

Unit VI.

Online test (typical questions)

- How will the decrease in temperature affect the surface tension value of pure liquids on the liquid–air boundary surface? The surface tension will:
a) decrease b) increase c) not change d) first decrease, then increase
- Molecules of surfactants:
a) are hydrophobic
b) are hydrophilic
c) consist of hydrophobic and hydrophilic fragments
d) contain less than three carbon atoms
- The presence of sodium chloride in aqueous solutions:
a) lowers the surface tension b) increases the surface tension
c) does not affect the surface tension d) sodium chloride is not an electrolyte
- For which solution the number of drops will be the greatest in stalagmometric measurements of the surface tension? The experiments were carried out under the same conditions with solutions of the same densities.
a) 5% glycerol b) 10% KBr c) 3% bile d) 4% bile
- Which type of adsorption is observed when carbon dioxide passes through a tube with calcium oxide?
a) chemisorption b) physical adsorption c) ionic adsorption d) exchange adsorption
- When the concentration of sodium stearate ($C_{17}H_{35}COONa$) in an aqueous solution increases, its adsorption on the liquid–air surface:
a) decreases b) increases
c) does not change d) first decreases, then increases
- How will a decrease in pressure affect the adsorption of carbon dioxide on activated charcoal?
a) it will increase up to a maximum value b) it will decrease
c) it will first decrease, then increase d) it will not change
- Which of the following ions will be selectively adsorbed on a crystal of barium carbonate?
a) Zn^{2+} ; b) Cl^- ; c) Ba^{2+} ; d) SO_4^{2-} .
- The electrical double layer is formed due to:
a) the transfer of ions from one phase to another
b) an increase in concentration of the disperse system
c) the thermal movement of continuous phase particles
d) a decrease in temperature
- The electrical double layer is responsible for the formation of:
a) electrokinetic and electrothermodynamic potentials
b) electrothermodynamic potential only;
c) electrokinetic potential only
d) none of the above, as the system is electrically neutral
- The addition of indifferent electrolytes to sols:
a) increases the electrokinetic potential
b) changes the value of the electrothermodynamic potential

- c) decreases the absolute value of the electrokinetic potential
 d) can change the sign of the electrothermodynamic potential
12. Choose the correct structure for a micelle of the sol prepared by mixing a copper(II) sulfate solution with an excess of a sodium hydroxide solution:
- a) $\{[(m\text{Cu}(\text{OH})_2) \cdot n\text{OH}^- \cdot (n-x)\text{Na}^+] \cdot x\text{Na}^+\}$
 b) $\{[(m\text{Cu}(\text{OH})_2) \cdot n\text{OH}^- \cdot 0.5(n-x)\text{Cu}^{2+}] \cdot 0.5x\text{Cu}^{2+}\}$
 c) $\{[(m\text{CuSO}_4) \cdot n\text{OH}^- \cdot (n-x)\text{Na}^+] \cdot x\text{Na}^+\}$
 d) $\{[(m\text{Cu}(\text{OH})_2) \cdot n\text{Cu}^{2+} \cdot (n-x)\text{SO}_4^{2-}] \cdot x\text{SO}_4^{2-}\}$
13. Colloidal systems are thermodynamically unstable because:
- a) they have an excess of interface energy
 b) they do not have an excess of interface energy
 c) the particles of dispersed phase participate in the Brownian motion
 d) the dispersed and continuous phases are electrically neutral
14. Sedimentation stability can be described as the ability of the system to maintain:
- a) a uniform distribution of dispersed phase particles in the continuous phase
 b) the size of dispersed phase particles
 c) the definite composition of the system
 d) the magnitude of the electrokinetic potential
15. Which electrolyte will be indifferent to a sol with the following micelles: $\{[(m\text{AlPO}_4) \cdot n\text{PO}_4^{3-} \cdot 3(n-x)\text{Na}^+] \cdot 3x\text{Na}^+\}$?
- a) aluminium nitrate b) sodium nitrate c) sodium bromide
 d) potassium chloride
16. Consider the following micelle: $\{[(m\text{BaSO}_4) \cdot n\text{SO}_4^{2-} \cdot 2(n-x)\text{Na}^+] \cdot 2x\text{Na}^+\}$. What is the ratio of critical concentrations of coagulation for potassium and magnesium nitrates with respect to this sol?
- a) 1 : 64 b) 2 : 1 c) 32 : 1 d) 1 : 2
17. Which of the following compounds are colloidal surfactants?
- a) $\text{CH}_3(\text{CH}_2)_3\text{OH}$ b) $\text{C}_{15}\text{H}_{31}\text{COONa}$ c) $\text{CH}_3(\text{CH}_2)_2\text{NH}_2$
 d) $\text{C}_{12}\text{H}_{25}\text{OSO}_3\text{Na}$
 e) CH_3COOH f) $\text{C}_8\text{H}_{17}\text{C}_6\text{H}_4\text{SO}_3\text{Na}$ g) $[\text{C}_{18}\text{H}_{37}\text{NH}_3]^+\text{Cl}^-$
18. The critical micelle concentration (CMC) is the surfactant concentration in the solution where:
- a) surfactant molecules begin to distribute between the boundary surface and the bulk of the solution
 b) the surface tension value of the solution reaches its maximum
 c) the surfactant begin to precipitate
 d) micelles of the surfactant begin to form
19. Indicate the compounds that will be solubilised in direct micelles formed in the following aqueous solutions:
- a) hydrocarbons b) inorganic salts c) water insoluble vitamins d) water soluble dyes
20. Which of the following compounds will stabilize a reverse emulsion?
- a) sodium chloride b) sodium oleate (HLB = 20)
 c) calcium stearate (HLB = 4.3) d) oleic acid (HLB = 1).
21. The quantitative characteristic of the stability of foams is the time required to:

