1. For the reaction $2A \rightleftharpoons B + C$, $K_C = 4 \times 10^{-3}$. At a given time, the composition of reaction mixture is : $[A] = [B] = [C] = 2 \times 10^{-3}\ M$.
Then, which of the following is correct? **(2024)**
(a) Reaction has a tendency to go in forward direction
(b) Reaction has a tendency to go in backward direction
(c) Reaction has gone to completion in forward direction
(d) Reaction is at equilibrium

2. In which of the following equilibria, k_p and k_c are **NOT** equal? **(2024)**
(a) $H_{2(g)} + I_{2(g)} \leftrightharpoons 2\,HI_{(g)}$
(b) $CO_{(g)} + H_2O_{(g)} \leftrightharpoons CO_{2(g)} + H_{2(g)}$
(c) $2\,BrCl_{(g)} \leftrightharpoons Br_{2(g)} + Cl_{2(g)}$
(d) $PCl_{5(g)} \leftrightharpoons PCl_{3(g)} + Cl_{2(g)}$

3. Consider the following reaction in a sealed vessel at equilibrium with concentrations of $N_2 = 3.0 \times 10^{-3}$ M, $O_2 = 4.2 \times 10^{-3}$M and $NO = 2.8 \times 10^{-3}$M .
$2NO_{(g)} \leftrightharpoons N_{2(g)} + O_{2(g)}$
If 0.1 mol L^{-1} of $NO_{(g)}$ is taken in a closed vessel.
What will be degree of dissociation (α) of $NO_{(g)}$ at equilibrium? **(2024)**
(a) 0.0889 (b) 0.8889
(c) 0.717 (d) 0.00889

4. For a weak acid HA, the percentage of dissociation is nearly 1% at equilibrium. If the concentration of acid is 0.1 mol L^{-1}, then the correct option for its K_a at the same temperature is: **(2023)**
(a) 1×10^{-4} (b) 1×10^{-6}
(c) 1×10^{-5} (d) 1×10^{-3}

5. An acidic buffer is prepared by mixing: **(2023)**
(a) weak acid and it's salt with strong base
(b) equal volumes of equimolar solutions of weak acid and weak base
(c) strong acid and it's salt with strong base
(d) strong acid and it's salt with base (The pK_a of acid = pK_b of the base)

6. 0.01 M acetic acid solution is 1% ionised, then pH of this acetic acid solution is: **(2022)**
(a) 1
(b) 3
(c) 2
(d) 4

7. K_H value for some gases at the same temperature 'T' are given: **(2022)**

Gas	K_H/k bar
Ar	40.3
CO_2	1.67
HCHO	1.83×10^{-5}
CH_4	0.413

Where K_H is Henry's Law constant in water. The order of their solubility in water is:
(a) HCHO < CH_4 < CO_2 < Ar
(b) Ar < CO_2 < CH_4 < HCHO
(c) Ar < CH_4 < CO_2 < HCHO
(d) HCHO < CO_2 < CH_4 < Ar

8. K_p for the following reaction is 3.0 at 1000 K.
$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$
What will be the value of K_c for the reaction at the same temperature?
(Given: R = 0.083 L bar K^{-1} mol^{-1}) **(2022)**
(a) 3.6
(b) 0.36
(c) 3.6×10^{-2}
(d) 3.6×10^{-3}

9. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is **(2022)**
[Given: pK_a of CH_3COOH = 4.57]
(a) 5.57 (b) 3.57
(c) 4.57 (d) 2.57

10. $3O_2(g) \rightleftharpoons 2O_3(g)$
For the above reaction at 298 K, K_c is found to be 3.0×10^{-59}. If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is **(2022)**
(a) 4.38×10^{-32} (b) 1.9×10^{-63}
(c) 2.4×10^{31} (d) 1.2×10^{21}

11. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T(K). The correct option for the pH of dimethylammonium acetate solution is: **(2021)**

(a) 5.50 (b) 7.75
(c) 6.25 (d) 8.50

12. Find out the solubility of $Ni(OH)_2$ in 0.1 M NaOH. Given that the ionic product of $Ni(OH)_2$ is 2×10^{-15}. **(2020)**

(a) 2×10^{-8} M (b) 1×10^{-13} M
(c) 1×10^{8} M (d) 2×10^{-13} M

13. HCl was passed through a solution of $CaCl_2$, $MgCl_2$ and NaCl. Which of the following compound(s) crystallize? **(2020)**

(a) Only NaCl
(b) Only $MgCl_2$
(c) NaCl, $MgCl_2$ and $CaCl_2$
(d) Both $MgCl_2$ and $CaCl_2$

14. Which among the following salt solutions is basic in nature? **(2020 covid Re-NEET)**

(a) Ammonium sulphate
(b) Ammonium nitrate
(c) Sodium acetate
(d) Ammonium chloride

15. The solubility product for a salt of the type AB is 4×10^{-8}. What is the molarity of its standard solution? **(2020 Covid Re-NEET)**

