PROBLEM SOLVING TECHNIQUES OF PHYSICAL CHEMISTRY FOR NEET

BY

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Basic Exercise

Introduction

1. 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) $2Cu + 2I_2 + 4K^+ \rightleftharpoons 2Cu^{+2} + 4KI$

Ans. **(1)**

2. 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

Ans. **(3)**

3. 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

Ans. **(4)**

4. 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) $3O_2 + C_2H_5OH \rightarrow 2CO_2 + 3H_2O$

Ans. **(2)**

Factors Affecting Rate of Reaction

5. 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

Ans. **(3)**

6. $2A_{(g)} + B_{(g)} \rightleftharpoons$ 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

Ans. **(2)**

Equilibrium & Chemical Process

7. $x \rightleftharpoons y$ reaction is said to be in equilibrium, when :-

(1) Only 10% conversion x to y is just

(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

Ans. **(4)**

8. In the chemical reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at equilibrium, state whether :-

(1) Equal volumes of N_2 & H_2 are reacting

(2) Equal masses of N_2 & H_2 are reacting

(3) The reaction has stopped

(4) The same amount of ammonia is formed as is decomposed into N_2 and H_2

Ans. **(4)**

9. Active mass of 5 g CaO :-

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

Ans. **(2)**

10. 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

Ans. **(4)**

11. 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.

Ans. **(1)**

12. 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.

Ans. **(3)**

Law of Mass Action

13. The equilibrium concentration of $[B]_e$ for the reversible reaction $A \rightleftharpoons B$ can be evaluated by the expression:-

(1) $K_C [A]_e^{-1}$ (2) $\frac{k_f}{k_b}[A]_e^{-1}$ (3) $k_f k_b^{-1} [A]_e$ (4) $k_f k_b [A]^{-1}$

Ans. **(3)**

14. 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) 5×10^{-5} R (4) $5 \times 10^{-5} \times R^{-1}$

Ans. **(4)**

15. 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

Ans. **(4)**

16. $\log \frac{K_p}{K_c} + \log RT = 0$ 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

Ans. **(2)**

17. 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

Ans. **(4)**

18. 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

Ans. **(2)**

19. 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) 2×10^{-3} (4) 2×10^6

Ans. **(1)**

20. 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 $\quad 4SO_3(g) \rightleftharpoons 4SO_2(g) + 2O_2(g)$; 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) $K_2 = \frac{1}{K_1}$

Ans. **(1)**

21. For the reactions :- $A \rightleftharpoons B$; $K_C = 2$,

$B \rightleftharpoons C$; $K_C = 4$, $C \rightleftharpoons D$; $K_C = 6$

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

(1) 12 (2) 4/3 (3) 24 (4) 48

Ans. **(4)**

22. If $A \rightleftharpoons B$ ($K_c = 3$), $B \rightleftharpoons C$ ($K_c = 5$),

$C \rightleftharpoons D$ ($K_c = 2$)

The value of equilibrium constant for the above reaction are given, the value of equilibrium constant for $D \rightleftharpoons A$ will be:-

(1) 15 (2) 0.3 (3) 30 (4) 0.03

Ans. **(4)**

23. 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) ΔH = positive (4) $K_2 > K_1$

Ans. **(1)**

24. 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

Ans. **(2)**

25. Which Oxide of Nitrogen is most stable :-

(1) $2NO_{2(g)} \rightleftharpoons N_{2(g)} + 2O_{2(g)}$
$K = 6.7 \times 10^{16}\ mol\ L^{-1}$

(2) $2\ NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$
$K = 2.2 \times 10^{30}$

(3) $2\ N_2O_{5(g)} \rightleftharpoons 2N_{2(g)} + 5O_{2(g)}$
$K = 1.2 \times 10^{34}\ mol^5\ L^{-5}$

(4) $2N_2O_{(g)} \rightleftharpoons 2N_{2(g)} + O_{2(g)}$
$K = 3.5 \times 10^{33}\ mol\ L^{-1}$

Ans. **(1)**

26. The equilibrium constant for the reaction

$Br_2 \rightleftharpoons 2Br$ at 500 K and 700 K are 1×10^{-10} and 1×10^{-5} respectively. The reaction is:-

(1) Endothermic (2) Exothermic (3) Fast (4) Slow

Ans. **(1)**

27. The equilibrium constant in a reversible reaction at a given temperature:-

(1) Depends on initial concentration of the reactants.

