. **Selective solvents** are used in laboratories and factories to isolate and refine essential oils, alkaloids, antibiotics and other pharmaceutical substances. This process is called:

A. Extraction C. Coagulation  
B. Sedimentation D. Flotation E. Flocculation

30. For calculation of the chloroform volume used for **extraction** of dibazole from aqueous solution we apply:

A. **distribution** coefficient  
B. chloroform boiling temperature  
C. diffusion coefficient  
D. dibazole fusion temperature  
E. water ebullioscopic constant

Name the process of removing one or several substances from a complex system by means of a **selective solvent**:

A. Dispersion  
B. **Extraction**  
C. Evaporation  
D. Crystallization  
E. Condensation

31. A **selective solvent** which is used for extracting of substance from medicinal plant material is called...

A. **Extracting agent** C. Extractor  
B. Extract D. Rafinate E. Eluent

32. **Extraction** is commonly used in pharmacy for separating mixtures, increasing the concentration of any solute and extracting lipophilic compounds from the herbal material. This process is based on:

A. Nernst **distribution** law  
B. Hess's law D. Third law of thermodynamics  
C. Dalton's second law E. Kononov's first law

33. The rate of **extraction** of a drug substance depends on the value of its distribution coefficient. If the distributed substance is characterized by different rates of **dissociation or association** in different phases, the distribution coefficient is calculated by:

A. **Shilov-Lepin equation** D. Gibbs' phase rule  
B. The first Raoult's law E. Nernst distribution law  
C. Van't Hoff rule

34. **Extraction** is a widely used method of isolating substances from systems. What is the best extractor for

iodine from the aqueous solution if distribution coefficients change in the range of the solvents:  $K_{CS_2} > K_{C_6H_6} > K(\text{cyclohexane}) > K_{C_6H_{14}} > K_{C_6H_{13}OH}$ ?

A. CS<sub>2</sub> C. C<sub>6</sub>H<sub>6</sub> E. C<sub>6</sub>H<sub>12</sub>  
B. Cyclohexane D. C<sub>6</sub>H<sub>13</sub>OH

35. Essential oils are used both in pharmaceutical and cosmetic industry. To **extract** essential **oils** from herbal raw material the following technology is used:

A. **Steam distillation** D. Potentiometry  
B. Conductometry E. Colorimetry  
C. Calorimetry

36. What is the name of the lowest temperature under which melt **crystallizations finishes**?

A. **Eutectic**

37. The bases of **extraction** process is:

A. **Distribution law**

## SOLUTIONS

1. Determine which parameter takes into account the deviation of the properties of **real solution from ideal one**

A. **Activity** D. fugitivity  
B. isotonic coefficient E. dissociation degree  
C. concentration

2. The best example of ideal solution which corresponds to **Raults** law is:

A. **any extremely diluted** D. acetone in chloroform  
B. chloroform in cyclohexane E. benzene in water  
C. benzene in ethanol

Saline solution with **0,9% of NaCl** in relation to blood serum can be characterized as:

A. **Isotonic**  
B. -  
C. Hypertonic  
D. Colloidal  
E. Hypotonic

3. Which mass of **sodium chloride** is necessary for production of **100 g** of the **isotonic** solution?

A. **0.85 g** C. 8.5 g E. 4.5 g  
B. 0.45 g D. 5.0 g

4. **Isotonic glucose** solution is widely used as a solvent or infusion medium for introduction of various drugs. What mass fraction is characteristic of this solution?

A. **5%** C. 1% E. 20%  
B. 15% D. 10%

5. The **pressure** of liquid vapor at **boiling** should be

A. **equal to atmosphere pressure**  
B. Minimal E. Maximal  
C. equal to the saturated vapour pressure at room temperature

D. equal to the saturated vapour pressure at 273 K

6. The pharmacopoeia **ebullioscopic** method of quantitative analysis of alcohol in the composition of an aqueous-alcohol mixture is based on the experimental determination of

A. **Boiling temperature** D. Crystallization temperature  
B. Resistance E. Temperature of dissolution  
C. Osmotic pressure

7. **Ebullioscopy** is a physical-chemical method based on determination of

A. **boiling temperature of the solution**  
B. freezing temperature of the solution

- C. osmotic pressure  
 D. relative deviation of solvent pressure  
 E. relative deviation of solution pressure
8. To determine the **molecular weight** of new medicines, as well as the estimation of their **isotonic concentration** one can use the method of:  
 A. **Cryoscopy** D. pH-metry  
 B. Polarography E. Calorimetry  
 C. Potentiometry
9. The **cryoscopic constant** equals the freezing temperature decrease of the solution containing 1 mole of the substance in:  
 A. **1000 g of the solvent** D. 1 L of the solvent  
 B. 100 g of the solution E. 1 L of the solution  
 C. 1000 g of the solution
10. **Cryoscopic constants** of water, benzene, chloroform, acetic acid and **camphor** equal to 1.86; 5.12; 4.9; 3.9; **40.0** respectively. Which of these solvents should be selected for the most accurate determination of the molar mass of a drug substance (nonelectrolyte) by the cryoscopic method?  
 A. **Camphor** C. Chloroform E. Acetic acid  
 B. Benzene D. Water
11. The **cryoscopic and ebullioscopic constants** depend on the:  
 A. **Solvent's nature**  
 B. Solution's concentration  
 C. Temperature  
 D. Nature of the dissolved substance  
 E. Nothing of the mentioned above
12. **Isotonic** solutions are the solutions which:  
 A. **Identical osmotic pressure**  
 B. Identical oncotic pressure  
 C. Identical pH in solution  
 D. Identical polarity of the molecules of dissolved substances  
 E. Identical mass fraction of dissolved substances
13. The **isotonic solutions** used in medicine should have the **osmotic pressure** equal to:  
 A. **700-800 kPa** D. 200-300 kPa  
 B. 300-400 kPa E. 500-600 kPa  
 C. 900-1000 kPa
14. Determine the **osmotic pressure** of the solutions used in medicine as isotonic to blood?  
 A. **740-780 kPa** D. 420-448 kPa  
 B. 900-960 kPa E. 600-670 kPa  
 C. 690-720 kPa
15. What solutions can be used as **infusion** ones?  
 A. **Isotonic**  
 B. Colloid solutions solutions  
 C. Hypertonic solutions  
 D. Ideal solutions  
 E. Hypotonic solutions
16. **Isotonicity** is required of infusion solutions. What phenomenon occurs when a **hypertensive** solution is introduced into blood plasma?  
 A. **Plasmolysis** C. Hemolysis  
 B. Osmosis D. Thixotropy E. Denaturation
17. A part of the **osmotic pressure** formed by highmolecular compounds, mainly by **proteins** is called:  
 A. **oncotic pressure** D. surface pressure  
 B. surface tension E. partial pressure  
 C. no correct answer
18. When calculating the **osmotic pressure of electrolyte** solutions according to the **van't Hoff law** the following coefficient is used:  
 A. **Isotonic coefficient** D. Osmotic coefficient  
 B. Activity coefficient E. Cryoscopic constant  
 C. Ebullioscopic constant
19. What solutions are characterized by using the **isotonic coefficient**?  
 A. **Electrolytes solutions**  
 B. Non-electrolytes solutions  
 C. Solutions of high-molecular substances  
 D. Solutions of colloid surfactants  
 E. Solutions of surface active substances
20. **Isotonicity** is a requirement for infusion solutions and eyes drops. Are 1% solutions of **glucose** and **potassium iodide isotonic** at the same temperature?  
 A. **No, they aren't** D. Yes, they are  
 B. Yes, they are at 310 K E. Yes, they are at 298 K  
 C. Yes, they are at 273 K
21. **Isotonicity** is a necessary requirement to infusive solutions. Give the value **impossible** for **isotonic coefficient**.  
 A. 1 B. 2 C. 3 D. 4 E. 4.5
22. Determine the value of **isotonic coefficient** for **zink sulfate** under the condition of complete dissociation in aqueous solution?  
 A. 2 B. 0 C. 1 D. 3 E. 4
23. Solution of some electrolytes are medicines. What is the maximum value of **isotonic coefficient for MgSO<sub>4</sub> solution**?  
 A. 2 B. 4 C. 3 D. 5 E. 7
24. Aqueous solution of **CaCl<sub>2</sub>** with mass concentration 10% is used for intravenous injections. What is the maximum value of **isotonic coefficient** of CaCl<sub>2</sub> in an aqueous solution?  
 A. 3 B. 4 C. 2 D. 5 E. 1
25. **Isotonicity** is a necessary requirement to injection solutions and eye drops. Which substance solution has the **highest osmotic pressure** at the same molar concentration and temperature?  
 A. **Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>** C. Cu(NO<sub>3</sub>)<sub>2</sub>  
 B. CuSO<sub>4</sub> D. C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> E. C<sub>12</sub>H<sub>22</sub>O<sub>12</sub>
26. The apparent degrees of dissociation of given electrolytes in 0.01 M aqueous solution are the same. Determine the substance the solution of which has the **highest boiling temperature**:  
 A. **Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>** C. KCl E. Na<sub>3</sub>PO<sub>4</sub>  
 B. Cu(NO<sub>3</sub>)<sub>2</sub> D. K<sub>3</sub>PO<sub>4</sub>
27. Which of the given 0.1M solutions: glucose, saccharose, AlCl<sub>3</sub>, KNO<sub>3</sub>, CaCl<sub>2</sub>, has the **highest osmotic pressure**?  
 A. **solution of AlCl<sub>3</sub>**  
 B. solution of glucose  
 C. solution of saccharose  
 D. solution of CaCl<sub>2</sub>  
 E. solution of KNO<sub>3</sub>
28. Which of the given 0.01 M solutions has the **highest osmotic pressure**  
 A. **Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>** C. urea E. fructose  
 B. Cu(NO<sub>3</sub>)<sub>2</sub> D. KCl

