1. In a chemical equilibrium, the rate constant for the backward reaction is 2×10^{-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) 3×10^{-4} (4) 9.0×10^{-4}

2. For the reaction

$CuSO_4.5H_2O_{(s)} \rightleftharpoons CuSO_4.3H_2O_{(s)} + 2H_2O_{(g)}$

Which one is correct representation :–

(1) $K_p = (P_{(H_2O)})^2$ (2) $K_c = [H_2O]^2$

(3) $K_p = K_c(RT)^2$ (4) All

3. $\log \frac{K_p}{K_c} + \log RT = 0$ is true relationship for the following reaction:-

(1) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

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

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

(4) (2) and (3) both

4. For any reversible reaction if concentration of reactants increases then effect on equilibrium constant:-

(1) Depends on amount of concentration

(2) Unchange

(3) Decrease

(4) Increase

5. Sulfide ion in alkaline solution reacts with solid sulfur to form polysulfide ions having formulas S_2^{2-}, S_3^{2-}, S_4^{2-} and so on. The equilibrium constant for the formation of S_2^{2-} is 12 (K_1) & for the formation of S_3^{2-} is 132 (K_2), both from S and S^{2-}.What is the equilibrium constant for the formation of S_3^{2-} from S_2^{2-} and S?

(1) 11 (2) 12

(3) 132 (4) None of these

6. What should be the value of K_c for the reaction $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$, if the amount are SO_3 = 48 g, SO_2= 12.8 g and O_2 = 9.6 g at equilibrium and the volume of the container is one litre?

(1) 64 (2) 30 (3) 42 (4) 8.5

7. For the reaction $A + 2B \rightleftharpoons 2C + D$, initial concentration of A is a and that of B is 1.5 times that of A. Concentration of A and D are same at equilibrium. What should be the concentration of B at equilibrium ?

(1) $\frac{a}{4}$ (2) $\frac{a}{2}$

(3) $\frac{3a}{4}$ (4) All of the above.

8. The degree of dissociation of SO_3 is α at equilibrium pressure p^0.

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

(1) $\frac{p^0\alpha^3}{2(1-\alpha)^3}$ (2) $\frac{p^0\alpha^3}{(2+\alpha)(1-\alpha)^2}$

(3) $\frac{p^0\alpha^2}{2(1-\alpha)^2}$ (4) None of these

9. The equilibrium constant for the reaction

$A(g) + 2B(g) \rightleftharpoons C(g)$

is 0.25 dm^6mol^{-2}. In a volume of 5 dm^3, what amount of A must be mixed with 4 mol of B to yield 1 mol of C at equilibrium.

(1) 3 moles (2) 24 moles

(3) 26 moles (4) None of these

10. The equilibrium constant K_C for the reaction,

$A(g) + 2B(g) \rightleftharpoons 3C(g)$ is 2×10^{-3}

What would be the equilibrium partial pressure of gas C if initial pressure of gas A & B are 1 & 2 atm respectively.

(1) 0.0625 atm (2) 0.1875 atm

(3) 0.21 atm (4) None of these

11. At 675 K, $H_2(g)$ and CO_2 (g) react to form CO(g) and H_2O (g), K_p for the reaction is 0.16.

If a mixture of 0.25 mole of $H_2(g)$ and 0.25 mol of CO_2 is heated at 675 K, mole % of CO(g) in equilibrium mixture is :

(1) 7.14 (2) 14.28

(3) 28.57 (4) 33.33

12. The equilibrium constant K_P (in atm) for the reaction is 9 at 7 atm and 300 K.

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

Calculate the average molar mass (in gm/mol) of an equilibrium mixture.

Given : Molar mass of A_2, B_2 and C_2 are 70, 49 & 21 gm/mol respectively.

(1) 50 (2) 45
(3) 40 (4) 37.5

13. The equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ shifts forward if :-

(1) A catalyst is used.

(2) An adsorbent is used to remove SO_3 as soon as it is formed.

(3) Small amounts of reactants are removed.

(4) None of these

14. Change in volume of the system does not alter the number of moles in which of the following equilibrium

(1) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
(2) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(3) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
(4) $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

15. Densities of diamond and graphite are 3.5 and 2.3 gm/mL.

C (diamond) $\rightleftharpoons$ C (graphite)
$\Delta_r H = -1.9$ kJ/mole

favourable conditions for formation of diamond are

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

16. The equilibrium $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$ is attained at 25°C in a closed rigid container and an inert gas, helium is introduced. Which of the following statements is/are correct.

