

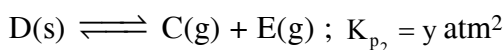
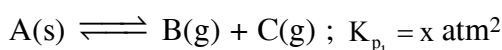
## CHEMICAL EQUILIBRIUM

1. एक रासायनिक अभिक्रिया,  $A + 2B \xrightleftharpoons{K} 2C + D$  में, B की प्रारम्भिक सान्द्रता A की सान्द्रता की 1.5 गुना थी लेकिन A तथा B साम्य सान्द्रतायें बराबर पाई गई। उपरोक्त अभिक्रिया के लिए साम्य स्थिरांक (K) होगा

(1) 16 (2) 4

(3) 1 (4)  $\frac{1}{4}$

2. दो ठोस निम्न प्रकार वियोजित होते हैं

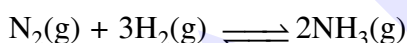


जब दोनों ठोस एक ही साथ वियोजित हों तो कुल दाब होगा

(1)  $(x + y) \text{ atm}$  (2)  $x^2 + y^2 \text{ atm}$

(3)  $2(\sqrt{x+y}) \text{ atm}$  (4)  $\sqrt{x+y} \text{ atm}$

3. निम्नलिखित अभिक्रिया पर विचार कीजिए :



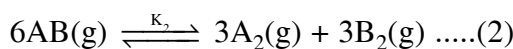
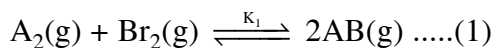
उपर्युक्त अभिक्रिया का साम्य स्थिरांक  $K_p$  है। यदि विशुद्ध अमोनिया को वियोजित होने दिया जाता है, तो साम्यावस्था पर अमोनिया का आंशिक दाब है :

(मान लीजिए साम्यावस्था पर  $P_{NH_3} \ll P_{\text{सम्पूर्ण}}$ )

(1)  $\frac{3^{\frac{3}{2}} K_p^{\frac{1}{2}} P^2}{4}$  (2)  $\frac{3^{\frac{3}{2}} K_p^{\frac{1}{2}} P^2}{16}$

(3)  $\frac{K_p^{\frac{1}{2}} P^2}{16}$  (4)  $\frac{K_p^{\frac{1}{2}} P^2}{4}$

4. निम्न उत्क्रमणीय अभिक्रियाओं पर विचार करें :



$K_1$  तथा  $K_2$  के बीच संबंध है :

(1)  $K_2 = K_1^3$  (2)  $K_2 = K_1^{-3}$

(3)  $K_1 K_2 = 3$  (4)  $K_1 K_2 = \frac{1}{3}$

5. 5.1g  $NH_4SH$  को  $327^\circ C$  पर 3.0L निर्वातित फ्लास्क में प्रवेशित किया गया है। ठोस  $NH_4SH$  का 30%  $NH_3$  तथा  $H_2S$  गैसों के रूप में विघटित हो जाता है।  $327^\circ C$  पर अभिक्रिया की  $K_p$  है

( $R = 0.082 \text{ L atm mol}^{-1} K^{-1}$ , S का मोलर द्रव्यमान =  $32 \text{ g mol}^{-1}$ , N का मोलर द्रव्यमान =  $14 \text{ g mol}^{-1}$ )

(1)  $1 \times 10^{-4} \text{ atm}^2$

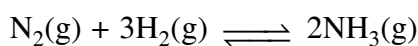
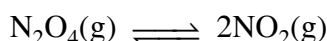
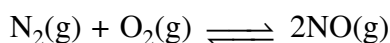
(2)  $4.9 \times 10^{-3} \text{ atm}^2$

(3)  $0.242 \text{ atm}^2$

(4)  $0.242 \times 10^{-4} \text{ atm}^2$

6. 300K पर, निम्न अभिक्रियाओं के लिये  $K_p/K_c$  के मान क्रमशः होंगे :

(300K पर,  $RT = 24.62 \text{ dm}^3 \text{ atm mol}^{-1}$ )



(1)  $1, 24.62 \text{ dm}^3 \text{ atm mol}^{-1},$

$606.0 \text{ dm}^6 \text{ atm}^2 \text{ mol}^{-2}$

(2)  $1, 4.1 \times 10^{-2} \text{ dm}^{-3} \text{ atm}^{-1} \text{ mol}^{-1},$

$606.0 \text{ dm}^6 \text{ atm}^2 \text{ mol}^{-2}$

(3)  $606.0 \text{ dm}^6 \text{ atm}^2 \text{ mol}^{-2},$

$1.65 \times 10^{-3} \text{ dm}^3 \text{ atm}^{-2} \text{ mol}^{-1}$

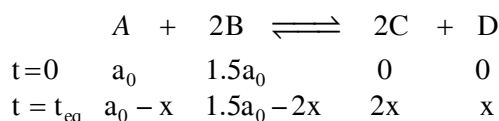
(4)  $1, 24.62 \text{ dm}^3 \text{ atm mol}^{-1},$

