Answer on Question #53010 - Physics - Mechanics - Kinematics - Dynamics

Carbon tetrachloride at $20\,°C$ has a viscosity of $\mu = 0.000967\ \text{Pa} \cdot \text{s}$ What shear stress τ is required to deform this fluid at a strain rate of $\frac{\partial v}{\partial y} = 5000\ \text{s}^{-1}$?

Solution:

The shear stress is given by

$$\tau = \mu \frac{\partial v}{\partial y},$$

where v – is the velocity of the fluid along the boundary, y – is the height above the boundary, and μ – is the dynamic viscosity of the fluid. Since $\frac{\partial v}{\partial y} = 5000\ \text{s}^{-1}$ and $\mu = 0.000967\ \text{Pa} \cdot \text{s}$, we obtain

$$\tau = \mu \frac{\partial v}{\partial y} = 0.000967\ \text{Pa} \cdot \text{s} \cdot 5000\ \text{s}^{-1} = 4.835\ \text{Pa}$$

Answer: 4.835 Pa.