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CENTRE FOR EXCELLENCE
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CHEMICAL EQUILIBRIUM - DPP **CLASS - XI (B-1) - JEE | NEET**

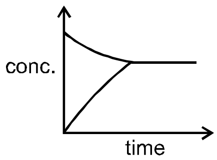
DPP-01 : Properties of Equilibrium, Law of mass action, Equilibrium constant and its properties, Factors affecting Equlibrium constant

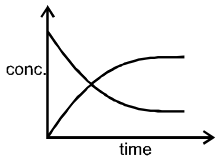
1. A chemical reaction is at equilibrium when
(1) Reactants are completely transformed into products
(2) The rates of forward and backward reactions are equal
(3) Formation of products is minimised
(4) Equal amounts of reactants and products are present

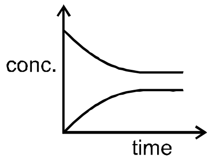
2. Which of the following statement is incorrect :
(1) At equilibrium, concentration of reactants must be equal to concentration of products.
(2) Equilibrium can be attained in both homogenous and heterogenous reaction.
(3) Approach to the equilibrium is fast in initial state but gradually it decreases.
(4) Equilibrium is dynamic in nature

3. In the given reaction $N_2 + O_2 \rightleftharpoons 2NO$, equilibrium means that
(1) Concentration of reactant is changing where as concentration of products is constant
(2) Concentration of all substances is constant
(3) Concentration of reactants is constant where as concentration of products is changing
(4) Concentration of all substances is changing

4. Rate of reaction curve for equilibrium can be like : [r_f = forward rate , r_b = backward rate]

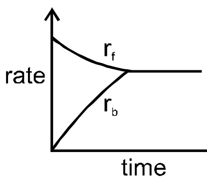
(1) 

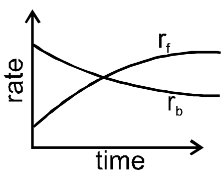
(2) 

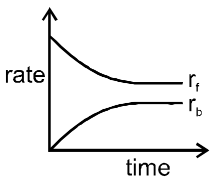
(3) 

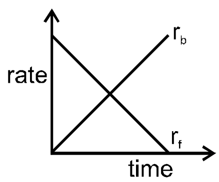
(4) All of these

5. Rate of reaction curve for equilibrium can be like :
[r_f = rate of forward, r_b = rate of backward]

(1) 

(2) 

(3) 

(4) 

6. At equilibrium rate of forward reaction is proportional to active mass's of reactants with the power of their stoichiometric coefficient. This statement is known as :
(1) Law of mass action
(2) Le-chatelie principle
(3) Faraday law of electrolysis
(4) Law of constant proportion

7. Active mass concentration of 96 g of $O_2(g)$ contained in a 2 L vessel is -
(1) 16 mol/L (2) 1.5 mol/L (3) 4 mol/L (4) 24 mol/L

8. In a reaction $A(g) + B(g) \rightleftharpoons C(g) + D(g)$ the rate constant of forward & backward reactions are k_1 and k_2 respectively then the equilibrium constant (K) for reaction is expressed as –
(1) $K = \frac{k_2}{k_1}$ (2) $K = \frac{k_1}{k_2}$ (3) $K = k_1 \times k_2$ (4) $K = k_1 + k_2$

9. In a chemical equilibrium, the rate constant for the backward reaction is 7.5×10^{-4} and the equilibrium constant is 1.5, the rate constant for the forward reaction is :

(1) 2×10^{-3} (2) 5×10^{-4} (3) 1.12×10^{-3} (4) 9.0×10^{-4}

10. The equilibrium constant for the reaction $2X(g) + 2Y(g) \longrightarrow 2Z(g)$ is given as :

(1) $\frac{[2X]\ [2Y]}{[2Z]}$ (2) $\frac{[X]\ [Y]}{[Z]}$ (3) $\frac{[Z]^2}{[X]^2\ [Y]^2}$ (4) $\frac{[Z]^2}{[X]\ [Y]}$

11. $N_2 + O_2 \rightleftharpoons 2NO$. For this reaction $K_p = 100$, then K_p for reaction, $2NO \rightleftharpoons N_2 + O_2$ will be :

(1) 0.01 (2)) 0.1 (3) 10 (4) 100

12. At a certain temperature, the following reactions have the equilibrium constant as shown below :

$$S(s) + O_2(g) \rightleftharpoons SO_2(g);\ K_{c1} = 5 \times 10^{52}$$

$$2S(s) + 3O_2(g) \rightleftharpoons 2SO_3(g);\ K_{c2} = 10^{29}$$

What is the equilibrium constant K_c for the reaction at the same temperature ?