(2) Depends on the concentration of the products at equilibrium.

(3) Does not depend on the initial concentrations.

(4) It is not characteristic of the reaction.

Ans. **(3)**

28. 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.

Ans. **(1)**

29. 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

Ans. **(3)**

30. 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

Ans. **(2)**

31. 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) $\frac{1}{K}$

Ans. **(2)**

32.

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

Ans. **(3)**

33. 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

Ans. **(4)**

34. The equilibrium constant for the reaction :

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ at 2000 K is 4×10^4. In presence of catalyst the equilibrium is established ten times faster at the same temperature. What is the value of equilibrium constant in presence of catalyst :-

(1) 40×10^{-4} (2) 4×10^{-4} (3) 4×10^4 (4) None

Ans. **(3)**

35. The equilibrium constant of the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is 64. If the volume of the container is reduced to one fourth of its original volume, the value of the equilibrium constant will be

(1) 16 (2) 32 (3) 64 (4) 128

Ans. **(3)**

36. If some Helium 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

Ans. **(3)**

Degree of Dissociation and Application of Law of Mass Action

37. 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

Ans. **(3)**

38. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

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

Ans. **(1)**

39. 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

Ans. **(2)**

40. 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 dissociated completely. What is the total number of moles at equilibrium:-

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

Ans. **(1)**

41. 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

Ans. **(4)**

42. 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

Ans. **(2)**

43. In the reaction $2P(g) + Q(g) \rightleftharpoons 3R(g) + S(g)$. If 2 mol each of P and Q taken initially in a 1 L flask. At equilibrium which is true:-

(1) [P] < [Q] (2) [P] = [Q] (3) [Q] = [R] (4) None of these

Ans. **(1)**

44. 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

Ans. **(3)**

45. 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

Ans. **(1)**

46. '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

Ans. **(3)**

47. 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) $\frac{1}{32}$

Ans. **(1)**

48. 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) $\frac{4}{9}$

Ans. **(4)**

49. 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) $\frac{3}{2}$

Ans. **(2)**

50. 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

Ans. **(2)**

51. 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) $\sqrt{4}$

Ans. **(2)**

52. 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 would be :-

(1) 0.42 (2) 6.75 (3) 1.7 (4) 1.5

Ans. **(2)**

53. 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

Ans. **(1)**

54. 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

Ans. **(1)**

55. $X_2 + Y_2 \rightleftharpoons 2XY$ 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) $(1 - 0.6), (2 - 0.6)$

Ans. **(1)**

56. 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

Ans. **(2)**

57. 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

Ans. **(2)**

58. If the pressure of N_2 and 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

Ans. **(2)**

59. 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

Ans. **(2)**

60. If 340 g of mixture of N_2 and H_2 in the correct ratio gave a 20% yield of NH_3. The produced mass of NH_3 would be:-

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

Ans. **(4)**

Le-Chatlier's Principle

61. When $NaNO_3$ is heated in a closed vessel, O_2 is liberated and $NaNO_2$ 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.

Ans. **(3)**

62. The equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ shifts forward if :-

(1) A catalyst is used.

(2) An adsorbent is used to remove SO_3 as soon as it is formed.

(3) Small amounts of reactants are used.

(4) None

Ans. **(2)**

63. In manufacture of NO, the reaction of N_2 and O_2 to form NO is favourable if :-

(1) Pressure is increased (2) Pressure is decreased

(3) Temperature is increased (4) Temperature is decreased

Ans. **(3)**

64. 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) $H_2 + Cl_2 \rightleftharpoons 2HCl$

Ans. **(3)**

65. The oxidation of SO_2 by O_2 to SO_3 is exothermic reaction. The yield of SO_2 will be minimum if :-

(1) Temperature is increased and pressure is kept constant

(2) Temperature is reduced and pressure is increased

(3) Both temperature and pressure are increased

(4) Both temperature and pressure are decreased

Ans. **(2)**

66. For the manufacture of ammonia by the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3 + 21.9$ K cal, the favourable conditions are :-

