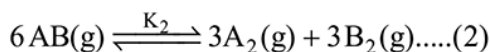
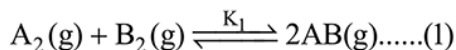


## JEE Mains 2019 Chapter wise Question Bank

## Chemical Equilibrium - Questions

Q1

Consider the following reversible chemical reactions:

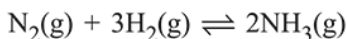
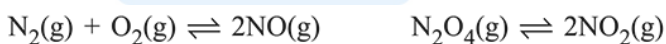
The relation between  $K_1$  and  $K_2$  is:

$$(1) K_1 K_2 = \frac{1}{3} \quad (2) K_2 = K_1^3$$

$$(3) K_2 = K_1^{-3} \quad (4) K_1 K_2 = 3$$

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Q2

The values of  $K_p/K_c$  for the following reactions at 300 K are, respectively: (At 300 K,  $RT = 24.62 \text{ dm}^3 \text{ atm mol}^{-1}$ )

$$(1) 1, 24.62 \text{ dm}^3 \text{ atm mol}^{-1}, \\ 606.0 \text{ dm}^6 \text{ atm}^2 \text{ mol}^{-2}$$

$$(2) 1, 24.62 \text{ dm}^3 \text{ atm mol}^{-1}, \\ 1.65 \times 10^{-3} \text{ dm}^{-6} \text{ atm}^{-2} \text{ mol}^2$$

$$(3) 1, 4.1 \times 10^{-2} \text{ dm}^{-3} \text{ atm}^{-1} \text{ mol}, \\ 606 \text{ dm}^6 \text{ atm}^2 \text{ mol}^{-2}$$

$$(4) 24.62 \text{ dm}^3 \text{ atm mol}^{-1}, \\ 606.0 \text{ dm}^6 \text{ atm}^2 \text{ mol}^{-2}, \\ 1.65 \times 10^{-3} \text{ dm}^{-6} \text{ atm}^{-2} \text{ mol}^2$$

10 Jan Morning

Q3

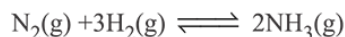
5.1 g  $NH_4SH$  is introduced in 3.0 L evacuated flask at  $327^\circ\text{C}$ , 30% of the solid  $NH_4SH$  decomposed to  $NH_3$  and  $H_2S$  as gases. The  $K_p$  of the reaction at  $327^\circ\text{C}$  is ( $R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$ , molar mass of S =  $32 \text{ g mol}^{-1}$ , molar mass of N =  $14 \text{ g mol}^{-1}$ )

$$(1) 0.242 \times 10^{-4} \text{ atm}^2 \quad (2) 1 \times 10^{-4} \text{ atm}^2 \\ (3) 4.9 \times 10^{-3} \text{ atm}^2 \quad (4) 0.242 \text{ atm}^2$$

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Q4

Consider the reaction

The equilibrium constant of the above reaction is  $K_p$ . If pure ammonia is left to dissociate, the partial pressure of ammonia at equilibrium is given by (Assume that  $P_{NH_3} \ll P_{\text{total}}$  at equilibrium)

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

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

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Q5

In a chemical reaction,  $A + 2B \xrightleftharpoons{K} 2C + D$ , the initial concentration of B was 1.5 times of the concentration of A, but the equilibrium concentrations of A and B were found to be equal. The equilibrium constant (K) for the aforesaid chemical reaction is:

$$(1) 4 \quad (2) 16$$

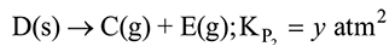
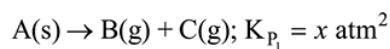
$$(3) \frac{1}{4} \quad (4) 1$$

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Q6

## Chemical Equilibrium

Two solids dissociate as follows



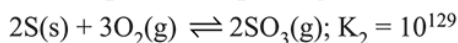
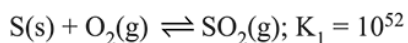
The total pressure when both the solids dissociate simultaneously is:

- (1)  $\sqrt{x+y}$  atm                      (2)  $2(\sqrt{x+y})$  atm  
(3)  $(x+y)$  atm                      (4)  $x^2 + y^2$  atm

