

A viscometer is constructed with two 30-cm-long concentric cylinders, one 20.0 cm in diameter and the other 20.2 cm in diameter. A torque of 0.13 Nm is required to rotate the inner cylinder at 400 rpm (revolutions per minute). Calculate the viscosity ( $\mu$ ).

$$R = \frac{20}{2} = 10 \text{ cm}$$

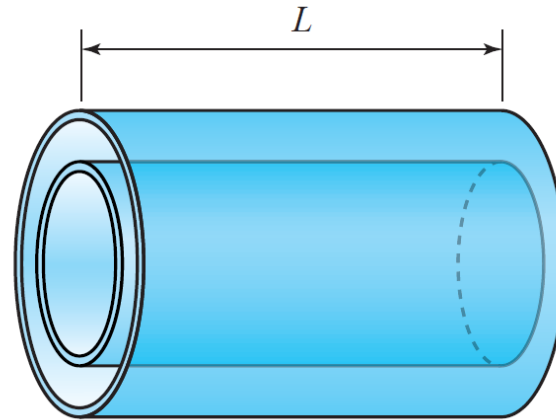
$$h = \frac{d_2 - d_1}{2} = \frac{20.2 - 20}{2} = 0.1 \text{ cm}$$

The rotational speed:

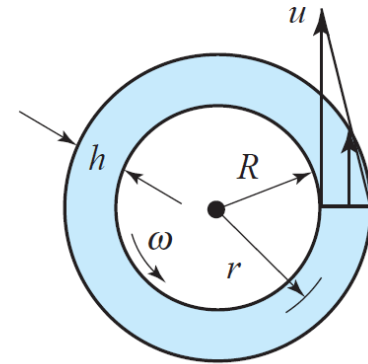
$$\begin{aligned} \omega &= 2\pi n = \frac{\pi n}{30} = \frac{3.14 \times 400}{30} \\ &= 41.89 \text{ s}^{-1} \end{aligned}$$

Viscosity

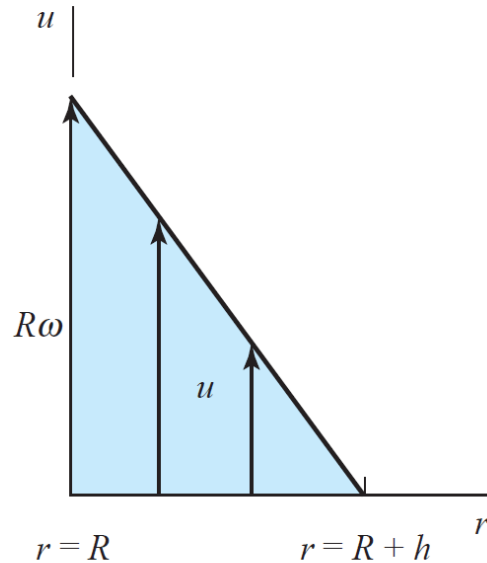
$$\begin{aligned} \mu &= \frac{Th}{2\pi R^3 \omega L} \\ &= \frac{0.13 \times 0.001}{2 \times 3.14 \times 0.1^3 \times 41.89 \times 0.3} \\ &= 0.001646 \text{ N} \frac{\text{s}}{\text{m}^2} \end{aligned}$$



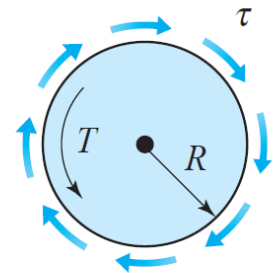
(a)



(b)



(c)



(d)