(1) Low temperature, low pressure & catalyst

(2) Low temperature, high pressure & catalyst

(3) High temperature, low pressure & catalyst

(4) High temperature, high pressure & catalyst

Ans. **(2)**

67. 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

Ans. **(1)**

68. $aA \rightleftharpoons bB + cC, \Delta H = -x$ 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

Ans. **(1)**

69. The reaction in which yield of production cannot be increased by the application of high pressure is :-

(1) $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$ (2) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(3) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (4) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Ans. **(2)**

70. In a vessel containing SO_3, SO_2 and O_2 at equilibrium, some helium gas is introduced so that the total pressure increases while temperature and volume remain constant. According to Le-Chatelier principle, the dissociation of SO_3,

(1) Increases (2) Decreases (3) Remains unaltered (4) None of these

Ans. **(3)**

Physical Equilibrium

71. 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

Ans. **(2)**

72. 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

Ans. **(3)**

Calculation of Degree of Dissociation by V.D. Method

73. 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%

Ans. **(2)**

74. 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%

Ans. **(1)**

75. Vapour density of PCl_5 is 104.16 but when heated to 230^0C 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%

Ans. **(2)**

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

Ans. **(2)**

Analytical Exercise

1. For the reversible reaction

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at 500°C, the value of K_p is 1.44×10^{-5} when partial pressure is measured in atmospheres. The corresponding value of K_C, with concentration in mol L^{-1} is:-

(1) $1.44 \times 10^{-5} / (0.082 \times 500)^{-2}$ (2) $1.44 \times 10^{-5} / (8.314 \times 773)^{-2}$

(3) $1.44 \times 10^{-5} / (0.082 \times 773)^{2}$ (4) $1.44 \times 10^{-5} / (0.082 \times 773)^{-2}$

Ans. **(4)**

2. In which reaction equilibrium moves in left hand side when pressure is increased :-

(1) $H_2 + Cl_2 \rightleftharpoons 2HCl$ (2) $2Mg(s) + O_2(g) \rightleftharpoons 2MgO(s)$

(3) $2H_2O \rightleftharpoons 2H_2 + O_2$ (4) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

Ans. **(3)**

3. $K_p \rightarrow 10^{-2} \quad 10^{-3}$

Temperature $\rightarrow$ 400K 450K

What would you consider by above information :-

(1) Equilibrium constant increases with increase in concentration

(2) more molecules form on left hand side

(3) Energy is released

(4) None

Ans. **(3)**

4. 3.1 mol of $FeCl_3$ and 3.2 mol of NH_4SCN are added to one litre of water. At equilibrium 3.0 mol of $FeSCN^{2+}$ are formed. The equilibrium constant K_C of the reacion

$Fe^{3+} + SCN^- \rightleftharpoons FeSCN^{2+}$ will be :

(1) 6.66×10^{-3} (2) 0.30 (3) 3.30 (4) 150

Ans. **(4)**

5. One mole of N_2O_4 in a 1 L flask decomposes to attain the equilibrium $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

At the equilibrium the mole fraction of 1/2. Hence K_C will be :

(1) 1/3 (2) 1/2 (3) 2/3 (4) 1

Ans. **(3)**

6. At equilibrium 500mL vessel contains 1·5 M of each A, B, C, D. If 0·5M of C and D expelled out than what would be the K_C :–

(1) 1 (2) $\frac{1}{9}$ (3) $\frac{4}{9}$ (4) $\frac{5}{9}$

Ans. **(1)**

7. The equilibrium constant K_c for the following reaction will be

$K_2CO_3(aq) + BaSO_4(s) \rightleftharpoons BaCO_3(s) + K_2SO_4(aq)$

(1) $\frac{[CO_3^{2-}]}{[SO_4^{2-}]}$ (2) $\frac{[K_2CO_3]}{[K_2SO_4]}$ (3) $\frac{[BaSO_4]}{[CO_3^{2-}]}$ (4) $\frac{[SO_4^{2-}]}{[CO_3^{2-}]}$

Ans. **(4)**

8. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction,

$2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$

with a degree of dissociation 'x' which is small as compared to unity. The expression for K_p in terms of 'x' and total pressure P is

