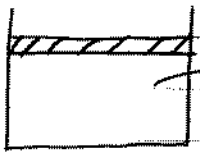
MCG 2135 HOMEWORK 5 (4.67, 4.106, 4.114)

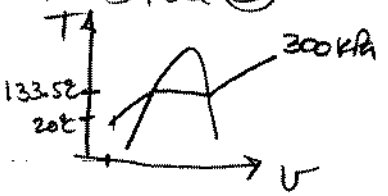
4.67



1 kg H_2O (liquid)
20°C & 300 kPa
$V_{max} = 0.002\ m^3$ (at stops)
$P_2 = 600$ kPa

Find U_2 & $_1W_2$

At state (1):



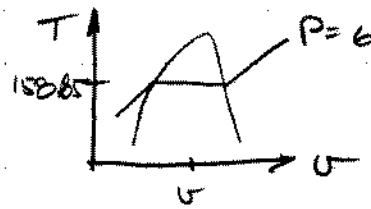
$v_1 = v_f$ (at 20°C) = 0.001002 m^3/kg

$V_1 = v_1 m_1 = 0.001002 \times 1$
$= 0.001002\ m^3$

At (2), $P_2 > P_{lift}$ ⇒ PISTON IS AGAINST STOPS

$V_2 = 0.002\ m^3$

$v_2 = V_2/m_2 = \frac{0.002 m^3}{1 kg} = 0.002\ m^3/kg$



$v_f < v < v_g$ at 600 kPa
∴ 2 PHASE
& $T_2 = T_{SAT} = 158.85$°C

Work is done while piston moves at P_{lift} = constant
(P_{lift} = 300 kPa)

$$_1W_2 = \int P dV = P_{lift}(V_2 - V_1)$$
$$= 300 kPa\ (0.002 - 0.001002)$$
$$= 299.4\ J$$
$$_1W_2 = 0.3\ kJ$$