CHEMICAL EQUILIBRIUM

Single Correct Answer Type:

1. The equilibrium constant for a reaction $A+2B \rightleftharpoons 2C$ is 40. The equilibrium constant for reaction $C \rightleftharpoons B+1/2\ A$ is

(A) 1/40 (B) $(1/40)^{1/2}$ (C) $(1/40)^2$ (D) 40

2. The equilibrium constant for the reaction $CaSO_4.5H_2O(s) \rightleftharpoons CaSO_4.3H_2O(s)+2H_2O(g)$ is equal to

(A) $\frac{[CaSO_4.3H_2O][H_2O]^2}{[CaSO_4.5H_2O]}$ (B) $\frac{[CaSO_4.3H_2O]}{[CaSO_4.5H_2O]}$

(C) $[H_2O]^2$ (D) $[H_2O]$

3. For a hypothetical reaction of the kind $AB_2(g)+\frac{1}{2}B_2(g) \rightleftharpoons AB_3(g); -x\,kj$ More AB_3 could be produced at equilibrium by

(A) using a catalyst (B) removing some of B_2

(C) Increasing the temperature (D) increasing the pressure.

4. Inert gas has been added to the following equilibrium system at constant volume

$SO_2(g)+\frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$. To which direction will be equilibrium shift?

(A) Forward (B) Backward (C) No effect (D) Unpredictable

5. One mole of N_2 is mixed with 3 moles of H_2 in a litre container. If 50% of N_2 is converted into ammonia by the reaction, $N_{2}(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$,then the total number of moles of gas at the equilibrium are

(A) 1.5 (B) 4.5 (C) 3.0 (D) 6.0

6. For the reactions

$A \rightleftharpoons B;\ K_c = 1$

$B \rightleftharpoons C;\ K_c = 2$

$C \rightleftharpoons D;\ K_c = 3$

K_c for the reaction $A \rightleftharpoons D$ is

(A) 5 (B) 6 (C) 15 (D) 1

7. For reactions :

I. $CaCO_3(s) \rightleftharpoons CaO(s)+CO_2(g), PCO_2 = 2$ atm

II. $CO_2(g)+C(s) \rightleftharpoons 2CO(g), K = 6$ atm

Hence, equilibrium constant, K_p (in the same units) for the reaction

$CaCO_3(s)+C(s) \rightleftharpoons 2CO(g)$, is

(A) 8 (B) 4 (C) 12 (D) 3

8. For reaction

$NH_2COONH_4(s) \rightleftharpoons 2NH_3(g)+CO_2(g)$ the equilibrium constant $K_p = 2.92\times10^{-5}\ atm^3$. The total pressure of the gaseous products when 1 mole of reactant is heated, will be

(A) 0.0194 atm (B) 0.0388 atm

(C) 0.0582 atm (D) 0.0667 atm

9. 1 mole of PCl_5 taken at 5atm, dissociates into PCl_3 and Cl_2 to the extent of 50%

$PCl_5 (g) \rightleftharpoons PCl_3 (g) + Cl_2 (g)$ Thus the K_p is:

(A) 2.5 (B) 1.67 (C) 0.5 (D) 2.0

10. For the following equilibrium $N_2O_4 \rightleftharpoons 2NO_2$

$K_c = 0.67$. if we start with 3 moles of NO_2 and 1 mole of N_2O_4 in 1 L flask, then NO_2 present at equilibrium is

(A) 1.5 mol (B) 2.0 mol (C) 0.5 mol (D) 1.0 mol

11. If α is the fraction of HI dissociated at equilibrium in the reaction $2HI \rightleftharpoons H_2 + I_2$

Then starting with 2 moles of HI, the total number of moles of reactants and products at equilibrium are

(A) 1 (B) 2 (C) $1+\alpha$ (D) $2 + 2\alpha$ $2+\alpha$

12. If one-third of HI decomposes at s particular temperature, K_c for the reaction

$2HI \rightleftharpoons H_2 + I_2$ is

(A) 1/16 (B) 1/4 (C) 1/6 (D) 1/2

13. The following equilibrium constant are given:

$N_2 + 3H_2 \rightleftharpoons 2NH_3 ; K_1$

$N_2 + O_2 \rightleftharpoons 2NO ; K_2$

$H_2 + 1/2O_2 \rightleftharpoons H_2O ; K_3$

The equilibrium constant for the oxidation of NH_3 by oxygen to give NO is:

(A) K_1K_2/K_3 (B) $K_2K_3^3/K_1$ (C) $K_2K_3^2/K_1$ (D) $K_2^2K_2/K_1$

14. Consider the following reactions in which all the reactants and the products are in gaseous state

$2PQ \rightleftharpoons P_2 + Q_2 ; K_1 = 2.5\times10^5$

$PQ + \frac{1}{2}R_2 \rightleftharpoons PQR, K_2 = 5\times10^{-3}$

The value of K_3 for the equilibrium

$\frac{1}{2}P_2 + \frac{1}{2}Q_2 + \frac{1}{2}R_2 \rightleftharpoons PQR$ is

(A) 2.5×10^{-3} (B) 2.5×10^3 (C) 1.0×10^{-5} (D) 5×10^3

15. For the gas phase reaction $2NO \rightleftharpoons N_2 + O_2$, $\Delta H = -43.5 \text{kcal mol}^{-1}$. Which one of the statement below is true

for $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(A) K is independent of *T* (B) K increases as *T* decreases

(C) K decreases as T decreases (D) K varies with the addition of NO.

16. For the reaction

$SnO_2(s) + 2H_2(g) \rightleftharpoons 2H_2O(g) + Sn(l)$

At 900 K, the equilibrium steam-hydrogen mixture was found to be 40% H_2 by volume. The K_p is

(A) 1.15 (B) 2.25 (C) 7.75 (D) 10

$P_4(s) + 6Cl_2(g) \longleftrightarrow 4PCl_3(g)$

17. The equilibrium $P_4(s) + 6Cl_2(g) \longleftrightarrow 4PCl_3(g)$ is attained by mixing equal moles of P_4 and Cl_2 in an evacuated vessel. Then at equilibrium

(A) $[Cl_2] > [PCl_3]$ (B) $[Cl_2] > [P_4]$

(C) $[P_4] > [Cl_2]$ (D) $[PCl_3] > [P_4]$

18. If concentration of OH^- ions in the reaction

$Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq) + 3OH^-(aq)$ is decreased by $\frac{1}{4}$ times, then equilibrium concentration of Fe^{3+} will increases by

(A) 8 times (B) 16 times (C) 64 times (D) 4 times

19. The dissociation constants for acetic acid and HCN at 25^0 C are 1.5×10^{-5} and 4.5×10^{-10} respectively. The equilibrium constant for the equilibrium

$CN^- + CH_3COOH \rightleftharpoons HCN + CH_3COO^-$ would be

(A) 3.3×10^{-5} (B) 3.3×10^{-4} (C) 3.3×10^{4} (D) 3.3×10^{5}

20. Pressure necessary to obtain 50% dissociation of PCl_5 at 500K will be equal to

(A) K_p (B) 2 K_p (C) 3 K_p (D) 4 K_p

Numerical Based:

21. Ammonium carbamate when heated to 200^0C gives a mixture of NH_3 and CO_2 vapours with a density of 16.0. What is the degree of dissociation of ammonium carbamate will be

22. $A(g) + 2B(g) \rightleftharpoons 2C(g) + D(g)$. Initial concentration of B was 1.5 times that of A but the equilibrium concentrations of A and B are found to be equal. The equilibrium constant for the reaction is

23. For the following gases equilibrium $N_2O_4(g) \rightleftharpoons 2NO_2(g)$. K_p is found to be equal to K_c. This is attained when temperature is

24. For the reaction $C_{(s)} + CO_2(g) \rightarrow 2CO(g)$, K_p =63 atm at 100 K. if at equilibrium, Pco=10 PCO_2, then the total pressure of the gases at equilibrium is _________ atm

25. The equilibrium constant of a reaction doubles when temperature is increased form 25^0C to 35^0C. the enthalpy change of the reaction is x kj/mol, then x is approximately

KEY

1.	B	2.	C	3.	D	4.	C	5.	C
6.	B	7.	C	8.	A	9.	A	10.	A
11.	B	12.	C	13.	A	14.	C	15.	C
16.	B	17.	C	18.	C	19.	C	20.	B
21.	0.71	22.	4	23.	12.19	24.	693	25.	53