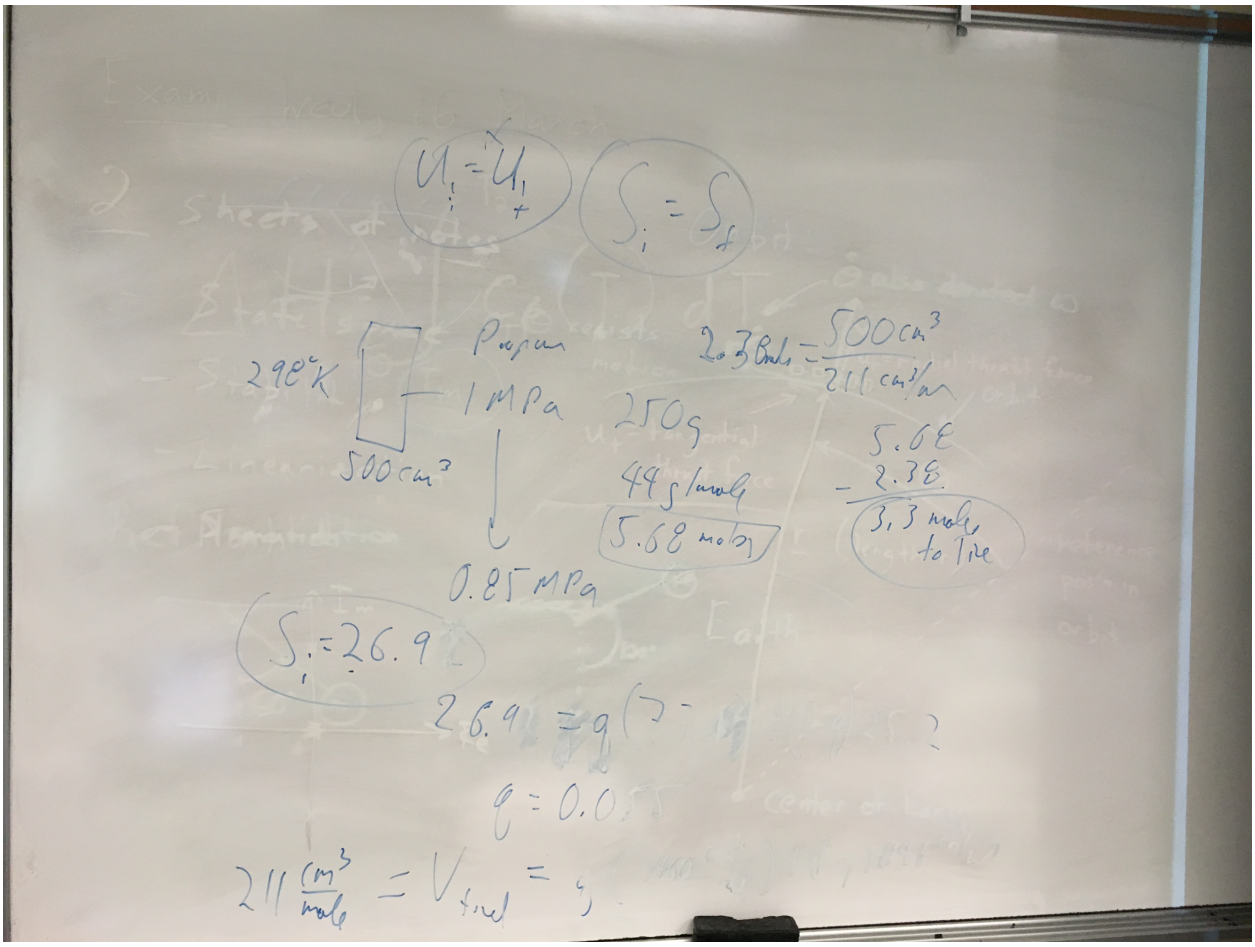
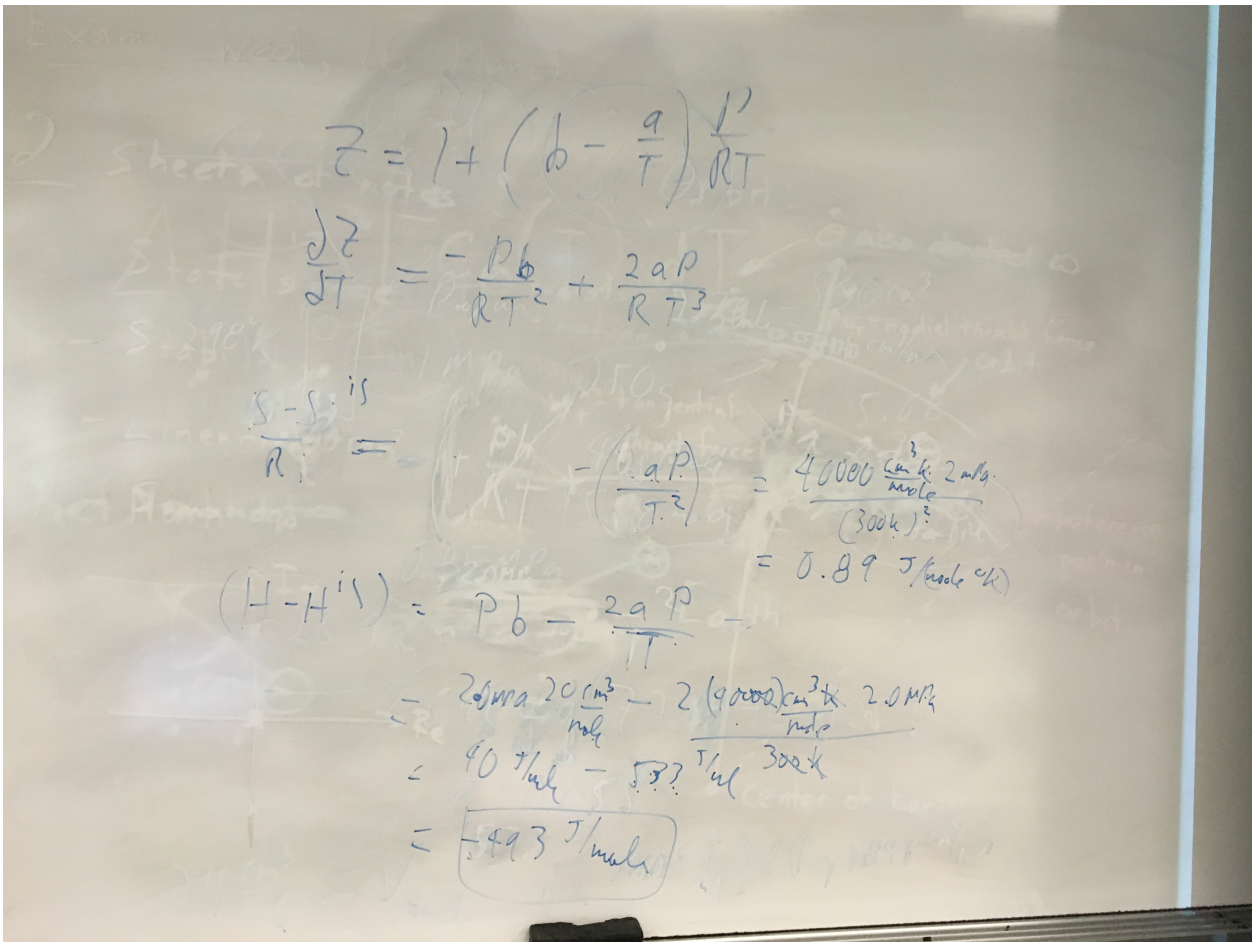
