Miscellaneous Exercise Question Bank

1. What concentration of CO_2 be in equilibrium with 0.025 M CO at 120°C for the reaction :

$$FeO(s) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$$

if the value of $K_c = 5.0$?

(A) 0.125 M **(B)** 0.0125 M **(C)** 1.25 M **(D)** 12.5 M

2. For the reaction $A(g) + 3B(g) \rightleftharpoons 2C(g)$ at 27°C, 2 moles of A, 4 moles of B and 6 moles of C are present in 2 litre vessel. If K_c for the reaction is 1.2, the reaction will proceed in :

(A) forward direction **(B)** backward direction

(C) neither direction **(D)** none of these

3. When sulphur (in the form of S_8) is heated at temperature T, at equilibrium, the pressure of S_8 falls by 30% from 1.0 atm, because $S_8(g)$ is partially converted into $S_2(g)$. Find the value of K_p for this reaction.

(A) 2.96 **(B)** 6.14 **(C)** 204.8 **(D)** None of these

4. In the presence of excess of $SrCl_2.2H_2O$ the amount of water taken up is governed by $K_p = 10^{12} atm^{-4}$ for the following reaction at 273K

$$SrCl_2 \cdot 2H_2O(s) + 4H_2O(g) \rightleftharpoons SrCl_2 \cdot 6H_2O(s)$$

What is equilibrium vapour pressure (in torr) of water in a closed vessel that contains $SrCl_2 \cdot 2H_2O(s)$?

(A) 0.001 torr **(B)** 10^3 torr **(C)** 0.76 torr **(D)** 1.31 torr

5. For the reaction $2A(g) \rightleftharpoons B(g) + 3C(g)$, at a given temperature, $K_c = 16$. What must be the volume of the flask, if a maximum of 2 mole each of A, B and C exist in equilibrium ?

(A) $\frac{1}{4}$ **(B)** $\frac{1}{2}$ **(C)** 1 **(D)** None of these

6. At 87°C the following equilibrium is established.

$$H_2(g) + S(s) \rightleftharpoons H_2S(g); K_c = 0.08$$

If 0.3 mole hydrogen and 2 mole sulphur are heated to 87°C in a 2L vessel, what will be the concentration of H_2S at equilibrium ?

(A) 0.011 M **(B)** 0.022 M **(C)** 0.044 M **(D)** 0.08 M

7. When heated, ammonium carbamate decomposes as follows :

$$NH_4COONH_2(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$$

At a certain temperature, the equilibrium pressure of the system is 0.318 atm. K_p for the reaction is :

(A) 0.128 **(B)** 0.426 **(C)** 4.76×10^{-3} **(D)** None of these

8. The equilibrium constant K_p for the reaction $H_2(g) + CO_2(g) \rightleftharpoons H_2O(g) + CO(g)$ is 4.0 at 1660°C. Initially 0.80 mole H_2 and 0.80 mole CO_2 are injected into a 5.0 litre flask. What is the equilibrium concentration of $CO_2(g)$?

(A) 0.533 M **(B)** 0.0534 M **(C)** 0.535 M **(D)** None of these

9. At 273K and 1 atm, 10 litre of N_2O_4 decomposes to NO_2 according to equation

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

What is degree of dissociation (α) when the original volume is 25% less than that of existing volume ?

(A) 0.25 **(B)** 0.33 **(C)** 0.66 **(D)** 0.5

10. The equilibrium constant for the reaction $CO(g)+H_2O(g) \rightleftharpoons CO_2(g)+H_2(g)$ is 5. How many moles of CO_2 must be added to 1 litre container already containing 3 moles each of CO and H_2O to make 2M equilibrium concentration of CO ?

(A) 15 **(B)** 19 **(C)** 5 **(D)** 20

11. At 27°C and 1 atm pressure, N_2O_4 is 20% dissociated into NO_2. What is the density of equilibrium mixture of N_2O_4 and NO_2 at 27°C and 1 atm ?

(A) 3.11 g/litre **(B)** 2.11 g/litre **(C)** 4.5 g/litre **(D)** None of these

12. $COCl_2$ gas dissociation according to the equation, $COCl_2(g) \rightleftharpoons CO(g)+Cl_2(g)$. When heated to 700K the density of the gas mixture at 1.16 atm and at equilibrium is 1.16 g/litre. The degree of dissociation of CO_2 at 700 K is :

(A) 0.8 **(B)** 0.6 **(C)** 0.72 **(D)** 0.48

13. Determine the value of equilibrium constant (K_c) for the reaction

$$A_2(g)+B_2(g) \rightleftharpoons 2AB(g)$$

If 10 moles of A_2; 15 moles of B_2 and 5 moles of AB are placed in a 2 litre vessel and allowed to come to equilibrium. The final concentration of AB is 7.5 M :

(A) 4.5 **(B)** 1.5 **(C)** 0.6 **(D)** None of these

14. At 87°C, the following equilibrium is established

$$H_2(g)+S(s) \rightleftharpoons H_2S(g); K_p = 7\times10^{-2}$$

If 0.50 mole of hydrogen and 1.0 mole of sulphur are heated to 87°C in 1.0 L vessel, what will be the partial pressure of H_2S at equilibrium ?

