CBSE TEST PAPER 03

CLASS XI CHEMISTRY (Equilibrium)

General Instruction:

- All questions are compulsory.
- Marks are given alongwith their questions.

1. Give the generalizations concerning the composition of equilibrium mixtures. [3]
2. Define reaction quotient. [1]
3. If Qc > Kc, what would be the type of reaction? [1]
4. What inference you get when Qc = Kc? [1]
5. The value of Kc for the reaction

$2A \rightleftharpoons B+C$ is $2x10^{-3}$. At a given time, the composition of the reaction mixture is [A] = [B] =[C] = $3x10^{-4}$ M. In which direction the reaction will proceed? [2]

6. Write the equilibrium constant expression for each of the following reactions. In each case, indicate which of the reaction is homogeneous or heterogeneous.

(a) $2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$

(b) $N_2O_5(g) \rightleftharpoons NO_2(g) + NO_3(g)$

(c) $Zn(s) + 2HCl(g) \rightleftharpoons ZnCl_2(s) + H_2(g)$

(d) $2H_2O(l) \rightleftharpoons 2H_2O(l) + O_2(g)$ [2]

7. The dissociation of HI is independent of pressure, while dissociation of PCl_5 depends upon the pressure applied. Why? [2]
8. On what factors does the value of the equilibrium constant of a reaction depend? [2]

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[ANSWERS]

Ans 1. (i) If Kc > 10^3, products predominates over reactants i.e; if Kc is very large, the reaction proceeds nearly to completion.

(ii) If Kc < 10^{-3}, reactants predominates over products i.e; if Kc is very small, the reaction proceeds rarely.

(iii) If Kc is in the range of 10^{-3} to 10^3, appreciable concentration of both reactants and products are present.

Ans 2. The reaction quotient, Q is same as equilibrium constant Kc, except that the concentrations in Qc are not necessarily equilibrium values.

Ans 3. If Qc > Kc, the reaction will proceed in the direction of the reactants (reverse reactions)

Ans 4. If Qc = Kc, the reaction mixture is already at equilibrium.

Ans 5. For the reaction the reaction Qc is given by

$$Qc = \frac{[B][C]}{[A]^2}$$

As [A] = [B] = [C] = $3x10^{-4M}$

$$Qc = \frac{\left(3x10^{-4}\right)\left(3x10^{-4}\right)}{\left(3x10^{-4}\right)^2} = 1$$

As Qc > Kc so the reaction will proceed in the reverse direction.

Ans 6. (a) $Kc = \frac{[CO_2]^2}{[CO]^2[O_2]}$ (b) $Kc = \frac{[NO_2][NO_3]}{[N_2O_5]}$

(c) $Kc = \frac{[H_2]}{[HCl]^2}$ (d) $Kc = [O_2]$

Homogeneous : a, b

Heterogeneous : c, d

Ans 7. For $2HI \rightleftharpoons H_2 + I_2$

$$Kc = \frac{x^2}{4(1-x)^2}$$

Where x is degree of dissociation

For $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

$$Kc = \frac{x^2}{v(1-x)}$$

Where x is degree of dissociation

Since Kc for HI does not have volume terms and thus dissociation of HI is independent of pressure. On the other hard Kc for PCl_5 has volume in denominator and thus an increase in pressure reduces volume. And to have kc constant, x decrease.

Ans 8. The equilibrium constant of a reaction depends upon

(i) Temperature

(ii) Pressure, &

(iii) Stoichiometry of the reaction