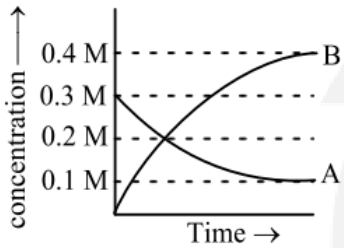
KATTAR NEET 2026

Physical Chemistry By Amit Mahajan Sir

Chemical Equilibrium

Q1 $K_c = 9$ for the reaction, $A + B \rightleftharpoons C + D$. If one mole of each A and B are taken, then amount of C in equilibrium is :
(A) 1 mol (B) 0.25 mol
(C) 0.75 mol (D) 0.50 mol

Q2 The figure show the change in concentration of species A and B as a functional of time. The equilibrium constant K_C for the reaction $A(g) \rightleftharpoons 2B(g)$ is:



(A) $K_C > 1$
(B) $K < 1$
(C) $K = 1$
(D) data insufficient

Q3 A chemical reaction is at equilibrium when:
(A) Reactants are completely transformed into products
(B) The rates of forward and backward reactions are equal
(C) Formation of products is minimized
(D) Equal amounts of reactants and products are present

Q4 A reversible reaction is one which:
(A) Proceeds in one direction
(B) Proceeds in both directions
(C) Proceeds spontaneously
(D) All the statements are wrong

Q5 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:
(A) 0.03 atm (B) 0.25 atm
(C) 0.025 atm (D) 0.04 atm

Q6 64g of HI is present in a 2 litre vessel. The active mass of HI is:
(A) 0.5 M (B) 0.25 M
(C) 1 M (D) 0.75 M

Q7 For which of the following K_p may be equal to 0.5 atm
(A) $2\,HI\,(g) \rightleftharpoons H_2\,(g) + I_2\,(g)$
(B) $PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$
(C) $N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2\,NH_3\,(g)$
(D) $2NO_2(g) \rightleftharpoons N_2O_4\,(g)$

Q8 The vapour density of undecomposed N_2O_4 is 46. When heated, vapour density decreases to 25.4 due to its dissociation to NO_2. The % dissociation of N_2O_4 at the final temperature is near by;
(A) 80 (B) 60
(C) 70 (D) 40

Q9 If pressure is applied to the following equilibrium, liquid $\rightleftharpoons$ vapours, the boiling point of liquid
(A) will increase
(B) will decrease
(C) may increase or decrease
(D) will not change

Q10 For the reaction
$A_{(g)} + B_{(g)} \rightleftharpoons 3C_{(g)}$ at 250°C, a 3 litre vessel contains 1, 2 and 4 mole of A, B and C

respectively. If K_C for the reaction is 10, the reaction will proceed in
(A) Forward direction
(B) Backward direction
(C) In equilibrium
(D) None of these

Q11 At a certain temperature 2 moles of carbonmonoxide and 3 moles of chlorine were allowed to reach equilibrium according to the reaction $CO + Cl_2 \rightleftharpoons COCl_2$ in a 5 lit vessel. At equilibrium if one mole of CO is present then equilibrium constant for the reaction is:
(A) 2 (B) 2.5
(C) 3.0 (D) 4

Q12 The reaction: $3O_2 \rightleftharpoons 2O_3$, $\Delta H = +69{,}000$ calories is favoured in forward direction by:
(A) high temperature and low pressure
(B) high temperature and high pressure
(C) low temperature and high pressure
(D) low temperature and low pressure

Q13 Which of the following reactions represent a heterogenous equilibrium?
(A) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
(B) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$
(C) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
(D) $2O_3(g) \rightleftharpoons 3O_2(g)$

Q14 Equilibrium constant for the reactions,
$2NO + O_2 \rightleftharpoons 2NO_2$ is K_{C_1};
$NO_2 + SO_2 \rightleftharpoons SO_3 + NO$ is K_{C_2} and
$2SO_3 \rightleftharpoons 2SO_2 + O_2$ is K_{C_3}
then **correct** relation is:
(A) $K_{C_3} = K_{C_1} \times K_{C_2}$
(B) $K_{C_3} \times K_{C_1} \times K_{C_2}^2 = 1$
(C) $K_{C_3} \times K_{C_1} \times K_{C_2} = 1$
(D) $K_{C_3} \times K_{C_1}^2 \times K_{C_2} = 1$

Q15 Pure ammonia is placed in a vessel at temperature where its dissociation constant (α) is appreciable. At equilibrium:
(A) K_p does not change significantly with pressure
(B) α does not change with pressure
(C) Concentration of NH_3 does not change with pressure
(D) Concentration of H_2 is less than that of N_2

Q16 $SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$
If observed vapour density of mixture at equilibrium is 35 then find out value of α:
(A) 0.28 (B) 0.38
(C) 0.48 (D) 0.58