(A) 0.966 atm **(B)** 1.38 atm **(C)** 0.0327 atm **(D)** 1 atm

15. Pure PCl_5 is introduced into an evacuated chamber and comes to equilibrium at 247°C and $2.0\,atm$. The equilibrium gaseous mixture contains 40% chlorine by volume.

Calculate K_p at 247°C for the reaction $PCl_5(g) \rightleftharpoons PCl_3(g)+Cl_2(g)$

(A) 15 **(B)** 19 **(C)** 5 **(D)** 20

16. For the reaction $SnO_2(s)+2H_2(g) \rightleftharpoons 2H_2O(g)+Sn(\ell)$ calculate K_p at $900\,K$, where the equilibrium steam-hydrogen mixture was 45% H_2 by volume :

(A) 1.49 **(B)** 1.22 **(C)** 0.67 **(D)** None of these

17. For the reaction $XCO_3(s) \rightleftharpoons XO(s)+CO_2(g), K_p = 1.642\,atm$ at 727°C. If 4 moles of $XCO_3(s)$ was put into a 50 litre container and heated to 727°C. What mole percent of the XCO_3 remains unreacted at equilibrium ?

(A) 20 **(B)** 30 **(C)** 50 **(D)** None of these

18. $Fe_2O_3(s)$ may be converted to Fe by the reaction $Fe_2O_3(s) + 3H_2(g) \rightleftharpoons 2Fe(s) + 3H_2O(g)$, for which $K_c = 8$ at temp. 720°C.

What percentage of the H_2 remains unreacted after the reaction has come to equilibrium ?

(A) $\simeq 22\%$ **(B)** $\simeq 34\%$ **(C)** $\simeq 66\%$ **(D)** $\simeq 78\%$

19. $AB_3(g)$ is dissociated as $AB_3(g) \rightleftharpoons AB_2(g) + \frac{1}{2}B_2(g)$.

When the initial pressure of AB_2 is 800 torr and the total pressure developed at equilibrium is 900 torr. What fraction of $AB_3(g)$ is dissociated ?

(A) 10% **(B)** 20%
(C) 25% **(D)** 30%

20. At 1000 K, a sample of pure NO_2 gas decomposes as :

$$2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$$

The equilibrium constant K_p is 156.25 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 :

(A) 0.01 **(B)** 0.02
(C) 0.04 **(D)** None of these

21. Pure nitrosyl chloride (NOCl) gas was heated to 240°C in a 1.0 L container. At equilibrium the total pressure was 1.0 atm and the NOCl pressure was 0.64 atm. What would be the value of K_p ?

(A) 1.02 atm **(B)** 16.875×10^{-3} atm
(C) 16×10^{-2} atm **(D)** None of these

22. At a certain temperature the equilibrium constant K_c is 0.25 for the reaction

$$A_2(g) + B_2(g) \rightleftharpoons C_2(g) + D_2(g)$$

If we take 1 mole of each of the four gases in a 10 litre container, what would be equilibrium concentration of $A_2(g)$?

(A) 0.331 M **(B)** 0.033 M **(C)** 0.133 M **(D)** 1.33 M

23. The vapour pressure of mercury is 0.002 mm Hg at 27°C. K_c for the process $Hg(\ell) \rightleftharpoons Hg(g)$ is :

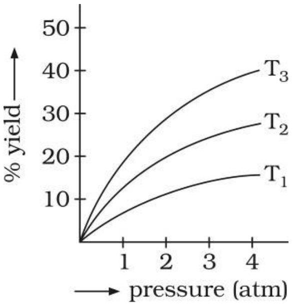
(A) 0.002 **(B)** 8.12×10^{-5}
(C) 6.48×10^{-5} **(D)** 1.068×10^{-7}

24. Calculate the equilibrium constant (K_c) for the reaction below if they are present at equilibrium 5.0 mole of A_2, 3 mole of B_2 and 2 mole of AB_2 at 8.21 atm and 300 K

$$A_2(g) + 2B_2(g) \rightleftharpoons 2AB_2(g) + \text{Heat}$$

(A) 1.333 **(B)** 2.66 **(C)** 20 **(D)** None of these

25. The preparation of $SO_3(g)$ by the reaction $SO_2(g)+\frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$ is an exothermic reaction. If the preparation follows the following temperature-pressure relationship for its % yield, then for temperatures T_1, T_2 and T_3. The correct option is :



(A) $T_3 > T_2 > T_1$

(B) $T_1 > T_2 > T_3$

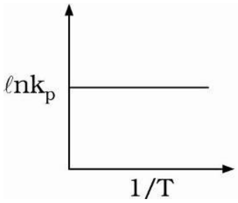
(C) $T_1 = T_2 = T_3$

(D) Nothing could be predicted about temperature through given information

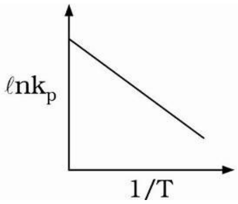
26. When 3.06 g of solid NH_4HS is introduced into a 2 litre evacuated flask at 27°C, 30% of the solid decomposed into gaseous ammonia and hydrogen sulphide. Calculate K_c of reaction.

