

**Control-Measurement materials
of Subject «Chemistry»
Specialty «Stomatology»**

Theme: «Stalagmometric determination of surface tension for solutions of surface-active substances (SAS).»

Variant 1.

1. Describe the reasons of surface tension existence on the interphase surface between liquid and gas phases. Which units are used for surface tension?
2. Task. Find the surface tension of bile, if with the use of Rebinder method the next data was obtained: pressure of air bubbles while their input in water is equal to $11,8 \times 10^2 \text{ N/m}^2$, and in bile solution – 616 N/m^2 . $\sigma_{\text{water}} = 71,25 \times 10^{-3} \text{ N/m}$.

Variant 2.

1. Free surface energy and ways of its decrease.
2. Task. Constants of Shishkovsky equations are given for aqueous solution of valerianic acid in temperature 294 K: $a = 15 \times 10^{-3} \text{ N/m}$, $b = 10,0 \text{ l/mol}$. In which concentration of surface tension of solution will be equal to $52 \times 10^{-3} \text{ N/m}$?
 $\sigma_{\text{water}} = 72,59 \times 10^{-3} \text{ N/m}$.

Variant 3.

1. Surface tension. Methods of the surface tension determination.
2. Task. Calculate the surface tension of aniline, if using Traube stalagmometer the next data was obtained: the number of aniline drops 42, the number of water drops 18. Temperature of experiment 293 K. The density of aniline $1,4 \times 10^3 \text{ kg/m}^3$.
 $\sigma_{\text{water}} = 72,75 \times 10^{-3} \text{ N/m}$.

Variant 4.

1. Classification of surface active substances.
2. Task. Constants of Shishkovsky equations are given for aqueous solution of valerianic acid in temperature 294 K: $a = 16,5 \times 10^{-3} \text{ N/m}$, $b = 8,2 \text{ l/mol}$. Calculate the surface tension of solution in concentration of SAS 0,3 mol/l. $\sigma_{\text{water}} = 71,66 \times 10^{-3} \text{ N/m}$.

Variant 5.

1. Hydrophilic-lipophilic balance of SAS and surface activity. Duclo-Traube rule.
2. Task. Calculate the value of surface tension of ethanol, if using Traube stalagmometer in temperature 298K the next data was obtained: the number of drops of ethanol 67, the number of drops of water 45. Surface tension of water $71,97 \times 10^{-3} \text{ N/m}$. Density of ethanol solution is 760 kg/m^3 , of water 1000 kg/m^3 .

Variant 6.

1. Isotherm of surface tension. Shishkovsky equation.
2. Task. The constants of Shishkovsky equation are given for the water solution of surface active substance: $a = 12,1 \times 10^{-3} \text{ N/m}$, $b = 4,2 \text{ l/mol}$. Calculate the surface tension of solution in SAS concentration $0,2 \text{ mol/l}$.

Variant 7.

1. What structure and nature have SAS molecules? How SS molecules are oriented on the interphase surface.
2. Task. While determination of surface tension of water solutions of acetic acid using Rebinder method the next data was obtained: the difference between levels of manometer liquid (h) in time of input of air bubble to water is 12 mm , and to the researched liquid 9 mm . Calculate the surface substance. The surface tension of water in the temperature of experiment is $73,26 \times 10^{-3} \text{ N/m}$.

Variant 8.

1. Describe the reasons of existence of surface tension on the interphase surface between liquid and gas. In which units it measured?
2. Task. For water solution of propanol the next values of Shishkovski equation constants are given: $a=14 \times 10^{-3}$, $b=7$. Calculate the surface tension of the solution with concentration of 1 kmol/m^3 , if $\sigma_{\text{H}_2\text{O}}=72,75 \times 10^{-3} \text{ N/m}$.

Variant 9.

1. What is Langmuir «palisade»?
2. Task. While determining the surface tension of water solutions formic acid with Rebinder method the next data was obtained: the difference between levels of manometer liquid (h) in time of input of air bubble to water is 24 mm , and to the researched liquid 11 mm . Calculate the surface substance. The surface tension of water in the temperature of experiment is $71,97 \times 10^{-3} \text{ N/m}$.

Variant 10.

1. What is HLB? Give examples of application of SAS with different HLB values.
2. Task. For water solution of propanol the next values of Shishkovski equation constants are given: $a=14 \times 10^{-3}$, $b=6,6$. Calculate the surface tension of the solution with concentration of $0,5 \text{ kmol/m}^3$, if $\sigma_{\text{H}_2\text{O}}=72,75 \times 10^{-3} \text{ N/m}$.

Variant 11.

1. Classification of SAS.

2. Task. Calculate the surface tension of solution of valerianic acid in concentration $0,01 \text{ kmol/m}^3$ and temperature 293K , if constants of Shishkovsky equation are: $a=17,7 \times 10^{-3}$, $b=19,72$, a $\sigma_{\text{water}}=72,75 \times 10^{-3} \text{ N/m}$.

Variant 12.

1. How the surface tension of liquids is changed with increase of temperature?
2. Task. Constants of Shishkovsky equations are given for water solution of valerianic acid in temperature 296 K : $a = 13,5 \times 10^{-3} \text{ N/m}$, $b = 9,8 \text{ l/mol}$. In which concentration of surface tension of solution will be equal to $47,2 \times 10^{-3} \text{ N/m}$?
 $\sigma_{\text{water}}=72,28 \times 10^{-3} \text{ N/m}$.

Variant 13.

1. Which property of SAS is called “surface activity”, how is it determined experimentally?
2. Task. Calculate the value of surface tension of ethanol, if using Traube stalagmometer in temperature 273K the next data was obtained: the number of drops of ethanol 115, the number of drops of water 86. Surface tension of water $72,75 \times 10^{-3} \text{ N/m}$. Density of ethanol solution is 786 kg/m^3 , of water 1000 kg/m^3 .

Variant 14.

1. Duclot-Traube rule.
2. Task. Find the surface tension of bile, if using Rebinder method the next data was obtained: air bubbles pressure while their going through water is equal to $11,8 \times 10^2 \text{ N/m}^2$, and through the bile solution is $- 712 \text{ N/m}^2$. $\sigma_{\text{воды}}=72,75 \times 10^{-3} \text{ H/M}$.

Variant 15.

1. Shishkovsky equation.
2. Task. Find the surface tension of SAS solution, if using Rebinder method the next data was obtained: air bubbles pressure while their going through water is equal to $16,2 \times 10^2 \text{ N/m}^2$, and through the bile solution is $- 513 \text{ N/m}^2$.
 $\sigma_{\text{воды}}=72,75 \times 10^{-3} \text{ H/M}$.

Variant 16.

1. How the surface activity will change in water solutions of SAS compare to water?
2. Task. Constants of Shishkovsky equations are given for water solution of valerianic acid in temperature 300 K : $a = 13,5 \times 10^{-3} \text{ N/m}$, $b = 9,8 \text{ l/mol}$. In which concentration of surface tension of solution will be equal to $47,8 \times 10^{-3} \text{ N/m}$?
 $\sigma_{\text{water}}=72,66 \times 10^{-3} \text{ N/m}$.