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

(1) 2.5×10^{76} (2) 4×10^{23} (3) 4×10^{-77} (4) None of these

13. Consider the two gaseous equilibrium involving SO_2 and the corresponding equilibrium constant at 299 K

$$SO_2(g) + {}^{1/2}O_2(g) \rightleftharpoons SO_3(g)\ ;\ K_1$$

$$4SO_3(g) \rightleftharpoons 4SO_2(g) + 2O_2(g)\ ;\ K_2$$

The value of the equilibrium constant are related by :

(1) $K_2 = \frac{1}{(K_1)^4}$ (2) $K_2 = K_1^4$ (3) $K_2 = \left(\frac{1}{K_1}\right)^{1/4}$ (4) $K_2 = \frac{1}{K_1}$

14. For the reaction $A \rightleftharpoons B$; $K_C = 2$

$B \rightleftharpoons C$; $K_C = 4$, $C \rightleftharpoons D$; $K_C = 6$

K_C for the reaction $A \rightleftharpoons D$

(1) 12 (2) 4/3 (3) 24 (4) 48

15. Equilibrium constant of some reaction are given as under ;

(a) $x \rightleftharpoons y$ $K = 10^{-1}$

(b) $y \rightleftharpoons z$ $K = 2 \times 10^{-2}$

(c) $P \rightleftharpoons Q$ $K = 3 \times 10^{-4}$

(d) $R \rightleftharpoons S$ $K = 2 \times 10^{-3}$

Initial concentration of the reactants for each reaction was taken be equal :

Review the above reaction and indicate the reactions in which the reactants and products respectively were of highest concentration : -

(1) d, c (2) c, a (3) a, d (4) b, c

16. For a reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of K_C depends upon :

(1) Initial concentration of the reactants (2) Pressure

(3) Temperature (4) catalyst

17. The equilibrium constant in a reversible reaction at a given temperature

(1) Depends on initial concentration of the reactant

(2) Depends on the concentration of the products at equilibtium

(3) Does not depend on the initial concentrations

(4) It is not characteristic of the reaction.

18. The equilibrium constant (K_p) for the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is 16. If the volume of the container is reduced to one half its original volume, the value of K_p for the reaction at the same temperature will be :

(1) 32 (2) 64 (3) 16 (4) 4

19. When $K_c >> 1$ for a chemical reaction,

(1) the equilibrium would be achieved rapidly
(2) the equilibrium would be achieved slowly
(3) product concentrations would be much greater than reactant concentrations at equilibrium
(4) reactant concentrations would be much greater then product concentrations at equilibrium.

20. For the following gases equilibrium, $N_2O_4\ (g) \rightleftharpoons 2NO_2\ (g)$, K_p is found to be equal to K_c. This is attained when :

(1) 0^oC (2) 273 K (3) 1 K (4) 12.19 K

21. The relation between K_p and K_c in equilibrium is :

(1) $K_p = K_c\ (RT)^{\Delta n}$ (2) $K_p = K_c \times RT$ (3) $K_c = K_p\ (RT)^{\Delta n}$ (4) $K_c = K_p \times \Delta n$

22. For which reaction at 298 K, the value of $\frac{K_p}{K_c}$ will be maximum and minimum respectively :

(a) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ (b) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3\ (g)$
(c) $X(g) + Y(g) \rightleftharpoons 4Z(g)$ (d) $A(g) + 3B(g) \rightleftharpoons 7C(g)$

(1) d,c (2) d,b (3) c,b (4) d,a

23. For which reaction is $K_p = K_C$:

(1) $2\ NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$ (2) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
(3) $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$ (4) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

24. For hypothetical equilibrium, $4A(g) + 5B(g) \rightleftharpoons 4X(g) + 6Y(g)$
The unit of K_C will be :

(1) litre mole^{-1} (2) mole litre^{-1} (3) litre mole^{-2} (4) mole^{2} litre^{-2}

25. What is the unit of K_P for the reaction ?

$$CS_2\ (g) + 4H_2\ (g) \rightleftharpoons CH_4\ (g) + 2H_2S\ (g)$$

(1) atm (2) atm^{-2} (3) atm^{2} (4) atm^{-1}

DPP-02 : K_c and K_p for Homogeneous Reaction

1. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

In above reaction, at equilibrium condition mole fraction of PCl_5 is 0.4 and mole fraction of Cl_2 is 0.3. Then find out mole fraction of PCl_3

(1) 0.3 (2) 0.7 (3) 0.4 (4) 0.6

2. The reaction $A(g) + B(g) \rightleftharpoons C(g) + D(g)$ is studied in a one litre vessel at 250°C. The initial concentration of A was 3n and that of B was n. When equilibrium was attained, equilibrium concentration of C was found to the equal to the equilibrium concentration of B. What is the concentration of D at equilibrium?

