

Thermo Quiz 9

1) $\dot{n} = 1000 \frac{\text{mol}}{\text{sec}}$ $x_{\text{CO}_2} = 0.25$

$$x_{\text{CO}_2} = \frac{\dot{n}_{\text{CO}_2}}{\dot{n}_{\text{total}}}$$

2) $T = 350 \text{ K}$ $P = 100 \text{ kPa}$ $G = H - TS = -394360 \frac{\text{kJ}}{\text{kmol}}$

$$W_s' = \dot{n} T \Delta S \quad \Delta S = -R \sum y_i \ln y_i$$

3) $\dot{V} = 8 \frac{\text{m}^3}{\text{s}}$ $T = 500^\circ \text{C}$ $P = 4.0 \text{ MPa}$ $d = 0.7 \text{ m}$

$$A_v = \dot{V} \quad v = \frac{\dot{V}}{A} \quad \frac{\text{m}^3}{\text{s}} \cdot \frac{1}{\text{m}^2}$$

4) $v = 0.08644 \frac{\text{kg}}{\text{m}^3} \therefore \dot{n} = 8 \frac{\text{m}^3}{\text{s}} \cdot 0.08644 \frac{\text{kg}}{\text{m}^3}$

5) $P_1 = 50 \text{ kPa}$ $\dot{m} = 3 \frac{\text{kg}}{\text{s}}$ $\eta_r = 0.8$
 $P_2 = 5000 \text{ kPa}$

$$W_s' = H_6 - H_5 = \int_5^6 v dP \quad v = 0.00103 \frac{\text{m}^3}{\text{kg}}$$

$$W_s' = \frac{3 \text{ kg}}{\text{s}} (0.00103) \frac{\text{m}^3}{\text{kg}} (5000 - 50) \text{ kPa} = 15.3 \text{ kW}$$

$$W_s = \frac{W_s'}{\eta} = \frac{15.3}{0.8} = 19.1 \text{ kW}$$