Q17 Which oxide of nitrogen is the most stable -
(A) $2NO_{2(g)} \rightleftharpoons N_{2(g)} + 2O_{2(g)}$; $K = 6.7 \times 10^{16}$ mol litre^{-1}
(B) $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$; $K = 2.2 \times 10^{30}$ mol litre^{-1}
(C) $2N_2O_{5(g)} \rightleftharpoons 2N_{2(g)} + 5O_{2(g)}$; $K = 1.2 \times 10^{34}$ mol^{-5} litre^{-5}
(D) $2N_2O_{(g)} \rightleftharpoons 2N_{2(g)} + O_{2(g)}$; $K = 3.5 \times 10^{33}$ mol litre^{-1}

Q18 The equilibrium constant of the reaction
$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$
at 100°C is 50. If one litre flask containing one mole of A_2 is connected to a two litre flask containing two moles of B_2, the number of moles of AB formed at 373 K will be -
(A) 1.87 (B) 2.317
(C) 18.86 (D) 0.943

Q19 The equilibrium composition for the reaction is -
$PCl_3 + Cl_2 \rightleftharpoons PCl_5$
0.20 0.10 0.40 moles/litre
If 0.20 mole of Cl_2 is added at same temp. Find equilibrium concentration of PCl_5 (K_C= 20)
(A) 0.48 moles (B) 0.38 moles
(C) 0.56 moles (D) 1.20 moles

Q20 A mixture of H_2 and I_2 in molecular proportion of 2 : 3 was heated at 440°C till the reaction
$H_2 + I_2 \rightleftharpoons 2HI$

reached equilibrium state. Calculate the percentage of iodine converted into HI
(K_C at 440°C is 0.02)

(A) 3.38% (B) 4.38%
(C) 5.38% (D) 6.38%

Q21 K_P for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at 400°C is $1.64 \times 10^{-4} atm^{-2}$. Calculate K_C.

(A) 0.3 mol^{-2} lit^2
(B) 0.4 mol^{-2} lit^2
(C) 0.5 mol^{-2} lit^2
(D) 0.6 mol^{-2} lit^2

Q22 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

Q23 When 1.0 mole of N_2 and 3.0 moles of H_2 was heated in a vessel at 773K and a pressure of 3.55 atm. 30% of N_2 is converted into NH_3 at equilibrium. Calculate K_P for the reaction -

(A) 3.1×10^{-2} atm^{-2}
(B) 4.1×10^{-2} atm^{-2}
(C) 5.1×10^{-2} atm^{-2}
(D) 6.1×10^{-2} atm^{-2}

Q24 Ammonium Hydrogen sulphide dissociates according to the equation,

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

If the observed pressure of the mixture is 1.12 atm at 106°C. What is the K_P of the reaction -

(A) 0.2136 (B) 0.3136
(C) 04136 (D) 0.5126

Q25 A reaction reaches a state of equilibrium only when:

(A) The reactants and products stop reacting
(B) The concentration of reactants and products become equal
(C) The products react together at the same rate at which they are formed
(D) All the reactants and products are in the same state of matter

Q26 Predict the effect of increased pressure on the following reaction's equilibrium.
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

(A) Equilibrium shifts to the right
(B) Equilibrium shifts to the left
(C) No effect in equilibrium
(D) Reaction stops

Q27 For a reversible reaction $A + B \rightleftharpoons C$, if the concentrations of the reactants are doubled at a definite temperature, then equilibrium constant will be;

(A) be doubled (B) be halved
(C) be one fourth (D) remain same

Q28 Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: For any chemical reaction at a particular temperature, the equilibrium constant is fixed and is a characteristic property.
Reason R:Equilibrium constant is independent of temperature
In the light of the above statements, choose the **correct** answer from the options given below:

(A) A is true but R is false.
(B) A is false but R is true.
(C) Both A and R are true and R is the correct explanation of A.
(D) Both A and R are true but R is NOT the correct explanation of A.

Q29 Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: K_p is related to K_c by the relation.
$Kp = \frac{K_c[RT]}{\Delta n}$
Reason R:K_p has different dimensions as that of K_c

In the light of the above statements, choose the **correct** answer from the options given below:
(A) A is true but R is false.
(B) A is false but R is true.
(C) Both A and R are true and R is the correct explanation of A.
(D) Both A and R are true but R is NOT the correct explanation of A.