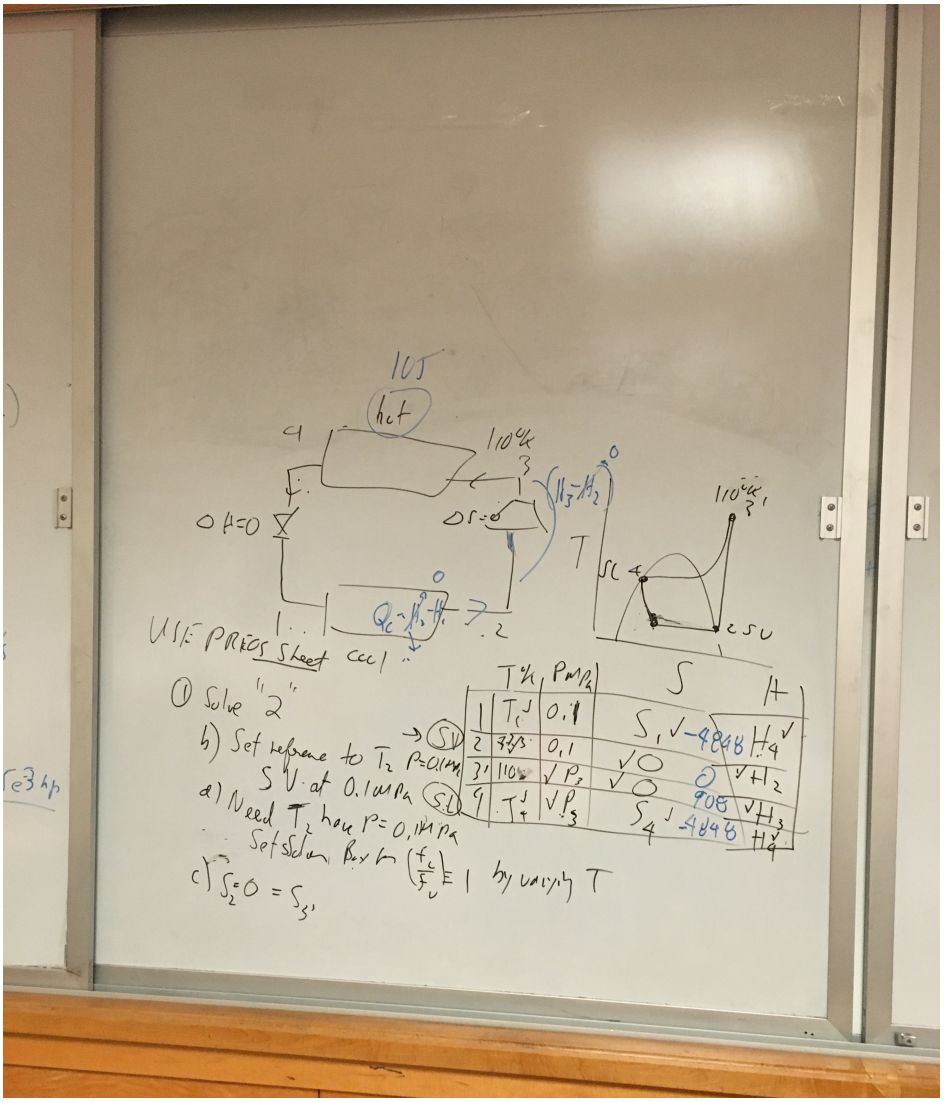

