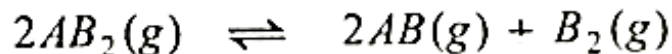


PROBLEM 9 At temperature T , a compound $AB_2(g)$ dissociates according to the reaction : $2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$ with a degree of dissociation 'x' which is small compared to unity. Deduce the expression for 'x' in terms of the equilibrium constant K_p and the total pressure P .
(IIT 1994)

Solution



Mole before dissociation	1	0	0
Mole after dissociation	$(1-x)$	x	$\frac{x}{2}$

$$\text{Total mole at equilibrium } (\Sigma n) = 1 - x + x + \frac{x}{2} = 1 + \frac{x}{2}$$

Now,

$$K_p = \frac{n_{B_2} \times (n_{AB})^2}{(n_{AB_2})^2} \times \left[\frac{P}{\Sigma n} \right]^{\Delta n}$$

$$K_p = \frac{\frac{x}{2} \cdot (x)^2}{(1-x)^2} \times \left[\frac{P}{1 + \frac{x}{2}} \right]^1$$

or

$$K_p = \frac{x^3 P}{2} \quad \left[\because x \text{ is small, } \therefore 1-x \approx 1 \text{ and } 1 + \frac{x}{2} \approx 1 \right]$$

$$x = \sqrt[3]{\frac{2K_p}{P}}$$

PROBLEM 13 In an equilibrium $A + B \rightleftharpoons C + D$; A and B are mixed in a vessel at temperature T . The initial concentration of A was twice the initial concentration of B . After the equilibrium has reached, concentration of C was thrice the equilibrium concentration of B . Calculate K_C .

SOL

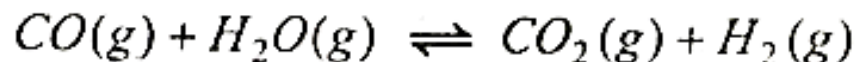
PROBLEM 17 60 mL of H_2 and 42 mL of I_2 are heated in a closed vessel. At equilibrium the vessel contains 28 mL HI. Calculate degree of dissociation of HI.

SOL

PROBLEM 23 The degree of dissociation of HI at a particular temperature is 0.8. Calculate the volume of 2 M $\text{Na}_2\text{S}_2\text{O}_3$ solution required to neutralise the iodine present in a equilibrium mixture of a reaction when 2 mole each of H_2 and I_2 are heated in a closed vessel of 2 litre capacity.

SOL

PROBLEM 28 *An equilibrium mixture of*



present in a vessel of one litre capacity at 815°C was found by analysis to contain 0.4 mole of CO, 0.3 mole of H₂O, 0.2 mole of CO₂ and 0.6 mole of H₂.

(a) Calculate K_c .

(b) *If it is desired to increase the concentration of CO to 0.6 mole by adding CO₂ to the vessel, how many mole must be added into equilibrium mixture at constant temperature in order to get this change?*

SOL

PROBLEM 31 *At a certain temperature, K_C for*



is 16. If we take one mole of each of all the four gases in one litre container, what would be the equilibrium concentrations of NO and NO_2 ?

SOL

PROBLEM 37 The K_p for the reaction $N_2O_4 \rightleftharpoons 2NO_2$ is 640 mm at 775 K. Calculate the percentage dissociation of N_2O_4 at equilibrium pressure of 160 mm. At what pressure, the dissociation will be 50%?
(Roorkee 1997)

SOL

PROBLEM 41 N_2O_4 dissociates as $N_2O_4 \rightleftharpoons 2NO_2$. At $55^\circ C$ and one atmosphere, % decomposition of N_2O_4 is 50.3%. At what P and same temperature, the equilibrium mixture will have the ratio of $N_2O_4 : NO_2$ as 1:8?

SOL

PROBLEM 45 Prove $\alpha = \sqrt{\left(\frac{K_p}{P + K_p}\right)}$ for $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$;

where α is degree of dissociation at temperature when equilibrium constant is K_p .

SOL

PROBLEM 90 Ammonium carbamate dissociates as $\text{NH}_2\text{COONH}_4(s) \rightleftharpoons 2\text{NH}_3(g) + \text{CO}_2(g)$. In a closed vessel containing ammonium carbamate in equilibrium, ammonia is added such that partial pressure of NH_3 now equals to the original total pressure. Calculate the ratio of total pressure now to the original pressure.

