Question 1B

$\Delta H = C_p(T_S - T_i)$

$= \frac{7 \times 8.314\ JK^{-1} mol^{-1}}{2}$

$= -11.15\ J$

$= -11.115\ J mol^{-1}$

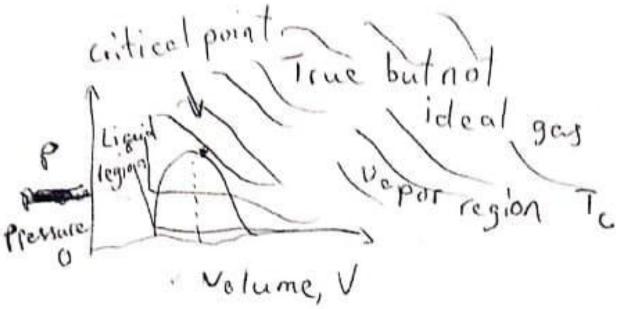
$C_p - C_v = R$

$C_p = C_v + R = \frac{5R}{2} + R = \frac{7R}{2}$

$\Delta S = n C_v \ln \frac{T_2}{T_1} = \frac{2.25 \times 5 \times 8.314}{2} \ln \frac{298}{680}$

$= -38.607\ JK^{-1}$

Qusstion 3 b



Question 2 b

$$\Delta G_{mixing} = nRT \sum x_1 \ln x_1 = (5.75\ mol) \times 8.314\ J\ mol^{-1}\ K^{-1} \times$$

$$\times 298.15\ K \times \left(\frac{2.50}{5.75} \ln \frac{2.50}{5.75} + \frac{1.75}{5.75} \ln \frac{1.75}{5.75} + \frac{1.50}{5.75} \ln \frac{1.50}{5.75} \right)$$

$$= -17.9 \times 10^3\ J$$

$$\Delta S_{mixing} = -nR \sum_i x_i \ln x_i = (-5.75\ mol) \times 8.314\ J\ mol^{-1}\ K^{-1} \times$$

$$\times \left(\frac{2.50}{5.75} \ln \frac{2.50}{5.75} + \frac{1.75}{5.75} \ln \frac{1.75}{5.75} + \frac{1.50}{5.75} \ln \frac{1.50}{5.75} \right)$$

$$= 51.4\ J\ K^{-1}$$

Question 1 a

Because $\Delta T = 0$ for the expansion of an ideal gas into a vacuum, $\Delta S = nR \ln \frac{V_1}{V_2} > 0$.
And so $\Delta S_{surroundings}$ is calculated using the actual heat flow into the surroundings, $\Delta S_{surroundings} = 0$ for an adiabatic process

$$\Delta S_{total} = \Delta S + \Delta S_{surroundings} > 0$$