(1) n/2 (2) (3n – 1/2) (3) (n – n/3) (4) n

3. A certain quantity of PCl_5 was heated in a 10 litre vessel at 250ºC. At equilibrium the vessel contains 0.1 mole of PCl_5 0.20 mole of PCl_3 and 0.2 mole of Cl_2; The equilibrium constant of the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is :

(1) 0.02 (2) 0.05 (3) 0.04 (4) 0.025

4. For the equilibrium $N_2 + 3H_2 \rightleftharpoons 2NH_3$ K_c at 1000K is 2.37×10^{-3} . If the equilibrium concentration of N_2 and H_2 are 2M and 3M respectively, then $[NH_3]$ at equilibrium is :

(1) 0.00358 M (2) 0.0358 M (3) 0.358 M (4) 3.58 M

5. In the reaction $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

The equilibrium concentration of PCl_5 and PCl_3 are 0.4 and 0.2 mole/litre respectively . If the value of K_c is 0.5 what is the concentration of Cl_2 at equilibrium?

(1) 2.0 (2) 1.5 (3) 1.0 (4) 0.5

6. 4 moles of A are mixed with 4 moles of B, when 2 moles of C are formed at equilibrium, according to the reaction, $A + B \rightleftharpoons C + D$. The equilibrium constant is :

(1) 4 (2) 1 (3) 2 (4) 3

7. In the reaction $2P(g) + Q(g) \rightleftharpoons 3R(g) + S(g)$. If 2 moles each of P and Q taken initially in a 1 litre flask. At equilibrium which is true :

(1) [P] < [Q] (2) [P] = [Q] (3) [Q] = [R] (4) None of these

8. When 3 moles of A and 1 mole of B are mixed in 1 litre vessel the following reaction takes place $A_{(g)} + B_{(g)} \rightleftharpoons 2C_{(g)}$. 1.5 moles of C are formed. The equilibrium constant for the reaction is

(1) 0.12 (2) 0.25 (3) 0.50 (4) 4.0

9. $K_c = 9$ for the reaction, $A + B \rightleftharpoons C + D$, If A and B are taken in equal amounts, then ratio of C to A at equilibrium is :

(1) 1 (2) 0.25 (3) 0.75 (4) None of these

10. 1 mole of N_2 and 2 moles of H_2 are allowed to react in a 1 dm^3 vessel. At equilibrium, 0.8 mole of NH_3 is formed. The concentration of H_2 in the vessel is :

(1) 0.6 mol/L (2) 0.8 mol/L (3) 0.2 mol/L (4) 0.4 mol/L

11. An equilibrium mixture for the reaction

$2H_2S \rightleftharpoons 2H_2(g) + S_2(g)$

had 1 mol of H_2S, 0.2 mol of H_2 and 0.8 mol of S_2 in a 2 litre flask. The value of K_C in mol lit^{-1} is :

(1) 0.08 (2) 0.016 (3) 0.004 (4) 0.160

12. The reaction, $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ is started in a five litre container by taking one mole of PCl_5. If 0.3 mole of PCl_5 is there at equilibrium, concentration of PCl_3 and K_C will respectively be :

(1) 0.14, $\frac{49}{150}$ (2) 0.12, $\frac{23}{100}$ (3) 0.07, $\frac{23}{100}$ (4) 20, $\frac{49}{150}$

13. In the reaction $A(g) + 2B(g) \rightleftharpoons 2C(g)$, if 2 mole of A, 3.0 moles of B and 2.0 moles of C are placed in a 2L flask. If equilibrium concentration of C is 0.5 mole/L. The value of equilibrium constant (K_C) will be:

(1) 0.073 (2) 0.147 (3) 0.05 (4) 0.026

14. 28 g of N_2 and 6 g of H_2 were kept at 400ºC in 1 litre vessel, the equilibrium mixture contained 17g of NH_3. The value of K_C for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is :

(1) 7.5 (2) 0.5 (3) 0.6 (4) 100

15. A mixture of 0.3 mole of H_2 and 0.3 mole of I_2 is allowed to react in a 10 litre evacuated flask at 500ºC. Equilibrium constant for the reaction $H_2 + I_2 \rightleftharpoons 2HI$, is found to be 64. The amount of unreacted I_2 at equilibrium is :

(1) 0.15 mole (2) 0.06 mole (3) 0.03 mole (4) 0.2 mole

16. At a certain temperature 50% HI is dissociated at equilibrium. The equilibrium constant for the reaction $2HI \rightleftharpoons H_2 + I_2$ is :

(1) 0.25 (2) 1.0 (3) 3.0 (4) 0.50

17. 0.6 mole of NH_3 in a reaction vessel of 2dm³ capacity was brought to equilibrium . The vessel was then found to contain 0.15 mole of H_2 formed by the reaction

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

Which of the following statement is true?