SOL

PROBLEM 116 For gaseous reaction $A + B \rightleftharpoons C$, the equilibrium concentration of A and B at a temperature are $15 \text{ mol litre}^{-1}$. When volume is doubled the reaction has equilibrium concentration of A as $10 \text{ mol litre}^{-1}$. Calculate:

(a) K_C

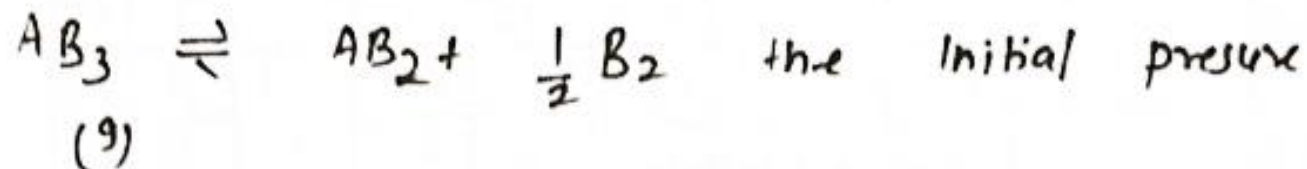
(b) concentration of C in original equilibrium.

SOL

When heated Ammonium Carbamate decomposes as follows $\text{NH}_2\text{COONH}_4 \rightleftharpoons 2\text{NH}_3 + \text{CO}_2$. At a certain temperature the equilibrium Pressure of the system is 0.318 atm. K_p for the reaction is

- a) 0.128 b) 0.426 c) 4.76×10^{-3} d) none

SOL



of AB_3 is 800 torr and the total pressure developed at equilibrium is 900 torr. What fraction of AB_3 is dissociated.

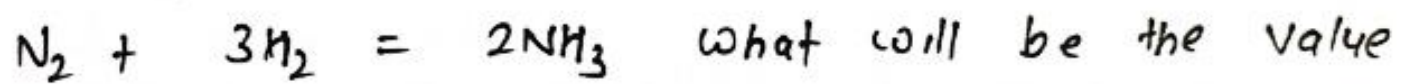
- a) 10% b) 20% c) 25% d) 30%

SOL

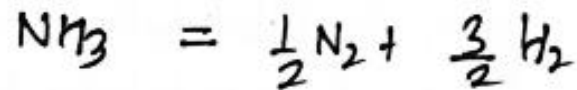
for the reaction $XCO_3(s) = XO(s) + CO_2(g)$ $k_p = 1.642 \text{ atm}$
at 727°C . if 4 moles of $XCO_3(s)$ was put into a
50 litre container and heated to 727°C what
mole % of XCO_3 remains unreacted at equilibrium
a) 20 b) 25 c) 50 d) none of these

SOL

One mole of N_2 is mixed with 2 moles of H_2 in a 4 litre vessel. if 50% of N_2 is converted to NH_3 by the following reaction.

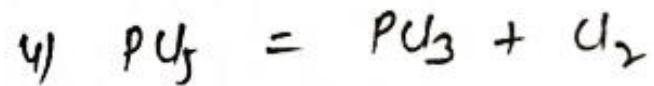
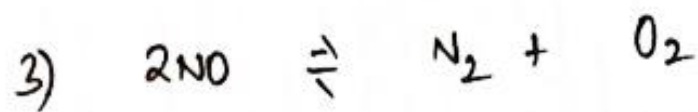
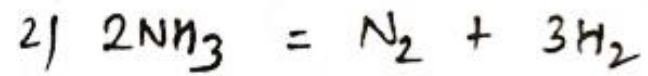
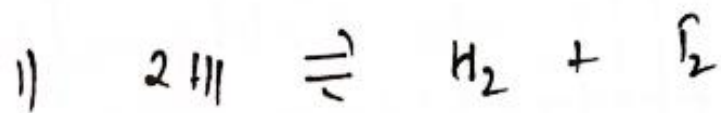


of K_c for the following equilibrium



SOL

For which of the following reactions, the degree of dissociation cannot be calculated from the V/D data



- ① 1 & III 2) I & IV 3) I & III 4) III & IV

SOL

At a certain temperature, 2 moles of carbon monoxide and 3 moles of chlorine were allowed to reach equilibrium according to the reaction $\text{CO} + \text{Cl}_2 \rightleftharpoons \text{COCl}_2$ in a 5 lit vessel. At equilibrium if one mole of CO is present, then equilibrium constant for the reaction is:

- (A) 2 (B) 2.5 (C) 3.0 (D) 4

SOL

A definite amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 0.50 atm pressure. NH_4HS decomposes to give NH_3 and H_2S and at equilibrium total pressure in flask is 0.84 atm. The equilibrium constant for the reaction is:

(A) 0.30

(B) 0.18

(C) 0.17

(D) 0.11

SOL

SOL