Calculation task № 2

The kinematic viscosity of oil at the temperature of + 22 °C is 4.5 cSt, whereas at the temperature of 5 °C it increases to 8.2 cSt. Determine the viscosity of oil at the temperature of + 10 °C. Use the Filonov's formula to solve the task.

$t = 10$ °C

$t_0 = 5$ °C

$t_1 = 22$ °C

$\nu_{22} = 4.5$ cSt

$\nu_5 = 8.2$ cSt

Determine : ν_{10} - ?

Solution

$$\nu = \nu_0 \cdot e^{-u \cdot (t_1 - t_0)}$$

$$\ln\left(\frac{\nu}{\nu_0}\right) = -u \cdot (t_1 - t_0)$$

$$u = -\frac{\ln\left(\frac{\nu}{\nu_0}\right)}{t_1 - t_0} =$$

$$= -\frac{\ln\left(\frac{4.5}{8.2}\right)}{22 - 5} = 0,024$$

$$\nu_{10} = \nu_5 \cdot e^{-u \cdot (t_0 - t)} =$$

$$= 8.2 \cdot e^{-0,024 \cdot (5 - 10)} =$$

$$= 7.1 \text{ cSt}$$

Answer : $\nu_{10} = 7.1$ cSt.