(1) 0.15 mole of the original NH_3 had dissociated at equilibrium

(2) 0.55 mole of ammonia is left in the vessel

(3) At equilibrium the vessel contained 0.45 mole of N_2

(4) The concentration of NH_3 at equilibrium is 0.25 mole per dm^3

18. Equimolar concentrations of H_2 and I_2 are heated to equilibrium in a 2 litre flask. At equilibrium, the forward and the backward rate constants are found to be equal, What percentage of initial concentration of H_2 has reacted at equilibrium for the reaction $H_2 + I_2 \rightleftharpoons 2HI$

(1) 33 % (2) 66 % (3) 50 % (4) 40 %

19. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ in the reversible reaction the moles of PCl_5, PCl_3 and Cl_2 are a, b and c respectively and total pressure is P then value of K_p is :

(1) $\frac{bc}{a}.RT$ (2) $\frac{b}{(a+b+c)}.P$ (3) $\frac{bc.P}{a\ (a+b+c)}$ (4) $\frac{c}{(a+b+c)}.P$

20. For the reaction

$A_2(g) + 3B_2 \rightleftharpoons 2C_2(g)$

the partial pressure of A_2, B_2 at equilibrium are 0.80 atm and 0.40 atm respectively. The pressure of the system is 2.80 atm. The equilibrium constant K_p will be

(1) 50 (2) 5.0 (3) 0.02 (4) 0.2

21. The equilibrium constant, K_p for the reaction

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

is 4.0 atm^{-1} at 1000 K. What would be the partial pressure of O_2 if at equilibrium the amount of SO_2 and SO_3 is the same ?

(1) 16.0 atm (2) 0.25 atm (3) 1 atm (4) 0.75 atm

22. A sample of pure NO_2 gas heated to 1000 K decomposes : $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$. The equilibrium constant K_P is 100 atm. Analysis shows that the partial pressure of O_2 is 0.25 atm. at equilibrium. The partial pressure of NO_2 at equilibrium is:

(1) 0.03 (2) 0.25 (3) 0.025 (4) 0.04

DPP-03 : Reaction Quotient and Its applications

1. When two reactants, A & B are mixed to give products C & D, the reaction quotient Q, at the initial stages of the reaction :

(1) is zero (2) decrease with time

(3) is independent of time (4) increases with time

2. The reaction quotient Q for

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

is given by $Q = \frac{[NH_3]^2}{[N_2][H_2]^3}$. The reaction will proceed in backward direction, when

(1) $Q = K_C$ (2) $Q < K_C$ (3) $Q > K_C$ (4) $Q = 0$

3. A reaction mixture containing H_2, N_2 and NH_3 has partial pressure 2 atm, 1 atm and 3 atm respectively at 725 K. If the value of K_P for the reaction, $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is 4.28×10^{-5} atm^{-2} at 725 K, in which direction the net reaction will go :

(1) Forward (2) Backward

(3) No net reaction (4) Direction of reaction cannot be predicted

4. For the reaction,

$2A + B \rightleftharpoons 3C$ at 298 K, $K_C = 49$

A 3L vessel contains 2, 1 and 3 moles of A, B and C respectively. The reaction at the same temperature

(1) must proceed in forward direction

(2) must proceed in backward direction

(3) must be equilibrium

(4) can not be predicted

5. 2 mole each of SO_3, CO, SO_2 and CO_2 is taken in a one lit. vessel. If K_C for

$SO_3(g) + CO(g) \rightleftharpoons SO_2(g) + CO_2(g)$ is 1/9 then

(1) total no. of moles at equilibrium are less than 8 (2) $n(SO_3) + n(CO_2) = 4$

(3) $[n(SO_2)/n(CO)] < 1$ (4) both (2) and (3).

