1.(A) A buffer is a solution of weak acid and its salt with strong base and vice versa.

HCl is a strong acid and NaCl is its salt with strong base so pH is less than 7 due to HCl.

2. (A) $HSO_4^- \rightarrow H^+ + SO_4^{2-}$ **(D)** $^-OH + H^+ \rightarrow H_2O$

Both (A) and (D)

3. (A) $Mg(OH)_2 \rightleftharpoons \underset{S}{Mg^{2+}} + \underset{2S}{2OH^-}$

$K_{sp} = [Mg^{2+}][OH^{-1}]^2 \qquad = S \times (2S)^2 = 4S^3 = 4X^3$

4. (C) $K_{sp} = 4S^2 = 4 \times (10^{-5})^3 = 4 \times 10^{-15} M^3$

5. (A) NH₃ is strongest base among these.

6. (A) pH of 1×10^8 M HCl is $7 \simeq$ (HCl is acid)

7. (C) Thunderstorm produces acidic oxides which on dissolution in water form acidic rains i.e., pH < 7.

8. (A) $\underset{\text{Acid}}{H_2PO_4^-} \rightarrow H^+ + \underset{\text{Base}}{HPO_4^{2-}}$

9. (A) $MX_4 \rightleftharpoons \underset{S}{M^{4+}} + \underset{4S}{4X^-}$

$K_{sp} = [M^{4+}][X^-]^4 = S \times (4S)^4 = 256 \, S^5$.

10. (B) $MX_2 \rightleftharpoons \underset{S}{M^{2+}} + \underset{2S}{2X^-}$

$K_{sp} = MS_2 = 4S^3 = 4 \times 10^{-12}$

$\therefore \ S = 10^{-4} \qquad \therefore \ [M^{2+}] = 10^{-4} \, M$

11. (D) $pH = 5.4 = -\log[H^+] \qquad \therefore \ [H^+] = \text{antilog}(-5.4) = 3.98 \times 10^{-6}$

12. (D) $OH^- \rightarrow O^{2-} + H$

Acid   Conjugate base

13. (C) For buffer solution

$pH = pK_a + \log \dfrac{[Salt]}{[Acid]} \quad = 4.5 + \log \dfrac{[Salt]}{[Acid]}$

As HA is 50% ionized, so [Salt] = [Acid]

$pH = 4.5$

$pH + pOH = 14 \quad \therefore \ pOH = 14 - 4.5 = 9.5$

14. (B) $AgIO_{3(S)} \rightleftharpoons Ag^+_{(aq)} + IO^-_{3(sq)}$
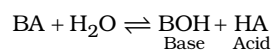
Let the solubility of $AgIO_3$ be S

$K_{sp} = [Ag^+][IO_3^-]$

$K_{sp} = S \times S$

or $S = \sqrt{K_{sp}}$

$S = \sqrt{1.0 \times 10^{-8}} = 1.0 \times 10^{-4}$ mol/litre $= 1.0 \times 10^{-4} \times 2.83$ g/litre

$= \dfrac{1.0 \times 10^{-4} \times 283}{1000} \times 100$ g/100ml $= 2.83 \times 10^{-3}$ g/100 ml

15. (C) In aqueous solution, BA(salt) hydrolyses to give

$\underset{}{BA} + H_2O \rightleftharpoons \underset{Base}{BOH} + \underset{Acid}{HA}$

Now pH since by

$pH = \dfrac{1}{2} pK_w + \dfrac{1}{2} pK_a - \dfrac{1}{2} pK_b$

Substituting the given values, we get

$pH = \dfrac{1}{2}(14 + 4.80 - 4.78) = 7.01$