- a) decrease the foam volume by 50%
 - b) destroy the foam completely
 - c) retain the initial volume
 - d) decrease the foam volume three times
22. Decide whether the following statements true or false.
- 1). The driving force for the formation of micelles in solutions of colloidal surfactants are hydrophobic interactions.
 - 2). Foams are polydisperse g/g systems.
- a) both are true b) only the first is true c) only the second is true d) both are false.
23. Which of the following phenomena is typical for the first stage of swelling?
- a) absorption of 70–80% of water (relative to dry polymer weight)
 - b) a slight increase in volume of the HMW compound
 - c) the diffusion of the HMW compound into the solvent
 - d) a significant increase in the volume of the HMW compound
24. The addition of copper(II) chloride to a protein solution causes:
- a) salting out of protein b) complex coacervation
 - c) syneresis d) denaturation
25. Thixotropy is:
- a) reversible isothermal conversions gel-sol or gel-polymer solution
 - b) decrease in the volume of a system polymer-solvent at the first stage of swelling
 - c) the precipitation of proteins caused by the addition of salts or organic solvents
 - d) separation of a new liquid phase, enriched in polymer, from a polymer solution
26. Size-exclusion chromatography is based on:
- a) the process of exchanging ions with the charges of the same sign
 - b) the different partition coefficients of compounds between mobile and stationary phases
 - c) highly specific interaction between analytes and the stationary phase
 - d) different abilities of analytes to enter the pores of the stationary phase
27. Which mixtures can be separated by ion-exchange chromatography?
- a) 1-hexanol, 2-pentanol, 2-methylhexan-2-ol
 - b) D-glucosamine, D-glucuronic acid, D-mannaric acid
 - c) pentanal, hexanal, butanal
 - d) propanone, pentan-2-one, butanone
28. Affinity chromatography can be used for:
- a) isolation of a certain enzyme from protein mixture;
 - b) detection of diethyl ether impurity in ethyl alcohol;
 - c) separation of amines;
 - d) separation of alcohols with low molecular masses.
29. The most effective chromatographic method to purify a protein solution from low molecular weight impurities is:
- a) ion-exchange chromatography; b) high performance liquid chromatography;

- c) size-exclusion chromatography; d) thin-layer chromatography.
30. The mixture of 1) lysine ($pI = 9.8$), 2) glutamic acid ($pI = 3.2$) and 3) alanine ($pI = 6.0$) is separated by ion-exchange chromatography using the mobile phase with increasing pH (from 2.5 to 11). In which order the amino acids will elute from the column?
- a) 1–3–2; b) 2–3–1; c) 2–1–3; d) 3–2–1.

Paper test (typical questions)

(I – 5, II – 5, III – 5, IV – 5 points)

- I.** 5 g of activated carbon was placed in 100 ml of a butylamine solution with $c = 0.45$ mol/L. After the adsorption equilibrium was reached, the concentration of butylamine decreased to 0.250 mol/L. Calculate the adsorption value.
- II.** A sol was prepared by mixing $Pb(NO_3)_2$ and Na_2S solutions. In micelles of this sol nitrate anions are counterions.
- a) Draw the structure of a micelle of this sol. Specify the signs of φ - and ζ -potentials.
- b) The coagulation of this sol was caused by addition of NH_4NO_3 solution. Specify the ions that cause the coagulation.
- III.** The drug is a W/O emulsion. Is it used for oral (through the mouth) or transdermal (through the skin) administration? Explain your answer. What emulsifiers are used to stabilize direct emulsions? What are their HLB numbers? Define the term "HLB".
- IV.** During electrophoresis a protein macro-ions move at different directions in solutions with pH 4.8 and 6.4.
- a) Estimate the pH range of pI of this protein. What is the direction of movement of macroions in both cases?
- b) In what forms does this protein exist in these solutions? Draw