Chem12 Equilibrium Exam Questions/2-70

1) Water is in equilibrium with water vapor in closed container at a constant temperature. Which one of the following is true?

a) water vapor pressure is increasing
b) the mass of $H_2O(l)$ is increasing
c) there is no more evaporation of $H_2O(l)$
d) rate of evaporation of $H_2O(l)$ = rate of condensation of $H_2O(g)$

2) Given : $NO_2(g) + SO_2(g) <-> SO_3(g) + NO(g)$, a mixture in a 10.0 L flask was analyzed at equilibrium and found to contain : 0.20 mol of $NO_2(g)$, 0.10 mol of $SO_2(g)$, 0.50 mol $SO_3(g)$, 0.30 mol of NO(g). K_{eq} =

a) 0.13   b) 0.30   c) 1.2   d) 7.5

3) Which of the following substances has the greatest entropy at STP?

a) NaCl(s)   b) $C_4H_{10}(l)$ c) $H_2(g)$ d) C(s)

4) The thermal dissociation of calcium carbonate is given by :
$CaCO_3(s)$ + heat $<->$ CaO(s) + $CO_2(g)$. In describing the compositions of different equilibrium mixtures produced at the same T, then it is correct to say that all compositions have the same :

a) mass of CaO   b) number of molecules of CO_2
c) partial pressure of CO_2 d) mass of $CaCO_3$

5) Given : A(aq) + B(aq) $<->$ C(aq) + D(aq) K_{eq} =1.0x10^{-20}
A mixture was made up of the following initially : [A] = 1.0 M, [B] = 1.0 M, [C] = 2.0 M, [D] = 2.0 M. Which of the following statements correctly describes the change in composition of the mixture at constant T?

a) [C] and [D] increase, [A] and [B] decrease
b) [C] and D] decrease, [A] and [B] increase
c) an equilibrium shift occurs in which all concentrations are equal
d) there will be no change as the system is initially at equilibrium

6) Given : $2NH_3(g) <-> N_2(g) + 3H_2(g)$, One mole of $NH_3(g)$ was introduced into a 1.0 L flask and allowed to come to equilibrium. At

equilibrium, analysis indicated that 0.60 mol of $H_2(g)$ had been produced. Find K_{eq}.

7) Given : $N_2O_2(g) + H_2(g)$ <-> $N_2O(g) + H_2O(g)$, At a known temperature the K_{eq} is 4.0. What is K_{eq} for the reverse reaction?

a) 0.25   b) 0.50   c) 4.0   d)16

8) Given : $2NO(g) + O_2(g)$ <-> $2NO_2(g) + 113kJ$, the yield of $NO_2(g)$ can be increased by :

a) adding a catalyst   b) decreasing P and increasing T
c) increasing P and increasing T   d) increasing P and decreasing T

9) The spontaneous evaporation of water illustrates that there is a:

a) state of equilibrium   b) high activation energy
c) natural tendency toward increasing randomness
d) natural tendency toward a state of minimum potential energy

10) Given the equilibrium reaction : $SnO_2(s) + 2CO(g) + heat$ <-> $Sn(s) + 2CO_2(g)$, Which of the following statements is true?

a) the partial pressure of $CO_2(g)$ is increasing
b) the temperature is decreasing
c) the mass of $SnO_2(s)$ is equal to the mass of $Sn(s)$
d) the rate of formation of $CO_2(g)$ = rate of formation of $CO(g)$

11) Given : $2SO_2(g) + O_2(g)$ <-> $2SO_3(g)$ and $K_{eq} = 798$. In a particular mixture at equilibrium, $[SO_2] = 4.20$ M and $[SO_3] = 11.0$ M. Calculate the equilibrium $[O_2]$ in the mixture.

12) Which of the following systems has the highest yield of products?

a) $2HBr(g)$ <-> $H_2(g) + Br(g)$ $K_{eq} = 1.2 \times 10^{-15}$
b) $COCl_2(g)$ <-> $CO(g) + Cl_2(g)$ $K_{eq} = 6.2 \times 10^{-3}$
c) $H_2SO_3(l) + H_2O(g)$ <-> $H_3O^+(aq) + HSO_3^-(aq)$ $K_{eq} = 1.7 \times 10^{-2}$
d) $SO_3^{2-}(aq) + H_2O(l)$ <-> $HSO_3^-(aq) + OH^-(aq)$ $K_{eq} = 1.6 \times 10^{-7}$

13) What is the appropriate K_{eq} expression for the following reaction?