29. Among given aqueous solutions of medicines of the identical molarity the **maximal temperature of boiling** corresponds to the solution of:

- A. **Sodium sulfate**                      D. Promedole  
 B. Nicotinamide                      E. Resorcin  
 C. Iodine

30. Among given aqueous solutions of medicinal substances the molality of which is 0.1 mol/kg the **maximal elevation of boiling point** corresponds to the solution of

- A. **sodium acetate**                      D. glucose  
 B. nicotinic acid                      E. ethanol  
 C. ascorbic acid

31. Which of the given solutions of the same molar concentration has the **maximal osmotic pressure**:

- A. **aluminum nitrate**                      D. Glucose  
 B. sodium chloride                      E. Magnesium sulfate  
 C. Potassium iodide

32. If aqueous solutions of the drugs listed below are all of the same molarity, the **highest boiling temperature** will belong to:

- A. **Sodium sulfate**                      D. Resorcin  
 B. Promedol                      E. Nicotinamide  
 C. Iodine

33. Which of the following solutions with the same molar concentration has the **maximum osmotic pressure**?

- A. **Aluminum nitrate**                      D. Glucose  
 B. Sodium chloride                      E. Magnesium sulfate  
 C. Potassium iodide

34. Technology of pharmaceutical preparations requires sometimes that some processes take place at low temperatures. In which solution will the **crystallization be the first to begin** provided that solutions have equal molality?

- A.  $C_6H_{12}O_6$                       C. NaCl                      E.  $CaCl_2$   
 B.  $Al_2(SO_4)_3$                       D. KBr

35. There 5 aqueous solution with molal concentration 0.05 mol/kg. Which of the given solutions **are isotonic to each other**?

- A. **NaCl i  $MgSO_4$**   
 B.  $AlCl_3$  i  $CaCl_2$   
 C.  $CH_3OH$  i NaCl  
 D.  $C_6H_{12}O_6$  i NaCl  
 E.  $AlCl_3$  i  $CaCl_2$

36. In pharmaceutical industry for **purification** and extraction of some organic compounds with high temperature of boiling and **insoluble in water** the following method can be applied:

- A. **Distillation with water vapor**  
 B. Fractional distillation  
 C. Rectification  
 D. Consequent rectification  
 E. Thermal analysis

37. Aqueous-alcoholic mixtures are widely used in the medical and pharmaceutical practice. They relate to the azeotropes. What is the peculiarity of **azeotropic mixtures**?

- A. **They produce a vapor of the same composition as the mixture**  
 B. They don't mix together  
 C. They interact with each other  
 D. They don't interact with each other

E. They mix together at a critical temperature

38. The second Konovalov's law is applied to **azeotropic** solutions that have extreme points on phase diagrams and are called:

- A. **Azeotropic** mixtures  
 B. Ideal solutions  
 C. Miscible in all proportions liquids  
 D. Partially miscible liquids  
 E. Mutually insoluble liquids

39. **Cryoscopic constant** is calculated for some solvents as the decrease in crystallization temperature for

A. **one molal solution**

40. **Rault law** was used to determine the quantitative property of a solution. Which concentration has been determined?

A. **Mole fraction**

41. Under intravenous injection the erythrocytes have been **shrunk (plasmolysis)**. Which solution has been introduced?

A. **Hypertonic**

42. To purify an abscess **5% solution of NaCl** has been used. This solution is called:

A. **Hypertonic**

## ELECTROCHEMISTRY

1. **Biopotentials** caused by physiological processes are the result of **arise** at the **interface** of

- A. **double electrical layer**  
 B. adhesion layer  
 C. absorption layer  
 D. diffusion layer  
 E. Nothing

2. According to the first model of double electric layer, electric layer is a **plane condensate**. By the author it is model of:

- A. **Helmholtz**                      C. Hui                      E. Hui-Chepmen  
 B. Chepmen                      D. Stern

3. Which equation is applied for calculation of **electrode potentials**?

- A. **Nernst**                      C. Vant Hoff  
 B. Kohlrausch                      D. Fick                      E. Goldman

4. The **equivalent point** in the method of **potentiometric titration** is determined by the **sharp change** in:

- A. **Electromotive force**  
 B. Electrical strength  
 C. Current power  
 D. Fluorescence intensity  
 E. Diffusive current

5. Potentiometry is widely used in analysis of medicines. What galvanic cell has the electromotive force, which **does not depend on the values of standard electrode potentials**?

- A. Concentration one  
 B. Chemical one  
 C. With transfer  
 D. Without transfer  
 E. Reversible one

6. What type does  $Au^{3+}|Au$  electrode belong to?

- A. **The electrode of the first type**  
 B. The electrode of the second type  
 C. The electrode of the third type  
 D. Oxidation-redundant electrode

E. Ion-selective electrode

7. Which electrode belongs to the electrodes of the **first kind**:

A. **Hydrogen gas electrode**

B. Calomel standard electrode

C. Silver-silver chloride standard electrode

D. Quinhydrone electrode

E. Glass electrode

8. Calomel electrode is listed in the State Pharmacopoeia of Ukraine as **auxiliary electrode for pH measurement**.

What type of electrodes is it?

A. **Second kind**

D. First kind

B. Gaseous

E. Redox

C. Ion-selective

9. **Glass electrode** is widely applied in pharmaceutical analysis. To which kind of electrode does it belong to?

A. **Ion-selective**

D. First kind

B. Second kind

E. Simple redox

C. Complex redox

10. The degree of influence of interferent ions on the potential of **ion-selective electrode** is determined by the value of:

A. **Coefficient of selectivity**

B. Coefficient of diffusion

C. Coefficient of activity

D. Coefficient of electrical conductivity

E. Osmotic coefficient

What value determines the degree of influence that foreign ions have on the potential of an **ion-selective electrode**?

A. **Selectivity coefficient**

B. Electrical conductivity coefficient

C. Activity coefficient

D. Osmotic coefficient

E. Diffusion coefficient

11. What of the electrodes mentioned below can be used as an **indicator electrode while base titrating**?

A. **The glass electrode**

B. The chlorine silver electrode

C. The quinhydrone electrode

D. The platinum electrode

E. The calomel electrode

12. Drugs are commonly analyzed by means of potentiometric pH measurement. Which of the electrodes can be **used for measuring the solution pH**?

A. **Glass**

C. Standard hydrogen

B. Zinc

D. Calomel

E. Chlorine-silver

What **reference electrode** can be used in potentiometric analysis of a medicinal substance?

A. **Silver chloride**

B. Zinc

C. Glass

D. Quinhydrone

E. Antimony

13. Which electrode is used as a **reference electrode in potentiometric method**?

A. **Sat. calomel**

D. Hydrogen

B. Glass

E. Copper

C. Quinhydrone

14. Potentiometric method of pH determination is regarded as the most universal and enters into the National Pharmacopoeia of Ukraine. Which electrode is used as a **reference electrode**?

A. **Saturated calomel**

D. Quinhydrone

B. Glass

E. Hydrogen

C. Zinc

15. **Silver-silver chloride** electrode is applied as a reference electrode comparison at potentiometric analysis of solutions of medicinal substances. Its scheme is:

A. **Ag | AgCl, KCl**

B. Ag | Cl<sub>2</sub>

C. (-) Ag | Ag(+)

D. Ag | AgCl | HCl | стекл. мембр. | H<sup>+</sup>

E. Ag | KCl

16. Different electrodes are used in electrochemical methods of analysis for pharmaceutical preparation determination. **Potential of which electrode depends on the concentration of ion under determination**?

A. **Indicator**

C. silver-silver-chloride

B. Platinum

D. calomel

E. silver

17. Which **pair of electrodes** are applied for determination of **pH**?

A. **Glass - sat. calomel**

B. Zinc - silver-silver chloride

C. Copper - hydrogen

D. Copper - calomel

E. Oxygen - quinhydrone

18. Choose the **pair of electrodes for potentiometric pH** measurement of a solution:

A. **Glass and silver chloride**

B. Glass and antimonial

C. Calomel and silver chloride

D. Quinhydrone and antimonial

E. Mercury sulphate and silver chloride

19. What type of electrodes does a **chloride silver** electrode belong to?

A. **The second type**

D. The first type

B. Gaseous

E. Oxidate-redundant

C. Ion-selective

20. Electrode made according to the scheme **Red, Ox, H<sup>+</sup> | Pt** belongs to following type:

A. **Complex redox electrode**

B. Electrode of the second kind

C. Electrode of the first kind

D. Ion-selective electrode

E. Gas electrode

21. What is the type of **quinhydrone** electrode?

A. **Redox**

C. ionselective

B. first kind

D. second kind

E. gas

22. A **standard hydrogen** electrode is a platinum plate covered with platinum black and immersed into the solution of sulphate acid at temperature 298 K and p=1.013 10<sup>5</sup> Pa with the ions hydrogen activity of:

A. **1 mol/l**

B. 0.5 mol/l

C. 0.1 mol/l

D. 0.2 mol/l

E. 2 mol/l

23. According to the Ukrainian State Pharmacopoeia a **saturated calomel electrode** can be used as a reference electrode in the potentiometric method of pH determination. Point out the scheme of the electrode and its type.

