

Topic : Chemical Equilibrium
Type of Questions

| Type of Questions | M.M., Min. |
|--|------------|
| Single choice Objective ('-1' negative marking) Q.1, 2, Q.4 to Q.8 | [21, 21] |
| Subjective Questions ('-1' negative marking) Q.3 | [4, 5] |
| Multiple choice objective ('-1' negative marking) Q.9 | [4, 4] |

- For $A(g) \rightleftharpoons 2B(g)$, equilibrium constant at total equilibrium pressure p_1 is K_{p_1} & for $C(g) \rightleftharpoons D(g) + E(g)$, equilibrium constant at total equilibrium pressure p_2 is K_{p_2} . If degree of dissociation of A & C are same, then the ratio p_1/p_2 , if $K_{p_1} = 2 K_{p_2}$, is :
 (A) 1/2 (B) 1/3 (C) 1/4 (D) 2
- Match the following : (Take reactants to be in stoichiometric proportions in case of two reactants)

| Reaction (Homogeneous gaseous phase) | Degree of dissociation of reactant in terms of equilibrium constant |
|--|--|
| 1. $A + B \rightleftharpoons 2C$ | (a) $(\sqrt{K})/(1 + \sqrt{K})$ |
| 2. $2A \rightleftharpoons B + C$ | (b) $(\sqrt{K})/(2 + \sqrt{K})$ |
| 3. $A + B \rightleftharpoons C + D$ | (c) $2K / (1 + 2K)$ |
| 4. $AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$ | (d) $\frac{2\sqrt{K}}{1 + 2\sqrt{K}}$ |

 (A) 1-d, 2-c, 3-b, 4-a (B) 1-a, 2-c, 3-b, 4-d
 (C) 1-b, 2-d, 3-a, 4-c (D) 1-b, 2-a, 3-d, 4-c
- 0.96 g of HI were heated to attain equilibrium $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$. The equilibrium mixture, on reaction requires 15 mL of M/10 Hypo ($Na_2S_2O_3$) solution. Calculate the degree of dissociation of HI.
 $I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + NaI$ (unbalanced)
- In an evacuated closed isolated chamber at $227^\circ C$, 0.02 mole PCl_5 and 0.01 mole Cl_2 are mixed and $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ equilibrium is attained. At equilibrium, density of mixture was 2.4 g/L and pressure was 1 atm. The number of total moles at equilibrium will be approximately :
 (A) 0.012 (B) 0.022 (C) 0.032 (D) 0.0488
- For $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$ reaction started only with $NH_4HS(s)$, the observed pressure for reaction mixture in equilibrium is 1.12 atm at $106^\circ C$. What is the value of K_p for the reaction ?
- For the reaction : $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, $K_p = 1$ atm at $727^\circ C$. If 20 g of $CaCO_3$ were kept in a 10 litre vessel at $727^\circ C$, then the percentage of $CaCO_3$ remaining at equilibrium is :
 (A) 40% (B) 60% (C) 46% (D) 66%
- 200 g of $CaCO_3(s)$ are taken in a 4 L container at a certain temperature. K_c for the dissociation of $CaCO_3$ at this temperature is found to be $1/4$ mole L^{-1} . Then, the concentration of CaO in mole/litre is : [Given $\rho_{CaO} = 1.12$ g cm^{-3}]
 (A) 1/2 (B) 1/4 (C) 0.02 (D) 20
- The exothermic formation of NH_3 is represented by the equation : $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
 Which of the following will increase the quantity of NH_3 in an equilibrium mixture of N_2 , H_2 and NH_3 :
 (A) Increasing the temperature (B) Increasing the volume of container
 (C) Removing N_2 (D) Adding H_2
- * When $AgNO_3$ is heated mildly in a closed vessel, oxygen is liberated and $AgNO_2$ is left behind. At equilibrium according to reaction $AgNO_3(s) \rightleftharpoons AgNO_2(s) + \frac{1}{2}O_2(g)$:
 (A) addition of $AgNO_2$ favours reverse reaction (B) addition of $AgNO_3$ favours forward reaction
 (C) increasing temperature favours forward reaction (D) increasing pressure favours reverse reaction

Answer Key

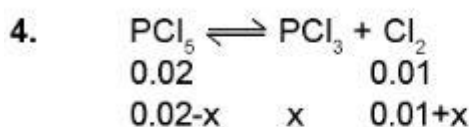
DPP No. # 41

1. (A) 2. (C) 3. 0.2. 4. (D)
 5. 0.3136 atm² 6. (A) 7. (D) 8. (D) 9.* (C,D)

Hints & Solutions

DPP No. # 41

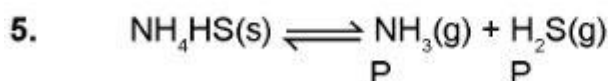
3. 0.2.



$$D = \frac{PM}{RT}$$

Calculate M_{avg} .

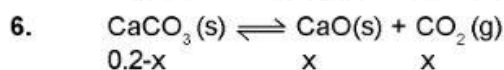
$$\frac{(0.02-x)208.5 + 137.5x + (0.01+x)71}{0.03+x} = M_{\text{avg}}$$



$$2P = 1.12$$

$$P = 0.56$$

$$K_p = P^2 = (0.56)^2 = 0.3136 \text{ atm}^2$$



$$K_p = P_{\text{CO}_2} = 1$$

$$x = \text{mole of CO}_2 = \frac{PV}{RT}$$

Remaining mass of $\text{CaCO}_3 = (0.2 - x) 100 \text{ g}$.

$$7. \quad [\text{CaO}] = \frac{P_{\text{CaO(s)}}}{M_{\text{CaO(s)}}} = \frac{1.12}{56} \times 1000$$

- 9.* Addition of solids have no effect on equilibrium and temperature favours endothermic direction while increasing pressure will shift equilibrium in backward direction as Δn_g is +ve.

