CHEM 1423
Chapters 20
Homework Answers

TEXTBOOK HOMEWORK

20.14 (a) $\lambda S^o > 0$

(b) $\lambda S^o < 0$

(c) $\lambda S^o > 0$

20.16 (a) $\lambda S^o > 0$

(b) $\lambda S^o < 0$

(c) $\lambda S^o > 0$

20.21 (a) Ribose < Glucose < Sucrose
(b) $CaCO_3 < CaO + CO_2 < Ca + C + (3/2)\ O_2$
(c) $SF_4(g) < SF_6(g) < S_2F_{10}(g)$

20.28 (a) -172.4 J/K
(b) +141.6 J/K
(c) -837 J/K

20.40 (a) -1138.0 kJ
(b) -1379.4 kJ
(c) -224.2 kJ

20.46 (a) λH^o = +90.7 kJ , λS^o = 220.7 J/K

(b) (1) T = 28 ^oC λG^o = +24.3 kJ

(2) T = 128 ^oC λG^o = +2.2 kJ

(3) T = 228 ^oC λG^o = -19.9 kJ

(c) For the reactants and products in their standard states, the reaction is non-spontaneous at 28 ^oC, near equilibrium at 128 ^oC and spontaneous at 228 ^oC. This illustrates that the effect of positive λS^o in driving a reaction towards spontaneity becomes more important at higher temperatures.

20.48 λH^o = 30.91 kJ

λS^o = 93.15 J/K = 0.09315 kJ/K

T_b = 59 ^oC

20.51 λH^o = -69 kJ

λS^o = +537.3 J/K = 0.5373 kJ/K

λG^o = -229.1 kJ

No, the temperature has no effect on spontaneity. That's because a reaction with $\lambda H^o < 0$ and $\lambda S^o > 0$ will yield $\lambda G^o < 0$ at all temperatures.

20.56 (a) 1.75×10^{6}
(b) 3.7×10^{-34}
(c) 1.3×10^{48}

20.64 (a) 28.7 kJ/mol
(b) to the left
(c) +7.0 kJ. to the left

20.74 (a) $2N_2O_5(g) + 6F_2(g) \overset{K_p}{\rightleftharpoons} 4NF_3(g) + 5O_2(g)$
(b) -569.2 kJ/mol
(c) -560. kJ/mol

SUPPLEMENTARY HOMEWORK

S1. D

S2. A

S3. D

S4. A

S5. D

S6. (a) T = 130 °C: λS_{sys} = 347.2 J/K , λS_{surr} = -331.0 J/K , λS_{univ} = +16.2 J/K

T = 111 °C: λS_{sys} = 347.2 J/K , λS_{surr} = -347.4 J/K , λS_{univ} = 0 J/K

T = 90 °C: λS_{sys} = 347.2 J/K , λS_{surr} = -367.5 J/K , λS_{univ} = -20.3 J/K

(b) T = 130 °C: λG^o = -6.52 kJ

T = 111 °C: λG^o = 0 kJ

T = 90 °C: ΔG^o = +7.37 kJ

(c) T = -115 °C: ΔS_{sys} = -130.6 J/K , ΔS_{surr} = +147.1 J/K , ΔS_{univ} = +16.5 J/K

T = -95 °C: ΔS_{sys} = -130.6 J/K , ΔS_{surr} = +130.6 J/K , ΔS_{univ} = 0 J/K

T = -75 °C: ΔS_{sys} = -130.6 J/K , ΔS_{surr} = +117.4 J/K , ΔS_{univ} = -13.2 J/K

(d) T = -115 °C: ΔG^o = -2.61 kJ

T = -95 °C: ΔG^o = 0 kJ

T = -75 °C: ΔG^o = +2.62 kJ

S7. Spontaneous above 835 °C

S8. (a) $K = 5.56 \times 10^5$
(b) $Q = 8.0 \times 10^{-3}$. Not at equilibrium because Q < K. Moves to right
(c) ΔG = -44.8 kJ/mol

S9. (a) T = 25 °C , ΔG^o = +130 kJ/mol
(b) T = 1500 °C , ΔG^o = -107 kJ/mol
(c) T = 833 °C

S10. Spontaneous below 77 °C