(1) concentrations of SO_2, Cl_2 and SO_2Cl_2 do not change

(2) more chlorine is formed

(3) concentration of SO_2 is reduced

(4) more SO_2Cl_2 is formed

17. When $NaNO_3$ is heated in a closed vessel, oxygen is liberated and $NaNO_2$ is left. At equilibrium

(1) addition of $NaNO_2$ favours reverse reaction

(2) addition of $NaNO_3$ favours forward reaction

(3) increasing temperature favours forward reaction

(4) increasing pressure favours forward reaction

18. Consider the equilibrium $HgO(s) + 4I^-(aq) + H_2O(l) \rightleftharpoons HgI_4^{2-}(aq) + 2OH^-(aq)$, which changes will decrease the equilibrium concentration of HgI_4^{2-}

(1) Addition of 0.1 M HI (aq)

(2) Addition of HgO (s)

(3) Removal of H_2O (l)

(4) Addition of KOH (aq)

19. The equilibrium constant for the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is 4×10^{-4} at 200 K. In presence of a catalyst, equilibrium is attained ten times faster. Therefore, the equilibrium constant in presence of the catalyst at 200 K is :-

(1) 40×10^{-4}

(2) 4×10^{-4}

(3) 4×10^{-3}

(4) difficult to compute without moe data

20. In the reaction $X(g) + Y(g) \rightleftharpoons 2\,Z(g)$, 2 mol X, 1 mol Y and 1 mole Z are placed in a 10 litre vessel and allowed to reach equailibrium. If final concentration of Z is 0.2 M, then K_c for the given reaction is :-

(1) 1.60 (2) $\frac{80}{3}$

(3) $\frac{16}{3}$ (4) $\frac{100}{3}$

21. 9.2 grams of $N_2O_4(g)$ is taken in a closed one litre vessel and heated till the following equilibrium is reached $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

At equilibrium, 50% $N_2O_4(g)$ is dissociated. What is the equilibrium constant (in mol litre^{-1}) (molecular weight of N_2O_4 = 92) :-

(1) 0.1
(2) 0.4
(3) 0.2
(4) 2

22. For which of the following reaction is product formation favoured by low pressure and low temperature?

(1) $CO_2(g)+C(s) \rightleftharpoons 2CO(g)$; $\Delta H° = 172.5$ kJ

(2) $CO(g)+2H_2(g) \rightleftharpoons CH_3OH_{(\ell)}$; $\Delta H° = -21.7$ kJ

(3) $2O_3(g) \rightleftharpoons 3O_2(g)$; $\Delta H° = -285$ kJ

(4) $H_2(g) + F_2(g) \rightleftharpoons 2HF(g)$; $\Delta H° = 541$ kJ

23. Two solid compounds X and Y dissociates at a certain temperature as follows

$$X(s) \rightleftharpoons A(g) + 2B(g);\ K_{p_1} = 9 \times 10^{-3}\ atm^3$$

$$Y(s) \rightleftharpoons 2B(g) + C(g);\ K_{p_2} = 4.5 \times 10^{-3}\ atm^3$$

The total pressure of gases over a mixture of X and Y is :-

(1) 4.5 atm (2) 0.45 atm

(3) 0.6 atm (4) None of these

24. For the following reaction :

$A+2B \rightleftharpoons C+3D$; if the partial pressure of all the four substances A,B,C and D at equilibrium are 0.20, 0.10, 0.30 and 0.50 respectively, then calculate the equilibrium constant :-

(1) 18.75 (2) 5.3

(3) 11.25 (4) None of these

25. For the dissociation reaction :

$$NH_4HS_{(s)} \rightleftharpoons NH_{3(g)} + H_2S_{(g)}$$

if $K_p = 25\ atm^2$; then the equilibrium pressure of the system is :-

(1) 25 atm (2) 5 atm

(3) 10 atm (4) 15 atm

26. Consider the equilibrium

$$CO_{2(g)} \rightleftharpoons CO_{(g)} + \frac{1}{2}O_{2(g)}$$

The equilibrium constant K is given by (when $\alpha << 1$)

(1) $K = \frac{\alpha^{3/2}}{\sqrt{2}}$ (2) $K = \frac{\alpha^3}{2}$

(3) $K = \frac{\alpha^{3/2}}{2}$ (4) $K = \frac{\alpha^{3/2}}{\sqrt{3}}$

27. For the reaction, $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$, If percentage dissociation of N_2O_4 are 25%, 50%, 75% and 100% then the sequence of observed vapour densities d_1, d_2, d_3 and d_4 at these conditions will be :-

(1) $d_1 > d_2 > d_3 > d_4$ (2) $d_4 > d_3 > d_2 > d_1$

(3) $d_1 = d_2 = d_3 = d_4$ (4) None of these

28. For the reaction $NH_4HS_{(s)} \rightleftharpoons NH_{3(g)} + H_2S_{(g)}$ in a closed flask, the equilibrium pressure is P atm . The standard free energy change (ΔG^o) of the reaction would be :-

(1) $-RT \ln p$

(2) $-2.303\ RT(\log P - \log 2)$

(3) $-2RT\ (\ln P - \ln 2)$

(4) $-2RT \ln P$

29. 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 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 while reduce the dissociation of N_2O_4

(4) will not disturb the equilibrium of the reactions

30. When sulphur in the form of gaseous S_8 is heated at 900K, the initial pressure of 1 atm is decreased by 30% at equilibrium. This is because of conversion of some $S_{8(g)}$ to $S_{2(g)}$. Find the value of equilibrium constant for this reaction :-

(1) 1.96 (2) 4.48

(3) 5.56 (4) 2.96

ANSWER KEY — Exercise-I

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**3**	**4**	**2**	**2**	**1**	**2**	**2**	**2**	**3**	**2**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**2**	**3**	**2**	**1**	**3**	**1**	**3**	**4**	**2**	**3**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**3**	**3**	**2**	**1**	**3**	**1**	**1**	**3**	**4**	**4**