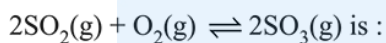
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### Q7

For the following reactions, equilibrium constants are given :



The equilibrium constant for the reaction,

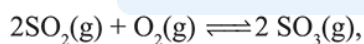


- (1)  $10^{154}$       (2)  $10^{181}$       (3)  $10^{25}$       (4)  $10^{77}$

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### Q8

For the reaction,



$$\Delta H = -57.2 \text{ kJ mol}^{-1} \text{ and } K_c = 1.7 \times 10^{16}$$

Which of the following statement is INCORRECT ?

- (1) The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required.  
(2) The equilibrium will shift in forward direction as the pressure increases.  
(3) The equilibrium constant decreases as the temperature increases.  
(4) The addition of inert gas at constant volume will not affect the equilibrium constant.

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### Q9

## JEE Mains 2019 Chapter wise Question Bank

In which one of the following equilibria,  $K_p \neq K_c$  ?

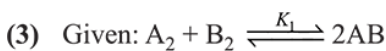
- (1)  $2C(s) + O_2(g) \rightleftharpoons 2CO(g)$   
(2)  $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$   
(3)  $NO_2(g) + SO_2(g) \rightleftharpoons NO(g) + SO_3(g)$   
(4)  $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$

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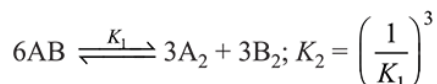
## JEE Mains 2019 Chapter wise Question Bank

## Chemical Equilibrium - Answers

Q1



$$\Rightarrow 2AB \rightleftharpoons A_2 + B_2; K = \frac{1}{K_1}$$

The relation between  $K_1$  and  $K_2$  is  $K_2 = K_1^{-3}$ 

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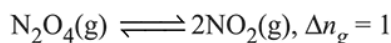
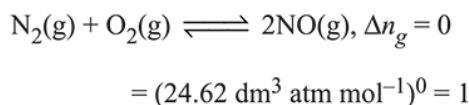
Q2

(2)  $K_p = K_c (RT)^{\Delta n_g}$

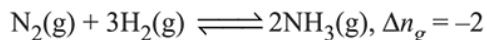
$$\Delta n_g = \text{No. of gaseous moles of products}$$

$$- \text{No. of gaseous moles of reactants}$$

$$\frac{K_p}{K_c} = (RT)^{\Delta n_g}$$



$$\frac{K_p}{K_c} = 24.62 \text{ dm}^3 \text{ atm mol}^{-1}$$



$$\frac{K_p}{K_c} = (24.62 \text{ dm}^{-6} \text{ atm}^{-2} \text{ mol}^{-2})^{-2}$$

$$= \frac{1}{(24.62 \text{ dm}^2 \text{ atm mol}^{-1})^2}$$

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

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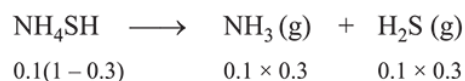
Q3

(4) Concerned reaction:



$$\text{Initial moles} = \frac{5.1}{51} = 0.1 \text{ mol}$$

Moles at equilibrium



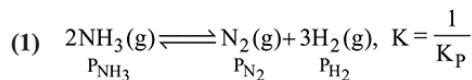
$$\therefore K_c = [NH_3][H_2S] = \left(\frac{0.03}{3}\right)^2 = 10^{-4}$$

$$K_p = K_c (RT)^{\Delta n_g}$$

$$= 10^{-4} \times (0.082 \times 600)^2 = 0.242 \text{ atm}^2$$

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Q4



$$\therefore K = \frac{1}{K_P} = \frac{P_{N_2} (P_{H_2})^3}{(P_{NH_3})^2} \quad \dots (i)$$

$$\Rightarrow P_{\text{Total}}(P) = P_{N_2} + P_{H_2} + P_{NH_3}$$

$$\approx P_{N_2} + P_{H_2} (\because P_{NH_3} \ll P_T)$$

Now,

$$\text{Partial pressure of } N_2 = \frac{1}{4}P; \text{ Partial pressure of } H_2 = \frac{3}{4}P$$