Q30 The equilibrium constant for the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is K_1 and the equilibrium constant for the reaction $NO(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{1}{2}O_2(g)$ is K_2 both at the same temperature. The value of K_1 and K_2 are related as.
(A) $K_1 = \left(\frac{1}{K_2}\right)^2$
(B) $K_1 = K_2^2$
(C) $K_2 = \left(\frac{1}{K_1}\right)^2$
(D) $K_2 = K_1^2$

Q31 For the following reactions, equilibrium constants are given:
$A(s) + O_2(g) \rightleftharpoons AO_2(g),\ K_1 = 10^{40}$
$2A(s) + 3O_2(g) \rightleftharpoons 2AO_3(g),\ K_2 = 10^{90}$
The equilibrium constant of the reaction,
$2AO_2(g) + O_2(g) \rightleftharpoons 2AO_3(g)$, is
(A) 10^{15} (B) 10^{10}
(C) 10^{18} (D) 10^{25}

Q32 When two reactant A and B are mixed to give products C and D, the reaction quotient, (Q) at the initial Stages of the reaction
(A) is zero
(B) decreases with time
(C) increases
(D) is independent of times

Q33 $N_2O_4(g)$ is 25% dissociated into $NO_2(g)$ at 37°C and one atmosphere pressure. Value of Kp for the dissociation is;
(A) 0.48 atm (B) 0.84 atm
(C) 0.62 atm (D) 0.26 atm

Q34 The **correct** statement regarding the following equilibrium is,
$NaNO_3(s) \rightleftharpoons NaNO_2(s) + \frac{1}{2}O_2(g)$
(A) Addition of $NaNO_2$ favours reverse reaction
(B) Increasing temperature favours forward reaction
(C) Increasing pressure favours forward reaction
(D) Removing $NaNO_3$ favours forward reaction

Q35 An example of a reversible reaction is;
(A) $KNO_3(aq) + NaCl(aq) \rightarrow KCl(aq) + NaNO_3(aq)$
(B) $Pb(NO_3)(aq) + 2NaI(aq) \rightarrow PbI_2(s) + 2NaNO_3(aq)$
(C) $2Na(g) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
(D) $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$

Q36 In which of the following equilibria, Kp ≠ Kc?
(A) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$
(B) $NO_2(g) + SO_2(g) \rightleftharpoons NO(g) + SO_3(g)$
(C) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(D) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$

Q37 Two solids dissociate as follows;
$A(s) \rightleftharpoons B(g) + C(g), K_{P_1} = x\,atm^2$
$D(s) \rightleftharpoons C(g) + E(g), K_{P_2} = y\,atm^2$
The total pressure when both solids dissociate simultaneously is;
(A) $\sqrt{x+y}$ (B) $(x+y)$
(C) $2(x+y)$ (D) $2(\sqrt{x+y})$

Q38 For the chemical reaction, $A + 2B \overset{K}{\rightleftharpoons} 2C + D$, the initial concentration of B was 1.5 times of initial concentration of A, but the equilibrium concentrations of A and B are equal. The equilibrium constant (K) of the reaction is;
(A) 4 (B) 8
(C) 12 (D) 16

Q39 Given below are two statements:
Statement-I: A catalyst does not influence the value of equilibrium constant.
Statement-II: at equilibrium, $\Delta G^\circ = 0$
In the light of the above statements, choose the

most appropriate answer from the options given below:
(A) Statement I is correct but Statement II is incorrect.
(B) Statement I is incorrect but Statement II is correct.
(C) Both Statement I and Statement II are correct.
(D) Both Statement I and Statement II are incorrect.

Q40 For the equilibrium,
$NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$
the equilibrium pressure at a certain temperature is 0.8 atm. The Kp of the reaction is;
(A) 0.4 atm^2 (B) 0.16 atm^2
(C) 0.64 atm^2 (D) 0.32 atm^2

Q41 Consider the equilibria,
$2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$,
if degree of dissociation of AB_2 is x (<<<<1) then the relation between x, equilibrium constant (K_p) and total pressure (P) at equilibrium is;
(A) $K_P = Pa^3$ (B) $K_P = 2Pa^3$
(C) $2K_P = Pa^3$ (D) $K_P = \sqrt{2}Pa^3$

Q42 In which of the following, a reaction will proceed almost towards completion?
(A) $K_{eq} = 10^4$ (B) $K_{eq} = 10$
(C) $K_{eq} = 10^{-3}$ (D) $K_{eq} = 1$

Q43 In the equilibrium, $A + B \rightleftharpoons C + D$, the concentration of A, B, C and D at equilibrium are 0.5M, 08M, 0.4M and 1M respectively. The value of equilibrium constant of the reaction is;
(A) 0.25 (B) 1.5
(C) 0.75 (D) 1

Q44 The **correct** statement(s) regarding the equilibria involving physical processesss is/are;
(A) Equilibrium is possible only in a closed system at a given temperature.
(B) Both the opposing processes occur at the same rate
(C) All measurable properties of the system remain constant
(D) All of these

Q45 The equilibrium
$SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$, is attained at 25°C in a closed vessel. When an inert gas (He) is added then;
(A) More Cl_2 is formed
(B) More SO_2Cl_2 is formed
(C) Concentration of SO_2Cl_2, SO_2 and Cl_2 Changes
(D) equilibrium will not disturb