(a) 16×10^{-16} mol/L
(b) 2×10^{-16} mol/L
(c) 4×10^{-4} mol/L
(d) 2×10^{-4} mol/L

16. Hydrolysis of sucrose is given by the following reaction.

$Sucrose + H_2O \rightleftharpoons Glucose + Fructose$

If the equilibrium constant (K_c) is 2×10^{13} at 300 K, the value of $\Delta_r G°$ at the same temperature will be :

(a) $8.314\ J\ mol^{-1}K^{-1} \times 300\ K \times \ln(2 \times 10^{13})$
(b) $8.314\ J\ mol^{-1}K^{-1} \times 300\ K \times \ln(3 \times 10^{13})$
(c) $-8.314\ J\ mol^{-1}\ K^{-1} \times 300\ K \times \ln(4 \times 10^{13})$
(d) $-8.314\ J\ mol^{-1}\ K^{-1} \times 300\ K \times ln(2 \times 10^{13})$

17. pH of a saturated solution of $Ca(OH_2)$ is 9. The solubility product (K_{sp}) of $Ca(OH)_2$ is: **(2019)**

(a) 0.5×10^{-15} (b) 0.25×10^{-10}
(c) 0.125×10^{-15} (d) 0.5×10^{-10}

18. Conjugate base for Bronsted acids H_2O and HF are : **(2019)**

(a) OH^- and H_2F^+, respectively
(b) H_3O^+ and F^-, respectively
(c) OH^- and F^-, respectively
(d) H_3O^+ and H_2F^+, respectively

19. Which will make basic buffer? **(2019)**

(a) 50 mL of 0.1 M NaOH + 25 mL of 0.1 M CH_3COOH
(b) 100 mL of 0.1 M CH_3COOH + 100 mL of 0.1 M NaOH
(c) 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH_4OH
(d) 100 mL of 0.1 M HCl + 100 mL of 0.1 M NaOH

20. Which one of the following conditions will favour maximum formation of the product in the reaction,

$A_2(g) + B_2(g) \rightleftharpoons X_2(g)\ \Delta_r H = -X\ kJ$ **(2018)**

(a) Low temperature and high pressure
(b) Low temperature and low pressure
(c) High temperature and low pressure
(d) High temperature and high pressure

21. The solubility of $BaSO_4$ in water is $2.42 \times 10^{-3}\ gL^{-1}$ at 298 K. The value of its solubility product (K_{sp}) will be: **(2018)**

(Given molar mass of $BaSO_4$ = 233 g mol^{-1})

(a) $1.08 \times 10^{-10}\ mol^2\ L^{-2}$
(b) $1.08 \times 10^{-12}\ mol^2\ L^{-2}$
(c) $1.08 \times 10^{-8}\ mol^2\ L^{-2}$
(d) $1.08 \times 10^{-14}\ mol^2\ L^{-2}$

22. Following solutions were prepared by mixing different volumes of NaOH and HCl of different concentrations : **(2018)**

(A) $60mL\ \frac{M}{10}HCl + 40mL\ \frac{M}{10}NaOH$
(B) $55mL\ \frac{M}{10}HCl + 45mL\ \frac{M}{10}NaOH$
(C) $75mL\ \frac{M}{5}HCl + 25mL\ \frac{M}{5}NaOH$
(D) $100mL\ \frac{M}{10}HCl + 100mL\ \frac{M}{10}NaOH$

pH of which one of them will be equal to 1?

(a) B (b) A
(c) C (d) D

23. The equilibrium constants of the following are : **(2017-Delhi)**

$N_2 + 3H_2 \rightleftharpoons 2NH_3$ K_1
$N_2 + O_2 \rightleftharpoons 2NO$ K_2
$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ K_3

The equilibrium constant (K) of the reaction:

$2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O$, will be:

(a) $K_2^3K_3/K_1$ (b) $K_1K_3^3/K_2$

(c) $K_2K_3^3/K_1$ (d) K_2K_3/K_1

24. Concentration of Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is 2.2×10^{-4} mol L^{-1}. Solubility product of Ag_2CO_4 is: **(2017-Delhi)**

(a) 5.3×10^{-12} (b) 2.42×10^{-8}
(c) 2.66×10^{-12} (d) 4.5×10^{-11}

25. Which one of the following statements is not correct? **(2017-Delhi)**

(a) Coenzymes increase the catalytic activity of enzyme
(b) Catalyst does not initiate any reaction
(c) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium
(d) Enzymes catalyse mainly bio-chemical reactions

26. The standard equilibrium constant K_P at 298 K for the reaction, $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is 5.8×10^5. The value of standard equilibrium constant, if the concentration of gases is expressed in terms of mol L^{-1}, will be:
[Given : R = 0.08314 L bar K^{-1} mol^{-1}] **(2017-Gujarat)**

(a) 3.99×10^9 (b) 3.51×10^6
(c) 3.84×10^7 (d) 3.56×10^8

27. Consider the following reaction for which the change in enthalpy is positive
$2A(g) + B(g) \rightleftharpoons C(g) + D(g)$
Which of the following will not affect the equilibrium? **(2017-Gujarat)**

