

Topic : Chemical Equilibrium
Type of Questions

Single choice Objective ('-1' negative marking) Q.1 to Q.6

(3 marks, 3 min.)

M.M., Min.

[18, 18]

Subjective Questions ('-1' negative marking) Q.7 to Q.8

(4 marks, 5 min.)

[8, 10]

1. $\text{CH}_3\text{-CO-CH}_3(\text{g}) \rightleftharpoons \text{CH}_3\text{-CH}_3(\text{g}) + \text{CO}(\text{g})$
 Initial pressure of CH_3COCH_3 is 100 mm. When equilibrium is set up, mole fraction of $\text{CO}(\text{g})$ is $1/3$. Hence value of K_p for given reaction is :
 (A) 100 mm (B) 50 mm (C) 25 mm (D) 0.6 mm
2. The degree of dissociation of N_2O_4 (α) obeying the equilibrium,
 $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$, is approximately related to the pressure at equilibrium by :
 (A) $\alpha \propto P$ (B) $\alpha \propto \frac{1}{\sqrt{P}}$ (C) $\alpha \propto \frac{1}{P^2}$ (D) $\alpha \propto \frac{1}{P^4}$
3. Two moles of HI were heated in a sealed tube at 440°C till the given equilibrium was reached. HI was found to be 20% decomposed. The equilibrium constant for dissociation is :
 $2\text{HI}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{I}_2(\text{g})$
 (A) $\frac{1}{16}$ (B) $\frac{1}{32}$ (C) $\frac{1}{64}$ (D) $\frac{1}{128}$
4. In the following reaction, $3\text{A}(\text{g}) + \text{B}(\text{g}) \rightleftharpoons 2\text{C}(\text{g}) + \text{D}(\text{g})$,
 Initial moles of B is double of A. At equilibrium, moles of A and C are equal. Hence % dissociation of B is :
 (A) 10% (B) 20% (C) 40% (D) 5%
5. For the equilibrium $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$ in gaseous phase, NO_2 is 50% of the total volume when equilibrium is set up. Hence percent of dissociation of N_2O_4 is :
 (A) 50% (B) 25% (C) 66.66% (D) 33.33%
6. PCl_5 is 40% dissociated according to the following reaction, when equilibrium pressure is 2 atm. It will be 80% dissociated, when equilibrium pressure is approximately : $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$
 (A) 0.2 atm (B) 0.5 atm (C) 0.3 atm (D) 0.6 atm
7. The equilibrium constant for the following reaction, $\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \rightleftharpoons 2\text{HBr}(\text{g})$ is 1.6×10^5 at 1024 K. Find the equilibrium pressure of all gases if 10 bar of HBr is introduced into a sealed container at 1024 K initially.
8. At a certain temperature, the equilibrium constant (K_c) is $9/4$ for the reaction :
 $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g})$
 If we take 10 mole of each of the four gases in a one-litre container, what would be the equilibrium mole percent of $\text{H}_2(\text{g})$?



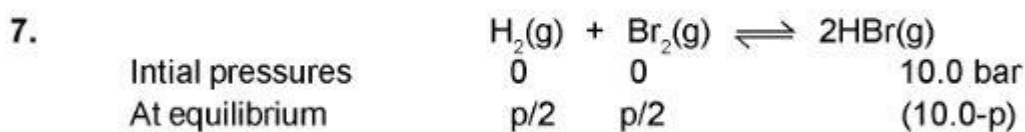
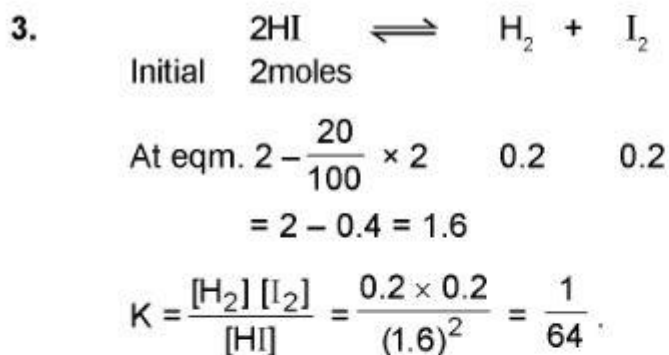
Answer Key

DPP No. # 40

1. (B) 2. (B) 3. (C) 4. (A) 5. (D)
 6. (A) 7. $p_{H_2} = 2.5 \times 10^{-2} \text{ bar}$; $p_{Br_2} = 2.5 \times 10^{-2} \text{ bar}$; $p_{HBr} \approx 10 \text{ bar}$ 8. 30%

Hints & Solutions

DPP No. # 40



$$K_p = \frac{p_{HBr}^2}{p_{H_2} \times p_{Br_2}}$$

$$1.6 \times 10^5 = \frac{(10-p)^2}{(p/2)(p/2)}$$

Taking square root of both sides

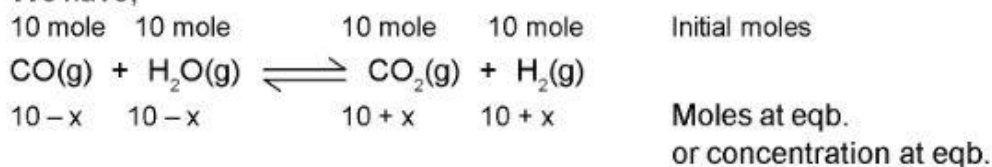
$$4 \times 10^2 = \frac{10-p}{p/2}$$

$$200 p = 10 - p ; p = \frac{10}{201} \text{ bar}$$

$$p_{\text{H}_2} = p/2 = \frac{1}{2} \left(\frac{10}{201} \right) \text{ bar} = 2.5 \times 10^{-2} \text{ bar} ; p_{\text{Br}_2} = p/2 = 2.5 \times 10^{-2} \text{ bar} ; p_{\text{HBr}} = 10 - p \approx 10 \text{ bar} .$$

8.

We have,



where x is the number of moles of each reactant changed to the products at equilibrium.

$$K = \frac{(10+x)^2}{(10-x)^2} = 9/4 \text{ (given)} \quad \text{or} \quad \frac{10+x}{10-x} = 3/2 ; x = 2$$

$$\text{Mole percent of H}_2 \text{ (g) at equilibrium} = \frac{10+x}{40} \times 100 = 30$$