   $CaC_2(s) + 2H_2O(l)$ <-> $C_2H_2(g) + Ca(OH)_2(s)$
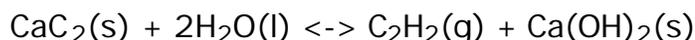
a) $[C_2H_2]$ b) $[C_2H_2]/[H_2O]^2$ c)$\{[C_2H_2][Ca(OH)_2]\}/\{[CaC_2][H_2O]^2\}$
d) $\{[C_2H_2][Ca(OH)_2]\}/[CaC_2]$

14) Given : $CH_4(g) + 2O_2(g) <-> CO_2(g) + 2H_2O(l) + heat$, Which procedure will make the equilibrium shift to the right?

a) add an inert gas   b) decrease T   c) increase the volume
d) decrease the partial pressure of $O_2(g)$

15) Given : $3A(g) + B(g) <-> C(g) + 2D(g)$, At equilibrium : $[A] = 0.50$ M, $[B] = 0.33$ M, $[C] = 0.25$ M, $[D] = 0.20$ M. Find K_{eq}.

a) 0.060   b) 0.24   c) 1.2   d) 4.1

16) Given : $2HI(g) <-> H_2(g) + I_2(g)$ and $K_{eq} = 0.0183$, If 3.00 mol of HI is placed in a 5.00 L vessel and allowed to reach equilibrium, find the equilibrium $[H_2(g)]$

17) What is the equilibrium expression for the reaction :
$2Fe^{3+}(aq) + Mg(s) <-> 2Fe^{2+}(aq) + Mg^{2+}(aq)$

a) $\{[Fe^{2+}]^2[Mg^{2+}]\}/[Fe^{3+}]^2$ b) $[Fe^{3+}]^2/\{[Fe^{2+}]^2[Mg^{2+}]\}$
c) $\{[2Fe^{2+}][Mg^{2+}]\}/[2Fe^{3+}]$ d) $\{[Fe^{2+}]^2[Mg^{2+}]\}/\{[Fe^{3+}]^2[Mg]\}$

18) Given : $CO(g) + 2H_2(g) <-> CH_3OH(g)$ H = -173 kJ, Which of the following procedures would cause an increase in the value of K_{eq}?

a) add more $CO(g)$ b) remove some $CH_3OH(g)$
c) increase P   d) decrease T

19) The chromate-dichromate equilibrium is given by the following reaction : $2CrO_4^{2-}(aq) + 2H_3O^+(aq) <-> Cr_2O_7^{2-}(aq) + 3H_2O(l)$. In order to shift this equilibrium to the left, one should add :

a) $H_2SO_4(l)$ b) $NaOH(s)$ c) $HCl(g)$ d) $K_2CrO_4(s)$

20) If only the container volume is increased, which of the following equilibria will shift toward the reactants?

a) $N_2O_4(g) <-> 2NO_2(g)$
b) $2NaHCO_3(s) <-> Na_2CO_3(s) + H_2O(g) + CO_2(g)$
c) $4NO(g) + 6H_2O(g) <-> 4NH_3(g) + 5O_2(g)$

d) $H_2(g) + I_2(g) <-> 2HI(g)$
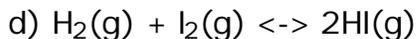
21) Given : $SO_3(g) + NO(g) <-> NO_2(g) + SO_2(g)$ with K_{eq} = 0.800. If the initial concentrations are; $[SO_3]$ = 0.40, $[NO]$ = 0.48, $[NO_2]$ = 0.60, $[SO_2]$ = 0.45.

a) Show that the mixture is not at equilibrium.
b) What happens to $[SO_3]$ and $[SO_2]$ as the system moves towards equilibrium?

22) Which of the following effects does a catalyst have on a chemical reaction ?

a) it decreases the reverse rate
b) it increases the forward rate but has no effect on the reverse rate
c) it provides an alternative reaction mechanism with a lower activation energy
d) it decreases the magnitude of the equilibrium constant for the reaction

Answers : 1) D, 2) D, 3) C, 4) C, 5) B, 6) 0.12, 7) A, 8) D, 9) C, 10) D, 11) 0.00860, 12) C, 13) A, 14) B, 15) B, 16) 0.0639, 17) A, 18) D, 19) B, 20) C, 21)a) K_{trial} = 1.4 > 0.80, shift is left, b) $[SO_3]$ goes up, $[SO_2]$ goes down, 22) C.