DPP-04 : Degree of dissociation and vapour density

1. $A_3(g) \rightleftharpoons 3A\ (g)$

In the above reaction, the initial concentration of A_3 is "a" moles/lit. If x is degree of dissociation of A_3. The total number of moles at equilibrium will be :

(1) $a - \frac{ax}{3}$ (2) $\frac{a}{3} - ax$ (3) $\left(\frac{a - ax}{2}\right)$ (4) $a + 2ax$

2. 4 moles of PCl_5 are heated at constant temperature in closed container. If degree of dissociation for PCl_5 is 0.5 calculate total number of moles at equilibrium :

(1) 4.5 (2) 6 (3) 3 (4) 4

3. The dissociation of CO_2 can be expressed as $2CO_2 \rightleftharpoons 2CO + O_2$. If the 2 moles of CO_2 is taken initially and 40% of the CO_2 is dissociated equilibrium then total number of moles at equilibrium :

(1) 2.4 (2) 2.0 (3) 1.2 (4) 5

4. In a 0.25 litre tube dissociation of 4 moles of NO is take place. If its degree of dissociation is 10%. The value of K_p for reaction $2NO \rightleftharpoons N_2 + O_2$ is :

(1) $\frac{1}{(18)^2}$ (2) $\frac{1}{(8)^2}$ (3) $\frac{1}{16}$ (4) $\frac{1}{32}$

5. The degree of dissociation of SO_3 is α at equilibrium pressure P_0 .

K_p for $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$ is

(1) $[(P_0\alpha^3)/2(1 - \alpha)^3]$ (2) $[(P_0\alpha^3)/(2+\alpha)(1 - \alpha)^2]$

(3) $[(P_0\alpha^2)/2(1 - \alpha)^2]$ (4) None of these

6. For the dissociation reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, the degree of dissociation (α) in terms of K_p and total equilibrium pressure P is:

(1) $\alpha = \sqrt{\frac{4p + K_p}{K_p}}$ (2) $\alpha = \sqrt{\frac{K_p}{4p + K_p}}$ (3) $\alpha = \sqrt{\frac{K_p}{4p}}$ (4) None of these

7. The degree of dissociation of $PCl_5(g)$ obeying the equilibrium, $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, is approximately related to the presure at equilibrium by -

(1) $\alpha \propto P$ (2) $\alpha \propto \frac{1}{\sqrt{P}}$ (3) $\alpha \propto \frac{1}{P^2}$ (4) $\alpha \propto \frac{1}{P^4}$

8. For the reaction $AB_{(g)} \rightleftharpoons A_{(g)} + B_{(g)}$, AB is 33% dissociated at a total pressure of P. Therefore, P is related to K_p by one of the following options

(1) $P = K_p$ (2) $P = 3K_p$ (3) $P = 4K_p$ (4) $P = 8K_p$

9. Two sample of HI each of 5 gm. were taken seperately into vessels of volume 5 an 10 litres respectively at 27ºC . The extent of dissociation of HI will be :

(1) More in 5 litre vessel (2) More in 10 litre vessel
(3) Equal in both vessel (4) None of these

10. What will be the amount of dissociation, if the volume is increased 16 times of initial volume in the reaction
$PCl_5 \rightleftharpoons PCl_3 + Cl_2$? (Assume dissociation is negligible)

(1) 4 (2) $\frac{1}{4}$ (3) 2 (4) $\frac{1}{5}$

11. The equation $\alpha = \frac{D - d}{(n-1)d}$ correctly matched for :

(1) $A(g) \rightleftharpoons (n/2)B(g) + (n/3)C(g)$ (2) $A(g) \rightleftharpoons (n/3)B(g) + (2n/3)C(g)$
(3) $A(g) \rightleftharpoons (n/2)B(g) + (n/4)C(g)$ (4) $A(g) \rightleftharpoons (n/2)B(g) + C(g)$

12. Consider the following hypothetical equilibrium
$2B(g) \rightleftharpoons B_2(g)$
If d is observed vapour density and D is theoretical vapour density, then degree of association (1) will be

(1) $\alpha = 2\left(\frac{D - d}{d}\right)$ (2) $\alpha = \frac{2D - d}{D}$ (3) $\alpha = 2 - \frac{2D}{d}$ (4) $\alpha = \frac{2D}{D - d}$

13. $SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2} O_2(g)$

If observed vapour density of mixture at equilibrium is 35 then find out value of α

(1) 0.28 (2) 0.38 (3) 0.48 (4) 0.58

14. For equilibrium
$N_2O_4(g) \rightleftharpoons 2NO_2(g)$
the observed vapour density of N_2O_4 is 40 at 350 K. Calculate percentage dissociation of $N_2O_4(g)$ at 350K.