(A) 8.1×10^{-5} **(B)** 9×10^{-4} **(C)** 1.3×10^{-5} **(D)** 4×10^{-5}

27. An exothermic reaction is represented by the graph :



(A)



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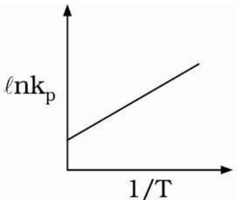

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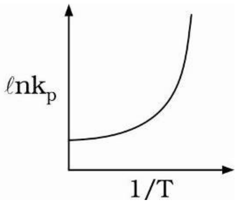
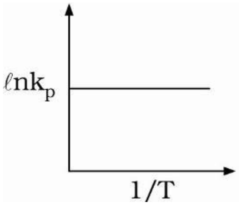
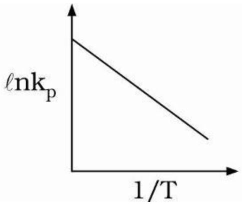


(D)

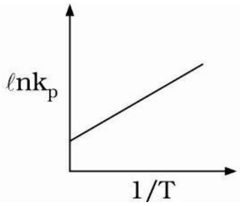
28. An endothermic reaction is represented by the graph :



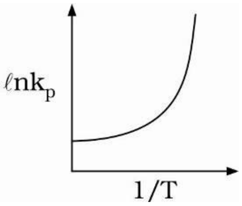
(A)



(B)



(C)



(D)

29. K_p has the value of $10^{-6}atm^3$ and $10^{-4}atm^3$ at 298 K and 323 K respectively for the reaction

$$CuSO_4\cdot3H_2O(s) \rightleftharpoons CuSO_4(s)+3H_2O(g)$$

$\Delta_rH°$ for the reaction is :

(A) 7.7 kJ/mol **(B)** -147.41 kJ / mol

(C) 147.41 kJ/mol **(D)** None of these

30. For the reaction at 300K

$$A(g) \rightleftharpoons V(g)+S(g)$$

$$\Delta_rH° = -30\,kJ/mol,\ \Delta_rS° = -0.1\,kJ\cdot K^{-1}\cdot mol^{-1}$$

What is the value of equilibrium constant ?

(A) 0 **(B)** 1 **(C)** 10 **(D)** None of these

31. Solid $Ca(HCO_3)_2$ decomposes as

$$Ca(HCO_3)_2(s) \rightleftharpoons CaCO_3(s) + CO_2(g) + H_2O(g)$$

If the total pressure is 0.2 bar at 420K, what is the standard free energy change for the given reaction $(\Delta_r G^\circ)$?

(A) 840 kJ/mol **(B)** 3.86 kJ/mol **(C)** 6.98 kJ/mol **(D)** 16.083 kJ/mol

32. The following equilibrium constant were determined at 1120 K :

$$2CO(g) \rightleftharpoons C(s) + CO_2(g); \qquad K_{P_1} = 10^{-14} atm^{-1}$$

$$CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g); \qquad K_{P_2} = 6 \times 10^{-3} atm^{-1}$$

What is the equilibrium constant K_c for the following reaction at 1120 K :

$$C(s) + CO_2(g) + 2Cl_2(g) \rightleftharpoons 2COCl_2(g)$$

(A) $3.31 \times 10^{11} M^{-1}$ **(B)** $5.5 \times 10^{10} M^{-1}$

(C) $5.51 \times 10^{6} M^{-1}$ **(D)** None of these

33. One mole of $N_2(g)$ is mixed with 2 moles of $H_2(g)$ in a 4 litre vessel. If 50% of $N_2(g)$ is converted to NH_3 according to reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, what will be the value of K_c for the following equilibrium ?

$$NH_3(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$$

(A) 256 **(B)** 16 **(C)** $\frac{1}{16}$ **(D)** None of these

34. Assume that the decomposition of HNO_3 can be represented by the following equation

$$4HNO_3(g) \rightleftharpoons 4NO_2(g) + 2H_2O(g) + O_2(g)$$

and the reaction approaches equilibrium at 400 K temperature and 30 atm pressure. At equilibrium partial pressure of HNO_3 is 2 atm. Calculate K_c in $(mol/L)^3$ at 400 K :

(Use : $R = 0.08$ atm - L / mol - K)

