**CLASS:13th RENEET** **SUBJECT: CHEMISTRY**

# DPP: CHEMICAL EQUILIBRIUM

## EXERCISE-I (Conceptual Questions) — BUILD UP YOUR UNDERSTANDING

### INTRODUCTION

**1.** Which of the following is a characteristic of a reversible reaction :
(1) Number of moles of reactants and products are equal.
(2) It can be influenced by a catalyst
(3) It can never proceed to completion
(4) None of the above

**2.** All reactions which have chemical disintegration
(1) Is reversible
(2) Is reversible and endothermic
(3) is exothermic
(4) is reversible or irreversible and endothermic or exothermic

**3.** Select the endothermic reaction :
(1) $2H_2 + O_2 \rightarrow 2H_2O$
(2) $N_2 + O_2 \rightarrow 2NO$
(3) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
(4) $3O_2 + C_2H_5OH \rightarrow 2CO_2 + 3H_2O$

**4.** Which of the following reaction goes in forward direction :-
(1) $Fe_2O_3 + 6HCl \rightarrow 2FeCl_3 + 3H_2O$
(2) $NH_3 + H_2O + NaCl \rightleftharpoons NH_4Cl + NaOH$
(3) $SnCl_4 + Hg_2Cl_2 \rightleftharpoons SnCl_2 + 2HgCl_2$
(4) $2Cu + 2I_2 + 4K^+ \rightleftharpoons 2Cu^{+2} + 4KI$

**5.** An example of reversible reaction is :
(1) $Pb(NO_3)_2 + 2NaI \rightarrow PbI_2 + 2NaNO_3$
(2) $AgNO_3 + HCl \rightarrow AgCl + HNO_3$
(3) $2Na + 2H_2O \rightarrow 2NaOH + H_2$
(4) $KNO_3 + NaCl \rightarrow KCl + NaNO_3$

### FACTORS AFFECTING RATE OF REACTION

**6.** Increase in temperature in a reversible equilibrium reaction favours :
(1) Forward reaction only
(2) Backward reaction only
(3) Either forward or backward reaction
(4) Neither forward nor backward reaction

**7.** The role of catalyst in a chemical reaction is :
(1) To help attain equilibrium in a shorter time.
(2) To lower the activation energy.
(3) To shift the equilibrium in such a way as to increase the concentration of the product
(4) Both 1 & 2

**8.** In the reaction $A + 2B \rightarrow 2C + D$. If the concentration of A is increased four times and B is decreased to half of its initial concentration then the rate becomes :
(1) Twice
(2) Half
(3) Unchanged
(4) One fourth of the rate

**9** $2A_{(g)} + B_{(g)} \rightleftharpoons$ Product
If pressure is increased three times of the initial pressure, the velocity of forward reaction will be ------ of the previous velocity :
(1) 9 times (2) 27 times
(3) $\frac{1}{9}$ times (4) $\frac{1}{27}$ times

**10.** Which of the following example shows effect of catalyst on reversible reaction
(1) It gives new reaction path with low activation energy.
(2) It shifts equilibrium right side.
(3) It decrease kinetic energy of activated molecules.
(4) It decrease rate of backward reaction.

### ACTIVE MASS AND LAW OF MASS ACTION

**11.** $x \rightleftharpoons y$ reaction is said to be in equilibrium, when :
(1) Only 10% conversion of x to y has taken place
(2) Complete conversion of x to y has taken place
(3) Conversion of x to y is only 50% complete
(4) The rate of change of x to y is just equal to the rate of change of y to x in the system

**12.** Active mass of 5 g CaO :

(1) 56 (2) 1 (3) 3.5 (4) 2

**13.** Ratio of active masses of 22g $CO_2$, 3g $H_2$ and 7g $N_2$ in a gaseous mixture :

(1) 22 : 3 : 7 (2) 0.5: 3 : 7

(3) 1 : 3 : 1 (4) 1 : 3 : 0.5

**14.** Select the correct statement from the following:

(1) Equilibrium constant changes with addition of catalyst

(2) Catalyst increases the rate of forward reaction.

(3) The ratio of mixture at equilibrium does not changed by catalyst

(4) Catalyst are active only in solution.