$U_i = U_f$
$S_i = S_f$
298°K
Propane
1 MPa
500 cm³
0.85 MPa
250g
44 g/mole
5.68 moles
2.38 Moles = 500 cm³ / 211 cm³/mol
5.68
- 2.38
3.3 moles to fire
$S_i = 26.9$
26.9 = q(
q = 0.0
211 cm³/mole = V final =


$Z = 1 + \left(b - \frac{a}{T}\right)\frac{P}{RT}$
$\frac{\partial Z}{\partial T} = -\frac{Pb}{RT^2} + \frac{2aP}{RT^3}$
$\frac{S - S^{is}}{R} = -\left(\frac{aP}{T^2}\right) = \frac{4000 \frac{cm^3}{mole} \cdot 2 atm}{(300k)^2}$
$= 0.89$ J/(mole °K)
$(H - H^{is}) = Pb - \frac{2aP}{T}$
$= 20 atm \frac{20 cm^3}{mole} - \frac{2(4000) cm^3 atm}{mole} \cdot \frac{2.0 atm}{300 k}$
$= 40$ J/mole $- 53$ J/mole
$= -493$ J/mole


105
hot
110%
OA=0
OS=0
$Q_c = H_3 - H_2$
$(H_3 = H_2)$
T
SC
SU
USE PROPS Sheet ccc1
① Solve "2"
b) Set reference to T_2 P=0.1MPa
SV at 0.1MPa
a) Need T_2 how P=0.1MPa
Set Scion Box to $\left(\frac{f_c}{f_v}\right) = 1$ by varying T
c) $S_2 = 0 = S_3$
T °C | P MPa | S | H
1 | T_1 J | 0.1 | S_1 ✓ -4848 | H_4 ✓
2 | 3 J/3 | 0.1 | ✓0 | 0 | ✓H_2
3 | 110% | ✓P_2 | ✓0 | 908 | ✓H_3
4 | T_4 J | ✓P_3 | S_4 J -4848 | H_4 ✓
SV
SL

② Solve "3"