A. **Cl<sup>-</sup> | Hg<sub>2</sub>Cl<sub>2</sub>, Hg second type electrode**

B. Cl<sup>-</sup> | AgCl, Ag second type electrode

C. Red, Ox, H<sup>+</sup> | Pt redox-electrode

D. Ag<sup>+</sup> | Ag first type electrode

E.  $H^+$  | glass membrane | HCl | AgCl, Ag ion-selective electrode

24. Calculate the solution's pH where  $[H^+] = 1.0 \cdot 10^{-8}$  mol/l.

A. 8 B. 6 C. 14 D. 1 E. 4

25. A copper plate was immersed into the 0.1 M copper sulphate solution. What **potential will appear at the interface of two phases?**

A. **Electrode potential** D. Diffusion one  
B. Contact one E. Membrane one  
C. Electrokinetic one

26. Which electrodes belong to **ion-selective?**

A. **All given**  
B. Ion-exchanger  
C. With solid ion-exchanger membranes  
D. On basis of a liquid ion-exchanger membrane  
E. Glass

27. What method is based on the functional dependence between the activity of the component studied and the **electrode potential** value?

A. **Potentiometry** D. Conductometry  
B. Polarography E. Amperometry  
C. Electrophoresis

28. **pH** of a liquid medicinal form can be measured with the help of:

A. **Ionomer** D. Polarograph  
B. Chromatograph E. Conductometer  
C. Polarimeter

29. Energy of **redox reactions on electrodes** is transferred into:

A. **Electric energy**

30. Among the listed cations the **greatest mobility** has the ion of:

A. **Hydroxone ( $H_3O^+$ )**

31. The method of physico-chemical measurement of electric **conductivity** is called:

A. **Conductometry**

### CHEMICAL KINETICS

1. **Chemical kinetics** it is a science that studies:

A. **the rates and mechanisms of chemical transformations and the factors affecting them**  
B. general rules of reactions proceeding  
C. the rates and the possibilities of reactions proceeding  
D. the factors affecting chemical reactions  
E. possibility and direction of reactions

2. How are the chemical **reaction rates of the same order compared:**

A. **By the chemical reaction rate constant value**  
B. By the chemical reaction rate value  
C. By the time of the reaction finish  
D. By the change in the concentration of the reagents  
E. By the change in the concentration of the reaction products

3. **Rates of chemical reactions** of the same order are compared by:

A. **Constant of chemical reaction rate**  
B. Change in the concentration of the reaction products  
C. Chemical reaction rate  
D. Change in the reactants concentration  
E. Endpoint of a reaction

4. Using the reaction rate constants it is possible to make a conclusion according to the process of different

reactions. Which of the **factors INFLUENCE on the reaction rate constant?**

A. **temperature**  
B. pressure  
C. volume  
D. concentration  
E. time

5. The study of dependence of the reaction rate on different factors allows to intensify technological processes of pharmaceutical manufactures and determine the shelf life of medicines. Which of the factors **does not affect the rate constant** of a chemical reaction?

A. **Concentration of the reagents**  
B. Temperature  
C. The nature of the reagents  
D. The nature of a solvent  
E. Dispersity of a solid substance

6. **Reaction rate constant numerically equals reaction rate, if molar concentrations of:**

A. **Reagents equal 1** D. Reagents differ by 1  
B. Products are identical E. Products differ by 1  
C. -

7. How does the rate of the elementary reaction  $2A + B \rightarrow 2C$  increase if the reagent concentrations **increase twice?**

A. **8 times** C. 4 times E. 2 times  
B. 6 times D. 16 times

8. How does the rate of a simple reaction of  $2A \rightarrow B + C$  type change when the concentration of substance A **decreases twice?**

A. **Decreases four times** D. Increases four times  
B. Decreases two times E. Increases two times  
C. Does not change

9. How will the rate of chemical reaction be changed  $2NO(g) + O_2(g) = 2NO_2(g)$  if the initial concentration will be **increased 3 times?**

A. **Increases 27 times**  
B. Decreases 27 times  
C. Increases 9 times  
D. Decreases 9 times  
E. Does not change

10. In which case do the **order and molecularity** of chemical reactions **coincide?**

A. **only for simple one-stage reactions**  
B. always coincide E. coincide never  
C. only for complex multistage reactions  
D. for enzyme reactions

11. The **rate** of a chemical reaction **does not depend on the concentration** of the reactants. Specify the order of such reaction:

A. **Zeroth** C. First E. Second  
B. Third D. Fraction

12. Determine the order and molecularity of reaction of **saccharose hydrolyses**  $C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 (gl) + C_6H_{12}O_6 (fr)$

A. **biomolecular, pseudofirst**  
B. biomolecular, third order  
C. biomolecular, second order  
D. monomolecular, second order  
E. monomolecular, first order

13. Which of the given reactions belongs to the reactions of **pseudofirst** order?



**A. saccharose hydrolysis**

B. etherification

D. saponification

C. neutralization

E. burning

14. Determine the order of the reaction of **saccharose hydrolysis**?

A. Pseudofirst

C. zeroth

B. Second

D. third

E. fractional

15. The reaction of **decomposition** of a medicine is the reaction of the

A. **First order**

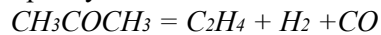
D. Second order

B. Zeroth order

E. Third order

C. Fractional order

Specify the order of acetone **breakdown reaction**:

A. **First**

B. Third

C. Zero

D. Second

E. Fractional

16. The **half-life** period of which of the reactions is expressed by equation  $t_{1/2} = \ln 2/K$

A. **First order**

D. Second order

B. Third order

E. Zeroth order

C. Fractional order

17. The dimension of **rate constant** of a hypothetical reaction is  $s^{-1}$ . Determine the total order of the reaction.

A. **First**

D. Zeroth

B. Second

E. Third

C. Fractional

18. What is the order of reaction if its half-life period is **reversely proportional to initial concentration**?

A. **Second**

C. first

B. Third

D. zero

E. fractional

19. Reaction rate constant has the **dimension L/mol\*min**. Determine the order of this reaction.

A. **Second**

C. first

B. Third

D. zero

E. fractional

20. Determine the order of a simple reaction of the type  $2A + B = 3D$ .

A. **reaction of the 3 order**

B. reaction of the 1 order

C. reaction of the 2 order

D. reaction of the 0 order

E. impossible

21. The **half-life period** of the reaction  $A \rightarrow B$  is **inversely proportional to the initial concentration** of substance A. What is the order of this reaction?

A. **The second order reaction**

B. The first order reaction

C. The third order reaction

D. The zero order reaction

E. The fractional order reaction

22. Specify the order of the reaction, for which  $k = 1/t(1/c - 1/c_0)$ :

A. **Second**

C. Zeroth

B. First

D. Fractional

E. Third

23. It is known that the half-life period of a reaction is **inversely proportional to the reagent's initial concentration square**. Name the order of the reaction:

A. **The third order reaction**

B. The first order reaction

C. The second order reaction

D. The zero order reaction

E. The fractional order reaction

24. Determine the order of a chemical reaction if the experimental data show the linear dependence of the **inverse concentration** of reagents on time:

A. **The second order**

B. The first order

C. The third order

D. The zero order

E. The fractional order

25. For precise calculation of rate constant by the activation energy value the **steric factor** is applied which takes into account:

A. **Interorientation of reacting molecules**

B. Chemical properties

C. Concentration of reacting substances

D. Temperature of a reaction mixture

E. Molecule structure of reacting compounds

26. How are the reactions in which the cycle of elementary acts with participation of active particles is **multiply repeated** called?

A. **Chain**

B. Conjugative

D. Consecutive

C. Parallel

E. Photochemical

27. Conditions of experimental determination of medical substance **shelf-storing by the accelerating method** differ from standard one by:

A. **The increased temperature**

B. The decreased temperature

C. The increased pressure

D. The decreased pressure

E. The addition of catalyst

28. The method of "**accelerated ageing**" used for studying of storage terms of medicines is based on

A. **Vant-Hoff rule**

B. Pannet-Fayans rule

C. Plank postulate

D. Ostwald law

E. Raoult law

29. According to **Vant Hoff rule**, when the temperature is raised by 10 degrees, the reaction rate increases by:

A. **2-4 times**

D. 5 times

B. 1.5 times

E. 10 times

C. Temperature does not affect reaction rate

30. The temperature coefficient for the rate of a chemical reaction is 4. How many times will the reaction rate increase if the temperature is raised by **30 °**?

A. **64 times**

C. 32 times

B. 128 times

D. 16 times

E. 8 times

32. **Van't Hoff** rule is used to determine the shelf-life of medical preparations. What are the limit of **temperature coefficient** for the majority of chemical reactions?

A. **2-4**

C. 2-3

E. 1-3

B. 3-4

D. 1-5

33. Temperature quotient of the reaction velocity is equal to 2. In how many times does the reaction velocity change, if the temperature changes by **40 °C**?

A. **In 16 times**

D. In 8 times

B. In 4 times

E. In 32 times

C. In 24 times

34. The temperature coefficient of the reaction rate is 3. How many times does the reaction rate increase if the temperature raises by 30 °C?

- A. 27 times                      C. 9 times  
B. 18 times                      D. 36 times                      E. 45 times

35. Research of reaction rate dependence from various factors allows to intensify technological processes. What factor **HAS NO effect on reaction rate constant**?

- A. **Reacting agents concentration**  
B. Temperature  
C. Reagents nature  
D. Solvent nature  
E. Solid substance dispersion degree

36. Which equation describes the dependence of the **rate constant of the chemical reaction on temperature**?

- A. **The Arrhenius equation**  
B. The Langmuir equation  
C. The Mendeleyev–Clapeyron equation  
D. The Kirchhoff equation  
E. The Nernst equation

37. The reaction of phenol nitration proceeds with formation of ortho- and para-nitrophenol. Which type of the reactions does it belong to?

