CHAPTER II

2.1 Which of the following species has the highest entropy (S°) at 25 °C?

(A) $CH_3OH(l)$ (B) $CO(g)$ (C) $MgSO_4(s)$ (D) $H_2O(l)$

2.2 Arrange the following compounds in order of increasing standard molar entropy at25°C:

$C_3H_8(g)$, $C_2H_4(g)$, $ZnS(s)$, and $H_2O(l)$

(A) $ZnS(s) < H_2O(l) < C_3H_8(g) < C_2H_4(g)$
(B) $C_2H_4(g) < H_2O(l) < C_3H_8(g) < ZnS(s)$
(C) $ZnS(s) < C_3H_8(g) < C_2H_4(g) < H_2O(l)$
(D) $C_3H_8(g) < C_2H_4(g) < H_2O(l) < ZnS(s)$
(E) $ZnS(s) < H_2O(l) < C_2H_4(g) < C_3H_8(g)$

2.3 Determine ΔS° for the reaction $SO_3(g) + H_2O(l) \rightarrow H_2SO_4(l)$ if you know: $S°(SO_3)$ =256.2 J/K.mol, $S°(H_2O)$=69.9 J/K.mol, $S°(H_2SO_4)$=156.9 J/K.mol

2.4 A negative sign for ΔG indicate that, at constant T and P,
(A) The reaction is exothermic (B) The reaction is endothermic
(C) The reaction is fast (D) The reaction is spontaneous

2.5 Ozone (O_3) in the atmosphere can react with nitric oxide (NO): $O_3(g)+NO(g)\rightarrow NO_2(g)+O_2(g)$, Calculate the ΔG° for this reaction at 25°C. (ΔH°= -199kJ/mol, ΔS°=-4.1 J/K.mol)

(A)1020 kJ/mol (B) $-1.22x10^3$ kJ/mol (C) $-1.42x10^3$ kJ/mol (D) -198 J/K.mol

2.6 Sodium carbonate can be made by heating sodium bicarbonate: $2NaHCO_3(s)\rightarrow Na_2CO_3(s)+CO_2(g)+H_2O(g)$, Given that ΔH°= 128.9 kJ/mol and ΔG°=33.1 kJ/mol at 25°C, above what minimum temperature will the reaction become spontaneous under standard state conditions?

(A) 0.4 K (B) 3.9 K (C) 321 K (D) 401 K

2.7 For the reaction $H_2(g)+S(s)\rightarrow H_2S(g)$, ΔH°=-20.2 kJ/mol and ΔS°=+43.1 J/K.mol. Which of the following statement is true?
(A) The reaction is only spontaneous at low temperatures
(B) The reaction is spontaneous at all temperatures.
(C) ΔG° become less favorable as temperature increases.
(D) The reaction is spontaneous only at high temperatures.

2.8 Determine the equilibrium constant Kp at 25°C for the reaction $N_2(g)+3H_2(g)\leftrightarrow 2NH_3(g)$ ($\Delta G_f°(NH_3(g))$=-16.6 kJ/mol)

(A) $1.52x10^{-6}$ (B) $6.60x10^5$ (C) $8.28x10^{-2}$ (D) 13.4

2.9 For the reaction 2C (graphite)+ $H_2(g) \rightarrow C_2H_2(g)$, $\Delta G° = 209.2$ kJ/mol at 25°C. if $P(H_2) = 100$atm and $P(C_2H_2) = 0.10$ atm, calculate ΔG for this reaction?

(A) 207.8kJ/mol (B) 226.3 kJ/mol (C) 192.1 kJ/mol (D) 17.3 kJ/mol

2.10 The values of $\Delta H°$ and $\Delta S°$ for the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ are 177.8 kJ and 160.5 J/K, respectively. The pressure of CO_2 at equilibrium for the process at 800°C is _____.

(A) 1.04 atm.
(B) 12.3 atm
(C) 0.535 atm
(D) 4.35 atm