(A) 4 **(B)** 8 **(C)** 16 **(D)** 32

35. For the equilibrium $LiCl \cdot 3NH_3(s) \rightleftharpoons LiCl \cdot NH_3(s) + 2NH_3(g)$; $K_P = 9\,atm^2$ at 37°C. A 5 litre vessel contains 0.1 mole of $LiCl \cdot NH_3$. How many moles of NH_3 should be added to the flask at this temperature to drive the backward reaction for completion ?
(Use : $R = 0.082$ atm - L / mol - K)

(A) 0.2 **(B)** 0.59 **(C)** 0.69 **(D)** 0.79

36. For the reaction $C_2H_6(g) \rightleftharpoons C_2H_4(g) + H_2(g)$

K_P is 5×10^{-2} atm. Calculate the mole per cent of $C_2H_6(g)$ at equilibrium if pure C_2H_6 at 1 atm is passed over a suitable catalyst at 900 K :

(A) 20 **(B)** 33.33 **(C)** 66.66 **(D)** None of these

37. $2\,NOBr(g) \rightleftharpoons 2\,NO(g) + Br_2(g)$.

If nitrosyl bromide (NOBr) is 40% dissociated at certain temperature and a total pressure of 0.30 atm. K_P for the reaction $2\,NO(g) + Br_2(g) \rightleftharpoons 2\,NOBr(g)$ is :

(A) 45 **(B)** 25 **(C)** 0.022 **(D)** 0.25

38. Consider the partial decomposition of A as $2A(g) \rightleftharpoons 2B(g) + C(g)$

At equilibrium 700 mL gaseous mixture contain 100 mL of gas C at 10 atm and 300 K. What is the value of K_P for the reaction ?

(A) $\frac{40}{7}$ **(B)** $\frac{1}{28}$ **(C)** $\frac{10}{28}$ **(D)** $\frac{28}{10}$

39. At a certain temperature and 2 atm pressure equilibrium constant (K_P) is 25 for the reaction

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

Initially if we take 2 moles of each of the four gases and 2 moles of inert gas, what would be the equilibrium partial pressure of NO_2 ?

(A) 1.33 atm **(B)** 0.1665 atm **(C)** 0.133 atm **(D)** None of these

40. A reaction system in equilibrium according to reaction $2\,SO_2(g) + O_2(g) \rightleftharpoons 2\,SO_3(g)$ in one litre vessel at a given temperature was found to be 0.12 mole each of SO_2 and SO_3 and 5 mole of O_2. Another vessel of one litre contains 32g of SO_2 at the same temperature. What mass of O_2 must be added to this vessel in order that at equilibrium 20% of SO_2 is oxidized to SO_3 ?

(A) 0.4125 g **(B)** 11.6 g **(C)** 1.6 g **(D)** None of these

41. The equilibrium constant K_P for the reaction $N_2O_4(g) \rightleftharpoons 2\,NO_2(g)$ is 4.5

What would be the average molar mass (in g/mol) of an equilibrium mixture of N_2O_4 and NO_2 formed by the dissociation of pure N_2O_4 at a total pressure of 2 atm ?

(A) 69 **(B)** 57.5 **(C)** 80.5 **(D)** 85.5

42. A flask containing 0.5 atm pressure of $A_2(g)$, some AB added into flask which undergoes dissociation according to $2\,AB(s) \rightleftharpoons A_2(g) + B_2(g)$ $K_P = 0.06\,atm^2$?

The total pressure (in atm) at equilibrium is :

(A) 0.70 **(B)** 0.6 **(C)** 0.10 **(D)** None of these

43. For the reaction $2A(g) + B(g) \rightleftharpoons C(g) + D(g); K_c = 10^{12}$. If initial moles of A, B, C and D are 2, 1, 7 and 3 moles respectively in a one litre vessel. What is the equilibrium concentration of A ?

(A) 4×10^{-4} **(B)** 2×10^{-4} **(C)** 10^{-4} **(D)** 8×10^{-4}

44. The equilibrium constant for the reaction in aqueous solution

$$H_3BO_3 + \text{glycerin} \rightleftharpoons (H_3BO_3 - \text{glycerin}) \text{ is } 0.90.$$

How many moles of glycerin should be added per litre of 0.10 M H_3BO_3 so that 80% of the H_3BO_3 is converted to the boric-acid-glycerin complex ?

(A) 4.44 **(B)** 4.52 **(C)** 3.6 **(D)** 0.08

45. One mole of SO_3 was placed in a two litre vessel at a certain temperature. The following equilibrium was established in the vessel $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$ the equilibrium mixture reacted with 0.2 mole $KMnO_4$ in acidic medium. Hence, K_c is :

(A) 0.50 **(B)** 0.25
(C) 0.125 **(D)** None of these

46. The equilibrium constant for the ionization of $RNH_2(g)$ in water as

$$RNH_2(g) + H_2O(\ell) \rightleftharpoons RNH_3^+(aq) + OH^-(aq)$$

is 8×10^{-6} at 25°C. Find the pH of a solution at equilibrium when pressure of $RNH_2(g)$ is 0.5 bar:

(A) ≈ 12.3 **(B)** ≈ 11.3
(C) ≈ 11.45 **(D)** None of these

47. For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, which of the following factors will have no effect on the value of equilibrium constant ?