- A. **Parallel reaction**  
B. Consecutive reaction  
C. Conjugative reaction  
D. Reversible reaction  
E. Chain reaction

38. Pharmaceutical synthesis requires studying complex reaction kinetics. If the first stage product is the **second stage initial substance**, then such reaction is called:

- A. **Consecutive**  
B. Inverse  
C. Concerted  
D. Second order  
E. Parallel

39. In nature some reactions proceed due to the **light energy** absorption by reacting substances. These reactions are:

- A. **Photochemical reactions**  
B. Chain reactions  
C. Consecutive reactions  
D. Parallel reactions  
E. Conjugative reactions

40. **Enzymes** increase biochemical reactions more than in  $10^8$  times. Which equation describes the **rate** of enzyme catalysis?

- A. **Mihaelis-Menten equation**  
B. Van't-Hoff equation                      E. Arrhenius equation  
C. Acting mass law  
D. Isotherm of chemical reaction Van't-Hoff equation

41. Which of the factors plays the main role in **reaction rate increasing while temperature rises**?

- A. **Active molecules part increases**  
B. General number of collisions increases  
C. Activation energy increases  
D. Activation energy decreases  
E. Rate of molecules movement increases

42. **Enzymes** (biological **catalysts**) are used as pharmaceutical preparations. What is the mechanism of the action of enzymes (biological catalysts) in biochemical reactions?

A. **Decrease activation energy of reaction**

- B. Increase activation energy  
C. Inhibit the reaction process  
D. Change the reaction rate constant  
E. Change the reaction kind

43. **What data** is required to determine the **activation energy**?

- A. **Constants of reaction rate at two temperatures**  
B. Thermal energy of the reaction  
C. Energy change of the system  
D. Internal energy of the system  
E. Reaction order

44. The **decrease in activation energy** increases the output of products in the synthesis. This process can be promoted by:

- A. **Addition of a catalyst**  
B. Increase in temperature  
C. decrease in temperature  
D. Increase in concentration  
E. Decrease in concentration

45. Why does the reaction rate in the presence of a **catalyst** increase?

- A. **Activation energy decreases**  
B. Total number of the molecule collisions increases  
C. Activation energy increases  
D. The number of the molecule collisions decreases  
E. The velocity of moving molecules increases

46. Determine the type of homogeneous catalysis for the **biochemical** processes with participation of proteins as **catalysts**?

- A. **Enzymatic**  
B. Acid-base                      D. Oxidation-reduction  
C. Coordination                      E. Homogeneous gas-phase

47. Determine basic difference of enzymes from non-**biological catalysts**.

- A. **High specific action and selectivity**  
B. High universality  
C. Low universality  
D. High dispersivity  
E. High homogeneity

Enzymes are widely used as drugs in pharmacy. What is the main **difference** that separates **enzymes** from non-biological catalysts?

- A. **High specificity and selectivity**  
B. Low universality  
C. High universality  
D. High homogeneity  
E. High dispersion

48. What is the dimension of **activation energy**?

- A. **J/mol**                      C. J                      E. J/K  
B. J/m<sup>2</sup>                      D. Kkal

#### SURFACE PHENOMENA

If in the process of molecular adsorption the **solute is being adsorbed more than the solvent**, then the following occurs:

- A. **Positive adsorption**  
B. Ion adsorption  
C. No adsorption  
D. Selective adsorption  
E. Negative adsorption

In medical and pharmaceutical practice the phenomena of **adsorption, wetting, and adhesion** are regularly observed. Name this group of phenomena:

**A. Surface phenomena**

**B. Electrokinetic phenomena**

**C. Physico-chemical phenomena**

**D. Molecular-kinetic phenomena**

**E. Optical phenomena**

1. The that take place on the **interface** of different phases – wetting, adhesion, **adsorption** and other are called:

**A. Surface phenomena**

**D. Phase equilibria**

**B. Chemical interaction**

**E. Kinetics**

**C. -**

2. The adsorbing action of powders with the increase in **dispersivity**

**A. Increases**

**D. decreases**

**B. Does not change**

**E. disappear**

**C. Nothing**

3. If **surface tension decreases** while **concentration** of the substance **increases**, such a substance is called:

**A. surface active**

**D. surface nonactive**

**B. surface inactive**

**E. indifferent**

**C. polar**

4. Characteristic **feature** of the structure of **SAS** molecule is:

**A. Diphility**

**D. Polarity**

**B. Nonpolarity**

**E. Ionogeneity**

**C. Non-ionogeneity**

5. Which liquid substance has the **maximal surface tension**?

**A. Water**

**D. Ethanole**

**B. Benzene**

**E. Acetone**

**C. Chloroform**

6. Which equation can be used for calculation of **surface tension** in the aqueous solution of propionic acid?

**A. Shishkovsky**

**B. Freundlich**

**D. Gibbs**

**C. Helmholtz-Smolukchovsky**

**E. Rayleigh**

7. Give the unit of **surface tension** value:

**A. N/m**

**C. N/m<sup>2</sup>**

**E. N\*m<sup>2</sup>**

**B. N/kg\*m<sup>2</sup>**

**D. N\*kg/m<sup>2</sup>**

What device is used to **measure surface tension** of a liquid?

**A. Stalagmometer**

**B. Viscometer**

**C. Areometer**

**D. Calorimeter**

**E. Nephelometer**

8. Determine the **surface-active substance** for aqueous solution-air interface?

**A. butiric acid**

**C. Saccharose**

**B. NaCl**

**D. NaOH**

**E. HCl**

9. Choose the colloid **surfactant** among the substances listed below?

**A. potassium oleate**

**D. iodine**

**B. sodium chloride**

**E. polyethylene**

**C. gelatin**

10. Name a **surfactant** among the given substances:

**A. C<sub>2</sub>H<sub>5</sub>OH**

**C. H<sub>2</sub>O**

**E. NaCl**

**B. HNO<sub>3</sub>**

**D. K<sub>4</sub>Fe[(CN)<sub>6</sub>]**

11. In the terms of water-air interface, the following substance acts as a **surface-active substance**:

**A. Valeric acid**

**C. HCl**

**B. NaOH**

**D. Urea**

**E. Nothing**

Surfactants are compounds that lower the surface tension (or interfacial tension) between two liquids, between a gas and a liquid, or between a liquid and a solid. Which of the following substances exhibits the properties of a surfactant at the air-water interface?

**A. Valeric acid**

**B. NaOH**

**C. -**

**D. HCl**

**E. Urea**

12. Which of the substances listed below are **surface-nonactive** towards water solution-air surface interface:

**A. sodium chloride**

**D. acetic acid**

**B. sodium stearate**

**E. ethanol**

**C. acetone**

13. The addition of surfactants with the purpose of formation of adsorption layers is widely applied in the technology of drug production. What substance is **surface indifferent** in relation to the aqueous solution-air interface?

**A. Saccharose**

**B. Acetic acid**

**C. Ethanol**

**D. Methylamine**

**E. Acetone**

14. Aqueous solution of the following substance will have the **smallest surface tension**, if all the listed solutions are taken in the same concentration:

**A. Sodium stearate**

**D. Sucrose**

**B. Sodium hydroxide**

**E. Sodium chloride**

**C. Ethanol**

15. What substances given bellow belong to **surface non-active agents** with respect to the aqueous solution-air interface?

**A. Inorganic acids, bases and their salts**

**B. Aldehydes and alcohols**

**C. Carboxylic acids and soaps**

**D. Amines and sulphoacids**

**E. Alcohols and soaps**

16. Microorganisms that reach blood and other biological systems have **negative** surface charge. That surfactants are used as **antibacterial** agents to suppress the action of microorganisms?

**A. Cationic**

**C. Lyophobic**

**B. Lyophilic**

**D. Anionic**

**E. Micellar**

17. Surfactants are commonly used in pharmaceutical production. What kind of surfactant is potassium **oleate**?

**A. Anionic**

**D. None of the above**

**B. Cationic**

**E. Amphoteric**

**C. Nonion**

18. Choose the formula of **nonionic surfactant** among those listed below:

**A. CH<sub>3</sub>(OCH<sub>2</sub>CH<sub>2</sub>)<sub>10</sub>OH**

**B. C<sub>15</sub>H<sub>31</sub>COONa**

**C. C<sub>11</sub>H<sub>23</sub>OSO<sub>3</sub>Na**

**D. C<sub>6</sub>H<sub>13</sub>NH<sub>2</sub>COONa**

**E. C<sub>2</sub>H<sub>5</sub>NH<sub>2</sub>\*HCl**

19. **C<sub>n</sub>H<sub>2n-1</sub> C<sub>6</sub>H<sub>4</sub>SO<sub>3</sub>H<sup>-</sup> \* Na<sup>+</sup> SAS** is used in synthetic washing soaps. What is the kind of such a SAS?

