

SHOW ALL WORK TO RECEIVE CREDIT.

1. (5 Pts) Given the ΔH_f° values in kJ/mole: $\text{NH}_3(\text{g})$ -45.9, $\text{NO}(\text{g})$ = 90.3, $\text{H}_2\text{O}(\text{g})$ -241.8, calculate the standard enthalpy change for the following reaction:

$$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$$

$$\Delta H_{\text{rxn}}^\circ = \sum \Delta H_{\text{prod}} - \sum \Delta H_{\text{react}}$$

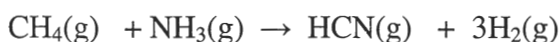
$$= [4(90.3) + 6(-241.8)] - [4(-45.9) + 0] = -906 \text{ kJ}$$

2. (5 Pts) $\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$ $\Delta H = -2803 \text{ kJ}$

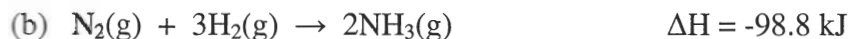
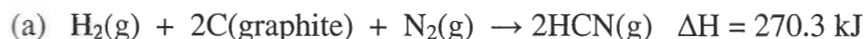
Calculate the value of ΔH if 85.9 g of $\text{H}_2\text{O}(\text{g})$ are produced.

$$\frac{85.9 \text{ g H}_2\text{O}}{18.02 \text{ g}} \times \frac{-2803 \text{ kJ}}{6 \text{ mol H}_2\text{O}} = -2227 \text{ kJ}$$

3. (10 Pts) Calculate the value of ΔH for the reaction:



Use the following reactions:



$$\begin{array}{lcl} \text{CH}_4: \text{rev. c} & \text{CH}_4(\text{g}) & \rightarrow \text{C}(\text{graphite}) + 2\text{H}_2(\text{g}) & + 74.9 \text{ kJ} \\ \text{NH}_3: \text{rev. b} \div 2 & \text{NH}_3(\text{g}) & \rightarrow \frac{1}{2}\text{N}_2(\text{g}) + \frac{3}{2}\text{H}_2(\text{g}) & + 49.4 \text{ kJ} \\ \text{HCN: a} \div 2 & \frac{1}{2}\text{H}_2(\text{g}) + \text{C}(\text{graphite}) + \frac{1}{2}\text{N}_2(\text{g}) & \rightarrow \text{HCN}(\text{g}) & 135.15 \text{ kJ} \\ \hline & \text{CH}_4(\text{g}) + \text{NH}_3(\text{g}) & \rightarrow \text{HCN}(\text{g}) + 3\text{H}_2(\text{g}) & + 259.45 \text{ kJ} \end{array}$$

4. (5 Pts) Given the reaction: $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$ $\Delta H = -114 \text{ kJ}$

Calculate the enthalpy change per gram of NO.

$$\text{Since } \Delta H = \frac{-114 \text{ kJ}}{2 \text{ mol NO}}$$

$$\text{and molar mass of NO} = \frac{30.007 \text{ g}}{\text{mol}}$$

$$\frac{-114 \text{ kJ}}{2 \text{ mol NO}} \times \frac{1 \text{ mol NO}}{30.007 \text{ g}} = -1.90 \text{ kJ/g NO}$$