Law of equilibrium and Equilibrium constant

21. For the reaction $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$, the correct expression of equilibrium constant *K* is

(a) $K = \frac{[NH_3]^2}{[N_2][H_2]^3}$

(b) $K = \frac{[N_2][H_2]^3}{[NH_3]^2}$

(c) $K = \frac{2[NH_3]}{[N_2]\times 3[H_2]}$

(d) $K = \frac{[N_2]\times 3[H_2]}{2[NH_3]}$

22. The suitable expression for the equilibrium constant of the reaction $2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$ is

(a) $K_c = \frac{[2NOCl]}{[2NO][Cl_2]}$

(b) $K_c = \frac{[NOCl]^2}{[NO]^2[Cl_2]}$

(c) $K_c = \frac{[NOCl]^2}{[NO][Cl_2]^2}$

(d) $K_c = \frac{[NOCl]^2}{[NO]^2[Cl_2]^2}$

23. *A* + *B* ⇌ *C* + *D*. If finally the concentration of *A* and *B* are both equal but at equilibrium concentration of *D* will be twice of that of *A* then what will be the equilibrium constant of reaction.

(a) 4 / 9 (b) 9 / 4

(c) 1 / 9 (d) 4

24. If in the reaction $N_2O_4 = 2NO_2, \alpha$ is that part of N_2O_4 which dissociates, then the number of moles at equilibrium will be

(a) 3 (b) 1

(c) $(1-\alpha)^2$ (d) $(1+\alpha)$

25. In the gas phase reaction, $C_2H_4 + H_2 \rightleftharpoons C_2H_6$, the equilibrium constant can be expressed in units of

(a) $litre^{-1}mole^{-1}$

(b) $litremole^{-1}$

(c) $mole^2litre^{-2}$

(d) $molelitre^{-1}$

26. For the reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$, the units of K_c are

(a) $litremole^{-1}$

(b) $mollitre^{-1}$

(c) $(mollitre^{-1})^2$

(d) $(litremole^{-1})^2$

27. A quantity of PCl_5 was heated in a 10 litre vessel at 250^oC; $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$. At equilibrium the vessel contains 0.1 mole of $PCl_5$0.20 mole of PCl_3 and 0.2 mole of Cl_2. The equilibrium constant of the reaction is

(a) 0.02 (b) 0.05

(c) 0.04 (d) 0.025

28. A mixture of 0.3 mole of H_2 and 0.3 mole of I_2 is allowed to react in a 10 *litre* evacuated flask at 500^oC. The reaction is $H_2 + I_2 \rightleftharpoons 2HI$, the K is found to be 64. The amount of unreacted I_2 at equilibrium is

(a) 0.15 mole (b) 0.06 mole

(c) 0.03 mole (d) 0.2 mole

29. In a chemical equilibrium, the rate constant of the backward reaction is 7.5×10^{-4} and the equilibrium constant is 1.5. So the rate constant of the forward reaction is

(a) 5×10^{-4} (b) 2×10^{-3}

(c) 1.125×10^{-3} (d) 9.0×10^{-4}

30. 28 g of N_2 and 6 g of H_2 were kept at 400^oC in 1 *litre* vessel, the equilibrium mixture contained $27.54g$ of NH_3. The approximate value of K_c for the above reaction can be (in $mole^{-2}litre^2$)

(a) 75 (b) 50

(c) 25 (d) 100

31. The equilibrium concentration of X, Y and YX_2 are 4, 2 and 2 moles respectively for the equilibrium $2X + Y \rightleftharpoons YX_2$. The value of K_c is

(a) 0.625 (b) 0.0625

(c) 6.25 (d) 0.00625

32. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 0.50 *atm*. pressure. Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask. When the decomposition reaction reaches equilibrium, the total pressure in the flask rises to 0.84 *atm*. The equilibrium constant for NH_4HS decomposition at this temperature is

(a) 0.30 (b) 0.18

(c) 0.17 (d) 0.11

33. In the reaction $A + 2B \rightleftarrows 2C$, if 2 moles of A, 3.0 moles of B and 2.0 moles of C are placed in a $2.0l$ flask and the equilibrium concentration of C is 0.5 mole/l. The equilibrium constant (K_c) for the reaction is

(a) 0.073 (b) 0.147

(c) 0.05 (d) 0.026

34. In a $500ml$ capacity vessel CO and Cl_2 are mixed to form $COCl_2$. At equilibrium, it contains 0.2 moles of $COCl_2$ and 0.1 mole of each of CO and CO_2. The equilibrium constant K_c for the reaction $CO + Cl_2 \rightleftharpoons COCl_2$ is

(a) 5 (b) 10

(c) 15 (d) 20

35. A reaction is $A + B \rightarrow C + D$. Initially we start with equal concentration of A and B. At equilibrium we find the moles of C is two times of A. What is the equilibrium constant of the reaction

(a) 4 (b) 2

(c) $1/4$ (d) $1/2$

36. 4.5 moles each of hydrogen and iodine heated in a sealed ten litre vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is

(a) 1 (b) 10

(c) 5 (d) 0.33

37. An equilibrium mixture of the reaction $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$ had 0.5 mole H_2S, 0.10 mole H_2 and 0.4 mole S_2 in one litre vessel. The value of equilibrium constant (K) in *mole litre*$^{-1}$ is

(a) 0.004 (b) 0.008

(c) 0.016 (d) 0.160

38. At 3000 *K* the equilibrium pressures of CO_2, *CO* and O_2 are 0.6,0.4 and 0.2 atmospheres respectively. K_p for the reaction, $2CO_2 \rightleftharpoons 2CO + O_2$ is

(a) 0.089 (b) 0.0533

(c) 0.133 (d) 0.177

39. The rate constant for forward and backward reactions of hydrolysis of ester are 1.1×10^{-2} and 1.5×10^{-3} per minute respectively. Equilibrium constant for the reaction is $CH_3COOC_2H_5 + H_2O \rightleftharpoons CH_3COOH + C_2H_5OH$

(a) 4.33 (b) 5.33

(c) 6.33 (d) 7.33

40. At a certain temp. $2HI \rightleftharpoons H_2 + I_2$ Only 50% *HI* is dissociated at equilibrium. The equilibrium constant is

(a) 0.25 (b) 1.0

(c) 3.0 (d) 0.50