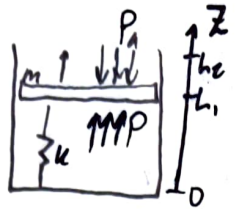
Thermodynamics Will Buziak Hw 3

1.



$g = 9.81\ m/s^2$ $m = 45\ kg$ $A = .012\ m^2$

$h_2 = .6\ m$ $h_1 = .4\ m$ $P_a = 101,325\ Pa$

$k = 2000\ N/m$ $Q = 0$

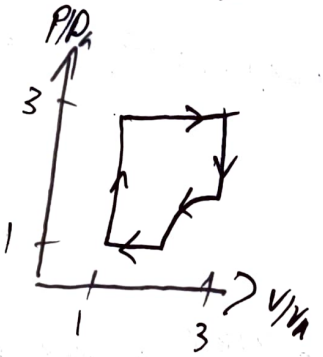
$E_{tot} = Q - W$

$mg(h_2 - h_1) + 1/2\,k(h_2 - h_1)^2 = -W$

$\Rightarrow 45(9.81)(.6 - .4) + 1/2(2000)(.2)^2 = .09229$

$\Rightarrow W = -.09229\ kJ$

2.



$P_A = 1.1\ atm$ $V_A = .32\ m^3$

$P_2 = 3.3$; $P_1 = 1.1 \rightarrow P = 2.2$

$V_2 = .16$, $V_1 = .32 \rightarrow V = .64$

$2 \times 2 - \frac{\pi(1)}{4} = 3.215$

$3.215\ P.V = \frac{3.215}{2.2(.64)} = 2.283\ kJ$

3.

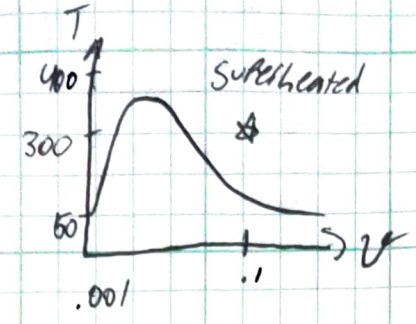
$H = 9500\ kJ$ $P = 300\ kPa$ $m = 5\ kg$ $T = 133.52\ ^\circ C$ $\rightarrow$ table A-5

$H/m = h = \frac{9500}{5} = 1900$

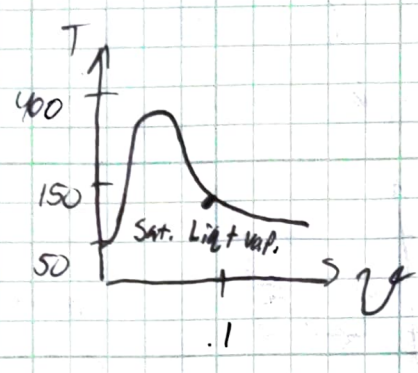
$h = h_f + x\,h_{fg} \Rightarrow 1900 = 561.43 + x(2163.5)$

$x = .619$

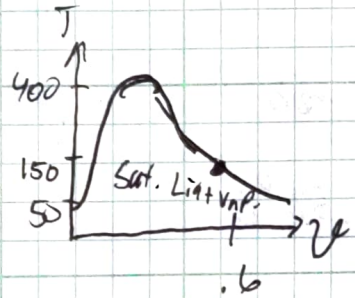
4. a) $T = 340^{\circ}C$ $v = .1\ m^3/kg$



b) $T = 155^{\circ}C$ $v = .1\ m^3/kg$



c) $T = 155^{\circ}C$ $v = .6\ m^3/kg$



d) $T = 155^{\circ}C$ $v = .001$

6. $T = 450\ K$ $\quad = 176.85^\circ C$ $\quad m_L = .5\ kg$ $\quad m_V = .1\ kg$

$m_{L,f} = .5(.7) = .35 = .15$ $\quad m_{V,f} = .45$

a) $P_i = P_{sat@176.85^\circ C} = 9,347\ kPa$

$P_f = 213\ kPa$

$P_i = \frac{RT}{v_i} = \frac{461.52(450)}{.0222195} = 9.35\ MPa$ $\quad P_f = \frac{RT}{v_f} = .2\ MPa$

b) $v_i = v_f + v_g = .5(.001121) + .1(.218659) = .0222195$

$v_f = .15(.001121) + .45(.218659) = .09763365$

$\Delta V = .075\ m^3$

c) $W = \int_{v_1}^{v_2} P\,\Delta v =$ $\quad 9,347(.0[illegible]) - 213(.09763365)$

$W = 186.89\ kJ$

5. $v = .1633$

$u = 3.1782\ e\ 3$

$h = 3.5681\ e\ 3$

$s = 7.6001$