Q46 Identify the **incorrect** statement(s) among the following
(I) All chemical equilibria are static in nature.
(II) Molar concentration of pure solid or liquid is constant
(II) A catalyst lowers the activation energy for the forward and reverse reactions by exactly the same amount.
(II) Equilibrium constant depends on concentration of reactants and products.
(A) (I) only
(B) (I) and (III) only.
(C) (I) and (IV) only
(D) (I), (II), (III) and (VI)

Q47 At what temperature, K_p (in atm) = $3K_c$ (in M) for the reaction;
$SO_2Cl_2\,(g) \rightleftharpoons SO_2\,(g) + Cl_2(g)$?
(A) 36.54 K (B) 298 K
(C) 0.28 K (D) 53.64 K

Q48 The standard Gibb's energy change ($\Delta rG°$) at 27°C for the reaction, $A \underset{K_b=10^2}{\overset{K_f=10^3}{\rightleftharpoons}} B$ is;
(Given: R = 8.3 J mol^{-1}K^{-1})
(A) 4.21 kJ mol^{-1} (B) 3.25 kJ mol^{-1}
(C) 5.73 kJ mol^{-1} (D) 6.11 kJ mol^{-1}

Q49 For the equilibrium mixture,
$SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$, the vapour density is 34. The degree of dissociation of SO_3 is;
(A) 0.45 (B) 0.15
(C) 0.35 (D) 0.20

Q50 For the reaction,

$$2X(g) + Y(g) \rightleftharpoons 3C(g) + D(g)$$

two moles each of X and Y are taken into a flask. The **correct** option for the equilibrium is;

(A) [X] = [Y] (B) [X] < [Y]

(C) [Y] = [C] (D) [C] < [D]

Q51 If the concentration of Z in the reaction;

$$X(s) \rightleftharpoons Y(g) + 3Z(g)$$

is decreased by $\left(\frac{1}{4}\right)$ times, then the equilibrium concentration of Y(g);

(A) Increases by 8 times

(B) Increases by 64 times

(C) Decreases by 4 times

(D) Decreases by 64 times

Q52 On heating a mixture of SO_2Cl_2 and CO, two equilibria are simultaneously established

$$SO_2Cl_2\,(g) \rightleftharpoons SO_2\,(g) + Cl_2(g)$$

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

on adding more SO_2 at equilibrium, what will happen?

(A) amount of CO will decrease

(B) amount of SO_2Cl_2 and $COCl_2$ will increase

(C) amount of CO will remain unaffected.

(D) amount of SO_2Cl_2 and CO will increase

Q53 In a closed vessel contaning ammonium carbamate in equilibrium, ammonia is added such that partial pressure of NH_3 now equals to the original total pressure.

$$NH_2COONH_4\,(s) \rightleftharpoons 2NH_3\,(g) + CO_2(g)$$

The ratio of the partial pressure of CO_2 now to the original partial pressure of CO_2 is;

(A) $\frac{1}{6}$ (B) $\frac{5}{9}$

(C) $\frac{2}{3}$ (D) $\frac{4}{9}$

Q54 Heat is evolve when a gas 'x' (solute) is dissolved in water. The solubility of gas 'x' will increase at

(A) low temperature, low pressure

(B) High temperature, high pressure

(C) High temperature, low pressure

(D) low temperature, High pressure

Q55

Calculate K_P for the given reaction at 900 K, where the equilibrium steam - Hydrogen mixture contains 45%. H_2 by Volume.

$$SnO_2(s) + 2H_2(g) \rightarrow 2H_2O(g) + Sn(l)$$

(A) 0.58 (B) 1.49

(C) 1.94 (D) 0.85

Q56 Unit of K_C for the given reaction is:

$$X(g) \rightleftharpoons Y(g) + 2Z(g);$$

(A) M^2 (B) M

(C) M^{-2} (D) M^3

Q57 In the reaction, $X(g) + Y(g) \rightleftharpoons 2Z(g)$

2 mole of X, 1 mole of Y and 1 mole of Z are placed in a 10L vessel and allowed to reach equilibrium. If final concentration of Z is 0.2 M, K_C for the reaction is;

(A) 4.12 (B) 5.89

(C) 5.33 (D) 4.91

Q58 For the reaction,

$I_2(g) + H_2(g) \rightleftharpoons 2HI(g)$, the equilibrium constant (K_P) changes with

(A) addition of Catalyst

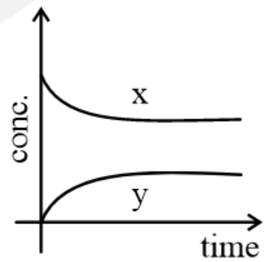
(B) Removal of HI

(C) increasing the volume

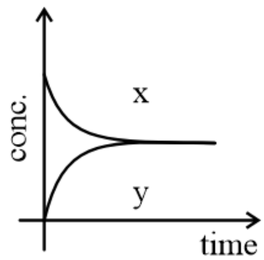
(D) decreasing the temperature

Q59 Which of the following curve represents equilibrium is attained in $X \rightleftharpoons Y$?

