



DPP-5 [Calculations related to equilibrium]

Chapter: Chemical Equilibrium

“Jo assignment tu kar raha hai... shayad tera dream college bhi usi ke peeche chhupa ho. — Weird Chemist.”

GROUP-1: Equilibrium Constant Determination

- Q1.** For reaction $A + 2B \rightleftharpoons 2C$ Initially 2 mole of A and B are taken in 10 lit flask at equilibrium 1 mole of C is formed then calculate K_c for given reaction :-
- (a) 6.66
 - (b) 3.33
 - (c) 2.22
 - (d) 1.11
- Q2.** 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 :-
- (a) 1
 - (b) 0.36
 - (c) 2.25
 - (d) $\frac{4}{9}$
- Q3.** 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 :-
- (a) 4
 - (b) 1
 - (c) $\sqrt{2}$
 - (d) $\sqrt{4}$
- Q4.** 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 reaction $\text{Fe}^{3+} + \text{SCN}^- \rightleftharpoons \text{FeSCN}^{2+}$ will be
- (a) 6.66×10^{-3}
 - (b) 0.30
 - (c) 3.30
 - (d) 150
- Q5.** Evaluate K_p for the reaction : $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$. If 2 moles each of H_2 and I_2 are taken initially. At equilibrium moles of HI are 2.
- (a) 2.5
 - (b) 4
 - (c) 0.25
 - (d) 1.0
- Q6.** 4.5 mol each of hydrogen and iodine heated in a sealed 10 litre vessel. At equilibrium,

3 mol of HI were found. The equilibrium constant for $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ is :-

- (a) 1
- (b) 10
- (c) 5
- (d) 0.33

Q7. 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 $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ at 717 K is

- (a) 0.4
- (b) 0.16
- (c) 25
- (d) 50

Q8. $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$ If initially of A and B are both are taken in equal amount but at equilibrium concentration of D will be twice of that of A then what will be the equilibrium constant of reaction :-

- (a) $\frac{4}{9}$
- (b) $\frac{9}{4}$
- (c) $\frac{1}{9}$
- (d) 4

Q9. In a reversible reaction $\text{A}(\text{g}) + \text{B}(\text{g}) \rightleftharpoons \text{C}(\text{g})$. Initially 1 mol of each reactant is taken in 2L container if at equilibrium 20% of A reacts with B. Then what will be equilibrium constant K_c for reaction :-

- (a) 0.225
- (b) 0.412
- (c) 0.625
- (d) 0.925

Q10. One mole of N_2O_4 in a 1 L flask decomposes to attain the equilibrium $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$ At the equilibrium the mole fraction of NO_2 is $\frac{1}{2}$. Hence K_c will be :-

- (a) $\frac{1}{3}$
- (b) $\frac{1}{2}$
- (c) $\frac{2}{3}$
- (d) 4

GROUP-2: Equilibrium Calculations

Q11. For the reaction, $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$, $K_c = 9$. If A and B are taken 1 mole each, then amount of C at equilibrium is :-

- (a) 1
- (b) 0.25
- (c) 0.75
- (d) None of these

Q12. The equilibrium constant K_p for the reaction $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$ is 4.0 at 1660°C . Initially 0.80 mole H_2 and 0.80 mole CO_2 are injected into a 5.0 liter

flask. What is the equilibrium concentration of $\text{CO}_2(\text{g})$:-

- (a) 0.533 M
- (b) 0.0534 M
- (c) 5.34 M
- (d) None of these

Q13. K_c for the esterification reaction : $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$ is 4. If 4 mol each of acid and alcohol are taken initially, what is the equilibrium concentration of the acid :-

- (a) $\frac{2}{3}$
- (b) $\frac{4}{3}$
- (c) $\frac{3}{4}$
- (d) $\frac{3}{2}$

Q14. 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 ?

- (a) 0.15
- (b) 0.25
- (c) 0.35
- (d) 0.05

Q15. 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 $[\text{HI}]$ and $[\text{I}_2]$ will be :-

- (a) 7
- (b) $\frac{1}{7}$
- (c) $\sqrt{\frac{1}{7}}$
- (d) 49

Q16. The reaction $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$ 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 :-

- (a) $\frac{n}{2}$
- (b) $2n$
- (c) $(3n - \frac{n}{2})$
- (d) n

Q17. $\text{X}_2 + \text{Y}_2 \rightleftharpoons 2\text{XY}$ 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 $[\text{XY}] = 0.6 \text{ mol L}^{-1}$).

