Lecture Notes G: Entropy and Free Energy III

1) Demonstrations

Lycopodium powder (powdered wood) burned in air

Cellulose (carbon, hydrogen, oxygen) + $O_2 \rightarrow CO_2 + H_2O$

Mg ribbon heated in air

 $\begin{array}{c} Mg + \frac{1}{2}O_2 \rightarrow MgO \\ 3Mg + N_2 \rightarrow Mg_3N_2 \end{array}$

Sugar and KClO₃ heated in a test-tube

KClO₃ (l) + sugar (s) sucose = $C_{12}H_{22}O_{11}$

 \rightarrow KCl (s) + CO₂(g) + H₂O(g)

Mg powder + KClO₃ powder headed in a crucible

$$Mg + KClO_3 \rightarrow MgO + KCl$$

Barium hydroxide mixed with ammonium chloride

 $Ba(OH)_{2} \cdot 8H_{2}O_{(s)} + 2NH_{4}Cl_{(s)} \rightarrow 2 NH_{3 (aq)} + 10 H_{2}O_{(l)} + BaCl_{2 (aq)}$

What is the sign of ΔH for the above reaction (use both chemical reasoning and observations made during the demonstration)?

a) $\Delta H < 0$ b) $\Delta H > 0$ c) ΔH is not obvious (need Appendix D)

What is the sign of the ΔS for the above reaction reaction (use both chemical reasoning and observations made during the demonstration)?

a) $\Delta S < 0$ b) $\Delta S > 0$ c) ΔS is not obvious (need Appendix D)

Ammonia gas mixed with HCl gas

 $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$

What is the sign of ΔH for the above reaction (use both chemical reasoning and observations made during the demonstration)?

a) $\Delta H < 0$ b) $\Delta H > 0$ c) ΔH is not obvious (need Appendix D)

What is the sign of the ΔS for the above reaction (use both chemical reasoning and observations made during the demonstration)?

a) $\Delta S < 0$ b) $\Delta S > 0$ c) ΔS is not obvious (need Appendix D)

	Molar Enthalpy of Atomization	H-	C-	C=	C∎	N-	N=	N≡	0-	0=
Н	218.0	436	413			391			463	
С	716.7	413	348	615	812	292	615	891	351	728
Ν	472.2	391	292	615	891	161	418	945		
0	249.2	463	351	728					139	498
S	278.8	339	259	477						
F	79.0	563	441			270			185	
Cl	121.7	432	328			200			203	
Br	111.9	366	276							
Ι	106.8	299	240							
	$H_2O_2\ _{(30\%\ aq)}\ +$	NaI $_{(aq)}$ >		Na	[_(aq) +	${ m H_{2}O}_{(l)}$ +				$O_{2(g)}$

If NaI is removed from the above reaction, does it alter ΔH or ΔS ? b) no

a) yes

What is the sign of ΔH for the above reaction (based on the bond enthalpies shown above)? a) $\Delta H < 0$ c) Δ H is not obvious (need Appendix D) b) $\Delta H > 0$

What is the sign of the ΔS for the above reaction reaction (use both chemical reasoning and observations made during the demonstration)?

a) $\Delta S < 0$ c) ΔS is not obvious (need Appendix D) b) $\Delta S > 0$