(A) Temperature **(B)** Initial concentration of N_2O_4
(C) Pressure of catalyst **(D)** Pressure

48. For the equilibrium at 298 K; $N_2O_4(g) \rightleftharpoons 2NO_2(g)$; $G^o_{N_2O_4} = 100\,\text{kJ mol}^{-1}$ and $G^o_{NO_2} = 50\,\text{kJ mol}^{-1}$. If 5 mol of N_2O_4 and 2 moles of NO_2 are taken initially in one litre container than which statement are correct.

(A) reaction proceeds in forward direction
(B) $K_c = 1$
(C) $\Delta G = -0.55\,\text{KJ}, \Delta G^o = 0$
(D) At equilibrium $[N_2O_4] = 4.84\,\text{M}$ and $[NO_2] = 2.212\,\text{M}$

49. Which are true for the reaction : $A_2 \rightleftharpoons 2C + D$?

(A) If $\Delta H = 0$; K_P increases with temperature and dissociation.
(B) If $\Delta H = +\text{ve}$; K_P increases with temperature and dissociation of A_2 increases.
(C) If $\Delta H = -\text{ve}$; K_P increases with temperature and dissociation of A_2 decreases.
(D) $K_P = 4\alpha^3\left[\dfrac{P}{1+2\alpha}\right]^2$

50. Select the incorrect statements :

(A) K_P or K_c are dimension less if pressure or concentration are expressed in standard state.
(B) The numerical value of K_P changes with experimental conditions, i.e. P, T and C at which equilibrium is attained.
(C) Active mass of reactant $\propto$ concentration of reactant.
(D) Dissolution of NH_3 in water increases with increasing pressure.

51. At temperature T_1, the compound $AB_2(g)$ dissociates according to the reaction.

$$2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$$

With degree of dissociation ,X, which is small compared with unity. Deduces the expression or x in terms of the equilibrium constant k_p and the total pressure p.

(A) $x = (2kp / p)^{1/3}$ **(B)** $x = (3kp / p)^3$

(C) $x = (2kp / 2p)^{1/3}$ **(D)** $x = (2kp / 3p)^{1/3}$

52. Given value of $\Delta G°$ at $25°C$ for liquid ethanol (–174.9 kJ/mol) and gaseous ethanol (– 168.6 kJ/mol). Calculate the vapour pressure of ethanol at $25°C$

(A) 0.06 atm **(B)** 0.034 atm **(C)** 0.079 atm **(D)** 0.71 atm

53. Unit of equilibrium constant is :

(A) $(\text{mol L}^{-1})^{1-n}$ **(B)** $(\text{mol L}^{-1})^{\Delta n}$ **(C)** $(\text{atm})^{\Delta n}$ **(D)** All of these

54. The rate of disappearance of A at two temperature is given by $A \rightleftharpoons B$

(i) $\dfrac{-d[A]}{dt} = 2 \times 10^{-2}[A] - 4 \times 10^{-3}[B]$ at 300 K

(ii) $\dfrac{-d[A]}{dt} = 4 \times 10^{-2}[A] - 16 \times 10^{-4}[B]$ at 400 K

From the given values of heat of reaction which are incorrect?

(A) 3.86 kcal **(B)** 6.93 kcal **(C)** 1.68 kcal **(D)** 1.68×10^{-2} kcal

55. In the dissociation of PCl_5 as $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ if the degree of dissociation is α at equilibrium pressure P, then the equilibrium constant for the reaction is :

(A) $K_P = \dfrac{\alpha^2}{1+\alpha^2 P}$ **(B)** $K_P = \dfrac{\alpha^2 P^2}{1-\alpha^2}$ **(C)** $K_P = \dfrac{P^2}{1-\alpha^2}$ **(D)** $K_P = \dfrac{\alpha^2 P}{1-\alpha^2}$

56. For a hypothetical reaction of the kind $AB_2(g) + \frac{1}{2}B_2(g) \rightleftharpoons AB_2(g);\ \Delta H = -x\,kJ$

More AB_3 could be produced at equilibrium by

(A) Using a catalyst **(B)** Removing some of B_2

(C) Increasing the temperature **(D)** Increasing the pressure

57. The equilibrium constant for a reaction, $A + B \rightleftharpoons C + D$ is 1.0×10^{-2} at 298 and is 2.0 at 373K. The chemical process resulting in the formation of C and D is :

(A) Exothermic **(B)** Endothermic

(C) Unpredictable **(D)** None of these

58. The equilibrium constant for a reaction, $A + 2B \rightleftharpoons 2C$ is 40. The equilibrium constant for reaction $C \rightleftharpoons B + 1/2A$ is :