**A. Anionic**

**D. Cationic**

- B. Nonionic                      E. Amphoteric  
 C. Nothing mentioned
20. Colloid surface active substances (SAS) of the different kind are widely used in pharmacy and cosmetic production. Such substances of biological origin as **aminoacids** are:
- A. **Ionic amphoteric SAS**  
 B. Ionic anionactive SAS  
 C. Nonionic amphoteric SAS  
 D. Nonionic SAS  
 E. Ionic cationic SAS
21. The **influence** of the **hydrocarbon radical** length on the **surface activity** is described by the:
- A. **Duclaux–Traube rule**  
 B. van't Hoff rule  
 C. Antonov rule  
 D. Schulze–Hardy rule  
 E. Rehbinder rule
22. According to **Duclot-Traube** rule applied in synthesis of SAS Traube coefficient is equal to:
- A. 3-3.5                      C. 1-2  
 B. 2-3                      D. 0-1                      E. 4-4.5
23. How many times does the surface activity increase at the increase in the length of **SAS hydrocarbon radical** by **CH<sub>2</sub> group**?
- A. 3.2                      C. 1.5                      E. 6.4  
 B. 2.8                      D. 0.5
24. **Activated carbon** application in medicinal practice is based on its:
- A. high **adsorption** ability  
 B. hydrophobic properties  
 C. hydrophilic properties  
 D. weak density  
 E. solubility in water
25. Which **adsorbent** adsorbs better SAS from **aqueous** solutions
- A. **Activated carbon**  
 B. Silica gel                      D. Bentonite  
 C. Quartz                      E. Cellulose
26. For the SAS **adsorption** from **nonpolar** benzyl solvent the best adsorbent is:
- A. **silicagel**  
 B. carbon                      D. charcoal  
 C. Talk                      E. smutty
27. The powders containing plant extract and **activated carbon** is characterized by low therapeutic activity. Which surface phenomenon depends on the decrease of their activity?
- A. **Adsorption**  
 B. Desorption                      D. Adhesion  
 C. Cohesion                      E. Spreading
28. Pharmacological effect of **enterosgel** (hydrogel of methylsilicic acid) is based upon the following phenomenon that is typical for disperse systems:
- A. **Adsorption**                      D. Adhesion  
 B. Cohesion                      E. Moistening  
 C. Desorption
29. Which phenomenon is on the basis of the method of **haemosorption**?
- A. **Adsorption**                      D. Osmosis  
 B. Electroconductivity                      E. Coagulation  
 C. Adhesion

30. The process of **spontaneous change** in the component **concentration** in a surface layer of aqueous solutions in comparison with phase volume is called
- A. **Adsorption**                      D. wetting  
 B. Desorption                      E. cohesion  
 C. adhesion
31. Which of the **adsorbents** is the most effective at adsorption of the substance from aqueous solution?
- A. **Activated carbon**                      D. Silica gel  
 B. Quartz                      E. White clay  
 C. Gyps
32. How does the **physical adsorption** change with the **increase in temperature**?
- A. **Decreases**                      E. increases  
 B. transforms into chemisorption  
 C. increases in heterogeneous systems  
 D. increases in homogeneous systems
33. How does the **physical adsorption** change with the **decrease in temperature**?
- A. **increases**  
 B. decreases  
 C. transforms into chemisorption  
 D. increases in heterogeneous systems  
 E. increases in homogeneous systems
34. The process of adsorption on activated carbon is widely applied in pharmacy. What equation should you choose to calculate adsorption on a **solid adsorbent**?
- A. The Freundlich equation  
 B. The Gibbs equation  
 C. The polymolecular adsorption isotherm equation  
 D. The Dubinin equation  
 E. The Shishkovsky equation
35. What are the units for **adsorption** on solid surface?
- A. **mol/kg**                      C. mol/dm<sup>3</sup>  
 B. mol/m<sup>3</sup>                      D. mol/L                      E. mol/m<sup>2</sup>
36. **Isotherms** of monomolecular adsorption are built in the coordinated:
- A. **adsorption-concentration**  
 B. surface tension-concentration  
 C. inverse adsorption-inverse concentration  
 D. adsorption logarithm-concentration  
 E. inverse adsorption-concentration
37. The process when the **chemical** interaction between molecules of **adsorbate** and active centers of **adsorbent** takes place is called:
- A. **Chemisorption**  
 B. Adsorption                      D. Solvation  
 C. Desorption                      E. Sublimation
38. The method of treating people with serious diseases and intoxications is based on the **adsorption** of toxic substances from the **blood**. What is this method called?
- A. **Hemosorption**                      D. Ultrafiltration  
 B. Electrophoresis                      E. Dialysis  
 C. Headsorption
39. **Molecular theory** of **adsorption** is described by the equilibrium state of:
- A. **Langmuir**                      C. Polany  
 B. Brunauer                      D. Emmet                      E. Teller
40. The **adsorption** of electrolytes occurs by the **Paneth–Fajans rule**, according to which the crystals are constructed by:

A. Only those ions or atoms that are in their composition or they are isomorphous with them

B. Only anions

C. Only cations

D. Any ions from the solution

E. Only those ions, which are not in their composition

41. Who are the authors of the rule "Only those ions or atoms that are in their composition or they are isomorphous with them are adsorbed on the surface of crystal lattice"?

A. Paneth, Fajans

B. Duclot, Traube

C. Vant-Hoff

D. Rehbinder

E. Schultze, Hardi

42. Technology of medicinal substances preparation widely uses adsorption and ion exchange. Which of the ions is adsorbed better from negatively charged adsorbent layer?

A.  $\text{Cs}^+$  B.  $\text{H}^+$  C.  $\text{Li}^+$  D.  $\text{K}^+$  E.  $\text{Na}^+$

43. Which of the ions adsorbs selectively from aqueous solution on the crystal of silver chloride?

A.  $\text{Ag}^+$  C.  $\text{H}^+$  E.  $\text{NO}_3^-$

B.  $\text{Cu}^{2+}$  D.  $\text{OH}^-$

44. When the sol is obtained using the condensation method by the reaction of the excess of barium chloride with sodium sulphate, the charge of a granule is determined by ions of:

A. Barium D. Sodium

B. Chloride E. Sulphate

C. Nothing of the mentioned above

45. Anionites are such sorbents that are able:

A. to exchange their anions and medium anions

B. to exchange their cations on medium cations

C. to exchange their ions on medium molecules

D. adsorb ions from the medium

E. adsorb molecules from the medium

46. Wetting occurs when a drop of a liquid comes into contact with the surface of a solid substance. The degree of wetting is measured through:

A. Contact angle

B. Surface tension

C. Drop size

D. Drop density

E. Work of adhesion

47. While water purification for pharmaceutical production such a method is used:

A. Ion exchange

48. Ionexchange adsorption is used for water softening. To do this water is washed through:

A. Cationite in  $\text{H}^+$  form and anionite in  $\text{OH}^-$  form

49. One of the most important characteristics of solid adsorbents is:

A. Specific surface

## COLLOID CHEMISTRY

1. Bioavailability of a powder depends on the degree of dispersing of substance the measure of which is:

A. Dispersivity of a system

B. Concentration of a substance

C. Volume of the particles

D. Mass of the particles

E. Density of a solution

2. Some drugs have the form of colloid solutions. What size of dispersal phase particles corresponds with colloidal dispersion?

A.  $10^{-9}$ -- $10^{-7}$  m

B.  $10^{-7}$ -- $10^{-4}$  m

C.  $>10^{-4}$  m

D.  $<10^{-9}$  m

E.  $10^{-9}$ -- $10^{-4}$  m

3. Prepared emulsion of a medicine has the particles of disperse phase of the size  $10^{-6}$  m. Which type of disperse systems does this medication (classification by dispersivity) belong to?

A. microheterogeneous system

B. heterogeneous system

C. coarse-disperse system

D. colloidal-disperse system

E. ultramicroheterogeneous

4. Blood is a complex lyophilic disperse system, where plasma is a disperse medium and the size of particles of the phase is in the limit 2-13  $\mu\text{g}$ . This blood fraction can be characterized as:

A. microheterogeneous

B. ultramicroheterogeneous

C. coarse dispersed

D. high dispersed

E. low dispersed

5. What is the type of disperse systems for foams?

A. Bound disperse

B. colloid-disperse

C. ion-molecular

D. hydrosols

E. aerosols

6. According to the structure colloid dispersed systems are divided on:

A. free dispersed and bound dispersed

B. lyophilic and lyophobic

C. hydrosols and aerosols

D. coarse dispersed and microheterogeneous

E. hydrosols and organosols

7. Disperse systems that disperse spontaneously and form thermodynamically stable colloid solutions are:

A. lyophilic

B. micellar

C. homogeneous

D. equilibrium

E. lyophobic

8. Interaction between disperse phase and dispersion medium for different systems is observed in different degree. If disperse phase has weak interaction with medium, such a system is called:

A. lyophobic

B. lyophilic

C. free dispersed

D. hydrophilic

E. bound disperse

9. Choose lyophilic disperse system from the mentioned below:

A. SAS solution

D. emulsion

B. Sol

E. suspension

C. solid clay

10. Pharmaceutical preparation "Panthenol" is a **gaseous disperse phase** in **liquid disperse medium**. What is the name of such a system?

- A. **Foam**                      D. Suspension  
 B. Aerosol                    E. Emulsion  
 C. Powder

11. Many medicinal remedies are disperse systems. Which type of disperse systems do **emulsions** belong to?

- A. **L-L**                      C. L-S  
 B. S-S                      D. S-L                    E. G-L

12. Which system belongs to disperse system **liquid-liquid**?

- A. **Milk**                    C. foam  
 B. Aerosol                    D. suspension                    E. powder

13. **Suspensions** are often used in pharmacy. Which type does this disperse system belong to?

- A. **S-L**                    C. G-G                    E. G-L  
 B. L-L                    D. L-G

14. The microheterogeneous systems with **liquid dispersive medium** and **solid disperse phase** are

- A. **Suspensions**                      D. foams  
 B. Powders                      E. aerosols  
 C. emulsions

15. Which class of disperse systems does a **paste** belong to?

- A. **Suspension**                    C. emulsion  
 B. Powder                    D. foam                    E. aerosol

16. **Pastes** are used in medicine for treating skin diseases. What class of disperse systems do pastes belong to?

