

#1

#4-56

$$L = 0.2 \text{ m} \quad D = 0.02 \text{ m}$$

$$k = 65 \text{ W/m}\cdot\text{C}$$

$$T_b = 150 \text{ C} \quad T_a = 20 \text{ C}$$

$$h = 15 \text{ W/m}\cdot\text{C}$$

$$\Delta T = T_b - T_a = 150 - 20 = 130 \text{ C}$$

$$A = \frac{\pi D^2}{4} = \frac{\pi (0.02)^2}{4} = 0.000314 \text{ m}^2$$

$$P = \pi D = \pi (0.02) = 0.0628 \text{ m}$$

$$m = \sqrt{\frac{4h}{kD}} = \sqrt{\frac{4(15)}{(65)(0.02)}} = 6.79 \text{ m}^{-1}$$

$$Q = \Delta T \sqrt{hPkA} \tanh(mL)$$

$$130 \sqrt{(15)(0.0628)(65)(0.000314)} \tanh(6.79)(0.2)$$

$$Q = 15.8 \text{ W}$$