PART B - CHEMISTRY

46. **c)** **It can never proceed to completion**
In a reversible reaction some amount of the reactants remains unconverted into products.

47. **b)** $AgNO_3 + NaCl \rightleftharpoons AgCl + NaNO_3$
Double decomposition reactions or precipitation reactions are not reversible.

48. **b)** **Few drops of water is present along with air in a balloon, temperature of balloon is constant**
Equilibrium can be achieved only in closed vessel.

49. **b)** **Molar concentration of reactants**
According to law of mass-action, "at a given temperature, the rate of a reaction at aparticular instant is proportional to the product of the active masses of the reactants at that instant raised to powers which are numerically equal to the numbers of their respective molecules in the stoichiometric equation describing the reaction".

50. **d)** **0.25**

$$[HI] = \frac{64 gm}{128 \times 2 litre}$$

= 0.25

51. **a)** **greater is the concentration of the substances involved in a reaction, lower is the speed of the reaction**
As we increase the concentration of substance, then speed of the reaction increases.

52. **d)** $\frac{[C]}{[A]^3[B]^2}$

Equilibrium constant for the reaction,

$$3A + 2B \rightleftharpoons C \text{ is } K = \frac{[C]}{[A]^3[B]^2}.$$

53. **c)** **1**

	A + B ⇌	C + D
Initial conc.	4, 4	0 0
After T time conc.	(4–2) (4–2)	2 2

$$\text{Equilibrium constant} = \frac{[C][D]}{[A][B]} = \frac{2 \times 2}{2 \times 2} = 1$$

54. **a)** $K = 10^3$
Those reaction which have more value of K proceeds towards completion.

55. **c)** **Does not depend on the initial concentrations**
Equilibrium constant is independent of original concentration of reactant.

56. **d)** $COCl_{2(g)} \rightleftharpoons CO_{(g)} + Cl_{2(g)}$
$\Delta n = 1$ for this change
So the equilibrium constant depends on the unit of concentration.

57. **c)** 1×10^{-5}

$$K = \frac{[NO_2]^2}{[N_2O_4]} = \frac{\left[2 \times \frac{10^{-3}}{2}\right]^2}{\left[\frac{2}{2}\right]} = \frac{10^{-6}}{10^{-1}} = 10^{-5}$$

58. **d)** $(1 + \alpha)$

$N_2O_4 \rightleftharpoons 2NO_2$

1 0

$(1-\alpha)$ 2a

total mole at equilibrium = $(1-\alpha) + 2\alpha = 1 + \alpha$

59. **b)** **0.06 mole**

$$K_c = \frac{[HI]^2}{[H_2][I_2]}; 64 = \frac{x^2}{0.03 \times 0.03}$$

$x^2 = 64 \times 9 \times 10^{-4}$

$x = 8 \times 3 \times 10^{-2} = 0.24$

x is the amount of HI at equilibrium amount of I_2 at equilibrium will be
0.30 – 0.24 = 0.06

60. **c)** **1.125×10^{-3}**

$$K_c = \frac{K_f}{K_b}$$

$K_f = K_c \times K_b = 1.5 \times 7.5 \times 10^{-4}$
$= 1.125 \times 10^{-3}$

61. **c)** **0.016**

$$K = \frac{[H_2]^2[S_2]}{[H_2S]^2} = \frac{[0.10]^2[0.4]}{[0.5]^2} = 0.016$$

62. **a)** **$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$**

$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$; $\Delta n = 2 - 2 = 0$

63. **d)** **27/16 mol² litre⁻²**

	$2NH_3 \rightleftharpoons$	N_2	$+ 3H_2$
Initial concentration	2	0	0
At equilibrium concentration	1	1/2	3/2

64. **c)** **1,1,2**

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

at t = 0 56gm 8gm 0gm
= 2mole 4mole 0mole
at equilibrium 2–1 4–3 34gm
= 1 mole = 1mole = 2mole

According to equation (i) w2 mole of ammonia are present and to produce 2 mole of NH_3, we need 1 mole of N_2 and 3 mole of H_2 hence 2–1 = 1 mole of N_2 and 4 – 3 = 1 mole of H_2 are present at equilibrium in vessel.

