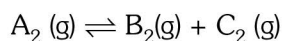


1. In a chemical equilibrium, the rate constant for the backward reaction is  $2 \times 10^{-4}$  and the equilibrium constant is 1.5. The rate constant for the forward reaction is:-  
 (1)  $2 \times 10^{-3}$  (2)  $5 \times 10^{-4}$   
 (3)  $3 \times 10^{-4}$  (4)  $9.0 \times 10^{-4}$
2. For the reaction  
 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}_{(s)} \rightleftharpoons \text{CuSO}_4 \cdot 3\text{H}_2\text{O}_{(s)} + 2\text{H}_2\text{O}_{(g)}$   
 Which one is correct representation :-  
 (1)  $K_p = (P_{\text{H}_2\text{O}})^2$  (2)  $K_c = [\text{H}_2\text{O}]^2$   
 (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)  $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$   
 (2)  $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$   
 (3)  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$   
 (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  $\text{S}_2^{2-}$ ,  $\text{S}_3^{2-}$ ,  $\text{S}_4^{2-}$  and so on. The equilibrium constant for the formation of  $\text{S}_2^{2-}$  is 12 ( $K_1$ ) & for the formation of  $\text{S}_3^{2-}$  is 132 ( $K_2$ ), both from S and  $\text{S}^{2-}$ . What is the equilibrium constant for the formation of  $\text{S}_3^{2-}$  from  $\text{S}_2^{2-}$  and S?  
 (1) 11 (2) 12  
 (3) 132 (4) None of these
6. What should be the value of  $K_c$  for the reaction  $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{SO}_{3(g)}$ , if the amount are  $\text{SO}_3 = 48$  g,  $\text{SO}_2 = 12.8$  g and  $\text{O}_2 = 9.6$  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  $\text{A} + 2\text{B} \rightleftharpoons 2\text{C} + \text{D}$ , 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  $\text{SO}_3$  is  $\alpha$  at equilibrium pressure  $p^0$ .  
 $K_p$  for  $2\text{SO}_3(g) \rightleftharpoons 2\text{SO}_2(g) + \text{O}_2(g)$   
 (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  $\text{A}(g) + 2\text{B}(g) \rightleftharpoons \text{C}(g)$  is  $0.25 \text{ dm}^6 \text{ mol}^{-2}$ . In a volume of  $5 \text{ dm}^3$ , 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,  
 $\text{A}(g) + 2\text{B}(g) \rightleftharpoons 3\text{C}(g)$  is  $2 \times 10^{-3}$   
 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,  $\text{H}_2(g)$  and  $\text{CO}_2(g)$  react to form  $\text{CO}(g)$  and  $\text{H}_2\text{O}(g)$ ,  $K_p$  for the reaction is 0.16.  
 If a mixture of 0.25 mole of  $\text{H}_2(g)$  and 0.25 mol of  $\text{CO}_2$  is heated at 675 K, mole % of  $\text{CO}(g)$  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.



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

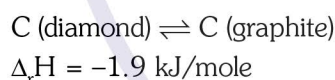
13. The equilibrium  $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$  shifts forward if :-

- (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.



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  $25^\circ\text{C}$  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  $4 \times 10^{-4}$  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)  $40 \times 10^{-4}$   
(2)  $4 \times 10^{-4}$   
(3)  $4 \times 10^{-3}$   
(4) difficult to compute without more data

20. In the reaction  $X(g) + Y(g) \rightleftharpoons 2Z(g)$ , 2 mol X, 1 mol Y and 1 mole Z are placed in a 10 litre vessel and allowed to reach equilibrium. 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  $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

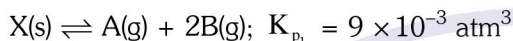
At equilibrium, 50%  $N_2O_4(g)$  is dissociated. What is the equilibrium constant (in  $\text{mol litre}^{-1}$ ) (molecular weight of  $N_2O_4 = 92$ ) :-

- (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)  $\text{CO}_2(\text{g}) + \text{C}(\text{s}) \rightleftharpoons 2\text{CO}(\text{g}); \Delta H^\circ = 172.5 \text{ kJ}$   
 (2)  $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_3\text{OH}(\text{l}); \Delta H^\circ = -21.7 \text{ kJ}$   
 (3)  $2\text{O}_3(\text{g}) \rightleftharpoons 3\text{O}_2(\text{g}); \Delta H^\circ = -285 \text{ kJ}$   
 (4)  $\text{H}_2(\text{g}) + \text{F}_2(\text{g}) \rightleftharpoons 2\text{HF}(\text{g}); \Delta H^\circ = 541 \text{ kJ}$

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



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 :

$\text{A} + 2\text{B} \rightleftharpoons \text{C} + 3\text{D}$ ; 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 :



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

- (1) 25 atm (2) 5 atm  
 (3) 10 atm (4) 15 atm

26. Consider the equilibrium



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

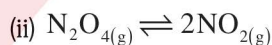
27. For the reaction,  $\text{N}_2\text{O}_{4(\text{g})} \rightleftharpoons 2\text{NO}_{2(\text{g})}$ , If percentage dissociation of  $\text{N}_2\text{O}_4$  are 25%, 50%, 75% and 100% then the sequence of observed vapour densities  $d_1, d_2, d_3$  and  $d_4$  at these conditions will be :-

- (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  $\text{NH}_4\text{HS}(\text{s}) \rightleftharpoons \text{NH}_3(\text{g}) + \text{H}_2\text{S}(\text{g})$  in a closed flask, the equilibrium pressure is P atm. The standard free energy change ( $\Delta G^\circ$ ) 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 :-



The addition of inert gas at constant volume :

- (1) will increase the dissociation of  $\text{PCl}_5$  as well as  $\text{N}_2\text{O}_4$ .  
 (2) will reduce the dissociation of  $\text{PCl}_5$  as well as  $\text{N}_2\text{O}_4$ .  
 (3) will increase the dissociation of  $\text{PCl}_5$  while reduce the dissociation of  $\text{N}_2\text{O}_4$ .  
 (4) will not disturb the equilibrium of the reactions

30. When sulphur in the form of gaseous  $\text{S}_8$  is heated at 900K, the initial pressure of 1 atm is decreased by 30% at equilibrium. This is because of conversion of some  $\text{S}_{8(\text{g})}$  to  $\text{S}_{2(\text{g})}$ . 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  |  |