- A. **Suspensions**                    D. Aerosol  
 B. Powders                    E. Emulsions  
 C. Foams

17. Suspension is a form of pharmaceuticals used in medical practice. Which pair of substances is able to form a **suspension**?

- A. **Water-clay**  
 B. Water-oil  
 C. Ethanol-ethyl acetate  
 D. Water-ethanol  
 E. Ethanol-diethyl ether

18. Medicines Zimesol, Hyposol, Promesol, etc. contain the particles of a colloidal size and the **gaseous** dispersion medium. Such medicinal form is called:

- A. **Aerosol**                    D. Foam  
 B. Emulsion                    E. Suspension  
 C. Paste

19. Many medicinal forms are disperse systems. Point out a **free disperse** system:

- A. **Emulsion**                    C. Gel  
 B. Jelly                    D. Diaphragm                    E. Membrane

20. **Emulsions** are one of the forms of pharmaceutical preparations applied in pharmacy. Which pair forms an emulsion:

- A. **water-oil**  
 B. water-ethanol  
 C. ethanol-diethylether  
 D. water-diethylether  
 E. methylstearate-water

21. Disperse systems are of great importance among medicinal forms. Point out a **bound disperse** system:

- A. **Gel**                    D. Emulsion  
 B. Lyosol                    E. Suspension  
 C. Aerosol

22. The process of **spontaneous dissolution** of **insoluble** in given solution substances into micellar systems of colloidal surface-active agents is

- A. **solubilization**  
 B. condensation  
 C. sedimentation  
 D. coagulation  
 E. adhesion

What two methods of obtaining a disperse system can be characterized as **physical condensation**?

- A. **Vapour condensation and solvent substitution**  
 B. Ultrafiltration and peptization  
 C. Ultrafiltration and vapour condensation  
 D. Chemical condensation and peptization  
 E. Dispergation and peptization

23. Hydrosols of sulphur, colophony, cholesterol are obtained adding **alcoholic solutions** of these substances to **water**. What method is used?

- A. **Solvent substitution**  
 B. Chemical condensation  
 C. Condensation from vapours  
 D. Mechanical dispersing  
 E. Nothing of the mentioned above

24. Which method of production of sols belongs to **physical condensation**?

- A. **Solvent substitution**  
 B. Reduction  
 C. Oxidation  
 D. Hydrolysis  
 E. Double exchange

25. Emulsions, ointments, pastes, etc. can be prepared by **powdering** of solid and liquid substances in a corresponding medium. This process is:

- A. **Dispersion**                    D. Condensation  
 B. Sedimentation                    E. Coagulation  
 C. Adhesion

26.  $\text{Al}(\text{OH})_3$  sol is produced by treatment of fresh **sediment** of  $\text{Al}(\text{OH})_3$  with small amount of HCl solution. Which method is applied?

- A. **Chemical peptization**  
 B. Chemical condensation  
 C. Washing by solvent  
 D. Mechanical dispersing  
 E. Physical condensation

27. The method consisting in **removal** of low-molecular **impurities** from a colloidal systems and high-molecular compound solutions by **semipermeable** membrane diffusion is called?

- A. **Dialysis**  
 B. Complex dialysis  
 C. Ultra-filtration  
 D. Decantations  
 E. Electrodialysis

28. Colloid system is **purified** by the method of **filtration** under **excess** of **pressure** through semipermeable membrane. Such a method is called:

- A. **Ultrafiltration**  
 B. Filtration  
 C. Diffusion  
 D. Dialysis  
 E. Electrodialysis

29. In "artificial kidney" blood under high pressure flows between two membranes which are washed by physiological solution outside. This process is based on

**A. dialysis and ultrafiltration**

B. coagulation

C. sedimentation

D. dispersing

E. adsorption

29. Name the **structural unit of a colloidal solution** of a medicinal substance:

**A. Micelle**

B. Atom

C. Molecule

D. Zwitterion

E. Ion

30. The **structural unit** of a **colloidal solution** of medicine is:

A. micelle

C. molecule

E. atom

B. ion

D. zwitter-ion

31. **Microcrystals** of an **insoluble** compound located in the **centre** of micelle form:

**A. Aggregate**

B. Diffusive layer of counter-ions

C. Granule

D. Layer of the potential-determining ions

E. Adsorption layer of counter-ions

32. What particles of the micelle described by the following formula:  $m(\text{AgCl}) n\text{Ag}^+ (n-x) \text{NO}_3^- x\text{NO}_3^-$  are situated in **diffusion** layer?

**A.  $\text{NO}_3^-$**

B. AgCl

D.  $\text{Ag}^+$

C. AgCl and  $\text{Ag}^+$

E.  $\text{Ag}^+$  and  $\text{NO}_3^-$

33. What will be the formula of micelle of Argentum (I) iodine sol, produced from the solutions of  **$\text{AgNO}_3$  and KI** in the excess of **Argentum (I) nitrate**?

**A.  $m[\text{AgI}]n\text{Ag}^+(n-x)\text{NO}_3^- x + x\text{NO}_3^-$**

B.  $m[\text{AgI}]n\text{K}^+(n-x)\text{I}^- x + x\text{I}^-$

C.  $m[\text{AgI}]n\text{I}^- (n-x)\text{K}^+ x - x\text{K}^+$

D.  $m[\text{AgI}]n\text{NO}_3^- (n-x)\text{Ag}^+ x - x\text{Ag}^+$

E.  $m[\text{AgI}]n\text{Ag}^+ (n-x)\text{I}^- x + x\text{I}^-$

34. What electrolyte should be used as a stabilizer for a **positively charged** granules of a **Berlin blue** sol?

**A.  $\text{FeCl}_3$**

B.  $\text{K}_4[\text{Fe}(\text{CN})_6]$

C.  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$

D. KCl

E. any other electrolyte

35. Blood is a typical colloid system. As a result of a complex fermentative process the blood **coagulates** that provides minimal **blood loss**. It is conditioned by the ability of the particles to:

**A. coagulation**

B. adsorption

C. adhesion

D. cohesion

E. wetting

36. Protargolum and **collargolum** may lose the aggregative stability at **sticking together** of the particles of a disperse phase, this process is called

**A. coagulation**

B. peptization

C. swelling

D. sedimentation

E. gelation

37. At pouring together of sols with **unlikely charged granules** the following process takes place:

**A. Intercoagulation**

B. Sedimentation

C. Increase in aggregative stability

D. Increase in sedimentation stability

E. Colloidal protection

38. What happens if the equal volumes of **positively** and **negatively charged** sols of Berlin blue are poured together?

**A. Mutual coagulation**

B. Sedimentation

C. Syneresis

D. Peptization

E. Tixotropy

39. The **coagulating** action of an **electrolyte** depends on:

**A. charge of a coagulating ion**

B. ions of the charge identical to a colloidal particle

C. electrical conductivity of solution

D. composition of the micelle aggregate

E. size of the particles of a colloidal system

40. By **Schultze Hardy** rule the **coagulating** action of coagulating ion depends on:

**A. ion charge**

B. ion size

C. Adsorptive capability

D. Hydration capability

E. Polarization

41. The **coagulating** ability of electrolytes with respect to some sols **decreases** in the consequence:  $(\text{NH}_4)_3\text{PO}_4$ ,  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{NH}_4\text{NO}_3$ . Determine the charge of a colloidal particle?

**A. Positive**

D. Negative

B. No charge

E. electroneutral

C. First no charge, then becomes negative

42. Coagulation thresholds of a medicinal sol with electrolytes  $\text{MgSO}_4$ ,  $\text{NaCl}$ ,  $\text{Al}(\text{NO}_3)_3$  are 0.81; 51.0; **0.095** mmol/l. Which of the electrolyte ions shows the most coagulating action?

**A.  $\text{Al}^{3+}$**

D.  $\text{Mg}^{2+}$

B.  $\text{Na}^+$

E.  $\text{Cl}^-$

C.  $\text{SO}_4^{2-}$

43. **Positively** charged sol of ferrum hydroxide is produced by hydrolysis method. Which of the coagulating ions has the **lowest coagulation threshold**?

**A. phosphate**

B. sulfate

D. chloride

C. nitrate

E. bromide

44. What ions have maximal coagulative effect, when added into **positive** sols?

**A.  $\text{PO}_4^{3-}$**

B.  $\text{SO}_4^{2-}$

C.  $\text{Cl}^-$

D.  $\text{K}^+$ ;  $\text{Na}^+$

E.  $\text{Al}^{3+}$ ;  $\text{Fe}^{3+}$

45. Sol of iron (III) hydroxide is **positively** charged. Specify the ion which has the **lowest coagulation threshold**:

**A.  $\text{SO}_4^{2-}$**

B. I

- C.  $\text{Na}^+$   
 D.  $\text{Cu}^{2+}$   
 E.  $\text{Cl}^-$
46. According to Smolukhovskiy theory of fast coagulation the process of **coagulation** is described by kinetic equation of the  
 A. **Second order**  
 B. Zeroth order  
 C. First order  
 D. Third order  
 E. Fractional order
47. **Coagulation threshold** of disperse systems has a unit of:  
 A. **mmol/L**  
 B. L  
 C. L/mmol  
 D.  $\text{mmol}^{-1}$   
 E.  $\text{mmol} \cdot \text{L}$
48. The **strengthening** of coagulating action of one electrolyte at addition of other one is called?  
 A. **Synergy**  
 B. Antagonism  
 C. Additivity  
 D. Pheopexy  
 E. Phoretism
49. How is the phenomenon of **strengthening** of coagulating action of electrolytes in mixture?  
 A. **Synergy**  
 B. Antagonism  
 C. Additivity  
 D. Syneresis  
 E. Tixotropy
50. Choose the ions that will have **additivity** under the coagulation with electrolyte mixture:  
 A.  $\text{K}^+$ ,  $\text{Na}^+$   
 B.  $\text{Na}^+$ ,  $\text{Al}^{3+}$   
 C.  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$   
 D.  $\text{Li}^+$ ,  $\text{Ca}^{2+}$                       E.  $\text{Cl}^-$ ,  $\text{PO}_4^{3-}$
51. **Colloidal protection** is used at producing of medicines. The colloidal preparation of silver protected by proteins is called?  
 A. **Protargol**  
 B. Festale  
 C. Enzymtale  
 D. Argentum  
 E. Collagen
52. In laboratory a colloidal solution of a medicine substance is produced. **Why is high-molecular substance added to this sol:**  
 A. **To increase its stability**  
 B. To decrease its stability  
 C. For coagulation of colloidal solution  
 D. For coalescence of colloidal solution  
 E. For sedimentation of colloidal solution
53. Pharmaceutical preparation **collargol** is a **colloid** silver solution containing a **high-molecular compound**. What is the function of this compound?  
 A. **It enhances aggregative stability**  
 B. It induces coagulation  
 C. It facilitates sedimentation  
 D. It reduces aggregative stability  
 E. It increases dispersion degree

**54. Colloid silver preparations** Protargolum and collargolum are widely used in medical practice as bacterial drugs. In addition to the active ingredients, these drugs contain protein compounds. What is the **function of proteins** in these preparations?