a) Need P_3 from T_3 & $S_3 = 0$

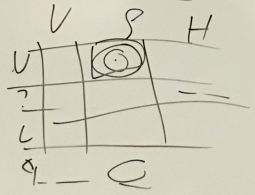
F(x) box is S_3

Desired Value is 0

Vary P

(b) → Get H_3

F(x)	= . . .
x	, ,



③ Solve 4

Have P_4 & SL

Target $\frac{f_v}{f_c} = 1$

Vary T

Get T_4 H_4 S_4

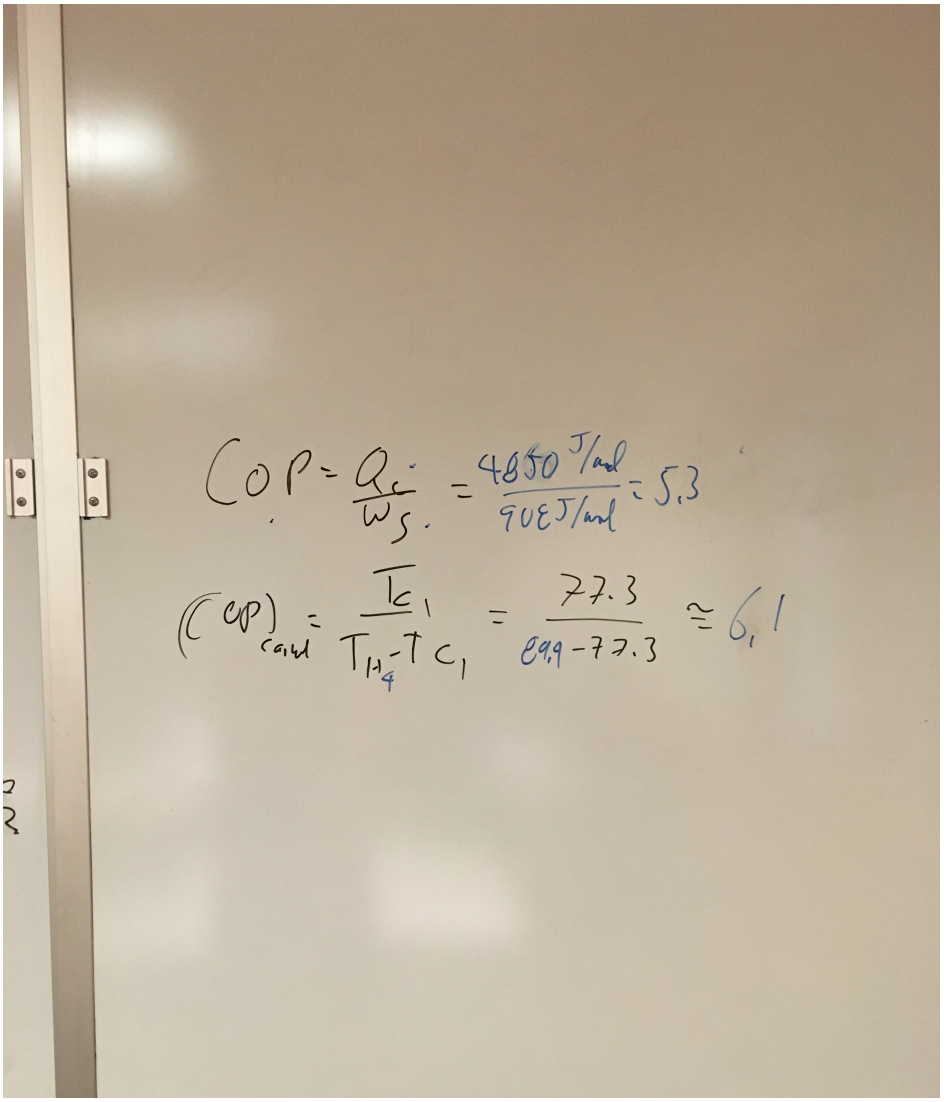
④ Solve 1

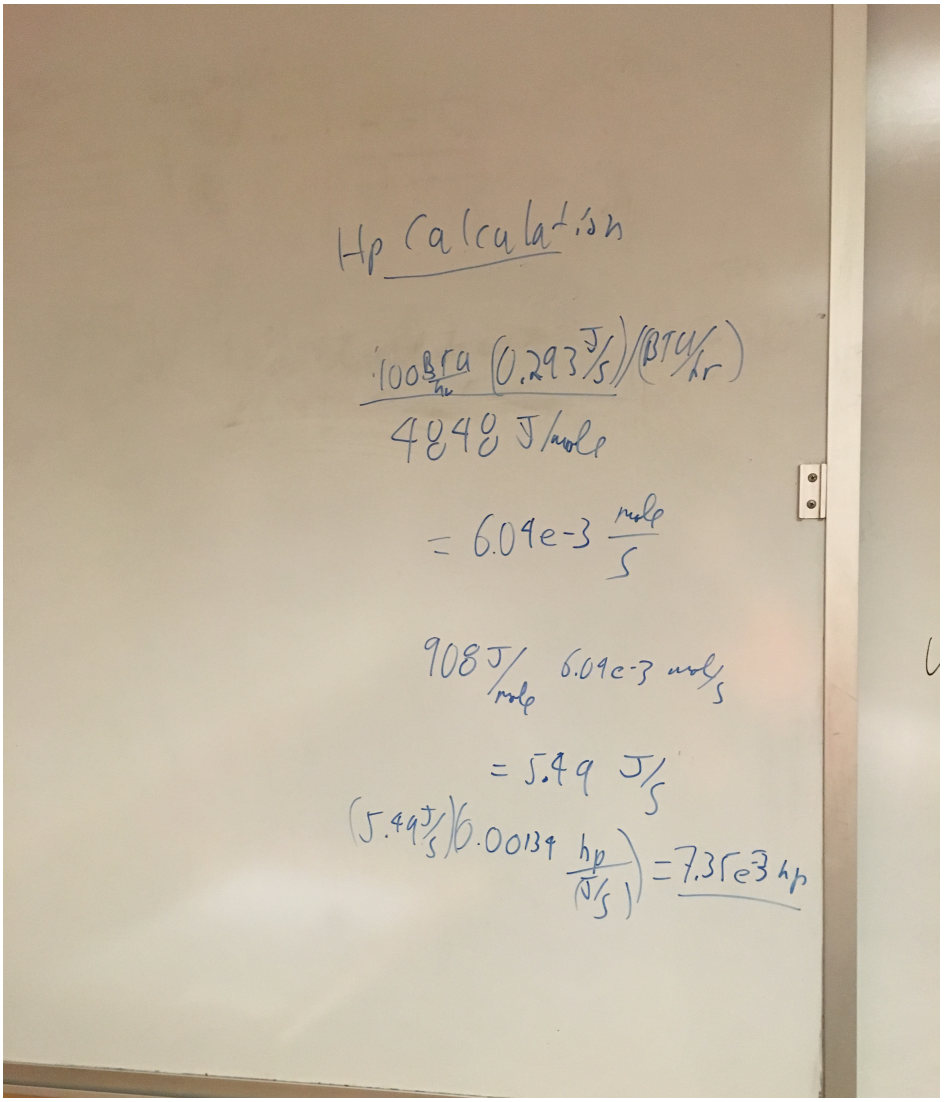
Have $H_1 = H_3$ $P_1 = P_2$

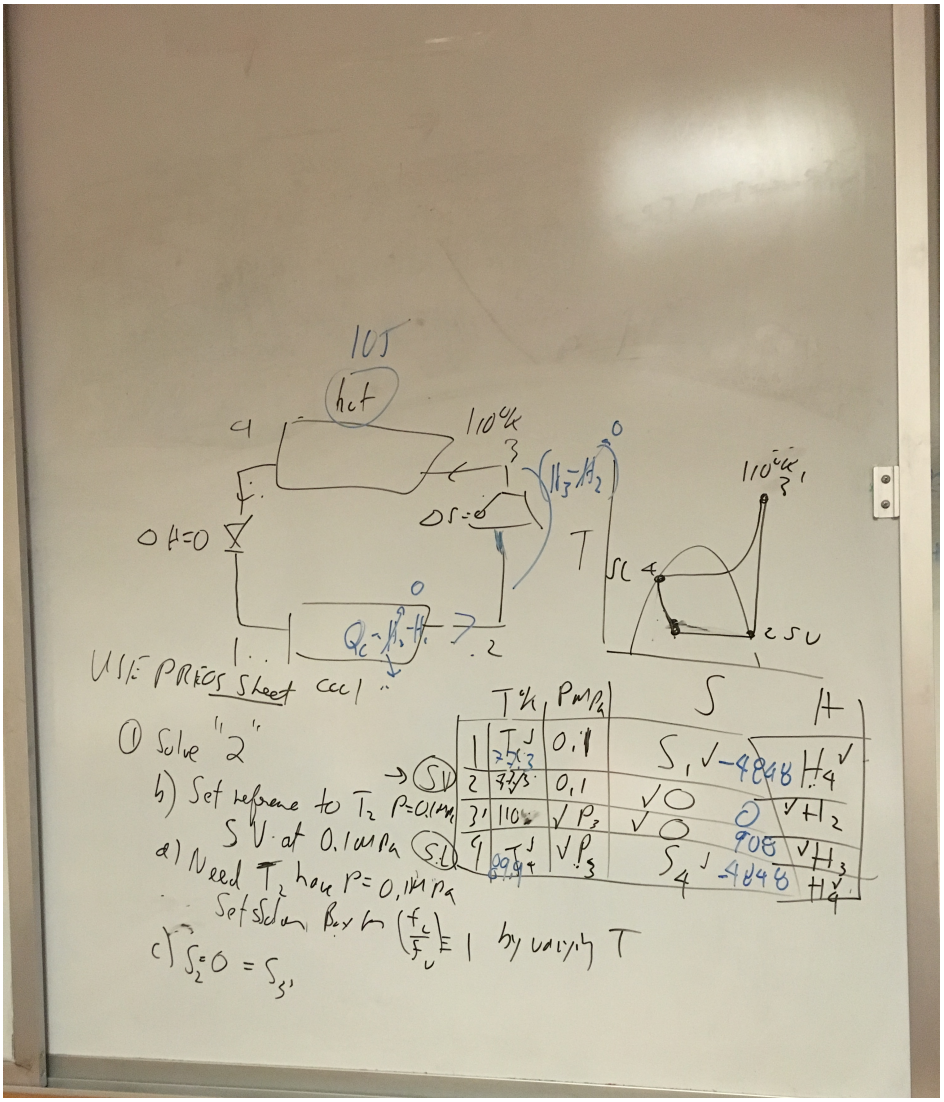
The Target IS

$H = H_4$

Vary T


$COP = \frac{Q_c}{W_s} = \frac{4850\ J/mol}{900\ J/mol} = 5.3$
$(COP)_{carnot} = \frac{T_{c_1}}{T_{H_4} - T_{c_1}} = \frac{77.3}{89.9 - 77.3} \approx 6.1$