(A) 1/40 **(B)** $(1/40)^{1/2}$ **(C)** $(1/40)^2$ **(D)** 4

59. The decomposition of N_2O_4 to NO_2 is carried out at 280°C in chloroform. When equilibrium is reached, 0.2 mole of N_2O_4 and 2×10^{-3} mole of NO_2 are present in a 2L solution. The equilibrium constant for the reaction $N_2O_4 \rightleftharpoons 2NO_2$ is :

(A) 1×10^{-2} **(B)** 2×10^{-3}

(C) 1×10^{-5} **(D)** 2×10^{-5}

60. For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, the degree of dissociation at equilibrium is 0.2 at 1 atm pressure. The equilibrium constant K_P will be :

(A) 1/2 **(B)** 1/4 **(C)** 1/6 **(D)** 1/8

61. 4 mole of carbon dioxide was heated in $1\,dm^3$ vessel under conditions which at equilibrium, undergo 25% dissociation into carbon monoxide and oxygen. The number of moles of carbon monoxide produced :

(A) 0.5 **(B)** 1.0 **(C)** 2.0 **(D)** 4.0

62. 1 mole of N_2 is mixed with 3 mole of H_2 in a litre container. If 50 % of N_2 is converted into ammonia by the reaction $N_2(g)+3H_2(g) \rightleftharpoons NH_3(g)$, then the total number of moles of gas at the equilibrium are:

(A) 1.5 **(B)** 4.5 **(C)** 3.0 **(D)** 6.0

63. For a reaction: $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$ at certain temperature, the value of equilibrium constant is 50. If the volume of the vessel is reduced to half of its original volume, the value of new equilibrium constant will be :

(A) 25 **(B)** 50 **(C)** 100 **(D)** Unpredictable

64. XY_2 dissociates $XY_2(g) \rightleftharpoons XY(g)+Y(g)$. When the initial pressure of XY_2 is 600 mm Hg, the total equilibrium pressure is 800 mm Hg. Calculate K for the reaction. Assuming that the volume of the system remains unchanged.

(A) 50.0 **(B)** 100.0 **(C)** 166.6 **(D)** 400.0

65. Consider the reaction $A(g)+B(g) \rightleftharpoons C(g)+D(g)$

Which occurs in one step. The specific rate constant are 0.25 and 5000 for the forward and reverse reaction, respectively. The equilibrium constant is :

(A) 2×10^{-4} **(B)** 4.0×10^{2}

(C) 5.0×10^{-5} **(D)** 2.5×10^{-6}

66. For the equilibrium system $2HX(g) \rightleftharpoons H_2(g)+X_2(g)$ the equilibrium constant is 1.0×10^{-5}. What is the concentration of HX if the equilibrium concentration of H_2 and X_2 are $1.2\times10^{-3}M$, and $1.2\times10^{-4}M$ respectively ?

(A) $12\times10^{-4}M$ **(B)** $12\times10^{-3}M$

(C) $12\times10^{-2}M$ **(D)** $12\times10^{-1}M$

67. In alkaline solution, the following equilibria exist

(a) $S^{2-} + S \longrightarrow S_2^{2-}$ equilibrium constant K_1

(b) $S_2^{2-} + S \longrightarrow S_3^{2-}$ equilibrium constant K_2

K_1 and K_2 have values 12 and 11, respectively.

$S_3^{2-} \longrightarrow S^{2-} + 2S$. What is equilibrium constant for the reaction ;

(A) 132 **(B)** 7.58×10^{-3} **(C)** 1.09 **(D)** 0.918

68. Given the equilibrium constants

$HgCl^{+} + Cl^{-} \longrightarrow HgCl_2, K_1 = 3 \times 10^{6}$

$HgCl_2 + Cl^{-} \longrightarrow HgCl_3^{-}, K_2 = 8.9$

The equilibrium constant for the disproportionation equilibrium

$2HgCl_2 \longrightarrow HgCl^{+} + HgCl_3^{-}$ is :

(A) -3.3×10^{5} **(B)** 3×10^{-5} **(C)** 3.3×10^{5} **(D)** 3×10^{-6}

69. The vapour density of a mixture consisting of NO_2 and N_2O_4 is 38.3 at 275K. The number of moles of NO_2 in the mixture is :

(A) 0.2 **(B)** 0.4 **(C)** 0.8 **(D)** 1.6

70. In the Q. 218, the number of mole of N_2O_4 in 100 g of the mixture is :

(A) 0.43 **(B)** 0.86 **(C)** 0.57 **(D)** 0.2

71. One mole of SO_3 was placed in a litre reaction flask at a given temperature when the reaction equilibrium was established in the reaction $2SO_3 \rightleftharpoons 2SO_2 + O_2$ the vessel was found to contain 0.6 mol of SO_2. The value of the equilibrium constant is :

(A) 0.36 **(B)** 0.675 **(C)** 0.45 **(D)** 0.54

72. The equilibrium constant for the reaction $W + X \rightleftharpoons Y + Z$ is 9. If one mole of each of W and X are mixed and there is no change in volume, the number of moles of Y formed is :

(A) 0.10 **(B)** 0.50 **(C)** 0.75 **(D)** 0.54

73. The equilibrium constant K for the reaction $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ at room temperature is 2.85 and that at 698 K is 1.4×10^{-2}. This implies :

(A) HI is exothermic compound **(B)** HI is very stable at room temperature

(C) HI is relatively less stable than H_2 and I_2.

