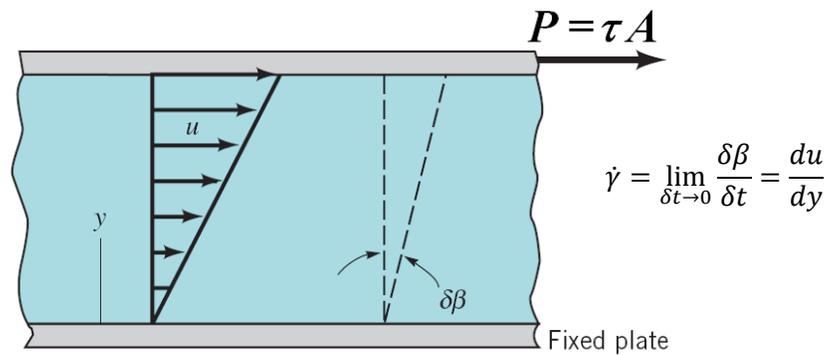NAME

Fluids-ID

Quiz 1.

Some measurements on a blood sample at 37°C (98.6° F) indicate a shearing stress τ of 0.52 N/m^2 for a corresponding rate of shearing strain $\dot{\gamma}$ of 200 s^{-1}. Determine the apparent viscosity of the blood μ_{blood} and compare it with the viscosity of water μ_{H20} at the same temperature.

(μ_{H20} = 6.96 × 10^{-4} N·s/m^2 at 37° C)

$$P = \tau A$$

$$\dot{\gamma} = \lim_{\delta t \to 0} \frac{\delta \beta}{\delta t} = \frac{du}{dy}$$

Fixed plate

Solution:

$$\tau = \mu \frac{du}{dy} = \mu \dot{\gamma}$$

(+5 points)

$$\mu_{blood} = \frac{\tau}{\dot{\gamma}} = \frac{0.52 \ N/m^2}{200 \ 1/s} = 26.0 \times 10^{-4} \ N \cdot s/m^2$$

(+3 points)

$$\frac{\mu_{blood}}{\mu_{H_2O}} = \frac{26.0 \times 10^{-4} \ N \cdot s/m^2}{6.96 \times 10^{-4} \ N \cdot s/m^2} = 3.74$$

(+2 points)