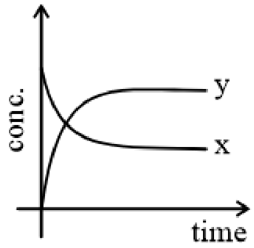
(A)



(B)



(C)



(D) All of these

Q60 The equilibrium constant (K_c) for the mutarotation process, α-D-glucose $\rightleftharpoons$ β-D-glucose is 1.8. The percentage of β-form that remains at equilibrium is,

(A) 52.8%
(B) 64.2%
(C) 35.7%
(D) 41.2%

Answer Key

Q1	(C)
Q2	(A)
Q3	(B)
Q4	(B)
Q5	(C)
Q6	(B)
Q7	(B)
Q8	(A)
Q9	(A)
Q10	(B)
Q11	(B)
Q12	(B)
Q13	(C)
Q14	(B)
Q15	(A)
Q16	(A)
Q17	(A)
Q18	(A)
Q19	(A)
Q20	(C)
Q21	(C)
Q22	(A)
Q23	(C)
Q24	(B)
Q25	(C)
Q26	(A)
Q27	(D)
Q28	(A)
Q29	(B)
Q30	(A)
Q31	(B)
Q32	(C)
Q33	(D)
Q34	(B)
Q35	(A)
Q36	(C)
Q37	(D)
Q38	(A)
Q39	(A)
Q40	(B)
Q41	(C)
Q42	(A)
Q43	(D)
Q44	(D)
Q45	(D)
Q46	(C)
Q47	(A)
Q48	(C)
Q49	(C)
Q50	(B)
Q51	(B)
Q52	(D)
Q53	(D)
Q54	(D)
Q55	(B)
Q56	(A)
Q57	(C)
Q58	(D)
Q59	(D)
Q60	(B)

Hints & Solutions

Q1 Text Solution:

	A + B	$\rightleftharpoons$	C + D
Initial	1 1		0 0
At equili.	(1 – x) (1 – x)		x x

$\therefore\ K_C = \frac{[C][D]}{[A][B]} = 9$

$\therefore\ \frac{x \cdot x}{(1-x)^2} = 9$

$\frac{x}{1-x} = 3$

$\therefore\ x = \frac{3}{4}$

Hence, among the given options, the option (C) i.e., 0.75 mol is correct.

Q2 Text Solution:

$$K_C = \frac{[B]^2}{[A]} = \frac{(0.4)^2}{0.1} = 1.6$$

Q3 Text Solution:

A chemical reaction is said to be at equilibrium when the rate of the forward reaction (reactants turning into products) is equal to the rate of the backward reaction (products turning back into reactants). At this point, the concentrations of reactants and products remain constant, but not necessarily equal in amount.

So, even though some reactants and products may still be present, no net change occurs in their concentrations.

Q4 Text Solution:

A reversible reaction is a chemical reaction where the products can react to form the original reactants again. This means the reaction can proceed in both the forward and backward directions, eventually reaching a state of equilibrium.

So, (B) is the correct choice.

Q5 Text Solution:

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

$$K_p = \frac{(p_{NO})^2 (p_{O_2})}{(p_{NO_2})^2}$$

Given, $p_{O_2} = 0.25$; $p_{NO} = 0.5$

$$100 = \frac{(0.5)^2 (0.25)}{(p_{NO_2})^2}$$

$$(p_{NO_2})^2 = \frac{(0.5)^2 (0.25)}{100}$$

$$p_{NO_2} = 0.025\ atm$$

Q6 Text Solution:

Molecular mass of HI = 128

$[HI] = \frac{64}{128} \times \frac{1}{2} = 0.25$ M

Q7 Text Solution:

For K_p = 0.5 atm

Δn = 1 (since the unit is atm)

and $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

Δn = 1

$\therefore$ (B)

Q8 Text Solution:

$N_2O_4 \rightleftharpoons 2NO_2$

1 0 at initial

$1 - \alpha$ 2α at equilibrium

$\therefore\ \frac{V.D._{innitial}}{V.D._{final}} = \frac{n_{final}}{n_{initial}}$

$\frac{46}{25.4} = \frac{1+\alpha}{1}$

$1.8 = 1 + \alpha \Rightarrow \alpha = 0.8$ or 80%

Q9 Text Solution:

Boiling point of a liquid is the temperature at which vapour pressure became equal to atm pressure. If the pressure is applied to the above equilibrium the reaction will go to the backward direction, i.e. vapour pressure decrease hence the boiling point increase.