65. **d)** **$K_c = 1/[O_2]^5$**

$P_4(s) + 5O_2(g) \rightleftharpoons P_4O_{10}(s)$

$$K_c = \frac{[P_4O_{10}(s)]}{[P_4(s)][O_2(g)]^5}$$

We know that concentration of a solid component is always taken as unity

$$K_c = \frac{1}{[O_2]^5}$$

66. **a)** **K_p**

$2Ag_2O(s) \rightleftharpoons 4Ag(s) + O_2(g)$

For this reaction, $K_p = P_{O_2}$ $\rightleftharpoons$ (AgO_2O and Ag are in solid state)

67. **d)** **Increasing temperature favours forward reaction**

68. **a)** **Remain constant**

On doubling P and volume with constant T, the equilibrium constant (K) will remain constant.
Pressure will never affect the value of K. It may result in the shifting of equilibrium but not the equilibrium constant value. Temperature always changes K because on adding heat to a system in state of equilibrium will always alter the forward reaction rate differently than the reverse reaction rate. Also by doubling the volume, the concentrations of both reactants and product evenly become half. Therefore, overall there is no change in equilibrium constant value(K).

69. **b)** **4.5**

$PCl_{5(g)} \rightleftharpoons$	$PCl_{3(g)}$	$+ Cl_{2(g)}$	
3	3	2	(Initially)
(3 – x)	(3 + x)	(2 + x)	(At equilibrium)

Given that, (3 – x) = 1.5; ∴ x = 1.5;
Therefore no. of moles of $PCl_{3(g)}$ present is = 3 + 1.5 = 4.5

70. **a)** **More PCl_5 will be produced**

$$Q_p = \frac{pPCl_3 \times pPCl_2}{pPCl_5} = \frac{1atm \times 1atm}{1atm} = 1$$

Since $Q_p > K_p$, the equilibrium shifs towards left.

71. **b)** $K_p = K_c(RT)^{\Delta n}$

72. **d)** **The temperature**

73. **c)** $2SO_2 + O_2 \rightleftharpoons 2SO_3$

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

$\Delta n = -1$ for reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$. So for this reaction K_p is less than K_c.

74. **d)** 1.72×10^{-4}

$2NOCl_{(g)} = 2NO_{(g)} + Cl_{2(g)}$

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

$K_p = 3 \times 10^{-6}(0.0821 \times 700)$

$= 172.41 \times 10^{-6}$

$= 1.72 \times 10^{-4}$

75. **b)** $< 1.2 \times 10^{-2}$

$K_p = K_c(RT)^{\Delta n}$; Δn

So K_c will be less than K_p.

76. **d)** **Does not affect equilibrium constant of reaction**

Catalyst does not affect equilibrium constant.

77. **b)** **100.0**

$XY_2 = XY + Y$

Initial pressure of XY_2= 600mm Hg

	XY_2	= XY	+ Y
Initial	600	0	0
At equilibrium	600–P	P	P

Total = 600 + P = 800

P = 200

$$K = \frac{200 \times 200}{400} = 100.0$$

78. **b)** $M \rightleftharpoons N$; **K = 10**

For a reaction, $K_c = \frac{[\text{Product}]}{[\text{Reactant}]}$

Hence,

If $K_c > 1$, then [Product] > [Reactant]

79. **b)** **Zero**

80. **a)** **More cis–2–pentene is formed**

Equilibrium shifts backward by Le-chatelier's principle.

81. **a)** **High temperature**

$N_2 + O_2 \rightleftharpoons 2NO$; Q cal

The above reaction is endothermic so for higher production of NO, and the temperature should be high.

82. **c)** $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

At low pressure, reaction proceeds where volume is increasing . This is the favourable condition for the reaction.

$PCl_5 \rightleftharpoons PCl_3 + Cl_2$

83. **a)** **More water will form**

Ice $\rightleftharpoons$ Water

More volume **less volume**

On increasing pressure, equilibrium shifts forward.

84. **c)** **Endothermic**

85. **a)** **Temperature and pressure**

Factors affecting equilibrium are pressure, temperature and concentration of product or reactant

86. **d)** **Shift in equilibrium position on changing value of a constant**

87. **b)** **Half**

88. **b)** $Fe_{(S)} + S_{(s)} \rightleftharpoons FeS_{(s)}$

Le chatelier principle is not applicable to solid-solid equilibrium

89. **a)** **Does not change**

In that type of reaction the state of equilibrium is not effected by change in volume (hence pressure) of the reaction mixture.

90. **c)** **1/RT**

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

$\Delta n = 1 - 2 = -1$

$K_p = K_c[RT]^{\Delta n}$; $\quad \therefore \dfrac{K_p}{K_c} = [RT]^{-1} = \dfrac{1}{RT}$