1. Adiabatic so $q = 0$

$dU = C_V(T)\,dT$

$\Delta U = \int C_V\,dT = C_V \int_{300}^{400} dT = C_V(400-300)$

$= 1000\ J/mol$

$\Delta U = q + w$ for 1mol ... 1000 J

$= w$

$w = 1000\ J/mol$ for 1 mol ... 1000J

$\Delta S = q/T = 0$

2. $CO + NO \rightarrow CO_2 + \frac{1}{2}N_2$

$CO + \frac{1}{2}O_2 \rightarrow CO_2$ $\Delta H_A = -283.0\ kJ$

$NO \rightarrow \frac{1}{2}O_2 + \frac{1}{2}N_2$ $\Delta H = -\frac{1}{2}\Delta H_B = -90.3\ kJ$

$CO + NO \rightarrow CO_2 + \frac{1}{2}N_2$ $\Delta H = -283.0 - 90.3$

$\boxed{= -373.3\ kJ}$

3. Trans $\ln\left(\frac{2\pi M k_B T}{h^2}\right)^{3/2}\frac{\bar{V}}{N_A}$

Rot $\ln \frac{T}{\sigma\Theta_A}$

Vib $-\ln\left(1 - e^{-\Theta_B/T}\right) + \frac{\Theta_B/T}{e^{\Theta_B/T}-1}$

Elec $\ln g_{e1}$

4. The entropy of an isolated system will increase until no more spontaneous processes occur, in which case the system will be at equilibrium.

5.

$$P(V-B) = nRT$$

$$PV - PB = nRT$$

$$PV = nRT + PB$$

$$V = \frac{nRT + PB}{P} = \frac{nRT}{P} + B$$

$$\left(\frac{\partial V}{\partial T}\right)_P = \frac{nR}{P}$$

$$\left(\frac{\partial H}{\partial P}\right)_T = V - T\left(\frac{nR}{P}\right) = \cancel{\frac{nRT}{P}} + B - \cancel{\frac{nRT}{P}} = \underline{B}$$

6.

$$dH = TdS + VdP$$

$$dH = \left(\frac{\partial H}{\partial S}\right)_P dS + \left(\frac{\partial H}{\partial P}\right)_S dP$$

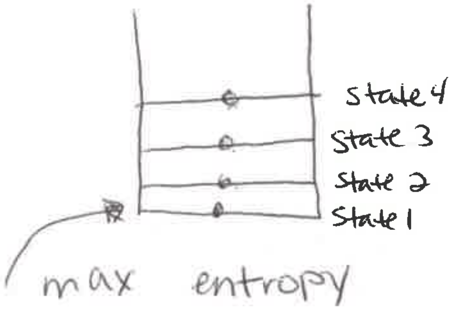
$$\left(\frac{\partial H}{\partial S}\right)_P = T \qquad \left(\frac{\partial H}{\partial P}\right)_S = V$$

$$\left(\frac{\partial^2 H}{\partial P \partial S}\right) = \left(\frac{\partial T}{\partial P}\right)_S \qquad \left(\frac{\partial^2 H}{\partial S \partial P}\right)_P = \left(\frac{\partial V}{\partial S}\right)_P$$

so $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$

7. $q_P \equiv \Delta H$ or choice d

8.



\# systems in each state are a_1, a_2, a_3 and a_4

maximum entropy with one system in each state

$a_1 = 1$

$a_2 = 1$

$a_3 = 1$

$a_4 = 1$