$1.65 \times 10^{-3} \text{ dm}^{-6} \text{ atm}^{-2} \text{ mol}^2$



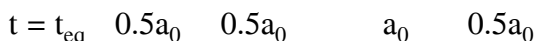
SOLUTION

1. Ans.(2)



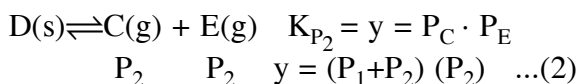
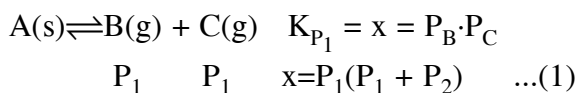
At equilibrium  $[A] = [B]$

$$a_0 - x = 1.5a_0 - 2x \Rightarrow x = 0.5a_0$$



$$K_C = \frac{[C]^2 [D]}{[A] [B]^2} = \frac{(a_0)^2 (0.5a_0)}{(0.5a_0) (0.5a_0)^2} = 4$$

2. Ans. (3)



Adding (1) and (2)

$$x + y = (P_1 + P_2)^2$$

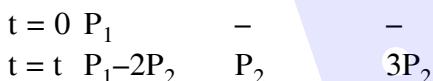
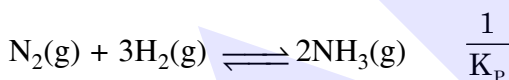
Now total pressure

$$P_T = P_C + P_B + P_E$$

$$= (P_1 + P_2) + P_1 + P_2 = 2(P_1 + P_2)$$

$$P_T = 2(\sqrt{x + y})$$

3. Ans. (2)



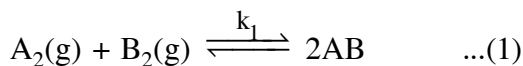
$$(P_1 - 2P_2) + P_2 + 3P_2 = P$$

As  $(P_1 - 2P_2) \ll P$

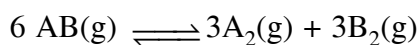
$$P_2 = \frac{P}{4}$$

$$\frac{1}{K_P} = \frac{(P/4)(3P/4)^3}{P_{NH_3}^2}$$

4. Ans. (2)

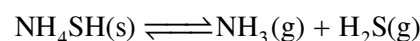


$\Rightarrow$  eq. (1)  $\times 3$



$$\Rightarrow \left(\frac{1}{k_1}\right)^3 = k_2 \Rightarrow k_2 = (k_1)^{-3}$$

5. Ans. (3)



$$n = \frac{5.1}{51} = 0.1 \text{ mole} \quad 0 \quad 0$$

$$0.1(1 - \alpha) \quad 0.1\alpha \quad 0.1\alpha$$

$$\alpha = 30\% = .3$$

so number of moles at equilibrium

$$\begin{array}{ccc}
 .1(1 - .3) & .1 \times .3 & .1 \times .3 \\
 = & .07 & =.03 & =.03
 \end{array}$$

Now use  $PV = nRT$  at equilibrium

$$P_{total} \times 3 \text{ lit} = (.03 + .03) \times .082 \times 600$$

$$P_{total} = .984 \text{ atm}$$

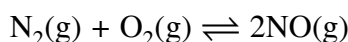
At equilibrium

$$P_{NH_3} = P_{H_2S} = \frac{P_{total}}{2} = .492$$

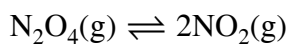
$$\text{So } k_p = P_{NH_3} \cdot P_{H_2S} = (.492) (.492)$$

$$k_p = 0.242 \text{ atm}^2$$

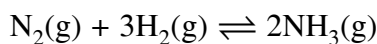
6. Ans. (4)



$$\frac{k_p}{k_c} = (RT)^{\Delta n_g} = (RT)^0 = 1$$

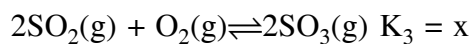
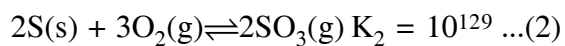


$$\frac{k_p}{k_c} = (RT)^1 = 24.62$$



$$\frac{k_p}{k_c} = (RT)^{-2} = \frac{1}{(RT)^2} = 1.65 \times 10^{-3}$$

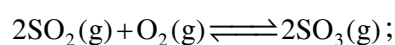
7. **Ans. (3)**



multiplying equation (1) by 2;



$\Rightarrow$  Subtracting (3) from (2); we get



8. **Ans. (1)**

**Sol.** In option (2)-  $\Delta n_g$  is -ve therefore increase in pressure will bring reaction in forward direction.

In option (3)- as the reaction is exothermic therefore increase in temperature will decrease the equilibrium constant.

In option (4)- Equilibrium constant changes only with temperature.

Hence, option (2), (3) and (4) are correct therefore option (1) is incorrect choice.

9. **Ans. (4)**

**Sol.** if  $\Delta n_g \neq 0$   
 $K_p \neq K_c$