Q10 Text Solution:

$$Q = \frac{[C]^3}{[A][B]} = \frac{4^3 \times 3 \times 3}{3^3 \times 1 \times 2} = 10.66$$

$> K_C$ reaction will proceed in backward direction

Q11 Text Solution:

	CO	+	Cl_2	$\rightleftharpoons$	$COCl_2$
At t = 0	2		3		0
At equilibrium	(2–1)		(3–1)		1
Concentrations (V = 5 lit)	$\frac{1}{5}$		$\frac{2}{5}$		$\frac{1}{5}$

$K_c = \frac{[COCl_2]}{[CO][Cl_2]} = \frac{1/5}{\frac{1}{5}\times\frac{2}{5}} = \frac{25}{10}$ or $K_c = 2.5$

Hence, **(B)** is correct.

Q12 Text Solution:

According to Le Chatalier principle formation of ozone is favoured by high temperature (endothermic reaction) and high pressure.

Hence, **(B)** is correct.

Q13 Text Solution:

In heterogenous equilibrium, physical state of all the reactants and products are not same.

Hence, **(C)** is correct.

Q14 Text Solution:

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

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

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

Now, -2 (ii) = (i) + (iii)

so, $K_{C_3} \times KC_1 = 1/K_{C_2}^2$

Q15 Text Solution:

K_p is a constant and does not change with pressure.

Q16 Text Solution:

$d_0 = \frac{D}{1+(n-1)\alpha}$ $\quad n = 1 + \frac{1}{2} = 1.5$

$35 = \frac{40}{1+0.5\alpha}$

$1 + 0.5\alpha = \frac{40}{35}$

$0.5\alpha = 1.14 - 1$

$0.5\alpha = 0.14$

$\alpha = 0.28$

Q17 Text Solution:

Greater is the value of K, more will be the tendency to show forward reaction.

Q18 Text Solution:

The equilibrium is represented as :

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

Initial mole

1 2 0

moles at equilibrium

1–x 2–x 2x

Total volume = 1 + 2 = 3 litres

$[A_2] = \frac{1-x}{3}$, $[B_2] = \frac{2-x}{3}$ $[AB] = \frac{2x}{3}$

$K = \frac{[AB]^2}{[A_2][B_2]} = \frac{\left(\frac{2x}{3}\right)^2}{\left(\frac{1-x}{3}\right)\left(\frac{2-x}{3}\right)} = 50$

On solving we get $23x^2 - 75x + 50 = 0$

∴ x = 2.31 or 0.943, since x can't be more than 1

So, x = 0.943

∴ moles of AB formed = 2 × 0.943 = 1.886

Q19 Text Solution:

$PCl_3 + Cl_2 \rightleftharpoons PCl_5$

0.20 0.10 0.40 moles/litre

If 0.20 mole of Cl_2 is added then at equilibrium

0.20 – x 0.30 – x 0.40 + x

$20 = \frac{0.40+x}{(0.20-x)(0.30-x)}$

or x = 0.08

$[PCl_5]$ = 0.4 + 0.08 = 0.48 moles

Q20 Text Solution:

$H_2 + I_2 \rightleftharpoons 2HI$

Initial moles 2 3 0

Equi. conc. $\frac{2-x}{V}$ $\frac{3-x}{V}$ $\frac{2x}{V}$

$K_C = \frac{4x^2}{(2-x)(3-x)} = 0.02$

$199x^2 + 5x - 6 = 0$

x = 0.1615

Out of 3 moles, 0.1615 moles of I2 is converted into HI

∴ Percentage of I_2 converted to

$HI = \frac{0.1615\times100}{3} = 5.38\%$

Q21 Text Solution:

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

$\Delta n_g = -2$ and $K_P = K_C(RT)^{\Delta n_g}$

$1.64 \times 10^{-4} = K_C(0.0821 \times 673)^{-2}$

and $K_C = 0.5\ mol^{-2}\ lit^2$

Q22 Text Solution:

$Q_C = \frac{\left(\frac{6}{2}\right)^2}{\left(\frac{2}{2}\right)\left(\frac{4}{2}\right)^3} = \frac{9}{8}$

$Q_C < K_C$ so reaction will proceed in forward direction.

Q23 Text Solution:

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

1 mole   3 moles   0 at the start
1-0.3   3.0-0.9   0.6 moles
At equilibrium
Total moles = 3.4

$$K_P = \frac{\left(\frac{0.6}{3.4}\times 3.55\right)^2}{\left(\frac{0.7}{3.4}\times 3.55\right)\left(\frac{2.1}{3.4}\times 3.55\right)^3}$$

= 5.1×10^{-2} atm^{-2}

Q24 Text Solution:

The reaction is

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

at equilibrium   1–α α α

Total moles of $NH_3 + H_2S = 2\alpha$ (NH_4HS in solid phase)

$$\text{Partial pressure} = \frac{\text{moles of substance}}{\text{total moles}} \times \text{total pressure}$$

$$\therefore P_{NH_3} = \frac{\alpha}{2\alpha}\ p = 0.5p$$

$$P_{H_2S} = \frac{\alpha}{2\alpha}\ p = 0.5\ p$$

$$K_P = P_{NH_3} . P_{H_2S} = (p \times 0.5) \times (0.5 \times p) = 0.25p^2.$$

Substituting value of p = 1.12 atm

K_P = 0.25 × 1.12 × 1.12 = 0.3136

Q25 Text Solution:

Product & reactants react together at the same rate at which they are formed. Rate at which they are formed. Rate of forward reaction = Rate of backward reaction.

