Solutions

S1. **S7**. Ans.(b) Ans.(b) $2A \rightleftharpoons B + C, K_C = 4 \times 10^{-3}$ According to Henry's Law, At a given time t, Q_C is to be calculated $p = K_H \cdot X$ and been compared with K_C. $Q_{\rm C} = \frac{[{\rm B}][{\rm C}]}{[{\rm A}]^2} = \frac{(2 \times 10^{-3})(2 \times 10^{-3})}{(2 \times 10^{-3})^2}$ Where 'p' is partial pressure of gas in $Q_{\rm C} = 1$ vapour phase. As $Q_C > K_C$, so reaction has a tendency to 'K_H' is Henry's Law constant. move backward. S2. Ans.(d) 'x' is mole fraction of gas in liquid. $K_{\rm P} = K_{\rm C}({\rm RT})^{\Delta n_{\rm g}}$ Higher the value of $K_{\rm H}$ at a given for $K_p \neq K_C$, pressure, lower is the solubility of the gas $\Delta n_g \neq 0$ $\Delta n_{\rm g} = n_{\rm p} - n_{\rm r}$ in the liquid. (1) $\Delta n_g = 2 - 2 = 0$ (2) $\Delta n_g = 2 - 2 = 0$ \therefore Solubility: Ar < CO₂ < CH₄ < HCHO (3) $\Delta n_g = 2 - 2 = 0$ **S8**. Ans.(c) (4) $\Delta n_g = 2 - 1 = 1$ S3. $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$ Ans.(c) $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$ $\Delta n_g = 2 - 1 = 1$ $K_{c} = \frac{[N_{2}][O_{2}]}{[NO]^{2}}$ $K_p = K_c (RT)^{\Delta n_g}$ $= \frac{3 \times 10^{-3} \times 4.2 \times 10^{-3}}{-3}$ $\frac{1.607}{2.8 \times 10^{-3} \times 2.8 \times 10^{-3}} = 1.607$ $K_p = K_c(RT)$ 2NO(g)⇒ $N_2(g)$ $O_2(g)$ $[:: K_p = 3]$ $t = 0 \quad 0.1$ 0 0 $0.1 - 0.1 \alpha$ 0.05α 0.05α $K_{c} = \frac{K_{p}}{RT} = \frac{3}{0.083 \times 1000}$ $K_{\rm c} = \frac{0.05\alpha \times 0.05\alpha}{c}$ $(0.1-0.1\alpha)^2$ $K_{c} = \frac{\frac{0.5\alpha \times 0.05\alpha}{0.01(1-\alpha)^{2}}}{\frac{0.01(1-\alpha)^{2}}{0.01(1-\alpha)^{2}}}$ = 0.036 $1.607 = \frac{(0.05)^2 \alpha^2}{\alpha^2}$ $= 3.6 \times 10^{-2}$ $0.01(1-\alpha)^2$ **S9**. Ans.(a) $\frac{\alpha^2}{(1-\alpha)^2} = \frac{1.607 \times (0.1)^2}{(0.05)^2}$ It is a mixture of weak acid and salt of its $\frac{\alpha}{1-\alpha} = \frac{1.27 \times 0.1}{0.05}$ conjugate base. Hence, it is acidic buffer. = 2.541-α $pH = pK_a + \log \frac{[Salt]}{[Acid]}$ $3.54 \alpha = 2.54$ $\alpha = \frac{2.54}{3.54} = 0.717$ $= 4.57 + \log\left(\frac{0.1}{0.01}\right)$ **S4**. Ans.(c) = 4.57 + 1 = 5.57 $K_a = C\alpha^2$ $K_a = (0.1) \times (0.01)^2$ S10. Ans.(a) $K_a = 1 \times 10^{-5}$ $3O_2(g) \rightleftharpoons 2O_3(g)$ **S5**. Ans.(a) $K_{c} = \frac{[O_{3}]^{2}}{[O_{2}]^{3}}$ Acidic buffer is prepared by mixing weak acid and its salt with strong base. $[O_3]^2 = K_c[O_2]^3 = 3 \times 10^{-59} \times (0.04)^3$ **S6**. Ans.(d) For weak acid (i.e., CH₃COOH) $[O_3]^2 = 1.9 \times 10^{-63} = 19.2 \times 10^{-64}$ $[H^+] = C\alpha$ $[O_3] = 4.38 \times 10^{-32}$ $= 0.01 \times \frac{1}{100} = 10^{-4} \text{ M}$ Concentration of O_3 at equilibrium = 4.38 $pH = -\log H^+ = -\log 10^{-4} = 4$ × 10-32 M

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S11. Ans.(b)