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

Ans. **(1)**

9. Ammonium carbamate dissociates as

$NH_2COONH_{4(s)} \rightleftharpoons 2NH_{3(g)} + CO_{2(g)}$

In a closed vessel containing ammonium carbamate in equilibrium, ammonia is added such that the partial pressure of NH_3 now equals to the original total pressure. The ratio of total pressure now to the original pressure is

(1) $\frac{27}{31}$ (2) $\frac{31}{27}$ (3) $\frac{4}{9}$ (4) $\frac{9}{4}$

Ans. **(2)**

10. When 1 mole of N_2 and 1 mole of H_2 is enclosed in 3L vessel and the reaction is allowed to attain equilibrium, it is found that at equilibrium there is 'x' mole of H_2. The number of moles of NH_3 formed would be

(1) $\frac{2x}{3}$ (2) $\frac{2(1+x)}{3}$ (3) $\frac{2(1-x)}{3}$ (4) $\frac{(1-x)}{2}$

Ans. **(3)**

11. 1 mole of 'A', 1.5 mole of 'B' and 2 mole of 'C' are taken in a vessel of volume one litre. At equilibrium concentration of C is 0.5 mole/L. Equilibrium constant for the reaction, $A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)}$ is

(1) 0.66 (2) 0.066 (3) 66 (4) 6.6

Ans. **(2)**

12. $N_2 + 3H_2 \rightleftharpoons 2NH_3$; $K_c = 1.2$

At the start of a reaction, there are 0.249 mol N_2, 3.21×10^{-2} mol H_2 and 6.42×10^{-4} mol NH_3 in a 3.50 L reaction vessel at 375°C. Hence reaction will proceed in

(1) Forward direction (2) Backward direction (3) At equilibrium (4) Stops

Ans. **(1)**

13. Sodium ammonium carbamate dissociated according to the given reaction

$NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

Total pressure of the gases in equilibrium is 5 atm. Hence K_p

(1) 18.5 (2) 25 (3) 1/5 (4) 12.5

Ans. **(1)**

14. 1.1 mole of A is mixed with 1.2 mol of B and the mixture is kept in a 1 L flask till the equilibrium $A + 2B \rightleftharpoons 2C + D$ is reached. At equilibrium 0.1 mol of D is formed. The K_c of the reaction

(1) 0.002 (2) 0.004 (3) 0.001 (4) 0.003

Ans. **(2)**

15. $C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$; $\Delta H < 0$

The above equilibrium will proceed in forward direction when

(1) It is subjected to high pressure

(2) It is subjected to high temperature

(3) Inert gas (Argon) id added at constant pressure

(4) Carbon (solid) is added

Ans. **(3)**

16. In the equilibrium $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$ at 2000K and 10 atm pressure, $\%\, Cl_2 = \%\, SO_2 = 40$ (by volume) Then

(1) $K_c = 0.1$ mol lt^{-1}

(2) $\frac{n(SO_2Cl_2)}{n(SO_2)} = \frac{1}{4}$ at equilibrium

(3) $n(SO_2Cl_2) = n(SO_2) = n(Cl_2)$

(4) $K_p = 8$ atm

Ans. **(4)**

17. Le-chatelier's principle is not applicable to

(1) $Fe(s) + S(s) \rightleftharpoons FeS(s)$

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

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

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

Ans. **(1)**

18. For the reaction, $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

Equilibrium constant $K_c = 2$

Degree of association is

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

Ans. **(2)**

19. Which causes the change in the value of equilibrium constant of any equilibria ?

(1) Adding of inert gas at constant pressure

(2) Increasing the pressure

(3) Adding of inert gas at constant volume

(4) Decreasing the temperature

Ans. **(4)**

20. The value of K_p for the reaction,

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ is 5.

What will be the partial pressure of O_2 at equilibrium when equal moles of SO_2 and SO_3 are present at equilibrium ?

