CHAPTER 31
Analytical Chemistry

1. When H_2S is passed through Hg_2S we get **[2002]**

(a) HgS (b) $HgS + Hg_2S$

(c) $Hg_2S + Hg$ (d) None of these.

2. How do we differentiate between Fe^{3+} and Cr^{3+} in group III? **[2002]**

(a) by taking excess of NH_4OH solution

(b) by increasing NH_4^+ ion concentration

(c) by decreasing OH^- ion concentration

(d) both (b) and (c)

3. Which one of the following statements is correct ? **[2003]**

(a) From a mixed precipitate of AgCl and AgI, ammonia solution dissolves only AgCl

(b) Ferric ions give a deep green precipitate on adding potassium ferrocyanide solution

(c) On boiling a solution having K^+, Ca^{2+} and HCO_3^- ions we get a precipitate of $K_2Ca(CO_3)_2$

(d) Manganese salts give a violet borax bead test in the reducing flame

4. The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is **[2004]**

(a) $Fe_4[Fe(CN)_6]_3$ (b) $Na_3[Fe(CN)_6]$

(c) $Fe(CN)_3$ (d) $Na_4[Fe(CN)_5NOS]$

5. 29.5 mg of an organic compound containing nitrogen was digested according to Kjeldahl's method and the evolved ammonia was absorbed in 20 mL of 0.1 M HCl solution. The excess of the acid required 15 mL of 0.1 M NaOH solution for complete neutralization. The percentage of nitrogen in the compound is **[2010]**

(a) 59.0 (b) 47.4

(c) 23.7 (d) 29.5

6. For the estimation of nitrogen, 1.4 g of an organic compound was digested by Kjeldahl method and the evolved ammonia was absorbed in 60 mL of $\frac{M}{10}$ sulphuric acid. The unreacted acid required 20 mL of $\frac{M}{10}$ sodium hydroxide for complete neutralization. The percentage of nitrogen in the compound is: **[2014]**

(a) 6% (b) 10%

(c) 3% (d) 5%

Answer Key														
1	2	3	4	5	6									
(c)	(b)	(a)	(a)	(c)	(b)									

SOLUTIONS

1. **(c)** When H_2S is passed through Hg_2S we get a mixture of mercurous sulphide and mercury ($Hg_2S + Hg$).

2. **(b)** When we add NH_4Cl, it suppresses the ionisation of NH_4OH and prevents the precipitation of higher group hydroxide in gp(III).

NOTE Further ferric chloride and chromium chloride form different colour precipitates with NH_4OH.

$$FeCl_3 + 3NH_4OH \longrightarrow \underset{\text{reddish brown}}{Fe(OH)_3\downarrow} + 3NH_4Cl$$

$$CrCl_3 + 3NH_4OH \longrightarrow \underset{\text{Bluish green.}}{Cr(OH)_3} + 3NH_4Cl$$

3. **(a)** Between AgCl and AgI, AgI is less soluble, hence ammonia can dissolve ppt. of AgCl only due to formation of complex as given below:

$$AgCl + 2NH_3 \rightarrow [Ag(NH_3)_2]Cl$$

4. **(a)** Prussian blue $Fe_4[Fe(CN)_6]_3$ is formed in lassaigne test for nitrogen.

$$3Na_4[Fe(CN)_6 + 4Fe^{3+} \longrightarrow \underset{\text{Prussian blue}}{Fe_4[Fe(CN)_4]_6} + 12Na^+$$

5. **(c)** Moles of HCl taken $= 20 \times 0.1 \times 10^{-3}$
$= 2 \times 10^{-3}$

Moles of HCl neutralised by NaOH solution
$= 15 \times 0.1 \times 10^{-3} = 1.5 \times 10^{-3}$

Moles of HCl neutralised by ammonia
$= 2 \times 10^{-3} - 1.5 \times 10^{-3}$
$= 0.5 \times 10^{-3}$

$$\% \text{ of nitrogen} = \frac{1.4 \times N \times V}{\text{w.t. of Substance}} \times 100$$

$$= \frac{1.4 \times 0.5 \times 10^{-3}}{29.5 \times 10^{-3}} \times 100$$

$$= 23.7\%$$

6. **(b)** $$\% \text{ of N} = \frac{1.4 \times \text{meq. of acid}}{\text{mass of organic compound}}$$

$$\text{meq. of } H_2SO_4 = 60 \times \frac{M}{10} \times 2 = 12$$

$$\text{meq. of NaOH} = 20 \times \frac{M}{10} = 2$$

$\therefore$ meq. of acid consumed $= 12 - 2 = 10$

$$\therefore \% \text{ of N} = \frac{1.4 \times 10}{1.4} = 10\%$$