Hp calculation
100 BTU/hr (0.293 J/s)/(BTU/hr)
4848 J/mole
= 6.04e-3 mole/s
908 J/mole 6.04e-3 mole/s
= 5.49 J/s
(5.49 J/s)(0.00134 hp/(J/s)) = 7.35e-3 hp



	T °K	P MPa	S	H
1	T_1 253	0.1	S_1 ✓ -4848	H_4 ✓
2	253	0.1	✓ 0	✓ H_2
3	110	✓ P_3	✓ 0	✓ H_3
4	T_4	✓ P_3	S_4 ✓ -4848	H_4 ✓

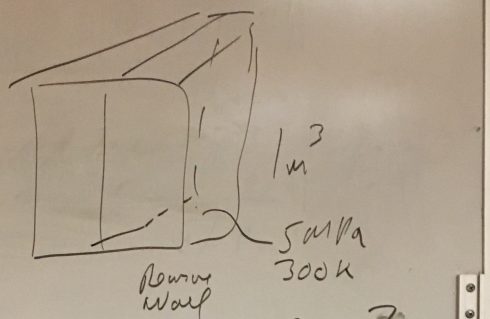
① Solve "2"

b) Set reference to T_2 P=0.1MPa → (SV)
SV at 0.1 MPa (SL)

a) Need T_2 how P=0.1MPa
Set Sat. Box to $\left(\frac{f_L}{f_V}\right)=1$ by varying T

c) $S_2=0=S_3$

8.14



T_f, P_f = ?

$PV = nRT$

V

$P \sim \frac{1}{V}$

$$Z = 1 + \left(b - \frac{a}{T}\right)\frac{P}{RT}$$

$b = 20 \frac{cm^3}{mol}$

$a = 40{,}000 \frac{cm^3 K}{mol}$

$C_p = 41.8 + 0.0\mathcal{E}4\,T$ (J/mol K), T in K

a) (Energy Balance)

$\Delta U = 0$

(Entropy Balance) $\Delta S = S_{gen} \geq 0$

(b) i) want U_{ideal} i.e. d_{ideal}

$$\frac{U-U^{is}}{RT} = \frac{H-H^{is}}{RT} - (Z-1) \quad \text{P.30E}$$

$$\frac{H-H^{is}}{RT} = -\int_0^P \frac{1}{T}\left(\frac{\partial Z}{\partial T}\right)_P \frac{dP}{P} \quad \text{P.310}$$

$$\left(\frac{\partial Z}{\partial T}\right)_P = -\left(b - \frac{2a}{T}\right)\frac{P}{RT^2}$$

$$\left(\frac{H-H^{is}}{RT}\right) = \frac{\left(b-\frac{2a}{T}\right)P}{RT}$$

$$\left(\frac{U-U^{is}}{RT}\right) = -\frac{a}{RT^2}P$$

c)

