

Topic : Chemical Equilibrium
Type of Questions

Single choice Objective ('-1' negative marking) Q.1 to Q.7

(3 marks, 3 min.)

M.M., Min.

[21, 21]

Subjective Questions ('-1' negative marking) Q.8 to Q.9

(4 marks, 5 min.)

[8, 10]

- In a reaction $A(g) + 2B(g) \rightleftharpoons 2C(g)$, 2 moles of 'A', 3 moles of 'B' and 1 mole of 'C' are placed in a 2 L flask and the equilibrium concentration of 'C' is 1 mol/L. The equilibrium constant (K_c) for the reaction is :
 (A) 0.33 lit/mol (B) 1.33 lit/mol (C) 1.66 lit/mol (D) 0.66 lit/mol
- For the reaction : $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, the equilibrium constant K_p changes with :
 (A) total pressure (B) addition of catalyst
 (C) the amounts of H_2 and I_2 taken initially (D) temperature
- In a reversible chemical reaction having two reactants in equilibrium with one product, if the initial concentration of both the reactants is doubled, then the equilibrium constant will :
 (A) also be doubled (B) be halved
 (C) become one fourth (D) remain the same.
- For the equilibrium $2H_2O(g) \rightleftharpoons 2H_2(g) + O_2(g)$, equilibrium constant is K_1 .
 For the equilibrium $2CO_2(g) \rightleftharpoons 2CO(g) + O_2(g)$, equilibrium constant is K_2 .
 Then, the equilibrium constant for $CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$ is :
 (A) $K_1 K_2$ (B) $\frac{K_1}{K_2}$ (C) $\sqrt{\frac{K_1}{K_2}}$ (D) $\sqrt{\frac{K_2}{K_1}}$
- For the reaction $A(g) + B(g) \rightleftharpoons C(g)$ at equilibrium, the partial pressure of the species are $P_A = 0.15$ atm, $P_C = P_B = 0.30$ atm. If the capacity of reaction vessel is reduced, the equilibrium is re-established. In the new situation, partial pressure A and B become twice. What is the partial pressure of C :
 (A) 0.3 atm (B) 0.6 atm (C) 1.2 atm (D) 1.8 atm
- The equilibrium constant for the reaction
 $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ is 20 at 500 K.
 The equilibrium constant for the reaction,
 $2AB(g) \rightleftharpoons A_2(g) + B_2(g)$ at 500 K would be :
 (A) 20 (B) 0.5 (C) 0.05 (D) 10
- The value of K_p for the reaction, $A(g) + 2B(g) \rightleftharpoons C(g)$ is 25 atm^{-2} at a certain temperature. The value of K_p for the reaction, $\frac{1}{2}C(g) \rightleftharpoons \frac{1}{2}A(g) + B(g)$ at the same temperature would be :
 (A) 25 atm^{-1} (B) $\frac{1}{25} \text{ atm}^{-1}$ (C) $\frac{1}{5} \text{ atm}$ (D) 5 atm
- For the gaseous reaction of XO with O_2 to form XO_2 , the equilibrium constant at 398 K is 1×10^{-4} lit/mole. If 1 mole of XO and 2 mole of O_2 are placed in a 1 L vessel and allowed to come to equilibrium, what will be the equilibrium concentration of each of the species ?
- Prove that the pressure at equilibrium obtained upon 50% dissociation of PCl_5 as follows at 250°C is numerically three times of K_p . $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

Answer Key

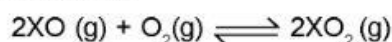
DPP No. # 39

1. (B) 2. (D) 3. (D) 4. (D) 5. (C)
 6. (C) 7. (C)
8. $[XO] = 0.985 \text{ M}$; $[O_2] = 1.992 \text{ M}$; $[XO_2] = 0.0141 \text{ M}$ 9. $K_p = \frac{1}{3} \cdot p$ or $p = 3K_p$.

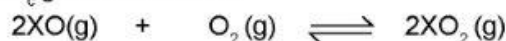
Hints & Solutions

DPP No. # 39

8. The equilibrium reaction is



since the unit of K_c given is lit/mole.



Initial conc.	1	2	0
Conc. at equilib.	$1 - 2x$	$2 - x$	$2x$

$$\therefore K_c = \frac{[XO_2]^2}{[XO]^2 [O_2]} = \frac{(2x)^2}{(1-2x)^2 (2-x)} = \frac{4x^2}{(1-2x)^2 (2-x)} = \frac{4x^2}{2}$$

Since, the value of equilibrium constant is very small (1×10^{-4}), so $2x$ can be ignored with respect to 1 and x can be ignored with respect to 2.

$$\therefore 1 \times 10^{-4} = \frac{4x^2}{2}$$

$$x = 7.07 \times 10^{-3}$$

we can see that the value of x is very small, so the assumption made was correct as it is within 1.4% of the actual value. Thus, the assumption made is correct and acceptable.

$$\therefore [XO] = 1 - 0.01414 = 0.985 \text{ M}$$

$$[O_2] = 2 - 0.00707 = 1.992 \text{ M}$$

$$[XO_2] = 0.0141 \text{ M}$$

- 9.
- | | | | |
|-----------|----------------------|----------------|----------------------|
| 1 | 0 | 0 | Initial moles (say) |
| PCl_5 | $\rightleftharpoons$ | $PCl_3 + Cl_2$ | |
| (1 - 0.5) | | 0.5 0.5 | Moles at equilibrium |
- Total moles at equilibrium = $0.5 + 0.5 + 0.5 = 1.5$

$$K_p = \frac{p_{PCl_3} \cdot p_{Cl_2}}{p_{PCl_5}} = \frac{\left(\frac{0.5}{1.5}p\right) \left(\frac{0.5}{1.5}p\right)}{\left(\frac{0.5}{1.5}p\right)} \quad (p = \text{total pressure})$$

$$\text{or } K_p = \frac{1}{3} \cdot p \quad \text{or } p = 3K_p$$