**15.** For a reversible reaction, the rate constants for the forward and backward reactions are $2.38 \times 10^{-4}$ and $8.15 \times 10^{-5}$ respectively. The equilibrium constant for the reaction is :

(1) 0.342 (2) 2.92 (2) 0.292 (4) 3.42

**16.** The equilibrium concentration of x, y and $yx_2$ are 4, 2 and 2 respectively for the equilibrium $2x + y \rightleftharpoons yx_2$. The value of equilibrium constant, $K_C$ is

(1) 0.625 (2) 6.25 (3) 0.0625 (4) 62.5

**17.** 4 mole of A are mixed with 4 mole of B when 2 mole of C are formed at equilibrium, according to the reaction, $A + B \rightleftharpoons C + D$

the equilibrium constant is :

(1) $\sqrt{2}$ (2) 2 (3) 1 (4) 4

**18.** For the following reaction at 250°C,

$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$ the value of $K_C$ is 26 then the value of Kp at same temperature will be:

(1) 0.57 (2) 0.61 (3) 0.83 (4) 0.91

**19.** The equilibrium constant for a reaction $A + B \rightleftharpoons C + D$ is $1 \times 10^{-2}$ at 298 K and is 2 at 273 K. The chemical process resulting in the formation of C and D is :

(1) exothermic

(2) endothermic

(3) unpredictable

(4) there is no relationship between $\Delta H$ and K

**20.** The equilibrium constant for the reaction, $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is $4.0 \times 10^{-4}$ at 2000 K. In the presence of a catalyst the equilibrium is attained ten times faster. Therefore, the equilibrium constant in presence of the catalyst at 2000 K is –

(1) $4 \times 10^{-4}$

(2) $40 \times 10^{-4}$

(4) $4 \times 10^{-2}$

(4) difficult to compute without more data

**21.** For the reaction :

$2A(g) + B(g) \rightleftharpoons 3C(g) + D(g)$

two mole each of A and B were taken into a flask. The following must always be true when the system attained equilibrium :

(1) [A] = [B] (2) [A] < [B]

(3) [B] = [C] (4) [A] > [B]

**22.** For the reactions,

$A \rightleftharpoons B$, $K_C = 1$, $B \rightleftharpoons C$, $K_C = 3$;
$C \rightleftharpoons D$, $K_C = 5$

$K_C$ for the reaction $A \rightleftharpoons D$ is :

(1) 15 (2) 5 (3) 3 (4) 1

**23.** 1.0 g mole of ethyl alcohol and 1.0 g mole of acetic acid are mixed. At equilibrium 0.666 g mole of the ester is present. The value of equilibrium constant is :

(1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) 2 (4) 4

**24.** Which one of the following oxides is most stable? The equilibrium constants are given at the same temperature:

(1) $2N_2O_5(g) \rightleftharpoons 2N_2(g) + 5O_2(g)$; $K=1.2\times10^{34}$

(2) $2N_2O(g) \rightleftharpoons 2N_2(g) + O_2(g)$; $K=3.5 \times 10^{35}$

(3) $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$; $K = 2.2 \times 10^{30}$

(4) $2NO_2(g) \rightleftharpoons N_2(g) + 2O_2(g)$; $K=6.71\times10^{16}$

**25.** Which of the following statements is not correct about the equilibrium constant ?

(1) Its value does not depend upon the initial conc. of the reactants

(2) Its value does not depend upon the initial conc. of the products

(3) Its value does not depend upon nature of the reactants.

(4) Its value does not depend upon presence of catalyst.

**26.** In a chemical reaction $K_p$ is greater than $K_c$ when

(1) the number of molecules entering into the chemical reaction is more than the number of molecules produced.

(2) the number of molecules entering into the chemical reaction is the same as the number of molecules produced.

(3) the number of molecules entering into the chemical reaction is less than the number of molecules produced.

(4) None of these

**27.** In a flask colourless $N_2O_4$ is in equilibrium with brown coloured $NO_2$. At equilibrium, when the flask is heated to 100°C the brown colour deepens and on cooling, the brown colour became less coloured. The change in enthalpy $\Delta H$ for the system is:

(1) negative (2) positive

(3) zero (4) not defined

**28.** For the reaction

$CuSO_4.5H_2O_{(s)} \rightleftharpoons CuSO_4 . 3H_2O_{(s)} + 2H_2O_{(g)}$

Which one is correct representation :–

(1) $K_p = p^2_{(H_2O)}$ (2) $K_c = [H_2O]^2$

(3) $K_p = K_c(RT)^2$ (4) All

**29.** For which reaction at 298 K, the value of $\frac{K_p}{K_c}$ is maximum and minimum respectively:-

(a) $N_2O_4 \rightleftharpoons 2NO_2$

(b) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

(c) $X + Y \rightleftharpoons 4Z$

(d) $A + 3B \rightleftharpoons 7C$

(1) d, c (2) d, b (3) c, b (4) d, a

**30.** $\log \frac{K_p}{K_c} + \log RT = 0$ is true relationship for the following reaction:-

(1) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

(2) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

(3) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

(4) (2) and (3) both

**31.** Consider the two gaseous equilibrium involving $SO_2$ and the corresponding equilibrium constants at 299 K

$SO_2(g) + \frac{1}{2} O_2(g) \rightleftharpoons SO_3(g) ; K_1$

$4SO_3(g) \rightleftharpoons 4SO_2(g) + 2O_2(g) ; K_2$

The value of the equilibrium constant are related by :-

(1) $K_2 = \frac{1}{(K_1)^4}$ (2) $K_2 = K_1^4$

(3) $K_2 = \left(\frac{1}{K_1}\right)^{\frac{1}{4}}$ (4) $K_2 = \frac{1}{K_1}$

**32.** For the reaction, $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ equilibrium constant, $K_P$ changes with :-

(1) Temperature

(2) Total pressure

(3) Catalyst

(4) Amount of $H_2$ and $I_2$ present

**33.** For any reversible reaction if concentration of reactants increases then effect on equilibrium constant :-

(1) Depends on amount of concentration

(2) Unchange

(3) Decrease

(4) Increase

**34.** For a reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of $K_c$ does not depends upon :-

(a) Initial concentration of the reactants

(b) Pressure

(c) Temperature

(d) Catalyst

(1) Only c (2) a, b, c

(3) a, b, d (4) a, b, c, d

**35.** In system $A(s) \rightleftharpoons 2B(g) + 3C(g)$ at equilibrium if concentration of 'C' is doubled then concentration of B at equilibrium.

(1) Double its original concentration

(2) Half its original concentration

(3) $2\sqrt{2}$ its original concentration

(4) $\frac{1}{2\sqrt{2}}$ its original concentration

**36.** A reaction in equilibrium is represented by the following equation –

$2A_{(s)} + 3B_{(g)} \rightleftharpoons 3C_{(g)} + D(g) + Q$ if the pressure on the system is reduced to half of its original value :

(1) The amounts of C and D decreases

(2) The amounts of C and D increases

(3) The amount of D decreases

(4) All the amounts remain constant

**37.** If some He gas is introduced into the equilibrium $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ at constant pressure and temperature then equilibrium constant of reaction :

(1) Increase

(2) Decrease

(3) Unchange

(4) Nothing can be said

**38.** HI was heated in a sealed tube at 400°C till the equilibrium was reached. HI was found to be 22% decomposed. The equilibrium constant for dissociation is :

(1) 1.99 (2) 0.0199

(3) 0.0796 (4) 0.282

**39.** For the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ the partial pressure of CO and $CO_2$ are 2.0 and 4.0 atm. respectively at equilibrium. The $K_P$ for the reaction is

(1) 0.5 (2) 4.0 (3) 8.0 (4) 1

**40.** In this reaction $Ag^+ + 2NH_3 \rightleftharpoons Ag(NH_3)_2^+$ at 298K molar concentration of $Ag^+$, $Ag(NH_3)_2^+$ and $NH_3$ is $10^{-1}$, $10^{-1}$ , and $10^3$. The value of $K_C$ at 298K for this equilibrium :-

(1) $10^{-6}$ (2) $10^6$

(3) $2 \times 10^{-3}$ (4) $2 \times 10^6$

**41.** At 1000 K, the value of $K_P$ for the reaction :

$A(g) + 2B(g) \rightleftharpoons 3C(g) + D(g)$

is 0.05 atm The value of $K_c$ in terms of R would be

(1) 20000 R (2) 0.02 R

(3) $5 \times 10^{-5}$ R (4) $5 \times 10^{-5} \times R^{-1}$

**42.** For the reaction : $2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$ ; the degree of dissociation ( $\alpha$ ) of HI(g) is related to equilibrium constant $K_p$ by the expression

(1) $\frac{1+2\sqrt{K_p}}{2}$ (2) $\sqrt{\frac{1+2K_p}{2}}$

(3) $\sqrt{\frac{2K_p}{1+2K_p}}$ (4) $\frac{2\sqrt{K_p}}{1+2\sqrt{K_p}}$ .