(1) 0.5 (2) 0.3 (3) 0.2 (4) 0.1

Ans. **(3)**

21. The equilibrium constants for $A_2(g) \rightleftharpoons 2A(g)$ at 400 K and 600 K are 1×10^{-8} and 1×10^{-2} respectively. The reaction is

(1) Exothermic

(2) Endothermic

(3) May be exothermic or endothermic

(4) No heat is evolved or absorbed

Ans. **(2)**

22. Two samples of CH_3COOH each of 10 g were taken separately in two vessels containing water of 6 litre and 12 litre respectively at 27°C. The degree of dissociation of CH_3COOH will be

(1) More in 12 litre vessel

(2) More in 6 litre vessel

(3) Equal in both vessels

(4) Half in 6 litre vessel than in 12 litre vessel

Ans. **(1)**

23. Following three gaseous equilibrium reactions are occuring at 27°C

A ; $2CO + O_2 \rightleftharpoons 2CO_2$ B; $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ C ; $2HI \rightleftharpoons H_2 + I_2$

The correct order of $\frac{K_P}{K_C}$ for the following reactions is

(1) A < C < B (2) A < B < C (3) C < B < A (4) B < C < A

Ans. **(1)**

24. Pure ammonia is placed in a vessel at a temperature where its dissociation constant is appreciable. At equilibrium:-

(1) K_p does not change significantly with pressure

(2) Degree of dissociation does not change with pressure

(3) concentration of NH_3 does not change with pressure

(4) concentration of H_2 is less than that of N_2

Ans. **(1)**

25. For the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the degree of dissociation varies inversely as the square root of pressure of the system. Supposing at constant temperature If the volume is increased 16 times the initial volume, the degree of dissociation for this reaction will becomes

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

Ans. **(1)**

26. 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

Ans. **(2)**

27. Two systems $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ and $COCl_2(g) \rightleftharpoons CO(g) + Cl_2(g)$ are simultaneously in equilibrium in a vessel at constant volume. If some CO(g) is introduced in the vessel at constant volume, then at new equilibrium the concentration of :

(1) PCl_5 is increases (2) PCl_3 remains unchanged

(3) PCl_5 is decreases (4) Cl_2 is increases

Ans. **(3)**

28. The effect of adding Krypton (Kr) gas on position of equilibrium, keeping the volume of the system constant is :-

(1) If $\Delta n = 0$, backward reaction is favoured. (2) If Δn = +ve, forward reaction is favoured

(3) If Δn = -ve , forward reaction is favoured (4) No effect whatever be the value of Δn.

Ans. **(4)**

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

List–I (Equilibrium)	List–II (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. $2AB_3(g) \rightleftharpoons A_2(g) + 3B_2(g)$ 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

Ans. **(3)**

30. $aA + bB \rightleftharpoons cC + dD$

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

Ans. **(4)**

31. 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) $a > (\ell + m)$

Ans. **(4)**

32. 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

Ans. **(3)**

33. 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 equilibrium 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

Ans. **(1)**

34. When two reactants A and B are mixed to give products C and D, the reaction quotient, Q at the initial stage of the reaction :

(1) is zero. (2) decreases with time (3) increases with time. (4) is independent of time.

Ans. **(1)**

35. 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 4.28×10^{-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

Ans. **(2)**

36. For the reaction $SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons SO_{3(g)}$, of $K_P = K_C (RT)^x$ where the symbols have usual meaning then the value of x is (assuming ideality)

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

Ans. **(4)**

37. If the amount of dissociation is $\sqrt{0.5}$, the value of K_p for the reaction $N_2O_3 \rightleftharpoons NO + NO_2$ will be

(1) equal to the pressure of the system

(2) $\frac{2}{8}$ of the pressure of the system

(3) $\frac{8}{3}$ of the pressure of the system

(4) 5 times of the pressure of the system

Ans. **(1)**

38. How many moles per litre of PCl_5 has to be taken to obtain 0.1 mol of Cl_2, if the value of equilibrium constant K_c is 0.04 ?

(1) 0.15 (2) 0.25 (3) 0.35 (4) 0.05

Ans. **(3)**

39. For the reaction, $N_2O_3 \rightleftharpoons NO + NO_2$, the value of equilibrium constant K_P at fixed temperature is 4. What will be the amount of dissociation at same temperature and 5 atmospheric pressure ?

(1) $\frac{1}{3}$ (2) $\frac{2}{3}$ (3) $\frac{7}{9}$ (4) $\frac{2}{4}$

Ans. **(2)**

40. One mole of PCl_5 is heated in a closed container of one litre capacity. At equilibrium, 20% PCl_5 is not dissociated. What should be the value of K_c ?