- A. **Prevention of coagulation of the colloidal solution**  
 B. Potentiation of the bacterial action of silver  
 C. Prolongation of shelf-life  
 D. Reduction of the side effects  
 E. Improvement of the drug technology

**55.** The medicine Protargol is a colloidal silver solution. High-molecular substances (proteins) are added to increase its aggregative stability. Using the values of the silver number (mg), select HMS with the **greatest protective action:**

- A. **Gelatin – 0.035**  
 B. Dextrine – 100.0  
 C. Saponine – 35.0  
 D. Egg albumin – 2.5  
 E. Hemoglobin – 0.25

**56.** Heparin is an **anticoagulating** agent of direct action which decreases blood coagulation and prevents thrombocyte-forming. Its action is based on the phenomenon of

- A. **"colloidal protection"**  
 B. syneresis  
 C. tixotropy  
 D. micelle-formation  
 E. dialysis

Name the ability of high-molecular compounds **to prevent precipitation of lyophobic sols** and deposition of cholesterol plaques on the vessel walls:

- A. **Colloid protection**  
 B. Coacervation  
 C. Sedimentation  
 D. Thixotropy  
 E. Coagulation

**57.** A pharmacist has been adding **small portions** of electrolyte to silver chloride sol, with resulting coagulation occurring under higher electrolyte concentration, if compared to single instance of adding electrolyte. This phenomenon is called:

- A. **Sol acclimatization**  
 B. Antagonism                      D. Synergism  
 C. Additivity                      E. Desensitization

**58.** If the amount of high-molecular substance added to the sol is very small, it may **not increase but decrease its stability**. This phenomenon is called:

- A. **sensibilization**  
 B. solubilization  
 C. intercoagulation  
 D. colloidal protection  
 E. sol accustoming

**59.** **Emulsions** containing **less than 0.1%** of dispersed phase (in volume) are classified as:

- A. **Diluted**  
 B. Concentrated  
 C. High-concentration  
 D. Water-in-oil type  
 E. Oil-in-water type

**60.** **Emulsions containing 0.1-74 %** (by volume) of the disperse phase belong to:



**A. Concentrated ones**

- B. Diluted ones
- C. High-concentrated ones
- D. w/o type
- E. o/w type

61. The **emulsion** in which the particles of disperse phase are **deformed and have the form of polyhedrons** called?

- A. **High-concentrated**
- B. Concentrated
- C. Dilute
- D. Direct
- E. Reverse

Surfactants and high-molecular compounds are added into concentrated **emulsion to stabilize** them. These substances are:

- A. **Emulsifiers**
- B. Absorbents
- C. Solvents
- D. Catalysts
- E. Activators

62. SAS and HMS which added to concentrated **emulsions** to **increase the stability** are called

- A. **emulsifying agent**
- B. activating agent
- C. catalyst
- D. solvent
- E. adsorbent

63. Stability of concentrated **emulsions** can be **increased** by **adding** surface-action substances and high-molecular compounds that are:

- A. **Emulsifiers**
- B. Activators
- C. Catalysts
- D. Solvents
- E. Absorbents

64. The process of spontaneous **sticking together** of drops in **emulsions** is called?

- A. **Coalescence**
- B. Flocculation
- C. Sedimentation
- D. Flotation
- E. Coagulation

Name the process of **spontaneous adhesion of drops in an emulsion** to each other:

- A. **Coalescence**
- B. Flocculation
- C. Flotation
- D. Sedimentation
- E. Coagulation

65. Which quantity characterizes **Brownian motion** of the particles of disperse systems?

- A. **Average displacement**
- B. diffusion coefficient
- C. Sedimentation rate
- D. Zeta-potential
- E. coagulation rate

66. The phenomenon of the **motion** of the particles of **disperse phase** in **dispersive medium** **under** the action of **potentials** difference is called:

- A. **Electrophoresis**
- B. Electroosmosis
- C. Flowing potential

D. Potential of sedimentation

E. Brownian motion

67. The **directed transition** of the **dispersion medium** in the constant electrical field is:

- A. **Electroosmosis**
- B. Electrophoresis
- C. Adsorption
- D. The flow potential
- E. The sedimentation potential

68. What is the of the process of aerosols particle **transition** under the **temperature gradient influence**?

- A. **Thermophoresis**
- B. Electrophoresis
- C. Electroosmosis
- D. Thermoprecipitation
- E. Osmosis

69. Most of the sols have the **value of critical zeta-potential in the interval**:

- A. **25-30 mV**
- B. 30-35 mV
- C. 45-50 mV
- D. 35-40 mV
- E. 20-25 mV

70. The **osmotic pressure** of **colloidal solutions** is characterized by:

- A. **Low and unconstant value**
- B. High and unconstant value
- C. High and constant value
- D. Low and constant value
- E. Nothing

71. The process of **spontaneous concentration equaling** in disperse systems is called:

- A. **Diffusion**
- B. Adsorption
- C. Brownian motion
- D. Dialysis
- E. Filtration

72. Some medicines are used as **colloidal solutions**. Comparing to true solutions the particles of a sol **diffuse**:

- A. **With significantly less rate**
- B. With the same rate
- C. With a greater rate
- D. With insignificantly less rate
- E. They do not diffuse at all

73. Macromolecules of protective proteins adsorb on the surface of bacterial cells and form the aggregates of a great number of particles. **The process taking place as a result of the growth in the size of particles is called**:

- A. **Sedimentation**
- B. Diffusion
- C. Dispersion
- D. Peptization
- E. Wetting

74. There is inscription on the labels of some medicinal preparations: "**Before the use to shake up!**". It warning is conditioned by

- A. **sedimentation**
- B. coagulation
- C. solubility of disperse system
- D. nonsolubility of disperse system
- E. nothing

**Sedimentation** is characteristic of the following systems:

**A. Suspensions****B.** Solutions of high-molecular compounds**C.** Nonelectrolyte solutions**D.** Electrolyte solutions**E.** Foams75. What systems is **sedimentation** characteristic for?**A. Suspensions****B.** HMS solutions**C.** Sols**D.** Electrolytes solutions**E.** Non-electrolytes solutions76. For which systems **sedimentation** is a characteristic feature?**A. suspensions****B.** HMS solutions**C.** Sols**D.** electrolyte solutions**E.** nonelectrolyte solutions77. Phenomena of disperse particles **sedimentation** lead to disorder of organism function. What is the value for kinetic sols stability?**A. sedimentation** constant**B.** coagulation constant**C.** inverse to coagulation constant**D.** dissociation constant78. Which equation is used for determination of the intensity of the **light scattered** by colloidal particles?**A. Rayleigh****B.** Lambert-Beer**C.** Bingham**D.** Einstain**E.** Poiseuille79. The phenomenon when the directed **light beam passes** through MnO<sub>2</sub> sol solution is called:**A. Light scattering****B.** Light refraction**C.** Light interferention**D.** Light reflection**E.** Optimal anisotropy80. Disperse systems are widely applied in pharmaceutical practice. Passing of light through the system is the method confirming a colloidal state of system. In this process the **light beam** is:**A. scatters as a luminous cone (Tyndall's effect)****B.** reflects**C.** adsorbs**D.** refracted**E.** passes inside the particle81. What **optical** phenomena are observed in the system with size of **particles 10<sup>-8</sup>**?**A. light scattering****B.** light reflection**C.** light adsorption**D.** light refraction**E.** light extraction82. What **optical phenomenon** is characteristic for **suspensions**?**A. Light reflection****B.** Light absorption**C.** Light scattering**D.** Light transmission**E.** Light refraction of83. According to the Rayleigh equation, the intensity of **scattered** light is inversely proportional to the wavelength of:**A. Incident light (fourth power)****B.** Incident light (second power)**C.** Incident light (fifth power)**D.** Incident light (third power)**E.** Incident light84. The difference of disperse systems from true solutions is a **blueish lightening** of colloid solutions on the dark background. This phenomenon bears a name :**A. Opalescence****B.** Emission**C.** Chemiluminescence**D.** Scattering**E.** Fluorescence85. The method of **ultramicroscopy** is applied to determine a radius of disperse phase. To perform such calculations in this method the following value is measured:**A. number of particles in the volume****B.** intensity of falling light**C.** intensity of scattered light**D.** time of moving of particles**E.** time of moving of particles for certain distance86. In which solution the **critical concentration** of micelle-forming has the **lowest value**?**A. C<sub>17</sub>H<sub>35</sub>COONa****B.** C<sub>12</sub>H<sub>25</sub>COONa**C.** C<sub>13</sub>H<sub>27</sub>COONa**D.** C<sub>15</sub>H<sub>31</sub>COONa**E.** C<sub>11</sub>H<sub>23</sub>COONa87. Micelle solutions of surfactants are applied in pharmaceutical production as stabilizers and solubilizers. What solution of colloidal surfactants will have the **greatest value of critical concentration of micelle formation**?**A. C<sub>9</sub>H<sub>19</sub>SO<sub>3</sub>Na****B.** C<sub>14</sub>H<sub>29</sub>SO<sub>3</sub>Na**C.** C<sub>16</sub>H<sub>33</sub>SO<sub>3</sub>Na**D.** C<sub>12</sub>H<sub>25</sub>SO<sub>3</sub>Na**E.** C<sub>10</sub>H<sub>21</sub>SO<sub>3</sub>Na88. Micelle of a colloid surfactant will have the following structure in a certain solvent: polar groups are **turned towards the solvent**, while radicals are facing the micelle center. What solvent is it?**A. Water****B.** Hydrogen sulfide**C.** Benzene**D.** Toluene**E.** Tetrachloromethane89. What **potential** predetermines the **stability of colloid** systems?**A. Electrokinetic****B.** Thermodynamic**C.** flow potential**D.** Sedimentation potential**E.** Diffusion potential90. The phenomena of particles **transition of** aerosols to the **temperature** decrease and **sedimentation** on the cold surface is called:**A. Thermoprecipitation**91. What phenomena is **NOT characteristic for aerosols**?**A. Dissociation**