**43.** In an experiment the equilibrium constant for the reaction $A + B \rightleftharpoons C + D$ is K when the initial concentration of A and B each is 0.1 mol $L^{-1}$ Under the similar conditions in an another experiment if the initial concentration of A and B are taken 2 and 3 mol $L^{-1}$ respectively then the value of equilibrium constant will be:-

(1) $\frac{K}{2}$ (2) K (3) $K^2$ (4) $\frac{1}{K}$

**44**. Effect of increasing temperature on equilibrium constant is given by $\log K_2 - \log K_1 = \frac{-\Delta H}{2.303R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$. Then for an endothermic reaction the false statement is:-

(1) $\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$ = positive

(2) $\log K_2 > \log K_1$

(3) $\Delta H$ = positive

(4) $K_2 > K_1$

**45.** Equilibrium constant of some reactions are given as under :

(a) $x \rightleftharpoons y$ $K = 10^{-1}$

(b) $y \rightleftharpoons z$ $K = 2 \times 10^{-2}$

(c) $P \rightleftharpoons Q$ $K = 3 \times 10^{-4}$

(d) $R \rightleftharpoons S$ $K = 2 \times 10^{-3}$

Initial concentration of the reactants for each reaction was taken to be equal :

Review the above reaction and indicate the reactions in which the reactants and products respectively were of highest concentration :-

(1) d, c (2) c, a (3) a, d (4) b, c

**46.**

| List X | List Y |
|---|---|
| (A) Active mass | (i) $\Delta n = 0$ |
| (B) Dynamic nature | (ii) Molar concentration |
| (C) A + heat $\rightleftharpoons$ B | (iii) Vant hoff's equation |
| (D) log $(K_{p_2}/K_{p_1})$ $= \frac{\Delta H}{2.303R}\left[\frac{1}{T_1}-\frac{1}{T_2}\right]$ | (iv) adaptation if temperature increases |
| (E) 2A(g)+B(g)$\rightleftharpoons$3C(g) | (v) Chemical equilibrium |

Correct match list X and Y

(1) A - (V), B - (II), C - (III), D - (I), E - (IV)

(2) A - (V), B - (IV), C - (III), D - (II), E - (I)

(3) A - (II), B - (V), C - (IV), D - (III), E - (I)

(4) None of these

**47.** Which one of the following statements is correct about equilibrium constant:-

(1) Equilibrium constant of a reaction changes with temperature.

(2) Equilibrium constant of a reaction depends upon the concentration of reactants with which we start.

(3) Equilibrium constant of a reaction,

$3Fe(s) + 4H_2O_{(g)} \rightleftharpoons Fe_3O_4(s) + 4H_{2(g)}$ is the same whether, the reaction is carried out in an open vessel or a closed vessel.

(4) Equilibrium constant of a reaction becomes double if the reaction is multiplied by 2 throughout.

**48.** $XY_2$ dissociates as

$XY_{2(g)} \rightleftharpoons XY_{(g)} + Y_{(g)}$. When the initial pressure of $XY_2$ is 600 mm of Hg, the total pressure developed is 800 mm of Hg. $K_p$ for the reaction is

(1) 200 (2) 50

(3) 100 (4) 150.

**49.** If 340 g of a mixture of $N_2$ and $H_2$ in the correct ratio gave a 20% yield of $NH_3$, the mass produced would be:

(1) 16 g (2) 17 g (3) 20 g (4) 68 g

## DEGREE OF DISSOCIATION AND APPLICATION OF LAW OF MASS ACTION

**50.** For the reaction : P $\rightleftharpoons$ Q + R. Initially 2 mol of P was taken. Up to equilibrium 0.5 mol of P was dissociated. What would be the degree of dissociation :-

(1) 0.5 (2) 1 (3) 0.25 (4) 4.2

**51.** $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

In above reaction, at equilibrium condition mole fraction of $PCl_5$ is 0.4 and mole fraction of $Cl_2$ is 0.3. Then find out mole fraction of $PCl_3$