(1) $(3.2)^{-1}$ (2) 3.2 (3) 2.4 (4) 42

Ans. **(2)**

41. For $N_2O_3 \rightleftharpoons NO + NO_2$, if total pressure is P atm and amount of dissociation is 50%, the value of K_p will be

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

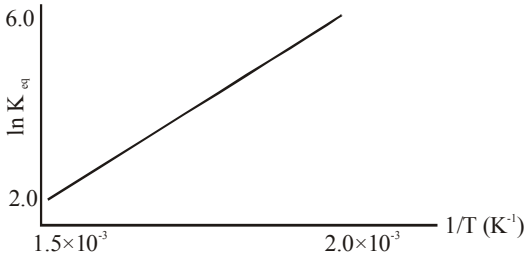
Ans. **(3)**

42. If 2/9 of 1 mol of HI is dissociates, the equilibrium constant of disintegration of acid at same temperature will be

(1) 64 (2) $\frac{1}{64}$ (3) 49 (4) $\frac{1}{49}$

Ans. **(4)**

43. A schematic plot of ln K_{eq} versus inverse of temperature for a reaction is shown below :



The reaction must be

(1) endothermic

(2) exothermic

(3) highly spontaneous at ordinary temperature

(4) one with negligible enthalpy change

Ans. **(2)**

44. For the reaction, $2NO_2(g) \rightleftharpoons 2\,NO(g) + O_2(g)$, ($K_C = 1.8 \times 10^{-6}$ at 184°C)

(R = 0.0831 kJ/(mol.K))

When K_p and K_c are compared at 184°C it is found that

(1) Whether K_p is greater than, less than or equal to K_c depends upon the total gas pressure

(2) $K_p = K_c$

(3) K_p is less than K_c

(4) K_p is greater than K_c

Ans. **(4)**

45. The exothermic formation of ClF_3 is represented by the equation :

$$Cl_2(g) + 3F_2(g) \rightleftharpoons 2ClF_3(g)\ ;\ \Delta_r H = -329\ J$$

which of the following will increase the quantity of ClF_3 in an equilibrium mixture of Cl_2, F_2 and ClF_3.

(1) Adding F_2 **(2)** Increasing the volume of container

(3) Removing Cl_2 **(4)** Increasing the temperature

46. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature at 0.50 atm pressure. Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask. When the decomposition reaction reaches equilibrium, the total pressure in the flask rises to 0.84 atm? The equilibrium constant for NH_4HS decomposition at this temperature is :

(1) 0.11 **(2)** 0.17 **(3)** 0.18 **(4)** 0.30

Ans. **(1)**

47. 1.1 mol of A mixed with 2.2 mol of B and the mixture is kept in a 1L flask and the equilibrium, $A + 2B \rightleftharpoons 2C + D$ is reached. If at equilibrium 0.2 mol of C is formed then the value of K_C will be

(1) 0.1 (2) 0.01 (3) 0.001 (4) 0.0001

Ans. **(3)**

48. If 0.5 mol of H_2 is reacted with 0.5 mol of I_2 in a 10 L container at 444°C and at same temperature value of equilibrium constant K_c is 49, the ratio of [HI] and $[I_2]$ will be :

(1) 7 (2) $\frac{1}{7}$ (3) $\sqrt{\frac{1}{7}}$ (4) 49

Ans. **(1)**

49. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm, the value of K is :-

(1) 0.3 atm (2) 0.18 atm (3) 1.8 atm (4) 3 atm

Ans. **(3)**

50. The equilibrium constant (K_C) for the reaction $N_2(g) + O_2(g) \longrightarrow 2NO(g)$ at temperature T is 4×10^{-4}. The value of K_C for the reaction. $NO(g) \longrightarrow \frac{1}{2} N_2(g) + \frac{1}{2} O_2(g)$ at the same temperature is :-

(1) 50.0 (2) 0.02 (3) 2.5×10^2 (4) 4×10^{-4}

Ans. **(1)**

51. For the reaction, $SO_{2(g)} + \frac{1}{2} O_{2(g)} \rightleftharpoons SO_{3(g)}$, if $K_p = K_C(RT)^x$ where the symbols have usual meaning then the value of x is : (assuming ideality)