Q26 Text Solution:

$2SO_2 + O_2 \rightleftharpoons 2SO_3$.

P↑, ∴ eq. shift in the direction where P ↓

∵ $\Delta ng = 2 - 3 = -1$.

∴ eq shifts in right where P↓, acc to Le – Chatelier principle.

Q27 Text Solution:

Equilibrium constant doesn't depend on concentration but depends only on temperature.

Q28 Text Solution:

Equilibrium constant is fixed for any chemical reaction and depends on temperature.

Q29 Text Solution:

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

K_c or K_p may be unitless as well as have units, K_c is expressed in terms of mol/L & K_p in terms of unit bar.

Q30 Text Solution:

$N_2 + O_2 \rightleftharpoons 2NO$.

$K_1 = \frac{[NO]^2}{[N_2][O_2]}$;

$$(K_1)^{1/2} = \frac{[NO]}{[N_2]^{1/2}[O_2]^{1/2}}$$

$$NO \rightleftharpoons \tfrac{1}{2}N_2 + \tfrac{1}{2}O_2$$

$$K_2 = \frac{[N_2]^{1/2}[O_2]^{1/2}}{[NO]} = \frac{1}{[K_1]^{1/2}}$$

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

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

$$K_1 = \left(\frac{1}{K_2}\right)^2.$$

Q31 Text Solution:

applying eq(2) - 2x eq(1),

$$K = \frac{K_2}{(K_1)^2} = \frac{10^{90}}{(10^{40})^2} = 10^{10}$$

Q32 Text Solution:

$$A + B \rightleftharpoons C + D$$

$$Q = \frac{[C][D]}{[A][B]}$$

During initial stages as time passes, C and D increases so Q increases.

Q33 Text Solution:

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

(i)   1   –
(f)   1 – a   2a

$$K_p = \frac{(P_{NO_2})^2}{(P_{N_2O_4})} = \frac{\left(P\frac{2a}{1+a}\right)^2}{\left(P\frac{1+a}{1+a}\right)}$$

$$= \frac{4Pa^2}{1-a^2} = \frac{4\times 1\times(0.25)^2}{1-(0.25)^2}$$

= 0.26 atm

Q34 Text Solution:

- Decomposition of $NaNO_3$ is endothermic reaction so on increasing temperature favours forward reaction.
- On addition or removal of solids, equlibrium is not affected.

Q35 Text Solution:

Reactions in which Solid ppt or gas is formed generally moves in one direction

Q36 Text Solution:

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$
$$\Delta n_g = 2 - 1 = 1$$
$$K_P = K_C(RT)' = K_C RT$$

Q37 Text Solution:

$$A(s) \rightleftharpoons B(g) + C(g)$$
$$\qquad\qquad P_1 \qquad P_1 + P_2$$
$$D(s) \rightleftharpoons C(g) \quad + \quad E_g$$
$$\qquad P_1 + P_2 \qquad P_2$$
$$K_{P_1} = (P_1)(P_1 + P_2) = x$$
$$K_{P_2} = (P_1 + P_2)P_2 = y$$
$$\therefore K_{P_1} + K_{P_2} = x + y = P_1(P_1 + P_2) + P_2(P_1 + P_2)$$
$$x + y = (P_1 + P_2)^2$$
$$P_1 + P_2 = \sqrt{x + y}$$
$$\therefore P_{total} = P_B + P_C + P_E = P_1 + P_1 + P_2 + P_2 = 2(P_1 + P_2) = 2\sqrt{x + y}.$$

Q38 Text Solution:

$$A + 2B \rightleftharpoons 2C + D$$
$$\text{(i)} \quad a \quad 1.5\,a \quad - \quad -$$
$$\text{(f)} \quad a - \text{x} \quad 1.5\text{a} - 2\text{x} \quad 2x \quad x$$

given:- a - x = 1.5a - 2x

x = 0.5a

$$K = \frac{(2x)^2(x)}{(a-x)(1.5a-2x)^2}$$
$$= \frac{(a)^2(0.5a)}{(0.5a)(0.5a)^2} = 4$$

Q39 Text Solution:

at equilibrium, $\Delta G = 0$

Q40 Text Solution:

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

Given: 0.8 = P + P = 2P

P = 0.4 atm

$$K_P = P \times P = (0.4)^2 = 0.16\ atm^2$$

Q41 Text Solution:

$$2AB_2(g) \rightleftharpoons 2AB(g) + BA_2$$
$$(i) \quad 1 \quad 0 \quad 0$$
$$(f) \quad 1 - \alpha \quad \alpha \quad \frac{\alpha}{2}$$
$$K_P = \frac{(P_{AB})^2(P_{B_2})}{(P_{AB_2})^2} = \frac{\left(\frac{Pa}{1+\frac{a}{2}}\right)^2\left(\frac{P\frac{a}{2}}{1+\frac{a}{2}}\right)}{\left(\frac{P(1-a)}{1+\frac{a}{2}}\right)^2}$$
$$K_P = \frac{a^2}{(1-a)^2} \times \frac{Pa}{2\left(1+\frac{a}{2}\right)} \simeq \frac{Pa^3}{2}$$

Q42 Text Solution:

when $K_{eq} > 10^3$ a reaction will proceed almost towards completion.

Q43 Text Solution:

$$K_C = \frac{1 \times 0.4}{0.5 \times 0.8} = 1$$

Q44 Text Solution:

All options A, B and C are true for physical equilibrium.

Q45 Text Solution:

During constant volume process, on addition of inert gas equilibrium will not disturb.

Q46 Text Solution:

- All chemical equlibria are dynamic in nature
- Equilibrium constant depends only on temperature.

Q47 Text Solution:

$$K_P = K_C(RT)^{\Delta ng}$$
$$3K_C = K_C(0.0821 \times T)^1$$
$$T = \frac{3}{0.0821} = 36.54\,K$$

Q48 Text Solution:

$$K_{eq} = \frac{K_f}{K_b} = \frac{10^3}{10^2} = 10$$
$$\Delta_r G^\circ = -2.303\,RT\,\log\,K$$

= -2.303 × 8.3 × 300 × log(10) J mol^{-1}

= 5.73 kJ mol^{-1}

Q49 Text Solution:

$$Initial\ vapour\ density\ (D) = \frac{M_{SO_3}}{2} = \frac{80}{2} = 40$$
$$\therefore a = \frac{D-d}{(n-1)d} = \frac{40-34}{\left(\frac{3}{2}-1\right)\times 34}$$

= 0.35

Q50 Text Solution:

$2X(g) + Y(g) \rightleftharpoons 3C(g) + D(g)$

$(i) \quad 2 \quad 2 \quad - \quad -$

$(f) \; (2 - Z) \quad (2\text{-}\frac{Z}{2}) \quad \frac{3Z}{2} \quad \frac{Z}{2}$

∴ at eq., [X] < [Y]

Q51 Text Solution:

$K_C = \left[Y\right][Z]^3 = \left[Y'\right]\left[\frac{Z}{4}\right]^3$

$[Y'] = 64[Y]$

Q52 Text Solution:

On adding SO_2, both equilibria will affected and amount of SO_2Cl_2 and CO will increase.

Q53 Text Solution:

(D)

$NH_2COONH_4\,(s) \rightleftharpoons 2NH_3\,(g) + CO_2(g)$

$2P \quad P$

$3P \quad P'$

at eq (1), $K_P = (2P)^2\,(P) = 4P^3$

total pressure = 2P + P = 3P

at eq (2), $K_P = (3P)^2\,P'$

$4P^3 = 9P^2 \times P'$

$P' = \frac{4}{9}P$

$\therefore \frac{P'}{P} = \frac{4}{9}$

Q54 Text Solution:

- Exothermic process on increasing tenperature moves in backwand directions
- On increasing pressure, solubility of gas in water increases

Q55 Text Solution:

$SnO_2(s) + 2H_2(g) \rightarrow 2H_2O(g) + Sn(l)$

$K_P = \frac{(P_{H_2O})^2}{(P_{H_2})^2} = \left(\frac{n_{H_2O}}{n_{H_2}}\right)^2 = \left(\frac{55}{45}\right)^2 = 1.49$

Q56 Text Solution:

Unit of $K_C = (M)^{(2+1)-(1)} = M^2$

Q57 Text Solution:

$X(g) + Y(g) \rightleftharpoons 2Z(g)$

$(i) \quad 0.2M \quad 0.1M \quad 0$

$.2M$

$(f) \; \left(0.2 \frac{-0.1}{2}\right)\mathrm{M} \quad \left(1 \frac{-0.1}{2}\right)\mathrm{M} \quad 0.2\mathrm{M}$

$=0.15M \quad =0.05M$

$\therefore K_C = \frac{(0.2)^2}{(0.15)(0.05)} = 5.33$

Q58 Text Solution:

K_P or K_C changes only with change in temperature.

Q59 Text Solution:

At equilibrium, concentration of reactants and products become constant.

Q60 Text Solution:

α-D-glucose ⇌ β-D-glucose

$(i) \quad 1 \quad -$

$(f) \; 1 - \alpha \quad \alpha$

$K_C = 1.8 = \frac{\alpha}{1-\alpha}$

α = 0.642