

Homework #7

4-17 :

$$Q_{in} - W_{out} = m \left(h_2 - h_1 + \frac{V_2^2}{2 \cdot g_c} - \frac{V_1^2}{2 \cdot g_c} \right)$$

$$0 - 1500 = \frac{18000}{3600} \left(h_2 - h_1 + \frac{(450)^2}{2 \cdot 1000} \right)$$

h_1 : use Table A-6-1

$$h_1 = 2746.4 \text{ kJ/kg}$$

$$h_2 = 2450 \text{ kJ/kg}$$

$$= h_f + x (h_g - h_f)$$

$$\Rightarrow x = 0.94$$

4-18 :

$$Q_{in} - W_{out} = m (h_2 - h_1)$$

$$h_1 : P = 4100 \text{ kPa.}$$

$$h_2 = m h_1 - W_{out} \quad \dots \quad (1)$$

$$h_2 : P = 3.99 \text{ kPa.}$$

$$h_2 = 2310 \text{ kJ/kg.}$$

$$\text{From (1): } h_1 = 3140 \text{ kJ/kg}$$

$$h_1 = 3140 \text{ KJ/kg} \quad P = 4100 \text{ kPa}$$

$$\Rightarrow T = 371^\circ\text{C}$$

4-23:

$$Q_{in} = \dot{m} \left(h_2 - h_1 + \frac{v_2^2}{2 \cdot g_c} - \frac{v_1^2}{2 \cdot g_c} \right)$$

$$\begin{aligned} \dot{m} &= \rho \cdot \Delta V = 1.75 * 0.014 * 200 \\ &= 4.9 \text{ kg/s} \end{aligned}$$

$$\cancel{Q_{in} = 4.9 \text{ t}}$$

$$h_1 = 0.4 * 2684 + 0.6 * 442 = 1339 \text{ KJ/kg}$$

$$h_2 = \left(\begin{array}{l} P = 125 \text{ kPa} \\ T = 40^\circ\text{C} \end{array} \right) 167.6 \text{ KJ/kg}$$

$$\begin{aligned} Q_{in} &= 4.9 \left(167.6 - 1339 - \frac{(200)^2}{2 \cdot 1000} \right) \\ &= -5837.9 \text{ KJ/kg} \end{aligned}$$

~~4-24:~~

4-30:

$$Q_{in} - W_{out} = \dot{m} (h_2 - h_1)$$

$$h_1 = 0.95 \cdot 1565 + 0.05 \cdot 195 = 1497 \text{ KJ/kg}$$

$$h_2 = 1832 \text{ KJ/kg}$$

$$\dot{m} = \frac{1497 - 1832}{\dots}$$

$$\dot{m} = \frac{25 \text{ kJ/s}}{1832 - 1497} = 0.075 \text{ kg/s}$$

4-31:

$$1: P = 1500 \text{ kPa}, T = 30^\circ\text{C}$$

$$2: P = 200 \text{ kPa}$$

$$h_1 = h_2 = 500 \text{ kJ/kg}$$

use Table A-8-1:

$$500 = \cancel{x \cdot 261.3 + (1-x) \cdot 1586.7}$$

$$\Rightarrow \cancel{x = \dots}$$

$$500 = x \cdot 1586.7 + (1-x) \cdot 261.3$$

$$\Rightarrow x = 0.18$$

4-32:

$$Q_{in} = \dot{m}(h_2 - h_1)$$

$$h_2 = 1589.3 \text{ kJ/kg}$$

$$h_1 = h_f + x(h_g - h_f) = 501.8 \text{ kJ/kg}$$

$$Q_{in} = 0.5 (1589.3 - 501.8) = 543.75 \text{ kJ/kg}$$