92. The drop of oil-water emulsion is put on the **paraffin plate**. No **wetting** was observed. This phenomenon characterizes the emulsion as:

A. **Direct**

93. According to **Bancroft** rule the disperse medium of emulsion is a solution to which **emulsifier** has:

A. **Affinity**

94. What emulsions are stabilized by **emulsifiers** that are **soluble in water**?

A. **Direct**

95. Ratio of **hydrophilic** and **lipophilic** properties of emulsifier is determined by:

A. **Hydrophilic-lipophilic balance**

### HIGH MOLECULAR SUBSTANCES

1. The swollen material of synthetic high-molecular lenses **adsorbs some amount of water**. This is the example of

A. **limiting swelling**

B. unlimiting swelling

C. synthetic swelling

D. kinetic swelling

E. adhesion swelling

2. Which substance should be added to the **suspensions** to **increase their stability**?

A. **gelatin**

B. sodium chloride

C. glucose

D. ethanole

E. Nothing

3. In which given **solvents** does **gelatin** swell better?

A. **Water**

B. Benzene

C. Ethanol

D. Chloroform

E. Acetone

4. The **solutions** of **high-molecular compounds** are produced through:

A. **Dissolution in a corresponding solvent**

B. polymerization reaction

C. polycondensation reaction

D. Dispersing

E. Peptization

5. The **one-way penetration** of **solvent** molecules into the **polymer** phase resulting in complete dissolution of the polymer is called:

A. **Unlimited swelling**

B. Coacervation

C. Salting-out

D. Limited swelling

E. Thixotropy

6. Under which conditions does **limiting swelling** of gelatin turn to **unlimiting** one (formation of solution)?

A. **At heating**

B. At cooling

C. At the presence of  $\text{SO}_4^{2-}$  ions

D. At the presence of  $\text{Cl}^-$  ions

E. At medium pH corresponding to the isoelectrical point

7. The isoelectric point of myosin in muscles is equal to 5. At which pH values does the electrophoretic **mobility of macroions is equal to 0**?

A. **5.0**

B. 2.0

C. 3.0

D. 4.0

E. 7.0

8. The isoelectric point of albumen is **5.7**. At which value of pH does the protein macroion **move to the anode**?

A. **7.0**

B. 5.0

C. 5.7

D. 4.0

E. 4.7

9. The **isoelectric** state of a **protein** molecule depends on:

A. **pH in medium**

B. Concentration of a solvent

C. Mass of dissolved substance

D. Form of a protein molecule

E. Methode of the production of solutiona

10. The isoelectric point of a protein is **4.7**. At which pH does the protein **macroion move to the cathode**?

A. **3.5**

B. 4.7

C. 5.0

D. 7.0

E. 11.5

11. At which pH value does the electrophoretic **mobility** of gelatine **is equal to zero** (isoelectric point of gelatine is **4.7**)

A. **4.7**

B. 7.0

C. 14.0

D. 5.5

E. 9.4

12. IEP of a protein is **8.3**. At which pH value is electrophoretic **mobility** of a protein macromolecule **equal to zero**?

A. **8.3**

B. 7.0

C. 11.5

D. 2.3

E. 4.7

13. The solution contains the mixture of proteins: globulin, albumen and collagen the isoelectrical points of which are equal to 7.0; **4.9** and 4.0, respectively. At which value of pH can **albumen** be extracted?

A. **4.9**

B. 7.0

C. 4.0

D. 4.4

E. 4.2

14. To which electrode does a protein particle move at electrophoresis if its isoelectric point is **4.0**, and **pH is 5.0**?

A. **To anode**

B. To cathode

C. First to cathode, then to anode

D. First to anode, then to cathode

E. Does not move

15. If **pH of a solution is lower than its isoelectric point**, it means in this solution:

A. **Cation forms of amino acids are prevalent**

B. Anion forms of amino acids are prevalent

C. Anion and cation forms of amino acids are balanced

D. Certain protein aggregates are formed

E. Irreversible protein precipitation occurs

16. Isoelectric point of proteins can be determined by the swelling degree dependence of highmolecular substances of pH. In the field  $pH=IEP$  the protein swelling degree is:

- A. minimal
- B. maximal
- C. equal to 50% of protein mass
- D. equal to 100% of protein mass
- E. greater then 100% of protein mass

17. **Microcapsulation** of medicines protects them from the effects of the environment. This process based on the phenomenon of:

- A. **Coacervation**
- B. Adsorption
- C. Wetting
- D. Adhesion
- E. Cohesion

18. Which method is pharmacopoeic for determination of **molecular mass of high-molecular substances**?

- A. **Viscosimetry**
- B. Osmometry
- C. Cryometry
- D. Ebullioscopy
- E. Potentiometry

19. The Ukrainian State Pharmacopoeia includes the method of determination of the **molecular weight** of a **polymer** based on measuring such property of HMS solutions as:

- A. **Viscosity**
- B. Light-scattering
- C. Freezing temperature
- D. Osmotic pressure
- E. Saturated vapour pressure

20. What order of the kinetic equation describes the process of **swelling** of a polymer?

- A. **The first order**
- B. The second order
- C. The zero order
- D. The fractional order
- E. The third order

21. **High-molecular substances** under certain conditions form jellies, which are widely applied when preparing medicinal forms. Which phenomenon is observed at "ageing" of such jellies?

- A. **Syneresis**
- B. Thixotropy
- C. Swelling
- D. Solvation
- E. Diffusion

22. **Separation** of biopolymers solutions by the **gel-chromatography** method proceeds in relation to

- A. **Molecules sizes**
- B. Adsorption on the sorbent surface
- C. Interaction of the substances determined by ionogenic groups of a sorbent
- D. Molecules hydration
- E. Physical separation of substances between two phases

23. The state of colloid particles, where **electrokinetic potential equals zero** and that is characterized with the absence of a direct motion of granules in electric field is called:

- A. **isoelectric**
- B. electroneutral
- C. neutralized
- D. neutral

E. compensated

24. Phenomenon of **decreasing system volume** resulting from polymer swelling is called:

- A. **Contraction**
- B. Sedimentation
- C. Dissolution
- D. Solvation
- E. Coagulation

25. **Solution of polyvinilpirollidone** is widely used in pharmacy for prolongation of medical substances. Its average number **molecular mass** can be determined by the method:

- A. **osmometry**
- B. cryoscopy
- C. polarimetry
- D. conductometry
- E. -

26. Which equation can be applied for calculation of **osmotic pressure for HMS solutions**?

- A. **Haller**
- B. Van't Hoff
- C. Peters
- D. Nernst
- E. Fick

27. HMS are widely applied in pharmacy. Which property of **true solutions** is **characteristic** for **HMS solutions** as well?

- A. **The thermodynamic stability**
- B. The Brownian motion
- C. Light-scattering
- D. The low osmotic pressure
- E. Nothing of the mentioned above

28. Jellies are one of perspective medicinal forms. How is the process of **decomposition** of **jellies** and their formation again during the mechanical action called?

- A. **Thixotropy**
- B. Syneresis
- C. Diffusion
- D. Stratification
- E. Gelatinization

29. The **extraction** of **HMS** from solutions using an **electrolyte** is in the basis of one of the methods of their fractioning and it is called:

- A. **Salting out**
- B. Coagulation
- C. Sedimentation
- D. Electrophoresis
- E. Dialysis

31. The important characteristics of **protein** that can be used to calculate a lot of its properties is:

- A. **IEP**

32. **First stage of HMS dissolution is:**

- A. **Swelling**

33. **Jellies are produced while:**

- A. **Polymer solution transformation into elastic form**

34. Under certain conditions, solutions of high-molecular substances can lose their flowability, meaning that the bonds begin to form between macromolecules, leading to the formation of a spatial grid. Name this process:

- A. **Gel formation**
- B. Peptization
- C. Condensation
- D. Coagulation
- E. Coacervation