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

Ans. **(4)**

52. The standard Gibbs energy change at 300K for the reaction $2A \rightleftharpoons B + C$ is 2494.2J. At a given time, the composition of the reaction mixture is [A] = $\frac{1}{2}$, [B] = 2 and [C] = $\frac{1}{2}$. The reaction proceeds in the : [R = 8.314 J/K/mol, e = 2.718]

(1) forward direction because $Q < K_C$ **(2)** reverse direction because $Q < K_C$

(3) forward direction because $Q > K_C$ **(4)** reverse direction because $Q > K_C$

Ans. **(4)**

53. The equilibrium constant at 298 K for a reaction $A + B \rightleftharpoons C + D$ is 100. If the initial concentration of all the four species were 1M each, then equilibrium concentration of D (in mol L^{-1}) will be:

(1) 0.818 **(2)** 1.818 **(3)** 1.182 **(4)** 0.182

Ans. **(2)**

ASSERTION & REASON QUESTIONS

These questions consist of two statements each, printed as *Assertion* and *Reason.* While answering these Questions you are required to choose any one of the following four responses.

A. If both *Assertion* & *Reason* are True & the *Reason* is a correct explanation of the *Assertion*.

B. If both *Assertion* & *Reason* are True but *Reason* is not a correct explanation of the Assertion.

C. If *Assertion* is True but the *Reason* is False.

D. If both *Assertion* & *Reason* are False.

1. ***Assertion :–*** Solubility of a gas in liquids increases with increase in pressure of the gas in equilibrium with solution.

Reason :– The dissolution of a gas in liquids is an exothermic process.

Ans. (B)

2. ***Assertion :–*** The effect of temperature on equilibrium constant is given by Vant Hoff's equation.

Reason :– Vant Hoff's equation is

$$\log\frac{K_1}{K_2} = \frac{\Delta H}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

Ans. (C)

3. ***Assertion :–*** Solubility of a gas in water decreases with increase in temperature.

Reason :– Dissolution of a gas in water is an exothermic process.

Ans. (A)

4. ***Assertion :–*** The value of K increases when concentration of the reactants are increased.

Reason :– With increases of concentration of reactants the equilibrium shifts in forward direction.

Ans. (D)

5. ***Assertion :–*** For the reaction

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, $K_p = K_c$.

Reason :– K_p of all gaseous reactions is equal to K_c.

Ans. (C)

6. ***Assertion :–*** $K_P = K_C$ for all reactions.

Reason :– At constant temperature, the pressure of the gas is proportional to the concentration.

Ans. (D)

7. ***Assertion :–*** Effect of temperature of K_C or K_P depends on enthalpy change.

Reason :– Increase in temperature shifts the equilibrium in exothermic direction and decrease in temperature shifts the equilibrium position in endothermic direction.

Ans. (C)

8. ***Assertion :–*** On opening a sealed soda bottle dissolved carbon dioxide gas escapes.

Reason :– Gas escapes to reach the new equilibrium condition of lower pressure.

Ans. (A)

9. ***Assertion :-*** Equilibrium constant has meaning only when the corresponding balanced chemical equation is given at equilibrium.

Reason :- Its value changes for the new equation obtained by multiplying or dividing the original equation by a number.

Ans. **(A)**

10. ***Assertion :-*** Catalyst affects the final state of the equilibrium.

Reason :- It enables the system to attain a new equilibrium state by complexing with the reagents.

Ans. **(D)**

11. **Assertion :-** There is no effect on equilibrium constant if inert gas is added to the reaction $A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)}$.

Reason :- Equilibrium constant changes only with temperature.

Ans. **(A)**

12. **Assertion :** For equilibrium Ice $\rightleftharpoons$ Water on increasing temperature and pressure more of water will form.

Reason : Forward reaction is endothermic and volume decreases on product side.

Ans. **(1)**

13. **Assertion :** At equilibrium concentration of the reactant and product does not change with time for a chemical reaction.

Reason : The rate of reaction is zero at equilibrium.

Ans. **(3)**

14. **Assertion :** The reaction $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$ is favoured in the forward direction with increase of pressure.

Reason : The above reaction is exothermic

Ans. **(2)**