(D) HI is resonance stabilised.

74. K_1 and K_2 are equilibrium constants for reaction (i) and (ii)

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ .... (i)

$NO(g) \rightleftharpoons 1/2N_2(g) + 1/2O_2(g)$ .... (ii)

Then,

(A) $K_1 = (1/K_2)^2$ **(B)** $K_1 = K_2^2$ **(C)** $K_1 = 1/K_2$ **(D)** $K_1 = (K_2)^3$

75. In a chemical reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, at equilibrium point :

(A) Equal volumes of N_2 and H_2 are reacting

(B) Equal masses of N_2 and H_2 are reacting

(C) The reaction has stopped

(D) The same amount of ammonia is formed as is decomposed into N_2 and H_2

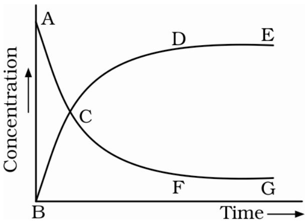
76. $N_2O_4 \rightleftharpoons 2NO_2, K_c = 4$ This reversible reaction is studied graphically as shown in the given figure. Select the correct statements out of I, II and III.

I : Reaction quotient has maximum value at point A.

II : Reaction proceeds left to right at a point when.

$[N_2O_4] = [NO_2] = 0.1M$.

III : $K_c = Q$ when point D or F is reached.



(A) I, II **(B)** II, III **(C)** I, III **(D)** I, II, III

77. For the system $A(g) + 2B(g) \rightleftharpoons C(g)$ the equilibrium concentration is :

$A = 0.06\,\text{mol L}^{-1}; B = 0.12\,\text{mol L}^{-1}$

$C = 0.216\,\text{mol L}^{-1}$ The K_{eq} for the reaction is :

(A) 250 **(B)** 416

(C) 4×10^{-3} **(D)** 125

78. 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 value of equilibrium constant is :

(A) 4 **(B)** 1

(C) 1/2 **(D)** 1/4

79. At certain temperature 50% of HI is dissociated into H_2 and I_2, the equilibrium constant is :

(A) 1.0 **(B)** 3.0

(C) 0.5 **(D)** None of these

80. For reaction $A(g) \rightleftharpoons B(g) + C(g)$. K_P at 400°C is 1.5×10^{-4} and K_P at 600°C is 6×10^{-3}. Which statement is incorrect ?

(A) The reaction is exothermic

(B) Increase in temperature increases the formation of B

(C) Increase in pressure increases the formation of A

(D) Decrease in temperature and increase in pressure shift the equilibrium backward

81. 8 mol of a gas AB_3 are introduced into a $1.0\,dm^3$ vessel. It dissociates as

$2\,AB_3(g) \rightleftharpoons A_2(g) + 3B_2(g)$

At equilibrium, 2 mol of A_2 is found to be present. The equilibrium constant for the reaction is:

(A) $2\ mol^2\,L^{-2}$ **(B)** $3\,mol^2\,L^{-2}$

(C) $27\,mol^2\,L^{-2}$ **(D)** $36\,mol^2\,L^{-2}$

82. 1 mol of XY(g) and 0.2 mol of Y(g) are mixed in 1L vessel. At equilibrium, 0.6 mol of $Y(g)$ is present. The value of K for the reaction $XY(g) \rightleftharpoons X(g) + Y(g)$ is :

(A) $0.6\ mol\ L^{-1}$ **(B)** $0.8\ mol\ L^{-1}$

(C) $0.2\ mol\ L^{-1}$ **(D)** $0.4\ mol\ L^{-1}$

83. For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, the value of K_P is 1.7×10^3 at 600 K. Which of the following is/are correct ?

(A) The proportions of NO_2 in the equilibrium mixture is increased by decrease in pressure

(B) The standard enthalpy change for the forward reaction is negative

(C) Units of K_P are atm^{-1}

(D) At 600 K the degree of dissociation N_2O_4 decreases by 50% by decreasing the pressure

Paragraph for Question No. 84 – 86

Two solids X and Y dissociate into gaseous products at a certain temperature as follows :

(i) $X(s) \rightleftharpoons A(g) + C(g)$ and **(ii)** $Y(s) \rightleftharpoons B(g) + C(g)$

At a given temperature, pressure over excess solid 'X' is 40 mm of Hg and total pressure over solid 'Y(s)' is 60 mm of Hg.