(1) 15 (2) 30 (3) 92 (4) 46

DPP-05 : Heterogeneous Equlibrium

1. How many of the following reactions are homogenous reversible reactions ?

(1) $CH_3COOH(\ell) + C_2H_5OH(\ell) \rightleftharpoons CH_3COOC_2H_5(\ell) + H_2O(\ell)$

(2) $C(s) + CO_2(g) \rightleftharpoons CO(g) + H_2O(g)$

(3) $H_2(g) + CO_2(g) \rightleftharpoons CO(g) + H_2O(g)$

(4) $CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$

(5) $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$

(6) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

(7) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(8) $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$

(9) $SO_2(g) + NO_2(g) \rightleftharpoons SO_3(g) + NO(g)$

(10) $NO(g) + \frac{1}{2} Br_2(\ell) \rightleftharpoons 2NOBr(g)$

(1) 4 (2) 5 (3) 6 (4) 7

2. On decomposition of NH_4HS, the following equilibrium is established :

$$NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$$

If the total pressure is P atm, then the equilibrium constant K_P is equal to

(1) P atm (2) P^2 atm^2 (3) $P^2 / 4$ atm^2 (4) 2P atm

3. For $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$ reaction started only with $NH_4HS(s)$, the observed pressure for reaction mixture in equilibrium is 1.2 atm at 106°C. What is the value of K_p for the reaction ?

(1) 1.44 atm^2 (2) 0.36 atm^2 (3) 0.16 atm^2 (4) 3.6 atm^2

4. Partial pressure of CO is twice to the partial pressure of CO_2 at the equilibrium. If total pressure at equlibriumis 12 atm. Then K_P will be

$C(s) + CO_2(g) \rightleftharpoons 2CO(g)$

(1) 8 (2) 12 (3) 16 (4) 32

5. What is the minimum mass of $CaCO_3$ (s), below which it decomposes completely, required to establish equilibrium in a 6.50 litre container for the reaction :

$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, $K_C = 0.05$ mole/litre

(1) 32.5 g (2) 24.6 g (3) 40.9 g (4) 8.0 gm

DPP-06 : Thermodynamics of Equilibrium

1. The correct relationship between free energy change in a reaction and the corresponding equilibrium constant K is :

(1) $-\Delta G^o = RT \ln K$ (2) $\Delta G = RT \ln K$ (3) $-\Delta G = RT \ln K$ (4) $\Delta G^o = RT \ln K$

2. In an equilibrium reaction for which $\Delta G° = 0$, the value of equilibrium constant K = is

(1) 0 (2) 1 (3) 2 (4) 10

3. The effect of temperature on equilibrium constant is expressed as $(T_2 > T_1)$

$$\log \frac{K_2}{K_1} = \frac{-\Delta H}{2.303R}\left[\frac{1}{T_2}-\frac{1}{T_1}\right]$$. For endothermic reaction false statement is

(1) $\left[\frac{1}{T_2}-\frac{1}{T_1}\right]$ = positive (2) ΔH = positive

(3) $\log K_2 > \log K_1$ (4) $K_2 > K_1$

4. For a reversible reaction $aA + bB \rightleftharpoons cC + dD$; the variation of K with temperature is given by

$$\log \frac{K_2}{K_1} = \frac{-\Delta H^{\circ}}{2.303R}\left[\frac{1}{T_2}-\frac{1}{T_1}\right]$$ then,

(1) $K_2 > K_1$ if $T_2 > T_1$ for an endothermic change

(2) $K_2 < K_1$ if $T_2 > T_1$ for an endothermic change

(3) $K_2 > K_1$ if $T_2 > T_1$ for an exothermic change

(4) All are correct

5. The equilibrium constant for the reaction $Br_2 \rightleftharpoons 2Br$ at 500 K and 700 K are 1×10^{-10} and 1×10^{-5} respectively. The reaction is :

(1) Endothermic (2) Exothermic (3) Fast (4) Slow

6. The standard state gibbs free energy change for the given isomerization reaction cis-2-pentene $\rightleftharpoons$ trans-2-pentene is –3.62kJ/mol at 400 K. If more trans-2-pentene is added to the reaction vessel, then

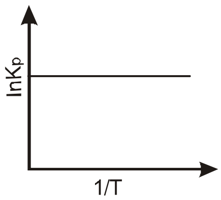
(1) More cis-2-pentene is formed

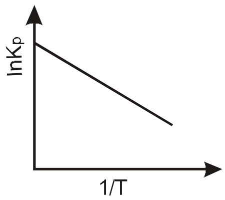
(2) Equilibrium is shifted in the forward direction

