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SET 1 – Equilibrium:

1. The word *equilibrium* means –
   a) A fast reaction
   b) A state of balance
   c) A complete reaction
   d) A reversible reaction

2. Chemical equilibrium is attained when –
   a) Reactants completely change to products
   b) The rate of forward reaction = rate of backward reaction
   c) Reaction stops completely
   d) Products start decomposing

3. Chemical equilibrium is a –
   a) Dynamic state
   b) Static state
   c) Stationary state
   d) Temporary state

4. In a reversible reaction, equilibrium is possible only when –
   a) Reaction is exothermic
   b) Reaction is endothermic
   c) Reaction occurs in a closed system
   d) Reaction occurs in open system

5. Dynamic equilibrium means –
   a) No molecules react
   b) Forward and backward reactions occur at equal rate
   c) Reaction stops
   d) Only reactants exist

6. At equilibrium, concentration of reactants and products –
   a) Become equal
   b) Become zero
   c) Remain constant
   d) Continuously change

7. Law of mass action was given by –
   a) Guldberg and Waage
   b) Le Chatelier
   c) Arrhenius
   d) Ostwald

8. Law of mass action states that –
   a) Rate $\propto$ product of molar concentrations
   b) Rate $\propto$ sum of molar concentrations
   c) Rate = constant
   d) Rate independent of concentration

9. For the reaction A + B $\rightleftharpoons$ C + D, equilibrium constant Kc =
    a) [C][D]/[A][B]
    b) [A][B]/[C][D]
    c) [A][B][C][D]
    d) None

10. When concentration is expressed in mol L^{-1}, equilibrium constant is –
    a) Kc
    b) Kp
    c) Ka
    d) Kb

11. When pressure terms are used, equilibrium constant is –
    a) Kp
    b) Kc
    c) Kw
    d) Ka

12. Relationship between Kp and Kc is –
    a) Kp = Kc (RT)^Δn
    b) Kp = Kc /(RT)^Δn
    c) Kp = 1/Kc (RT)^Δn
    d) Kp = Kc R/T

13. For the reaction N_2 + $3H_2$ $\rightleftharpoons$ $2NH_3$, Δn =
    a) 2 – 4 = –2
    b) 4 – 2 = +2
    c) 3
    d) 0

14. If Δn = 0, then Kp =
    a) Kc
    b) 1/Kc
    c) Kc^2
    d) Kc/RT

15. The equilibrium constant depends on –
    a) Temperature
    b) Pressure
    c) Catalyst
    d) Volume

16. The equilibrium constant is independent of –
    a) Catalyst
    b) Temperature
    c) Nature of substance
    d) Reaction

17. Value of Kc gives idea about –
    a) Extent of reaction
    b) Rate of reaction
    c) Mechanism of reaction

d) Temperature

18. Large value of Kc indicates –
    a) Reaction almost complete
    b) Reaction negligible
    c) Equilibrium far on reactant side
    d) Reaction slow

19. Small value of Kc indicates –
    a) Forward reaction favoured
    b) Backward reaction favoured
    c) Equilibrium at mid-point
    d) None

20. For homogeneous equilibrium –
    a) All reactants and products in same phase
    b) Different phases
    c) One gas and one solid
    d) None

21. For heterogeneous equilibrium –
    a) Different phases
    b) Same phase
    c) All gases
    d) All liquids

22. Example of heterogeneous equilibrium –
    a) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
    b) $H_2 + I_2 \rightleftharpoons 2HI$
    c) $N_2 + 3H_2 \rightleftharpoons 2NH_3$
    d) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

23. If Kc = 1, then –
    a) Both reactants and products equally favoured
    b) Forward favoured
    c) Backward favoured
    d) Reaction incomplete

24. The value of Kc changes with –
    a) Temperature
    b) Concentration
    c) Pressure
    d) Catalyst

25. When reaction quotient Q = K, the system is –
    a) At equilibrium
    b) Moving forward
    c) Moving backward
    d) Spontaneous

