Chemical Equilibrium

Q.1. In which of the following reaction Kp > Kc

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

Q.2. For reaction $PCl_3(g) + Cl_2(g) \leftrightharpoons PCl_5(g)$, the value of Kc at 250°C is 26 mol^{-1} $litre^1$. The value of Kp 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

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

$$AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2 \, ?$$

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 Keq is

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

Q.5. For the reaction $PCl_5(g) \leftrightharpoons PCl_3(g) + Cl_2(g)$ 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 $\Delta G = -RT\ln Kc + RT\ln Q_p$ 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 $1x10^{20}$ 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

$$CO(g) + (1/2)\,O_2(g) \rightleftharpoons CO_2(g),\ K_p/K_c \text{ is}$$

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

$N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3 + \text{Heat}$, The equilibrium shifts in forward direction

a) by increasing the concentration of $NH_3(g)$
b) by decreasing the pressure
c) by decreasing the concentration of $N_2(g)$ and $H_2(g)$
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 $PCl_3(g) + Cl_2(g) \leftrightharpoons PCl_5(g)$, the value of Kc at 250°C is 26 mol–1/litre. The value of Kp 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, $PCl_5(g) \leftrightharpoons PCl_3(g) + Cl_2(g)$ 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, $2A \leftrightharpoons B + C$, $\Delta H° = –40$ Kcal mol^{-1} .
which statement is correct for Kc ?

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

Q.19. On applying pressure to the equilibrium
ice ⇋ 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. Kp 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 Kc for the reaction at 40°C will be

a) 4.33×10^{-1} M
b) 3.33×10^{-2} M
c) 3.33×10^{-1} M
d) 4.33×10^{-2} M

Q.22. Densities of diamond and graphite are 3.5 and 2.3 grams respectively. Increase of pressure on the equilibrium: diamond ⇋ 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:**

$Fe(OH)_3(s) \leftrightharpoons Fe^{3+}(aq) + 3OH^-(aq)$

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 Kc