Answer on Question #53008 - Physics - Mechanics - Kinematics - Dynamics

Carbon tetrachloride at $20\,°\text{C}$, has an absolute viscosity of $\mu = 9.67 \times 10^{-4}\ \text{Pa} \cdot \text{s}$ and a kinematic viscosity of $v = 6.08 \times 10^{-7}\ \frac{\text{m}^2}{\text{s}}$. Calculate its density and specific weight.

Solution:

The connection between absolute and dynamic viscosities is given by

$$v = \frac{\mu}{\rho},$$

where ρ – is the density of the fluid. Since $\mu = 9.67 \times 10^{-4}\ \text{Pa} \cdot \text{s}$ and $v = 6.08 \times 10^{-7}\ \frac{\text{m}^2}{\text{s}}$, we obtain

$$\rho = \frac{\mu}{v} = \frac{9.67 \times 10^{-4}\ \text{Pa} \cdot \text{s}}{6.08 \times 10^{-7}\ \frac{\text{m}^2}{\text{s}}} = 1590.5\ \frac{\text{kg}}{\text{m}^3}$$

The specific weight is given by

$$\gamma = \rho \cdot g,$$

where g – is the acceleration due to gravity. Since $g = 9.8 \frac{\text{m}}{\text{s}^2}$, we obtain

$$\gamma = \rho \cdot g = 1590.5\ \frac{\text{kg}}{\text{m}^3} \cdot 9.8 \frac{\text{m}}{\text{s}^2} = 15587\ \frac{\text{N}}{\text{m}^3}$$

Answer: $\rho = 1590.5\ \frac{\text{kg}}{\text{m}^3}$, $\gamma = 15587\ \frac{\text{N}}{\text{m}^3}$.