

Chemical Equilibrium

Q.1. In which of the following reaction $K_p > K_c$

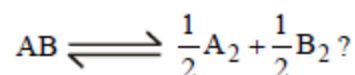
- a) $N_2 + 3H_2 \rightleftharpoons 2NH_3$
- b) $H_2 + I_2 \rightleftharpoons 2HI$
- c) $PCl_3 + Cl_2 \rightleftharpoons PCl_5$
- d) $2SO_3 \rightleftharpoons O_2 + 2SO_2$

Q.2. For reaction $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$, the value of K_c at $250^\circ C$ is $26 \text{ mol}^{-1} \text{ litre}^1$. The value of K_p at this temperature will be

- a) 0.61 atm^{-1}
- b) 0.57 atm^{-1}
- c) 0.83 atm^{-1}
- d) 0.46 atm^{-1}

Q.3. If the equilibrium constant for the reaction

$2AB \rightleftharpoons A_2 + B_2$ is 49, what is the value of equilibrium constant for



- a) 49
- b) $1/49$
- c) 7
- d) $1/7$

Q.4. The rate of forward reaction is two times that of the reverse reaction at a given temperature and identical concentration. Equilibrium constant K_{eq} is

- a) 0.5
- b) 1.5
- c) 2.5
- d) 2.0

Q.5. For the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ the forward reaction at constant temperature is favoured by

- a) introducing an inert gas at constant volume
- b) introducing $PCl_3(g)$ at constant volume
- c) introducing $PCl_5(g)$ at constant volume
- d) introducing $Cl_2(g)$ at constant volume

Q.6. Consider the expression $\Delta G = -RT \ln K_c + RT \ln Q_p$ and indicate the correct statement at equilibrium

- a) $\Delta G = 0$, $Q_p > K_p$ the equilibrium reaction will shift from left to right
- b) $\Delta G = 0$, $Q_p = K_p$ the equilibrium reaction will shift from left to right
- c) $\Delta G = \infty$, $Q_p < K_p$ the equilibrium reaction will shift from right to left
- d) $\Delta G = 0$, $Q_p > K_p$ the equilibrium reaction will shift from right to left [where Q_p and K_p term refer to reaction quotient and equilibrium constant at constant pressure respectively.]

Q.7. The equilibrium constant for a reaction is 1×10^{20} at 300 K. The standard free energy change for the reaction is

- a) + 115 KJ
- b) + 166 KJ
- c) -115 KJ
- d) -166 KJ

Q.8. At temperature T K, PCl_5 is 50% dissociated at an equilibrium pressure of 4 atm. At what pressure it would dissociate to 80% at the same temperature

- a) 0.75 atm
- b) 0.50 atm
- c) 0.60 atm
- d) 2.5 atm

Q.9. A reversible chemical reaction having two reactants in equilibrium. If the concentration of the reactants are doubled then the equilibrium constant will

- a) be doubled
- b) be halved
- c) become one-fourth
- d) remain same

Q.10. For the reaction



- a) RT
- b) $(RT)^{-1/2}$
- c) $(RT)^{1/2}$
- d) $(RT)^{-1}$

Q.11. Le Chatelier's principle is applicable to:

- a) only homogeneous chemical reversible reactions
- b) only heterogeneous chemical reversible reactions
- c) only physical equilibria
- d) all systems, chemical or physical in equilibrium

Q.12. For the reversible reaction

$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3 + \text{Heat}$, The equilibrium shifts in forward direction

- a) by increasing the concentration of $\text{NH}_3(\text{g})$
- b) by decreasing the pressure
- c) by decreasing the concentration of $\text{N}_2(\text{g})$ and $\text{H}_2(\text{g})$
- d) by increasing pressure and decreasing temperature

Q.13. When KOH is dissolved in water, heat is evolved. If the temperature is raised, the solubility of KOH.

- a) Increases
- b) Decreases
- c) Remains the same
- d) Cannot be predicted

Q.14. A reaction takes place in two steps with equilibrium constants 10^{-2} for slow step and 10^2 for last step. The equilibrium constant of the overall reaction will be

- a) 10^4
- b) 10^{-4}
- c) 1
- d) 10^{-2}

Q.15. For the reaction $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$, the value of K_c at 250°C is $26 \text{ mol}^{-1}/\text{litre}$. The value of K_p at this temperature will be

- a) 0.61 atm^{-1}
- b) 0.57 atm^{-1}
- c) 0.85 atm^{-1}
- d) 0.46 atm^{-1}

Q.16. One mole of ethanol is treated with one mole of ethanoic acid at 25°C . One-fourth of the acid changes into ester at equilibrium. The equilibrium constant for the reaction will be

- a) $1/9$
- b) $4/9$
- c) 9
- d) $9/4$

Q.17. The equilibrium, $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ is attained at 25°C in a closed container and an inert gas He is introduced. Which of the following statements are correct.

- a) concentration of PCl_5 , PCl_3 and Cl_2 are changed
- b) more Cl_2 is formed
- c) concentration of PCl_3 is reduced
- d) Nothing happens to the equilibrium state

Q.18. For the gaseous phase reaction, $2\text{A} \rightleftharpoons \text{B} + \text{C}$, $\Delta H^\circ = -40 \text{ Kcal mol}^{-1}$. which statement is correct for K_c ?

- a) K_c is independent of temperature
- b) K_c increase as temperature decrease
- c) K_c increase as temperature increases
- d) K_c varies with addition of A

Q.19. On applying pressure to the equilibrium
 $\text{ice} \rightleftharpoons \text{water}$, Which phenomenon will happen?

- a) More ice will be formed
- b) More water will be formed
- c) Equilibrium will not be disturbed
- d) Water will evaporate

Q.20. Vapour density of PCl_5 is 104.16 but when heated at 230°C its vapour density is reduced to 62. The degree of dissociation of PCl_5 at this temperature will be

- a) 6.8%
- b) 68%
- c) 46%
- d) 64%

Q.21. K_p for a reaction at 25°C is 10 atm. The activation energy for forward and reverse reactions are 12 and 20 kJ / mol respectively. The K_c for the reaction at 40°C will be

- a) $4.33 \times 10^{-1} \text{ M}$
- b) $3.33 \times 10^{-2} \text{ M}$
- c) $3.33 \times 10^{-1} \text{ M}$
- d) $4.33 \times 10^{-2} \text{ M}$

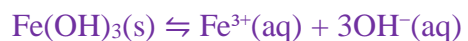
Q.22. Densities of diamond and graphite are 3.5 and 2.3 grams respectively. Increase of pressure on the equilibrium: $\text{diamond} \rightleftharpoons \text{graphite}$

- a) Favours backward reaction
- b) Favours forward reaction
- c) Have no effect
- d) Increase the reaction rate

Q.23. A vessel at 1000K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. The value of K if the total pressure at equilibrium is 0.8 atm is

- a) 1.8 atm
- b) 3 atm
- c) 0.3 atm
- d) 0.18 atm

Q.24. Find the increase in equilibrium concentration of Fe^{3+} ions if OH^- ions concentration decreases to 1/4th in the following reaction:



- a) 8 times
- b) 16 times
- c) 4 times
- d) 64 times

Q.25. What do you think will happen if reaction quotient is smaller than the equilibrium constant?

- a) equilibrium constant will change
- b) reaction quotient remains constant
- c) reaction quotient increases continuously
- d) reaction quotient increases till K_c