

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:

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

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

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

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:

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

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

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

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

Homework: 8

4-70:)

$$Q = \Delta H = \int c_p dt = 1.5 * \Delta T = 712.5 \text{ KJ/kg}$$

4-91):

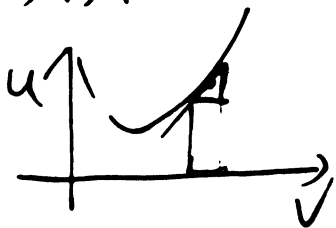
$$Q_{in} - W_{out} = \dot{m} (h_2 - h_1)$$

$$Q_{in} = W_{out} + \frac{Pv}{RT} \cdot c_p \cdot \Delta T$$

$$= 3 \text{ MW} + \frac{101.325 \cdot \frac{1150}{60}}{8.314 \cdot 288} * 32 * 1.02 * 245$$

$$= 9485 \text{ KJ/s}$$

4-57):



$$\left(\frac{\partial u}{\partial v} \right)_T = \left(\frac{\Delta u}{\Delta v} \right)_T$$

1: 10 MPa, 400°C.

2: 9 MPa, 400°C

$$u_1 = 2800 \text{ KJ/kg} \quad v_1 = 0.02700 \text{ m}^3/\text{kg}$$

$$u_2 = 2848 \text{ KJ/kg} \quad v_2 = 0.02993 \text{ m}^3/\text{kg}$$

$$\frac{\Delta u}{\Delta v} = \frac{48}{0.00293} = 16382 \text{ KJ/m}^3$$

4-58:)

- 1: 350°F 80 psia

2: 350°F 120 psia

$u_1 = 1119 \text{ B/lbm}$ $v_1 = 5.797 \text{ ft}^3/\text{lbm}$

$u_2 = 1113 \text{ B/lbm}$ $v_2 = 3.780 \text{ ft}^3/\text{lbm}$

$\frac{\Delta u}{\Delta v} = 3 \text{ B/ft}^3$

4-42:)

- 1: $X = 0.2$, $V = 1.45 \text{ m}^3$ $P = 151.5 \text{ kPa}$

2: $X = 0.267$, $V = 1.45 \text{ m}^3$ $P = 151.5 \text{ kPa}$

$v_1 = 0.2 \times 0.7712 + 0.8 \times 0.001490 = 0.155 \text{ m}^3/\text{kg}$

$v_2 = \overset{0.733}{\cancel{0.267}} \times 0.7712 + \overset{0.267}{\cancel{0.733}} \times 0.001490 = \cancel{0.207 \text{ m}^3/\text{kg}} 0.566 \text{ m}^3/\text{kg}$

$\dot{m}_1 = \frac{V}{v_1} = 9.35 \text{ kg}$ $\dot{m}_2 = \cancel{7.11} 2.56 \text{ kg}$

~~$h = 0.2 \times 233.71 + 0.8 \times 1344.6 = 1122.92 \text{ kJ/kg}$~~

~~h = 0.~~

~~$h = 0.8 \times 233.71 + 0.2 \times 1344.6 = 435.88 \text{ kJ/kg}$~~

~~$h_2 = 0.267 \times 233.71$~~