(1) 0.3 (2) 0.7 (3) 0.4 (4) 0.6

**52.** 4 mol of $PCl_5$ are heated at constant temperature in closed container. If degree of dissociation for $PCl_5$ is 0.5 then calculate total number of moles at equilibrium

(1) 4.5 (2) 6 (3) 3 (4) 4

**53.** The dissociation of $CO_2$ can be expressed as $2CO_2 \rightleftharpoons 2CO + O_2$. If the 2 mol of $CO_2$ is taken initially and 40% of the $CO_2$ is dissociatated completely. What is the total number of moles at equilibrium:-

(1) 2.4 (2) 2.0 (3) 1.2 (4) 5

**54.** Evaluate $K_p$ for the reaction : $H_2 + I_2 \rightleftharpoons 2HI$. If 2 moles each of $H_2$ and $I_2$ are taken initially. The equilibrium concentration of HI is 2 mol $L^{-1}$ :-

(1) 2.5 (2) 4 (3) 0.25 (4) 1.0

**55** $K_c$ for the esterification reaction :

$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$ is 4. If 4 mol each of acid and alcohol are taken initially, what is the equilibrium concentration of the acid :-

(1) $\frac{2}{3}$ (2) $\frac{4}{3}$ (3) $\frac{3}{4}$ (4) $\frac{3}{2}$

**56.** In $A_3(g) \rightleftharpoons 3A(g)$ reaction, the initial concentration of $A_3$ is "a" mol $L^{-1}$ If x is degree of dissociation of $A_3$. The total number of moles at equilibrium will be:-

(1) a - $\frac{ax}{3}$ (2) $\frac{a}{3}$ - x

(3) $\left(\frac{a-ax}{2}\right)$ (4) None of these

**57.** The reaction A + B $\rightleftharpoons$ C + D is studied in a one litre Vessel at 250°C. The initial concentration of A was 3n and of B was n. After equilibrium was attained then equilibrium concentration of C was found to be equal to equilibrium concentration of B. What is the concentration of D at equilibrium :-

(1) $\frac{n}{2}$ (2) $\left(3n-\frac{n}{2}\right)$

(3) $\left(n+\frac{n}{2}\right)$ (4) n

**58.** $X_2 + Y_2 \rightleftharpoons 2XY$ reaction was studied at a certain temperature. In the beginning 1 mole of $X_2$ was taken in a one litre flask and 2 moles of $Y_2$ was taken in another 2 litre flask. What is the equilibrium concentration of $X_2$ and $Y_2$ ? (Given equilibrium concentration of [XY] = 0.6 mol $L^{-1}$).

(1) $\left(\frac{1}{3}-0.3\right),\left(\frac{2}{3}-0.3\right)$

(2) $\left(\frac{1}{3}-0.6\right),\left(\frac{2}{3}-0.6\right)$

(3) (1 – 0.3), (2 – 0.3)

(4) (1 – 0.6), (2 – 0.6)

**59.** In a 0.25 L tube dissociation of 4 mol of NO is take place. If its degree of dissociation is 10%. The value of $K_P$ for reaction 2 NO $\rightleftharpoons$ $N_2 + O_2$ is :

(1) $\frac{1}{(18)^2}$ (2) $\frac{1}{(8)^2}$

(3) $\frac{1}{16}$ (4) $\frac{1}{32}$

**60.** 'a' mol of $PCl_5$, undergoes, thermal dissociation as : $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the mole fraction of $PCl_3$ at equilibrium is 0.25 and the total pressure is 2.0 atm. The partial pressure of $Cl_2$ at equilibrium is :-

(1) 2.5 (2) 1.0

(3) 0.5 (4) None

**61.** In the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ the partial pressure of $PCl_3$, $Cl_2$ and $PCl_5$ are 0.3, 0.2 and 0.6 atm respectively. If partial pressure of $PCl_3$ and $Cl_2$ was increased twice, what will be the partial pressure of $PCl_5$ is in atm:-

(1) 0.3 (2) 1.2

(3) 2.4 (4) 0.15

**62.** If 8 g mol of $PCl_5$ heated in a closed vessel of 10 L capacity and 25% of its dissociates into $PCl_3$ and $Cl_2$ at the equilibrium then value of Kp will be equal to:-

(1) P/30 (2) P/15

(3) 2/3P (4) 3/2P

**63.** In a 13 L vessel initially following reaction occur $C(s) + S_2(g) \rightleftharpoons CS_2(g)$ by 12 g C, 64 g $S_2$, 76 g $CS_2$ at 1027°C temperature then total pressure is.