(a) Presence of catalyst
(b) Change in concentration of reactants
(c) Change in pressure
(d) Change in temperature

28. For the reaction $CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$ $\frac{K_p}{K_c}$ is equal to: **(2017-Gujarat)**

(a) $(RT)^2$ (b) $\frac{1}{RT}$
(c) RT (d) $\sqrt{RT}$

29. Which of the following fluoro-compounds is most likely to behave as a Lewis base? **(2016-II)**

(a) CF_4 (b) SiF_4
(c) BF_3 (d) PF_3

30. The solubility of AgCl(s) with solubility product 1.6×10^{-10} in 0.1 M NaCl solution would be: **(2016-II)**

(a) 1.6×10^{-11} M (b) Zero
(c) 1.26×10^{-5} M (d) 1.6×10^{-9} M

31. The percentage of pyridine (C_5H_5N) that forms pyridinium ion ($C_5H_5N^+H$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is : **(2016-II)**

(a) 0.77% (b) 1.6%
(c) 0.0060% (d) 0.013%

32. Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3. If a larger amount of $KHSO_4$ is added to the mixture, the rate of nitration will be: **(2016-I)**

(a) Doubled (b) Increase
(c) Decrease (d) Unchanged

33. MY and NY_3, two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature, which statements would be true in regard to MY and NY_3? **(2016-I)**

(a) The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities
(b) The molar solubilities of MY and NY_3 in water are identical
(c) The molar solubility of MY in water is less than of NY_3
(d) The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water

34. If the equilibrium constant for $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is K, the equilibrium constant for $\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO(g)$ will be: **(2015 Re)**

(a) K^2 (b) $K^{1/2}$
(c) $\frac{1}{2}K$ (d) K

35. Which one of the following pairs of solution is not an acidic buffer? **(2015 Re)**

(a) H_3PO_4 and Na_3PO_4
(b) $HClO_4$ and $NaClO_4$
(c) CH_3COOH and CH_3COONa
(d) H_2CO_3 and Na_2CO_3

36. If the value of an equilibrium constant for a particular reaction is 1.6×10^{12}, then at equilibrium the system will contain: **(2015)**

(a) Mostly reactants
(b) Mostly products
(c) Similar amounts of reactants and products
(d) All reactants

37. The K_{sp} of Ag_2CrO_4, AgBr and AgI are respectively, 1.1×10^{-12}, 1.8×10^{-10}, 5.0

$\times 10^{-13}$, 8.3×10^{-17}. Which one of the following salts will precipitate last if $AgNO_3$ solution is added to the solution containing equal moles of NaCl, NaBr, NaI and Na_2CrO_4 ? **(2015)**

(a) AgCl (b) AgBr
(c) Ag_2CrO_4 (d) AgI

38. What is the pH of the resulting solution when equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed? **(2015 Re)**

(a) 2.0 (b) 7.0
(c) 1.04 (d) 12.65

39. Aqueous solution of which of the following compounds is the best conductor of electric current? **(2015 Re)**

(a) Hydrochloric acid, HCl
(b) Ammonia, NH_3
(c) Fructose, $C_6H_{12}O_6$
(d) Acetic acid, $C_2H_4O_2$

40. Which of the following statements is correct for a reversible process in a state of equilibrium? **(2015)**

(a) $\Delta G° = -2.303\ RT \log K$
(b) $\Delta G° = 2.303\ RT \log K$
(c) $\Delta G = -2.303\ RT \log K$
(d) $\Delta G = 2.303\ RT \log K$

41. Which of the following salts will give highest pH in water? **(2014)**

(a) NaCl (b) Na_2CO_3
(c) $CuSO_4$ (d) 4KCl

42. Using the Gibb's energy change, $\Delta G° = +63.3$ kJ, for the following reaction,

$Ag_2CO_3(s) \rightleftharpoons 2Ag^+(aq) + CO_3^-(aq)$

The K_{sp} of Ag_2CO_3(s) in water at 25°C is (R = 5.314 $JK^{-1}\ mol^{-1}$) **(2014)**

(a) 3.2×10^{-26}
(b) 8.0×10^{-12}
(c) 2.9×10^{-3}
(d) 7.9×10^{-2}

43. For the reversible reaction,

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat.$

The equilibrium shifts in forward direction: **(2014)**

(a) By decreasing the pressure
(b) By decreasing the concentration of N_2(g) and H_2(g)
(c) By Increasing pressure and decreasing temperature
(d) By increasing the concentration of NH_3(g)

44. Which of these is least likely to act as a Lewis base? **(2013)**

(a) CO (b) F^-
(c) BF_3 (d) PF_3

45. $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction:

$3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$

The reaction can go to completion by removing OH^- ions by adding: **(2013)**

(a) HCl
(b) KOH
(c) CO_2
(d) SO_2