Now, answer the following questions :

84. Ratio of K_P for reaction (i) to that of reaction (ii), is :

(A) 4 : 9 **(B)** 2 : 3 **(C)** 4 : 9 **(D)** 2 : 1

85. The ratio of moles of A and B in the vapour state over a mixture of solids X and Y, is :

(A) 2 : 3 **(B)** 2 : 5 **(C)** 4 : 9 **(D)** 1 : 1

86. The total pressure of gasses over a mixture of solids X and Y is :

(A) 100 mm **(B)** 74.84 mm **(C)** 50 mm **(D)** 120.74 mm

87. The equilibrium pressure of $NH_4CN(s) \rightleftharpoons NH_3(g) + HCN(g)$ is 2.98 atm. Calculate K_P. If $NH_4CN(s)$ is allowed to decompose in pressure of NH_3 at 0.25 atm, calculate partial pressure of HCN at equilibrium.

88. For a gaseous phase reaction $A + 2B \rightleftharpoons AB_2$, $K_c = 0.3475\,L^2\,mole^{-2}$ at 200°C. When 2 moles of B are mixed with one mole of A, what total pressure is required to convert 60% of A in AB_2?

89. For a reaction $2HI \rightleftharpoons H_2 + I_2$, at equilibrium 7.8g, 203.2g and 1638.4g of H_2, I_2 and HI, respectively were found. Calculate K_c.

90. 60 mL of H_2 and 42 mL of I_2 are heated in a closed vessel. At equilibrium, the vessel contains 20mL HI. Calculate degree of dissociation of HI.

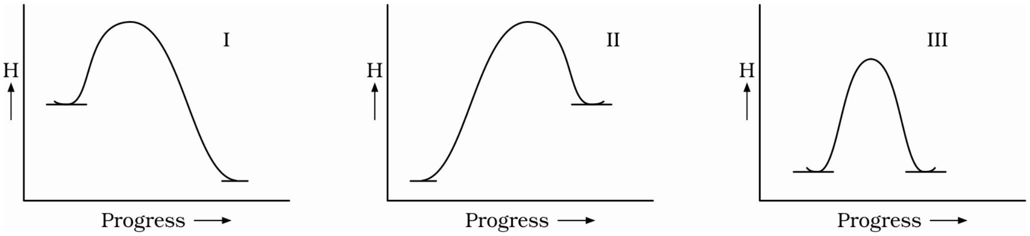
91. In the dissociation of HI, 20% of HI is dissociated at equilibrium. Calculate K_P for

$$HI(g) \rightleftharpoons 1/2H_2(g) + 1/2I_2(g)$$

92. The value of K_P for dissociation of $2HI \rightleftharpoons H_2 + I_2$ is 1.84×10^{-2}. If the equilibrium concentration of H_2 is 0.4789 mole L^{-1}, calculate the concentration of HI at equilibrium.

93. 0.96 g of HI were, heated to attain equilibrium $2HI \rightleftharpoons H_2 + I_2$. The reaction mixture on titration requires 15.7 mL of N/10 hypo solution. Calculate the degree of dissociation of HI.

94. In which case increase in temperature will increase the quantity of the product ?



(A) I, II **(B)** I, III **(C)** II, III **(D)** II

95. The degree of dissociation of PCl_5 at 1 atm pressure is 0.2. Calculate the pressure at which PCl_5 is dissociated to 50% ?

96. A reaction carried out by 1 mol N_2 and 3 mol of H_2 shows at equilibrium the mole fraction of NH_3 as 0.012 at 500°C and 10 atm pressure. Calculate K_P. Also report the pressure at which mole % of NH_3 in equilibrium mixture is increased to 10.4.

97. For $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$, the observed, pressure for reaction mixture in equilibrium is 1.12 atm. If 50% of CO_2 reacts, calculate K_P.

98. Would 1% CO_2 in air be sufficient to prevent any loss in weight when M_2CO_3 is heated at 120°C?

$M_2CO_3(s) \rightleftharpoons M_2O(s) + CO_2(g)$

$K_P = 0.0095\,atm$ at 120°C. How much would the partial pressure of CO_2 have to be to promote this reaction at 120°C ?

99. NO_2 (brown colour gas) exists in equilibrium with N_2O_4 (colourless gas) as given by chemical equation

$$2NO_2 \rightleftharpoons N_2O_4$$

Mixture is slightly brown due to existence of NO_2 . If pressure is increased

(A) colour intensity is increased

(B) colour intensity is decreased

(C) colour intensity first increases and then decreases

(D) no change in colour intensity

100. NO and Br_2 at initial pressures of 98.4 and 41.3 torr respectively were allowed to react at 300 K. At equilibrium the total pressure was 110.5 torr. Calculate the value of equilibrium constant, K_P and the standard free energy change at 300 K for the reaction:

$$2\,NO(g) + Br_2(g) \rightleftharpoons 2\,NOBr(g)$$