$$U^i = (U - U^{ig}) + \int_{T=300K}^{T_f} (C_p - R)\, dT$$

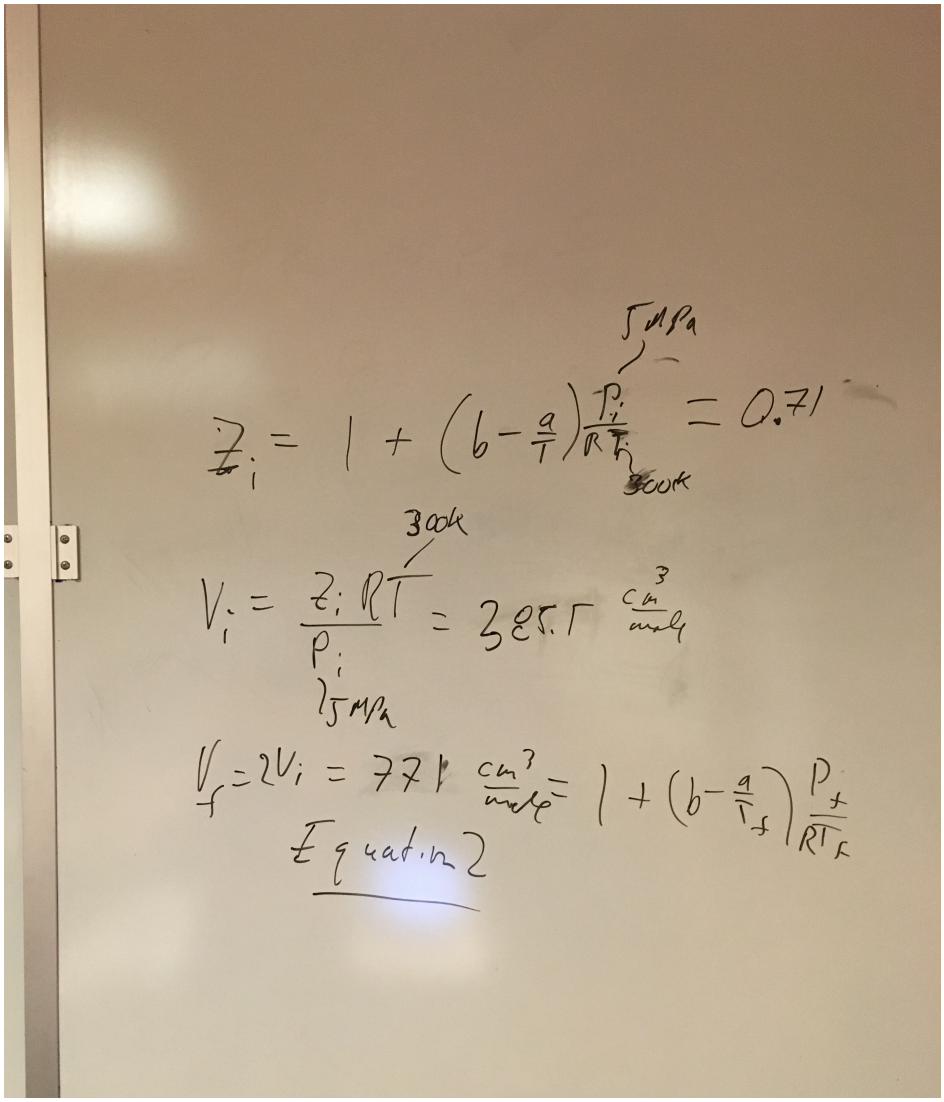
$$= \frac{-aP}{T} = -\frac{40{,}000 \frac{cm^3 K}{mol} \cdot \frac{J}{cm^3} \cdot MPa}{300K}$$

$$U^i = -677 \frac{J}{mol} = U^f$$

$$0 = 677 \frac{J}{mol} + \frac{-40{,}000 \frac{cm^3 K}{mol} \cdot P_f}{T_f} + 41.6 T_f + 0.0 E q \frac{T_f^2}{2} - 8.314 \frac{J}{molK} T_f$$

Equation 1

F(T,P),U	0	= 0
T →	300 K	= 0
P +	5/2 MPa	(initial values)


$Z_i = 1 + \left(b - \frac{a}{T}\right)\frac{P_i}{RT_i} = 0.71$
5 MPa
300K
$V_i = \frac{Z_i RT}{P_i} = 325.1 \frac{cm^3}{mole}$
300K
15 MPa
$V_f = 2V_i = 771 \frac{cm^3}{mole} = 1 + \left(b - \frac{a}{T_f}\right)\frac{P_f}{RT_f}$
Equation 2