(1) 200R (2) 158R

(3) 100R (4) 79R

**64.** Two moles of ammonia is introduced in a evacuated 500 mL vessel at high temperature. The decomposition reaction is :

$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$

At the equilibrium $NH_3$ becomes 1 mole then the $K_C$ would be :-

(1) 0.42 (2) 6.75

(3) 1.7 (4) 1.5

**65.** 4.5 mol each of hydrogen and iodine heated in a sealed ten litre vessel. At equilibrium, 3 mol of HI were found. The equilibrium constant for $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ is:-

(1) 1 (2) 10 (3) 5 (4) 0.33

**66.** In a chemical equilibrium A + B $\rightleftharpoons$ C + D when one mole each of the two reactants are mixed, 0.4 mol each of the products are formed. The equilibrium constant is :-

(1) 1 (2) 0.36 (3) 2.25 (4) $\frac{4}{9}$

**67.** 4 moles of A are mixed with 4 moles of B, when 2 mol of C are formed at equilibrium, according to the reaction, A + B $\rightleftharpoons$ C + D. The equilibrium constant is :-

(1) 4 (2) 1 (3) $\sqrt{2}$ (4) $\sqrt{4}$

**68.** 1.50 mol each of hydrogen and iodine were placed in a sealed 10 L container maintained at 717 K. At equilibrium 1.25 mol each of hydrogen and iodine were left behind. The equilibrium constant, $K_c$ for the reaction

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ at 717 K is

(1) 0.4 (2) 0.16 (3) 25 (4) 50

**69.** AB dissociates as $2AB(g) \rightleftharpoons 2A(g) + B_2(g)$

When the initial pressure of AB is 500 mm, the total pressure becomes 625 mm when the equilibrium is attained. Calculate $K_P$ for the reaction assuming volume remains constant.

(1) 500 (2) 125 (3) 750 (4) 375

**70.** If the pressure of $N_2/H_2$ mixture in a closed apparatus is 100 atm and 20% of the mixture reacts then the pressure at the same temperature would be -

(1) 100 (2) 90 (3) 85 (4) 80

**71.** In a 20 litre vessel initially 1 - 1 mole CO, $H_2O$, $CO_2$ is present, then for the equilibrium of

$CO + H_2O \rightleftharpoons CO_2 + H_2$ following is true:-

(1) $H_2$, more then 1 mole

(2) CO, $H_2O$, $H_2$ less then 1 mole

(3) $CO_2$ & $H_2O$ both more than 1 mole

(4) All of these

## LE-CHATELIER PRINCIPLE

**72.** The yield of product in the reaction,

$A_2(g) + 2B(g) \rightleftharpoons C(g) + Q$ kJ

would be higher at :

(1) low temperature and high pressure

(2) high temperature and high pressure

(2) low temperature and low pressure

(4) high temperature and low pressure

**73.** Manufacture of ammonia from the elements is represented by

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 22.4$ kcal

the maximum yield of ammonia will be obtained when the process is made to take place –

(1) at low pressure and high temperature

(2) at low pressure and low temperature

(3) at high pressure and high temperature

(4) at high pressure and low temperature

**74.** In the reaction,

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + X$ cal, most favourable conditions of temperature and pressure for greater yield of $SO_3$ are :

(1) low temperature and low pressure

(2) high temperature and low pressure

(3) high temperature and high pressure

(4) low temperature and high pressure

**75.** In a vessel containing $SO_2$, $SO_3$ and $O_2$ at equilibrium, some helium gas is introduced so that total pressure increases while temperature and volume remain the same. According to the Le Chatelier's principle, the dissociation of $SO_3$:

(1) increases

(2) decreases

(3) remains unaltered

(4) change unpredictably

**76.** The equilibrium

$SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$ is attained at 25°C in a closed container and an inert gas, helium, is introduced. Which of the following statements is correct ?