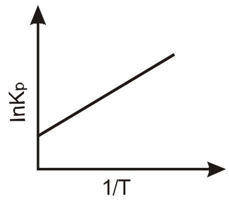
(3) Equilibrium remains unaffected

(4) Additional trans-2-pentene is formed

7. An exothermic reaction is represented by the graph :

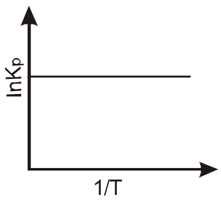
(1)


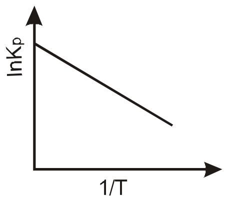
(2)


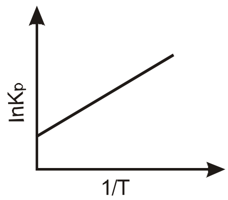
(3)


(4) None of these

8. An endothermic reaction is represented by the graph :

(1)


(2)


(3)


(4) None of these

DPP-07 : Le-chatelier's principle

1. For the reaction $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$ at a given temperature the equilibrium amount of CO_2 (g) can be increased by :

(1) adding a suitable catalyst (2) adding an inert gas

(3) decreasing the volume of container (4) increasing the amount of CO(g)

2. Given the following reaction at equilibrium $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$. Some inert gas at constant pressure is added to the system. Predict which of the following facts will be affected.

(1) More $NH_3(g)$ is produced
(2) Less $NH_3(g)$ is produced
(3) No affect on the equilibrium
(4) K_p of the reaction is decreased

3. Introduction of inert gas (at the same temperature) will affect the equilibrium if :

(1) volume is constant and $\Delta n_g \neq 0$
(2) pressure is constant and $\Delta n_g \neq 0$
(3) volume is constant and $\Delta n_g = 0$
(4) pressure is constant and $\Delta n_g = 0$

4. In the following reversible reaction

$2SO_2 + O_2 \rightleftharpoons 2SO_3 + Q$ cal

Most suitable condition for the higher production of SO_3 is

(1) High temperature and high pressure
(2) High temperature and low pressure
(3) Low temperature and high pressure
(4) Low temperature and low pressure

5. In the formation of SO_3 by contact process ($2SO_2 + O_2 \rightleftharpoons 2SO_3 + Q$ cal) the conditions used are

(1) Catalyst, optimum temperature and higher concentration of reactants
(2) Catalyst, optimum temperature and lower concentration of reactants
(3) Catalyst, high temperature and higher concentration of reactants
(4) Catalyst, low temperature and lower concentration of reactants

6. Consider the reactions

(i) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(ii) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

The addition of an inert gas at constant volume

(1) will increase the dissociation of PCl_5 as well as N_2O_4
(2) will reduce the dissociation of PCl_5 as well as N_2O_4
(3) will increase the dissociation of PCl_5 and step up the formation of NO_2
(4) will not disturb the equilibrium of the reactions

7. Vapour density of equilibrium $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is decreased by

(1) increasing temperature
(2) decreasing volume
(3) increasing pressure
(4) decreasing temperature

8. For the reaction : $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

The backward reaction at constant temperature is favoured by

(1) introducing chlorine gas at constant volume
(2) introducing an inert gas at constant pressure
(3) increasing the volume of the container
(4) introducing PCl_5 at constant volume

9. Which of the following reaction will shift in backward direction. When the respective change is made at equilibrium:

(1) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ increase in pressure at eq.
(2) $H_2O(s) \rightleftharpoons H_2O(\ell)$ addition of inert gas at constant volume
(3) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ addition of inert gas at constant pressure
(4) $CO_2(g) + CaO(s) \rightleftharpoons CaCO_3$ increase in temperature

10. If the volume of the reaction flask is reduced to half of its initial value and temperature is kept constant then in which of the following cases the position of equilibrium will not shift ?

(1) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$
(2) $I_2(g) \rightleftharpoons 2I(g)$
(3) $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$
(4) $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$

11. The dissociation of phosgene, which occurs according to the reaction

$$COCl_2\ (g) \rightleftharpoons CO(g) + Cl_2(g)$$

Is an endothermic process. Which of the following will increase the degree of dissociation of $COCl_2$?

