Homework #7

4-17 :

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

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

h_1 : use Table A-6-1

$$h_1 = 2746.4\ KJ/kg$$

$h_2 = 2450\ KJ/kg$

$= h_f + x(h_g - h_f)$

$\Rightarrow x = 0.94$

4-18 :

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

h_1 : $P = 4100\ KPa$.

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

h_2 : $P = 3.99\ KPa$.

$h_2 = 2310\ KJ/kg$.

From (1) : $h_1 = 3140\ KJ/Kg$

$h_1 = 3140 KJ/kg$. $P = 4100 kPa$

$\Rightarrow T \doteq 371°C$.

4-23:

$$Q_{in} = \dot{m}\left(h_2 - h_1 + \cancel{\frac{V_2^2}{2 g_c}}^{0} - \frac{V_1^2}{2 g_c}\right)$$

$$\dot{m} = \rho \cdot \Delta V = 1.75 * 0.014 * 200$$
$$= 4.9 kg/s$$

~~$Q_{in} = 4.9t$~~

$h_1 = 0.4 * 2684 + 0.6 * 442 = 1339 KJ/kg$

$h_2 = \begin{pmatrix} P=125kPa \\ T=40°C \end{pmatrix}$ $167.6 KJ/kg$

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

~~4-27~~:

4-30:

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

$h_1 = 0.95 \cdot 1565 + 0.05 \cdot 195 = 1497. KJ/kg$

$h_2 = 1832. KJ/kg$

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

$$\dot{m} = \frac{25\,KJ/s}{1832 - 1497.} = 0.075\,kg/s$$

4-31:

1: $P = 1500kpa$. $T = 30°C$

2: $P = 200kPa$.

$h_1 = h_2 \doteq 500\,KJ/kg$.

use Table A-8-1:

~~$500 = X \cdot 261.3 + (1-X)\,1586.7$~~

~~$\Rightarrow X =$~~

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

$\Rightarrow X = 0.18$

4-32:

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

$h_2 = 1589.3\,KJ/kg$

$h_1 = h_f + x(h_g - h_f) = 501.8\,KJ/kg$

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

Homework: 8

4-70:)

$$Q = \Delta H = \int C_p dT = 1.5 * \Delta T = 712.5\ KJ/kg$$

4-91):

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

$$Q_{in} = W_{out} + \frac{PV}{RT} \cdot C_p \cdot \Delta T$$

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

$$= 9485\ KJ/S$$

4-57):

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

1: 10MPa. 400°C.

2: 9MPa. 400°C

$u_1 = 2800\ KJ/kg$ $v_1 = 0.02700\ m^3/kg$

$u_2 = 2848\ KJ/kg$ $v_2 = 0.02993\ m^3/kg$

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