

### Problem 2A.3

**Volume flow rate through an annulus.** A horizontal annulus, 27 ft in length, has an inner radius of 0.495 in. and an outer radius of 1.1 in. A 60% aqueous solution of sucrose ( $C_{12}H_{22}O_{11}$ ) is to be pumped through the annulus at 20°C. At this temperature the solution density is  $80.3 \text{ lb}_m/\text{ft}^3$  and the viscosity is  $136.8 \text{ lb}_m/\text{ft} \cdot \text{hr}$ . What is the volume flow rate when the impressed pressure difference is 5.39 psi?

*Answer:*  $0.110 \text{ ft}^3/\text{s}$