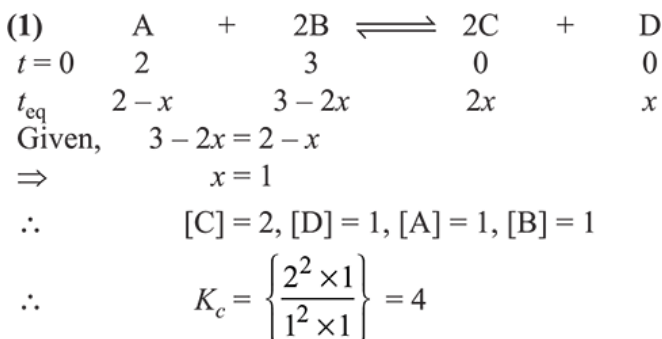
$$\text{From eq (1), } \frac{1}{K_P} = \frac{\left(\frac{1}{4}P\right)\left(\frac{3}{4}P\right)^3}{(P_{NH_3})^2}$$

$$P_{NH_3} = \frac{3^{3/2} \cdot P^2 \cdot K_P^{3/2}}{16}$$

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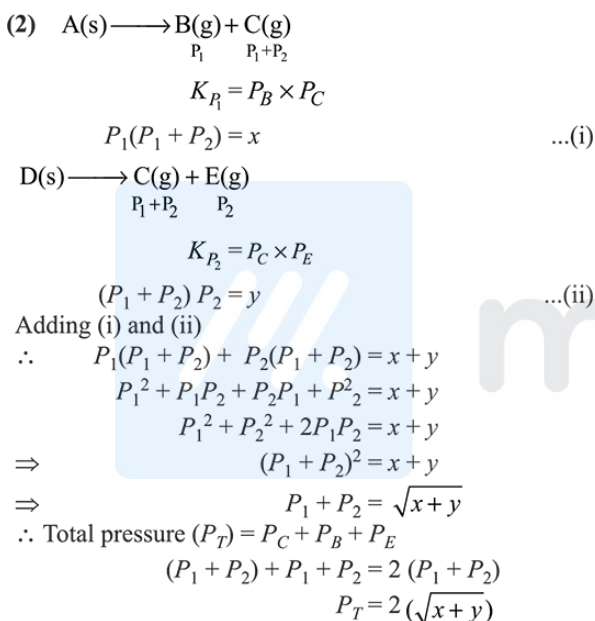
## Chemical Equilibrium

**Q5**



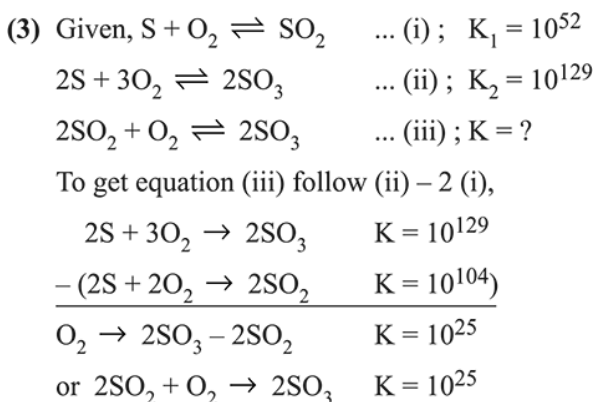
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**Q6**



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**Q7**



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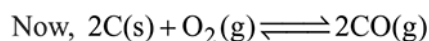
**Q8**

- (1) Equilibrium constant has no relation with catalyst. Catalyst only affects the rate of the reaction. Catalyst  $\text{V}_2\text{O}_5$  in the given reaction, is used to speed up the reaction.

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**Q9**

- (1) We know that,  $K_p = K_c \cdot (\text{RT})^{\Delta n_g}$   
 $\therefore$  If  $\Delta n_g \neq 0$  then  $K_p \neq K_c$



$$\begin{array}{l}
 \Delta n_g = +1 \\
 \Rightarrow K_p = K_c (\text{RT})^1 \\
 \text{Hence, } K_p \neq K_c
 \end{array}$$

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