(1) concentrations of $SO_2Cl_2$, $SO_2$ and $Cl_2$ do not change

(2) more $Cl_2$ is formed

(3) concentration of $SO_2$ is reduced

(4) more $SO_2Cl_2$ is formed

**77.** A cylinder provided with a piston has some $PCl_5$ which is in equilibrium with $PCl_3$ and $Cl_2$. The system is compressed with the help of piston. Indicate the correct statement :

(1) some more $PCl_5$ will decompose

(2) the system remains unaffected

(3) $PCl_3$ and $Cl_2$ will combine to form $PCl_5$

(4) explosion occurs

**78.** In the melting of ice, which one of the conditions will be more favourable ?

(1) high temperature and high pressure

(2) low temperature and low pressure

(3) low temperature and high pressure

(4) high temperature and low pressure

**79.** Cis -2- pentene $\rightleftharpoons$ Trans -2- pentene for the above equilibrium the value of standard free energy change at 400 K is –3.67 kJ/mol. If excess of trans -2- pentene is added to the system then :

(1) Additional trans -2- pentene will form

(2) Excess of cis -2- pentene will form

(3) Equilibrium will proceed in the forward

(4) Equilibrium will remain unaffected

**80.** When solid $NaNO_3$ is heated in a closed vessel, $O_2$ is liberated and solid $NaNO_2$ is left behind. At equilibrium –

(1) Addition of $NaNO_3$ favours forward reaction

(2) Addition of $NaNO_2$ favours reverse reaction

(3) Increasing pressure favours reverse reaction.

(4) Decreasing temperature favours forward reaction.

**81.** In which of the following equilibrium reactions, the equilibrium would shift to right side, if total pressure is decreased :-

(1) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

(2) $H_2 + I_2 \rightleftharpoons 2HI$

(3) $N_2O_4 \rightleftharpoons 2NO_2$

(4) $H_2 + Cl_2 \rightleftharpoons 2HCl$

**82.** Match list –I (equilibrium) with List –II (conditions for reaction) and select the correct answer using the codes given below the lists :-

| | **List-1 (Equilibrium)** | **List-2 (Conditions)** |
|---|---|---|
| P. | $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ Endothermic | 1. High temperature |
| Q. | $2AB_2(g) + B_2(g) \rightleftharpoons 2AB_3(g)$ Exothermic | 2. Low temperature |
| R. | $2AB_3(g) \rightleftharpoons A_2 + 3B_2(g)$ Endothermic | 3. High Pressure |
| | | 4. Low Pressure |
| | | 5. Independent of Pressure |

CODE :

| | P | Q | R |
|---|---|---|---|
| (1) | 1 & 3 | 2 & 3 | 2 & 4 |
| (2) | 2 &3 | 1 & 4 | 1 & 3 |
| (3) | 1 & 5 | 2 & 3 | 1 & 4 |
| (4) | 2 & 4 | 1 & 5 | 1 & 3 |

**83.** In the reaction $2A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)} + 362$ kcal. Which combination of pressure and temperature gives the highest yield of C at equilibrium:-

(1) 1000 atm and 500°C

(2) 500 atm and 500°C

(3) 1000 atm and 50°C

(4) 500 atm and 100°C

**84.** $aA \rightleftharpoons bB + cC$, $\Delta H = -x$ kcal.

If high pressure and low temperature are the favourable condition for the formation of the product in above reaction, hence:-

(1) $a > b + c$ (2) $a < b + c$

(3) $a = b + c$ (4) None of them

**85.** $aA + bB \rightleftharpoons cC + dD$

in above reaction low pressure and high temperature, conditions are shift equilibrium in back direction so correct set :–

(1) $(a + b) > (c + d)$, $\Delta H > 0$

(2) $(a + b) < (c + d)$, $\Delta H > 0$

(3) $(a + b) < (c + d)$, $\Delta H < 0$

(4) $(a + b) > (c + d)$, $\Delta H < 0$

**86.** For reaction $aA \rightleftharpoons \ell L + mM$. In condition of suddenly volume increase, degree of dissociation is decrease it represent that.

