

Practice Key

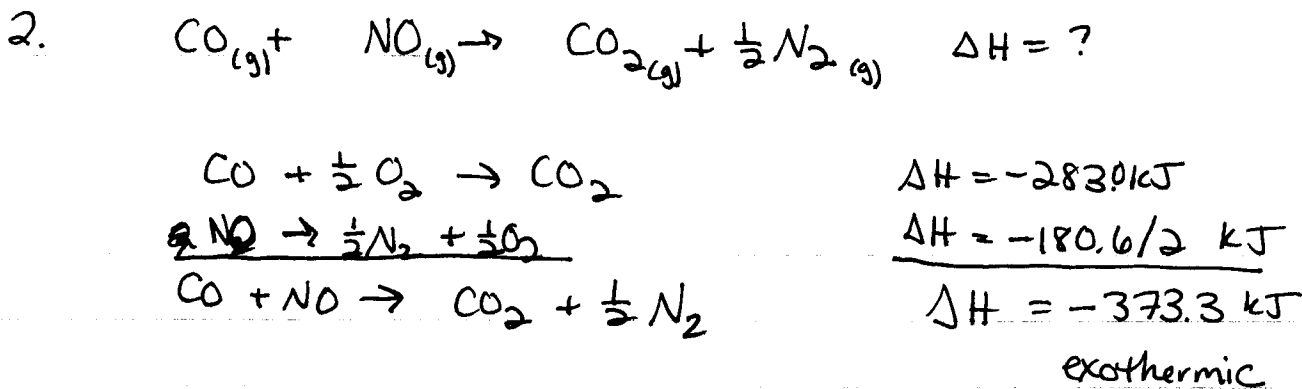
1. Adiabatic...  $q=0$   $S=q_{rev}/T=0$

$$u = q + w \quad u = w \quad du = C_v dT$$

$$u = \int_{300}^{400} C_v dT = C_v [400 - 300]$$

$$= 10(100) \text{ J/mol}$$

$$= 1000 \text{ J/mol}$$



3.  $dh = Tds + VdP$  total (formal) derivative:

$$dh = \left(\frac{\partial h}{\partial s}\right)_P ds + \left(\frac{\partial h}{\partial P}\right)_S dP$$

$$\left(\frac{\partial h}{\partial s}\right)_P = T \quad \left(\frac{\partial h}{\partial P}\right)_S = V$$

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

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

4. Trans:  $\ln \left[ \left( \frac{2\pi M k_B T}{h^2} \right)^{3/2} \frac{V}{N_A} \right] + \ln g_{int} = \ln \left[ \left( \frac{2\pi M k_B T}{h^2} \right)^{3/2} \frac{V}{N_A} \right] + \ln \left( \frac{e^{\theta_B/T}}{e^{\theta_B/T} - 1} \right) + \ln \left( \frac{T}{\theta_B} \right)$

Rot:  $\ln \left( \frac{T}{\theta_B} \right)$

Vib:  $-\ln(1 - e^{-\theta_B/T}) + \frac{\theta_B/T}{e^{\theta_B/T} - 1}$

Elec:  $\ln g_{elec}$

5. e

6. increase, equilibrium

$$7. V = \frac{nRT}{P} + B$$

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

$$= V - (V - B)$$

$$= B$$

The change in enthalpy with respect to pressure is always equal to B.

$$T \frac{dH}{dT} - H = \dots$$

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isobaric

$$q_p \left(\frac{\partial H}{\partial T}\right) + 2B \left(\frac{\partial H}{\partial P}\right) = H$$

$$T = \left(\frac{\partial H}{\partial T}\right)$$

$$\left(\frac{\partial H}{\partial T}\right) = \frac{H}{T}$$

$$\left(\frac{\partial H}{\partial T}\right) = \left(\frac{\partial H}{\partial T}\right)$$

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~~Handwritten notes and equations, including  $\left(\frac{\partial H}{\partial T}\right)_P = C_p$  and  $\left(\frac{\partial H}{\partial P}\right)_T = V - T \left(\frac{\partial V}{\partial T}\right)_P$~~

Final note