16. Amphoteric **17.(F)** ZnO: kAmphoteric

18.(C) Electron deficient species acts as Lewis acid.

19.(A) Protonated form of an anion.

20. $HCOOH \rightleftharpoons H^+ + HCOO^-$

$\underset{1-0.75}{HCOONa} \rightleftharpoons Na^+ + \underset{0.75}{HCOO^-}$

In the above buffer solution, the significant source of formate ion $(HCOO^-)$ is HCOONa. Hence,

$$K_a = 2.4 \times 10^{-4} = \frac{[H^+](0.75)}{[HCOOH]}$$

$$[H^+] = \frac{2.4 \times 10^{-4} \times 0.20}{0.75} = 6.4 \times 10^{-5}$$

$$pH = -\log(64 \times 10^{-5}) = 4.20$$

21.(F)

22. In pure water, solubility $= \frac{9.57}{58} \times 10^{-3}\ M = 1.65 \times 10^{-4} M$

$$K_{sp} = 4S^3 = 4(1.65 \times 10^{-4})^3 = 1.8 \times 10^{-11}$$

In 0.02 M $Mg(NO_3)_2$;

$$\text{Solubility of } Mg(OH)_2 = \sqrt{\frac{K_{sp}}{[Mg^{2+}]}} \times \frac{1}{2} = 1.5 \times 10^{-5} \text{ mol } L^{-1}$$

$$= 1.5 \times 10^{-5} \times 58 \text{ g } L^{-1} = 8.7 \times 10^{-4} \text{ g } L^{-1}$$

23. **(i)** 0.20 mole of HCl will neutralizes 0.20 mole CH_3COONa, producing 0.20 mol CH_3COOH. Therefore, in the solution moles of CH_3COOH = 1.20

Moles of CH_3COONa = 0.80

$$pH = pK_a + \log \frac{[Salt]}{[Acid]} = -\log(1.8 \times 10^{-5}) + \log \frac{(0.80)}{(1.20)} = 4.56$$

(ii)

	CH_3COONa	+	HCl	$\longrightarrow$	CH_3COOH	+	NaCl
Initial	0.10		0.20		0		0
Final	0		0.10		0.10		0.10

Now, the solution has 0.2 mole acetic acid and 0.1 mole HCl. Due to presence of HCl, ionisation of CH_3COOH can be ignored (common ion effect) and H^+ in solution is mainly due to HCl.

$$[H^+] = 0.10$$

$$pH = -\log(0.10) = 10$$

24. Hydration

25.(A) For precipitation to occur, $K_{sp} < Q_{sp}$.

$$Q_{sp} = \left(\frac{10^{-4}}{2}\right)\left(\frac{10^{-4}}{2}\right) = 2.5 \times 10^{-9} > K_{sp}$$

Hence, precipitate will be formed in this case. In all other case, $Q_{sp} < K_{sp}$ and no precipitation will occur.

26.(D) in stomach, pH is 2-3, i.e. strongly acidic and aspirin will be almost unionised here due to common ion effect. However, pH in small intestine is 8, basic, aspirin will be neutralized here.

27. HCN for buffer will be formed by the reaction

$NaCN + HCl \longrightarrow NaCl + KCN$

mmol of NaCN present initially $= \frac{0.01}{49} \times 1000 = 0.2$

let x mmol of HCl is added to that x m mol of NaCN will be neutralized forming x mmol of HCN.

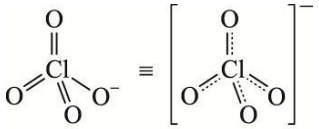
$pH = pK_a + \log\frac{[NaCN]}{[HCN]}$

$8.5 = -\log(4.1 \times 10^{-10}) + \log\frac{0.2 - x}{x} \quad \Rightarrow \quad x = 0.177 \text{ mmol}$

28. $HClO_4$ is strongest acid

As its conjugate base is most stable

$HClO_4 \longrightarrow H^+ + ClO_4^-$



Resonance stablized

29. pOH of buffer solution $= pK_b + \log\frac{[NH_4^+]}{[NH_4OH]} = -\log(1.8 \times 10^{-5}) + \log\frac{0.25}{0.005} = 5.44$

$[OH^-] = 3.6 \times 10^{-6} M$

$[Al^{3+}] = \frac{K_{sp}}{[OH^-]^3} = \frac{6 \times 10^{-32}}{(3.6 \times 10^{-6})} = 1.28 \times 10^{-15} M$

$[Mg^{2+}] = \frac{K_{sp}}{[OH^-]^2} = \frac{8.9 \times 10^{-12}}{(3.6 \times 10^{-6})^2} = 0.68 M$

30.(D) In case of hydroxides of Group II A, solubility increases down the group. Therefore, $Be(OH)_2$ is least soluble, has lowest value of K_{sp}.