(1) Adding Cl_2 to the system
(2) Adding helium to the system at constant pressure
(3) Decreasing the temperature of the system
(4) Increasing total pressure

12. For the reaction, $\frac{1}{2}\ N_2(g) + \frac{1}{2} O_2(g) \rightleftharpoons NO(g)$

If pressure is increased by reducing the volume of the container then :

(1) Degree of dissociation at equilibrium will change.
(2) Concentration of all the component at equilibrium will change.
(3) Concentration of all the component at equilibrium will remain same
(4) Equilibrium will shift in the forward direction

13. At constant temperature, the equilibrium constant (K_P) for the decomposition reaction $N_2O_4 \rightleftharpoons 2NO_2$ is expressed by $K_P = \frac{(4x^2\ \ P)}{(1-x^2)}$, where P = pressure, x = extent of decomposition. Which one of the following statements is true ?

(1) K_P increases with increase of P
(2) K_P increases with increase of x
(3) K_P increases with decrease of x
(4) K_P remains constant with change in P and x

14. Consider the following equilibrium in a closed container

$$N_2O_4\ (g) \rightleftharpoons 2NO_2\ (g)$$

At a fixed temperature, the volume of the reaction container is halved. For this change, which of the following statements holds true regarding the equilibrium constant (K_P) and degree of dissociation (1)?

(1) neither K_P nor α changes
(2) both K_P and α change
(3) K_P changes, but α does not change
(4) K_P does not change but α changes

15. When hydrogen molecules decomposed into its atoms which conditions give maximum yield of hydrogen atoms ?

(1) High temperature and low pressure
(2) Low temperature and high pressure
(3) High temperature and high pressure
(4) Low temperature and low pressure

DPP-08 : Physical Equlibrium

1. $Au(s) \rightleftharpoons Au(\ell)$

Above equilibrium is favoured at :

(1) High pressure low temperature
(2) High pressure high temperature
(3) Low pressure, high temperature
(4) Low pressure, low temperature

2. A gas 'X' when dissolved in water heat is evolved. Then solublity of 'X' will increase :

(1) Low pressure, high temperature
(2) Low pressure, low temperature
(3) high pressure, high temperature
(4) high pressure, low temperature

3. For an equilibrium $H_2O(s) \rightleftharpoons H_2O(\ell)$ which of the following statements is true.

(1) The pressure changes do not affect the equilibrium
(2) More of ice melts if pressure on the system is increased
(3) More of liquid freezes if pressure on the system is increased
(4) The degree of advancement of the reaction do not depend on pressure.

4. When the pressure is applied over system ice $\rightleftharpoons$ water what will happen

(1) More water will form
(2) More ice will form
(3) There will be no effect over equilibrium
(4) Water will decompose in H_2 and O_2

ANSWER KEY

DPP-01

1.	(2)	**2.**	(1)	**3.**	(2)	**4.**	(4)	**5.**	(1)	**6.**	(1)	**7.**	(2)
8.	(2)	**9.**	(3)	**10.**	(3)	**11.**	(1)	**12.**	(3)	**13.**	(1)	**14.**	(4)
15.	(2)	**16.**	(3)	**17.**	(3)	**18.**	(3)	**19.**	(3)	**20.**	(4)	**21.**	(1)
22.	(2)	**23.**	(3)	**24.**	(2)	**25.**	(2)						

DPP-02

1.	(1)	**2.**	(1)	**3.**	(3)	**4.**	(3)	**5.**	(3)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(4)	**10.**	(2)	**11.**	(2)	**12.**	(1)	**13.**	(3)	**14.**	(3)
15.	(2)	**16.**	(1)	**17.**	(4)	**18.**	(1)	**19.**	(3)	**20.**	(1)	**21.**	(2)
22.	(3)												

DPP-03

1.	(4)	**2.**	(3)	**3.**	(2)	**4.**	(1)	**5.**	(4)

DPP-04

1.	(4)	**2.**	(2)	**3.**	(1)	**4.**	(1)	**5.**	(2)	**6.**	(2)	**7.**	(2)
8.	(4)	**9.**	(3)	**10.**	(1)	**11.**	(2)	**12.**	(3)	**13.**	(1)	**14.**	(1)

DPP-05

1.	(2)	**2.**	(3)	**3.**	(2)	**4.**	(3)	**5.**	(1)

DPP-06

1.	(1)	**2.**	(2)	**3.**	(1)	**4.**	(1)	**5.**	(1)	**6.**	(1)	**7.**	(3)
8.	(2)												

DPP-07

1.	(4)	**2.**	(2)	**3.**	(2)	**4.**	(3)	**5.**	(1)	**6.**	(4)	**7.**	(1)
8.	(1)	**9.**	(4)	**10.**	(1)	**11.**	(2)	**12.**	(2)	**13.**	(4)	**14.**	(4)
15.	(1)												

DPP-08

1.	(3)	**2.**	(4)	**3.**	(2)	**4.**	(1)