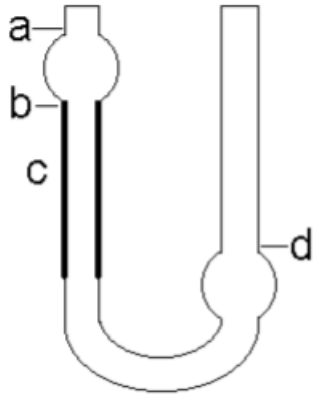
Lesson №7. Capillary viscometer method for Determination of liquid viscosity.

PRACTICAL PART

The viscosity of liquids is determined using an Ostwald capillary viscometer:



Ostwald capillary viscometer (a, b, d – marks that limit the liquid level, C – capillary).

The viscosity of the test liquid is determined by the formula:

$$\eta_x = \eta_0 \frac{\rho_x t_x}{\rho_0 t_0} \quad (1)$$

In order to determine the viscosity coefficient of the investigated liquid, you need to know:

η_0 - the viscosity coefficient of water,

t_0 - time of water flow between marks a and b,

t_x - time of flow of the test liquid between marks a and b,

ρ_0 – water density,

ρ_x is the density of the test liquid.

Task 1. Determine the viscosity coefficient of solutions with different concentrations.

1. Pour water into the knee of the viscometer that does not have a capillary up to the d mark.

2. Use a pear To suck the liquid through the capillary to mark a. After removing the pear, determine t_0 - the time of water flow between marks a and b.

3. Repeat the measurement 4-5 times.

4. Follow steps 1 to 3 for all the liquids to be tested.

5. Calculate the viscosity coefficients of the studied liquids using the formula (1).

6. Enter the Data in table 1.

Table 1

№	Concentration , %	t_1	t_2	t_3	t_4	t_5	t_{cp}	ρ	η
1									
2									
3									
4									
5									
6									

Task 2. Determine the concentration of an unknown solution.

1. Plot the dependence of the viscosity coefficient on the concentration of the solution.

2. Knowing the viscosity coefficient of an unknown solution, use the graph to determine its concentration.

Table 2. The density of water at different temperatures

ρ, 10^3 kg/m^3	t, ^{0}C	ρ, 10^3 kg/m^3	t, ^{0}C
0,99913	15	0,99802	21
0,99897	16	0,99780	22
0,99880	17	0,99757	23
0,99843	19	0,99732	24
0,99823	20	0,99707	25

Table 3. The viscosity of water at different temperatures

η, Pa s	t, ^{0}C	η, Pa s	t, ^{0}C
0,00114	15	0,00098	21
0,00111	16	0,00096	22
0,00108	17	0,00093	23
0,00103	19	0,00091	24
0,00100	20	0,00089	25

Table 4. Density of glycerol solutions of various concentrations

C, %	ρ, 10^3 kg/m^3	C, %	ρ, 10^3 kg/m^3
5	1,0125	45	1,1125
10	1,0250	50	1,1250
15	1,0375	55	1,1375
20	1,0425	60	1,1500
25	1,0525	65	1,1625
30	1,0750	70	1,1750
35	1,0875	75	1,1875
40	1,1000	80	1,2000