26. When Q < K, the reaction proceeds –
    a) Forward

b) Backward
c) Equilibrium
d) Stops

27. When Q > K, the reaction proceeds –
    a) Backward
    b) Forward
    c) Equilibrium
    d) None

28. Le Chatelier's principle predicts –
    a) Direction of equilibrium shift
    b) Rate of reaction
    c) Mechanism
    d) Catalyst effect

29. If concentration of reactant increases, equilibrium shifts –
    a) Forward
    b) Backward
    c) No change
    d) None

30. If concentration of product increases, equilibrium shifts –
    a) Backward
    b) Forward
    c) No effect
    d) None

31. For exothermic reaction, increase in temperature shifts equilibrium –
    a) Backward
    b) Forward
    c) No change
    d) None

32. For endothermic reaction, increase in temperature shifts equilibrium –
    a) Forward
    b) Backward
    c) No effect
    d) None

33. Decrease in temperature favours –
    a) Exothermic reaction
    b) Endothermic reaction
    c) Both
    d) None

34. Increase in temperature favours –
    a) Endothermic reaction
    b) Exothermic reaction
    c) Both
    d) None

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35. Increase in pressure favours the side with –
    a) Fewer moles of gas
    b) More moles of gas
    c) No gas
    d) None

36. Decrease in pressure favours the side with –
    a) More moles of gas
    b) Fewer moles
    c) Equal moles
    d) No change

37. In $N_2 + 3H_2 \rightleftharpoons 2NH_3$, increase in pressure shifts equilibrium –
    a) Right (towards NH_3)
    b) Left
    c) No change
    d) None

38. In $CaCO_3 \rightleftharpoons CaO + CO_2$, increase in pressure shifts equilibrium –
    a) Left
    b) Right
    c) No effect
    d) None

39. Effect of catalyst on equilibrium constant –
    a) No effect
    b) Increases
    c) Decreases
    d) Doubles

40. Catalyst affects –
    a) Rate of attainment of equilibrium
    b) Value of K
    c) Both
    d) None

41. Equilibrium constant of reverse reaction =
    a) 1/K
    b) K
    c) K²
    d) √K

42. If stoichiometric equation is multiplied by 2, K′ =
    a) K²
    b) K
    c) √K
    d) 1/K

43. If reaction is reversed, ΔG° =
    a) –ΔG°original
    b) +ΔG°original
    c) 0

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   d) None

44. Unit of Kc depends on –
    a) Δn
    b) ΔH
    c) ΔS
    d) ΔG

45. For $\Delta n = 0$, Kc is –
    a) Dimensionless
    b) Has units
    c) Variable
    d) Undefined

46. For $2NO_2 \rightleftharpoons N_2O_4$, $\Delta n =$
    a) –1
    b) +1
    c) 0
    d) 2

47. Equilibrium constant expresses –
    a) Concentration ratio at equilibrium
    b) Rate of reaction
    c) Activation energy
    d) None

48. Equilibrium in a physical process is –
    a) Physical equilibrium
    b) Chemical equilibrium
    c) Both
    d) None

49. Vapour pressure equilibrium between liquid and vapour is –
    a) Dynamic equilibrium
    b) Static equilibrium
    c) Mechanical equilibrium
    d) None

50. In equilibrium state –
    a) Properties remain constant
    b) Reaction stops
    c) Only products remain
    d) Only reactants remain

✅ **Answer Key – SET 1**

1–b 2–b 3–a 4–c 5–b 6–c 7–a 8–a 9–a 10–a
11–a 12–a 13–a 14–a 15–a 16–a 17–a 18–a 19–b 20–a
21–a 22–a 23–a 24–a 25–a 26–a 27–a 28–a 29–a 30–a

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31–a   32–a   33–a   34–a   35–a   36–a   37–a   38–a   39–a   40–a
41–a   42–a   43–a   44–a   45–a   46–a   47–a   48–a   49–a   50–a