$$pH = \frac{1}{2}[P^{k_{\alpha}} + P^{k_{\alpha}} - P^{k_{\beta}}]$$

$$= 7 + \frac{1}{2}P^{k_{\alpha}} - \frac{1}{2}P^{k_{\beta}}$$

$$= 7 + \frac{1}{2}Y^{k_{\beta}} - \frac{1}{2}Y^{k_{\beta}}$$

$$= 7 + \frac{1}{2}Y^{k_{\beta}} - \frac{1}{2}Y^{k_{\beta}}}$$

$$= 7 + \frac{1}{2}Y^{k_{\beta}} - \frac{1}{2}Y^$$

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10 mmol

0

mL

2.5

mmol

0

2.5

0

10 mmol

10 mmol

520. Ans.(a)

$$A_{2}(g) + B_{2}(g) = X_{2}(g): AH = -X kI$$
On increasing pressure, equilibrium
shifts in a direction where pressure
decreases i.e. forward direction.
So, high pressure and low temperature,
solubility of BaSO₄, s = $\frac{242 \times 10^{-2}}{233}$ (mol L⁻¹)
= 1.04×10^{-5} (mol L⁻¹)
= 3.55×10^{9}
521. Ans.(a)
 $K_{xp} = [Ba^{2+1}][SO_{4}^{-1}] = s^{2}$
= $(1.04 \times 10^{-5})^{2}$
= 1.04×10^{-10} mol² L⁻²
522. Ans.(c)
523. Ans.(c)
 M_{nq} of HCl = $75 \times \frac{1}{5} \times 1 = 5$
- M_{nq} of HCl in resulting solution = 10
- Molarity of [H¹] in resulting mixture
= $\frac{10}{100} = \frac{1}{10}$
pli = $-\log[H^{+1}] = -\log[\frac{1}{10}] = 1.0$
524. Ans.(c)
 $2NH_{3} \approx 2x + 3H_{2}$
 $K_{x} = M_{x} = \frac{1}{30}$
pli = $-\log[H^{+1}] = -\log[\frac{1}{10}] = 1.0$
524. Ans.(a)
 $A_{x}(c) \approx 2NO$ K_{2}
 $3H_{2} + \frac{2}{2}O_{2} \approx 2NO$ K_{2}
 $3H_{2} + \frac{2}{2}O_{2} \approx 2NO$ K_{2}
 $3H_{3} + \frac{2}{2}O_{4} \approx 2NO$ K_{2}
 $3H_{4} + \frac{2}{3}O_{4} \approx 3H_{2}$ K_{3}
 $2NH_{3} \approx \frac{1}{2}O_{4} \approx 2AO$ K_{3}
 $2NH_{3} \approx \frac{1}{2}O_{4} \approx 2AO$ K_{3}
 $2NH_{3} \approx \frac{1}{2}O_{4} \approx 2AO$ K_{3}
 $A_{x}(c) = Ag^{4} + Cl^{2}$
 $K_{xp} = [Ag^{4}]^{2}[C,O_{4} = (2e)^{2}(e)$

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not

the

S32. Ans.(c)

If large amount of KHSO₄ would be added then concentration of NO_2^+ will decrease, rate of nitration will also decrease.

S33. Ans.(c)

For $MY \rightleftharpoons M_s^+ + Y_s^ K_{sp} = 6.2 \times 10^{-13}$ $S = 7.9 \times 10^{-7} mol L^{-1}$ For $NY_3 \rightleftharpoons N^{3+} + 3Y^-$

$$K_{sp} = 27S^4 \implies S = \left(\frac{\kappa_{sp}}{27}\right)^{-7}$$
$$S = 3.89 \times 10^{-4} mol \ L^{-1}$$

So, solubility of NY_3 is more than solubility of MY in pure water. And addition of KY decrease the solubility because of common ion effect.

S34. Ans.(b)

If the reaction is multiplied by $\frac{1}{2}$, then new equilibrium constant, $K' = K^{1/2}$.

S35. Ans.(b)

 $HClO_4$ and $NaClO_4$ will not make a buffer solution because a buffer solution is formed by the mixture of a weak acid and its conjugate base and $HClO_4$ is not a weak acid.

S36. Ans.(b)

Such big equilibrium constant indicates large concentration of products so equilibrium is mostly towards product.

S37. Ans.(c)

According to solubility law:

 $Ag_2CrO_4 \rightleftharpoons 2Ag^+ + CrO^{4^{2^-}}$ $(2S)^2 \qquad S$

 $1.1 \times 10^{-12} = 4S^3$

 $Ag_2CrO_4 = S \sim 10^{-3}$ $AgCl = S \sim 10^{-5}$ $AgBr = S \sim 10^{-6}$

$$AgI = S \sim 10^{-8}$$

So, Ag_2CrO_4 will be the most soluble.

S38. Ans.(d)

 $\because 1 \,$ mole of NaOH is completely neutralized by 1 mole of HCl.

So, 0.01 mole is neutralized by 0.01 mole of HCl.

Left NaOH = 0.09 mole

$$[OH^{-}] = \frac{0.09}{2} = 0.045M$$
$$pOH = -\log[OH^{-}] = 1.35$$
$$pH = 14 - pOH = 14 - 1.35 = 12.65$$

S39. Ans.(a)

HCl is strong acid and dissociated completely into ions in aq. Solution.

S40. Ans.(a)

 $\therefore \Delta G = \Delta G^{\circ} + 2.303 RT \log Q$ At equilibrium

 $\Delta G = 0$ $Q = K_{eq}$

So,
$$\Delta G^\circ = (-)2.303 RT \log K_{eq}$$

S41. Ans.(b)

Highest pH is shown by alkali

So, Na₂CO₃ being salt of a strong base and weak acid will exhibit highest pH.

NaCl → neutral pH = 7

 $CuSO_4$ → Acidic pH < 7

 $KCl \rightarrow Neutral pH = 7$

S42. Ans.(b)

 $\therefore \Delta G^{\circ} = -2.303 \ RT \log K_{sp}$

$$63.3 \times 10^3 J = -2.303 \times 8.314 \times 298 \log K_{sp}$$

$$K_{sp} = 8.128 \times 10^{-12}$$

S43. Ans.(c)

On increasing pressure, equilibrium shifts in forward direction, where number of moles decreases, it is an example of exothermic reaction therefore decreasing temperature favours the forward direction.

S44. Ans.(c)

Lewis base species are those which are electron deficient and does require electron to complete their octet. BF_3 is an electron deficient species and is a Lewis acid.

S45. Ans.(c)

HCl and SO₂ are reducing agents so they can reduce MnO_4^- .

 CO_2 is neither oxidizing nor reducing agent it will provide only acidic medium and shift the direction in forward reaction towards completion.