31.(B) $K_{sp} = 4s^3$

32.(C) $Cr(OH)_{3(s)} \rightleftharpoons \underset{s}{Cr^{+3}_{(aq)}} + \underset{3s}{3OH^-_{(aq)}}$

$K_{sp} = 27s^4 \quad \Rightarrow \quad s = \left(\frac{K_{sp}}{27}\right)^{1/4}$

33.(D) $Ca_3(PO_4)_2 \longrightarrow 3Ca^{2+} + 2PO_4^{3-}$

s	–	–
–	3s	2s

$K_{sp} = (3s)^3 (2s)^2 = 108\,s^5$

34.(D) $MX_4 \longrightarrow M^{4+} + 4X^-$

s	–	–
–	s	4s

$K_{sp} = (s)(4s)^4 = 256\,s^5 \quad \Rightarrow \quad s = \left(\frac{K_{sp}}{256}\right)^{1/5}$

35.(C) $Hg_2I_{2(s)} \rightleftharpoons Hg^{2+}_{2aq} + 2I^-_{aq}$

$K_{sp} = [Hg_2^{2+}]\,[I^-]^2$

36.(D) $Fe(OH)_{3(s)} \rightleftharpoons Fe^{3+}_{(aq)} + 3OH^-_{(aq)}$

$K_{sp} = [Fe^{3+}]\,[OH^-]^3 = 27\,X^4$

37.(B) $Ag_2S_{(s)} \rightleftharpoons 2Ag^+_{(aq)} + S^{2-}_{(aq)}$

$K_{sp} = [Ag^+]^2[S^{2-}]$ (S^{2-} will come predominantly from $Na_2S = 0.1M$)

$10^{-17} = [Ag^+]^2 \times 10^{-1} \quad \Rightarrow \quad [Ag^+] = 10^{-8} = 2s \quad \Rightarrow \quad s = 5 \times 10^{-9}$

38.(A) $Mg(OH)_{2(s)} \rightleftharpoons Mg^{2+}_{(aq)} + 2OH^-_{(aq)}$

$K_{sp} = 1.96 \times 10^{-11} = 4S^3 \quad \Rightarrow \quad S = \left(\frac{1.96}{4} \times 10^{-11}\right)^{1/3}$

Now $pH = 14 + \log [OH^-] = 14 + \log (2S)$

39.(C) For precipitation I.P. > K_{sp}

40.(B) $S^2 = K_{sp}$

$\left(\frac{x}{0.1 \times 283}\right)^2 = 1 \times 10^{-8} \quad \Rightarrow \quad x = 2.83 \times 10^{-3}\,g$

41.(C) $pH = pK_a + \log \frac{[salt]}{[acid]}$ Since [salt] = [acid]

Hence $pH = pK_a$ $\quad pOH = 14 - pK_a = 9.5$

42.(D) Solutions of salts of strong acid and weak basic are acidic.

43.(A) $pH = pK_a$; $K_a = \frac{K_w}{K_b}$

44.(C) $K_h = Ch^2 \quad \Rightarrow \quad h = \sqrt{\frac{K_h}{C}}$

45.(C) $CO_3^{2-} + 2H_2O \rightleftharpoons H_2CO_3 + 2OH^-$