(1) $a < (\ell + m)$ (2) $a = (\ell + m)$

(3) $a = (\ell - m)$ (4) $a > (\ell + m)$

**87.** For the reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ the forward reaction at constant temperature is favoured by :-

(a) Introducing an inert gas at constant volume

(b) Introducing chlorine gas at constant volume

(c) Introducing an inert gas at constant pressure

(d) Increasing volume of the container

(e) Introducing $PCl_5$ at constant volume

(1) a, b, c (2) b, c, d

(3) c, d, e (4) a, c, d, e

**88.** For the equilibrium reaction,

$H_2O(\ell) \rightleftharpoons H_2O_{(g)}$, What happens, if pressure is applied:-

(1) More water evaporates

(2) The boiling point of water is increased

(3) No effect on boiling point

(4) None of the above

**89.** Does Le chatelier's principle predict a change of equilibrium concentration for the following reaction if the gas mixture is compressed

$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$

(1) Yes, backward reaction is favoured

(2) Yes, forward reaction is favoured

(3) No change

(4) No information

**90.** On cooling of following system at equilibrium

$CO_{2(s)} \rightleftharpoons CO_{2(g)}$ :-

(1) There is no effect on the equilibrium state

(2) More gas is formed

(3) More gas is solidifies

(4) None of above

**91.** Following equilibrium is present in a closed container at the temperature of 25° C.

$SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

When $Cl_2$ is added to the equlibrium mixture, the following statements will be correct for the system.

(a) Concentrations of $SO_2$, $Cl_2$ and $SO_2Cl_2$ change.

(b) $Cl_2$ is formed in more amount.

(c) Concentration of $SO_2$ decreases and that of $SO_2Cl_2$ increases.

(1) a, c (2) a, b

(3) b, c (4) a, b, c

**92.** A reaction mixture containing $H_2$, $N_2$ and $NH_3$ has partial pressures 2 atm, 1 atm and 3 atm respectively at 725K. If the value of $K_P$ for the reaction, $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is $4.28 \times 10^{-5}$ atm$^{-2}$ at 725K, in which direction the net reaction will go

(1) Forward

(2) Backward

(3) No net reation

(4) Direction of reaction cannot be predicted

## DEGREE OF DISSOCIATION FROM VAPOUR DENSITY METHOD

**93.** Vapour density of $PCl_5$ is 104.25 at T°C. Then degree of dissociation of $PCl_5$ is. (Mw = 208.5)

(1) 20% (2) 0%

(3) 30% (4) 15%

**94.** Vapour density of $PCl_5$ is 104.16 but when heated to $230^0$C its vapour density is reduced to 62. The degree of dissociation of $PCl_5$ at this temperature will be :

(1) 6.8% (2) 68%

(3) 46% (4) 64%

**95.** When heating $PCl_5$ then it decompose $PCl_3$ and $Cl_2$ in form of gas, The density of gas mixture is 70.2 and 57.9 at 200° C and 250°C. The degree of dissociation of $PCl_5$ at 200°C and 250°C is

(1) 48.50% & 80%

(2) 60% & 70%

(3) 70% & 80%

(4) 80% & 90%

**96.** The equation $\alpha = \frac{D-d}{(n-1)d}$ is correctly matched for Where D = Theoretical vapour density

d = Observed vapour density

(1) $A \rightleftharpoons \frac{nB}{2} + \frac{nC}{3}$

(2) $A \rightleftharpoons \frac{nB}{3} + \left(\frac{2n}{3}\right)C$

(3) $A \rightleftharpoons \left(\frac{n}{2}\right)B + \left(\frac{n}{4}\right)C$

(4) $A \rightleftharpoons \left(\frac{n}{2}\right)B + C$

## ANSWER KEY [EXERCISE-I]

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Que.** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| **Ans.** | 3 | 4 | 2 | 1 | 4 | 3 | 4 | 3 | 2 | 1 | 4 | 2 | 4 | 3 | 2 |
| **Que.** | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| **Ans.** | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 4 | 4 | 3 | 3 | 2 | 4 | 2 | 2 |
| **Que.** | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| **Ans.** | 1 | 1 | 2 | 3 | 4 | 2 | 3 | 2 | 4 | 1 | 4 | 4 | 2 | 1 | 2 |
| **Que.** | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| **Ans.** | 3 | 1 | 3 | 4 | 3 | 1 | 2 | 1 | 2 | 2 | 4 | 1 | 1 | 1 | 3 |
| **Que.** | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| **Ans.** | 3 | 2 | 1 | 2 | 1 | 4 | 2 | 2 | 2 | 2 | 2 | 1 | 4 | 4 | 3 |
| **Que.** | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| **Ans.** | 1 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | 4 | 4 | 3 | 2 | 1 | 3 |
| **Que.** | 91 | 92 | 93 | 94 | 95 | 96 | | | | | | | | | |
| **Ans.** | 1 | 2 | 2 | 2 | 1 | 2 | | | | | | | | | |