Chem12 Equilibrium : Exam Questions 1-50

1) All of the following reactions are at equilibrium. The reaction which does <u>not</u> undergo an equilibrium shift when only the volume is changed is :

a) $2SO_2(g) + O_2(g) <-> 2SO_3(g)$ b) $PCl_5(g) <-> PCl_3(g) + Cl_2(g)$
c) $2NO_2(g) <-> N_2O_4(g)$ d) $NO(g) + O_3(g) <-> NO_2(g) + O_2(g)$

2) Given : $O_2(g) + 2HF(g) <-> OF_2(g) + H_2O(g)$ $\Delta H = +318kJ$
After adding some $O_2(g)$, which will occur :

a) $HF(g)$ will increase, $OF_2(g)$ will decrease
b) $O_2(g)$ will decrease, $OF_2(g)$ will increase
c) $HF(g)$ will decrease, $OF_2(g)$ will increase
d) $O_2(g)$ and $OF_2(g)$ will remain unchanged

3) For the reaction given in question 2), what will happen if the temperature of the system is increased ?

a) K_{eq} will decrease   b) ΔH will decrease
c) K_{eq} will increase   d) ΔH will increase

4) For the reaction given in question 2), what will be the effect of adding a catalyst to the system?

a) K_{eq} cannot now be determined   b) K_{eq} increases
c) K_{eq} remains the same   d) K_{eq} decreases

5) Given : $Fe_2O_3(s) + 3CO(g) <-> 2Fe(s) + 3CO_2(g)$, $K_{eq} =$

a) $[CO_2]^3/[CO]^3$ b) $\{[Fe]^2[CO_2]^3\}/\{[Fe_2O_3][CO]^3\}$
c) $\{[Fe]^2[CO_2]^3\}/[CO]^3$ d) $[CO_2]^3/\{[Fe_2O_3][CO]^3\}$

6) For which of the following systems at equilibrium, will the reaction go most fully to completion?

a) $2KCLO_3(s) <-> 2KCl(s) + 3O_2(g)$ $K_{eq} = 2.6x10^{40}$
b) $N_2(g) + 3H_2(g) <-> 2NH_3(g)$ $K_{eq} = 9.0$
c) $HC_2H_3O_2(aq) + H_2O(l) <-> H_3O^+(aq) + C_2H_3O_2(aq)$ $K_{eq} = 1.8x10^{-5}$
d) $2HgO(s) <-> 2Hg(l) + O_2(g)$ $K_{eq} = 1.2x10^{-22}$

7) Given : $N_2(g) + O_2(g) <-> 2NO(g)$ $K_{eq} = 3.4 \times 10^{-3}$, The equilibrium constant for the reverse reaction is :

a) 3.4×10^{-6} b) 3.4×10^3 c) 2.9×10^2 d) 6.8×10^{-3}

8) For the reaction; $N_2(g) + 3H_2(g) <-> 2NH_3(g) + heat$, which of the following changes will increase the yield of $NH_3(g)$?

a) add a catalyst   b) reduce the partial pressure of $N_2(g)$
c) increase T   d) reduce the volume (T constant)

9) Calculate the value of the equilibrium constant K_{eq} for the reaction : A <-> B + 3C, when the equilibrium concentrations are : $[A] = 2.00 \times 10^{-4}$ M, $[B] = 8.00 \times 10^{-3}$ M, and $[C] = 1.00 \times 10^{-4}$M. (assume A, B, and C are gases)

a) 2.40×10^{12} b) 4.00×10^{-11} c) 4.00×10^{-5} d) none of these

10) The Haber process is : $N_2(g) + 3H_2(g) <-> 2NH_3(g)$. At a particular T and P, the K_{eq} is 75. If, at equilibrium, $[N_2] = 0.023$ M, and $[H_2] = 0.078$M, what is the equilibrium $[NH_3]$?

a) 8.2×10^{-4} M   b) 4.4×10^{-3} M   c) 0.029 M   d) 0.37 M

11) Given : $4NH_3(g) + 7O_2(g) <-> 4NO_2(g) + 6H_2O(g)$ $\Delta H = -1130$ kJ. Which of the following sets of conditions will give the greatest yield of NO_2.

a) low P, low T   b) low P, high T   c) high P, high T   d) high P, low T
e) high P, high T, and a catalyst

12) Given : $2NO(g) + Cl_2(g) <-> 2NOCl(g)$ $\Delta H = -37.9$ kJ
If the temperature (T) of the system is increased , then :

a) K_{eq} increases   b) K_{eq} decreases   c) ΔH increases   d) ΔH decreases

13) Which of the following equilibrium reactions does not shift when the volume is changed?

a) $2NOBr(g) <-> 2NO(g) + Br_2(g)$ b) $I_2(g) + Br_2(g) <-> 2IBr(g)$
c) $O_2(g) + 2CO(g) <-> 2CO_2(g)$
d) $2H_2S(g) + 3O_2(g) <-> 2H_2O(g) + 2SO_2(g)$

14) Gas X_2 reacts with gas Y_2 to give gaseous XY according to the equation $X_2 + Y_2$ <-> 2XY. $K_{eq} = 2.6 \times 10^{-3}$. What is K_{eq} for the reverse reaction?

a) 6.8×10^{-6} b) 5.1×10^{-2} c) 2.0×10^1 d) 3.8×10^2

15) Which one of the following statements about a reaction indicates that the products are favored at equilibrium?

a) high activation energy for forward reaction
b) K_{eq} is large   c) reaction is endothermic
d) rate constants for both directions are large

16) The reaction for the decomposition of $H_2S(g)$ at high T is :
$2H_2S(g)$ <-> $2H_2(g) + S_2(g)$. $K_{eq} =$

a) $\{[H_2][S_2]\}/[H_2S]^2$ b) $\{[H_2]^2[S_2]\}/[H_2S]^2$
c) $[H_2S]^2/\{[H_2]^2[S_2]\}$ d) $[H_2]^2[S_2]$

17) Describe what is meant by the term; "Chemical Equilibrium".

18) What is the value of the equilibrium constant for the reaction :
A + B <-> 2C, if at equilibrium, [A] = 0.0300 M, [B] = 0.400 M, and [C] = 1.20 M ? (assume A, B, and C are gases)

a) 8.33×10^{-3} b) 1.20×10^2 c) 1.00×10^4 d) 2.00×10^4

19) Given : $2SO_2(g) + O_2(g)$ <-> $2SO_3(g)$ $\Delta H = -198.0$ kJ.
Which one of the following sets of conditions below will give the greatest yield of SO_3 :

a) low P, low T   b) high P, low T   c) low P, high T   d) high P, high T

20) In which of the following situations will K_{eq} change?

a) when reactant concentrations change   b) when T is changed
c) when product concentrations change   d) when a catalyst is used

21) Which one of the following occurs when the pressure is increased in a chemical reaction involving gaseous reactants and products at equilibrium.?

a) no effect   b) eq. shifts right   c) eq. shifts left
d) equilibrium always shifts to form fewer molecules

Answers : 1) d, 2) c, 3) c, 4) c, 5) a, 6) a, 7) c, 8) d, 9) b, 10) c, 11) d, 12) b, 13) b, 14) d, 15) b, 16) b, 17) A chemical equilibrium exists when the forward rate equals the reverse rate for a reversible chemical reaction., 18) b, 19) b, 20) b, 21) d.