- (a) $(\frac{1}{3} - 0.3), (\frac{2}{3} - 0.3)$
- (b) $(\frac{1}{3} - 0.6), (\frac{2}{3} - 0.6)$
- (c) $(1 - 0.3), (2 - 0.3)$
- (d) $(1 - 0.6), (2 - 0.6)$

GROUP-3: Pressure-based Equilibrium (P, P_{total})

- Q18. In a 13 L vessel initially following reaction occur $C(s) + S_2(g) \rightleftharpoons CS_2(g)$ by 12 g C, 64 g S₂, 76 g CS₂ at 1027°C temperature then total pressure is :-
- (a) 200R
 - (b) 158R
 - (c) 100R
 - (d) 79R
- Q19. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ In above reaction, at equilibrium condition mole fraction of PCl₅ is 0.4 and mole fraction of Cl₂ is 0.3. Then find out mole fraction of PCl₃ :-
- (a) 0.3
 - (b) 0.7
 - (c) 0.4
 - (d) 0.6
- Q20. If K_p for the reaction $N_2O_4 \rightleftharpoons 2NO_2$ is 0.66 then what is the equilibrium pressure of N₂O₄. (Total pressure at equilibrium is 0.5 atm)
- (a) 0.168
 - (b) 0.322
 - (c) 0.1
 - (d) 0.5
- Q21. For the equilibrium $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ K_p = 63 atm at 1000 K. If at equilibrium P_{CO} = 10 P_{CO₂} then total pressure at equilibrium is :-
- (a) 6.30 atm
 - (b) 0.693 atm
 - (c) 6.93 atm
 - (d) 69.3 atm
- Q22. For a reaction $A(g) \rightleftharpoons B(g)$, if initial pressure at 300°C is 1 atm and its K_p is 4, then calculate P_B at equilibrium state.
- (a) $\frac{1}{5}$ atm
 - (b) $\frac{2}{5}$ atm
 - (c) $\frac{4}{5}$ atm
 - (d) $\frac{3}{5}$ atm
- Q23. 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.
- (a) 500
 - (b) 125
 - (c) 750
 - (d) 375
- Q24. A vessel at 1000 K contains CO₂ with a pressure of 0.5 atm. Some of the CO₂ is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm, the value of K is :-
- (a) 0.3 atm
 - (b) 0.18 atm
 - (c) 1.8 atm

(d) 3 atm

Q25. 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 :-

(a) 0.3 atm

(b) 0.18 atm

(c) 1.8 atm

(d) 3 atm

Q26. At a certain temperature and total pressure of 1 atm., Equilibrium mixture contains 20% by volume of A atoms $\text{A}_2(\text{g}) \rightleftharpoons 2\text{A}(\text{g})$. The K_p of reaction is:-

(a) 5×10^{-2}

(b) 2×10^{-3}

(c) 5×10^{-3}

(d) 4×10^{-2}

Q27. If the initial pressure of N_2 and H_2 mixture in a closed apparatus is 100 atm. At equilibrium 20% of the mixture reacts then total pressure at the same temperature would be :-

(a) 100

(b) 90

(c) 85

(d) 80

Q28. 'a' mol of PCl_5 undergoes thermal dissociation as: $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$, 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 :-

(a) 2.5

(b) 1.0

(c) 0.5

(d) None

Q29. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ for the reaction initially the mole ratio was 1 : 3 of N_2 : H_2 . At equilibrium 50% of each has reacted. If the equilibrium pressure is p, the partial pressure of NH_3 at equilibrium is :-

(a) $\frac{p}{3}$

(b) $\frac{p}{4}$

(c) $\frac{p}{6}$

(d) $\frac{p}{8}$

GROUP-4:Miscellaneous

Q30. In a 20 litre vessel initially 1 - 1 mole CO, H_2O , CO_2 is present, then for the equilibrium of $\text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2$ following is true :-

(a) H_2 , more than 1 mole

(b) CO, H_2O , H_2 less than 1 mole

(c) CO_2 H_2O both more than 1 mole

(d) All of these

Q31. $2P(g) + Q(g) \rightleftharpoons 3R(g) + S(g)$. If 2 mol each of P and Q taken initially in a 1 L flask.

At equilibrium which is true :-

- (a) $[P] < [Q]$
- (b) $[P] = [Q]$
- (c) $[Q] = [R]$
- (d) None of these