31 Analytical Chemistry

1. An aqueous solution of a salt X turns blood red on treatment with CNS^- and blue on treatment with $K_4[Fe(CN)_6]$. X also gives a positive chromyl chloride test. The salt X is :
(a) $CuCl_2$ (b) $FeCl_3$
(c) $Cu(NO_3)_2$ (d) $Fe(NO_3)_3$

2. $KMnO_4$ reacts with oxalic acid as :

Critical Thinking

$MnO_4^- \quad C_2O_4^{2-} \quad H \longrightarrow Mn^2 \quad CO_2 \quad H_2O$

Hence, 50 ml of 0.04 M $KMnO_4$ is acidic medium is chemically equivalent to
(a) 100 ml of 0.1 M $H_2C_2O_4$
(b) 50 ml of 0.2 M $H_2C_2O_4$
(c) 50 ml of 0.1 M $H_2C_2O_4$
(d) 25 ml of 0.1 M $H_2C_2O_4$

3. For detection of sulphur in an organic compound sodium nitroprusside is added to the sodium extract. A violet colour is obtained due to formation of
(a) $Fe(CN)_2$
(b) $K_3Fe(CN)_5NS$
(c) $Na_4[Fe(CN)_5NOS]$
(d) $Na_4Fe(CN)_6$

4. 0.45 g of acid (molecular weight 90) is neutralised by 20 ml of 0.5N caustic potash. The basicity of acid is
(a) 1 (b) 2 (c) 3 (d) 4

5. The cation that will not be precipitated by H_2S in the presence of dil. HCl is :
(a) Pb^{2+} (b) Cu^{2+} (c) Co^{2+} (d) As^{3+}

6. A pink coloured salt turns blue on heating. The presence of which cation is most likely ?
(a) Co^{2+} (b) Cu^{2+} (c) Zn^{2+} (d) Fe^{2+}

7. 0.5 g mixture of $K_2Cr_2O_7$ and $KMnO_4$ was treated with excess of KI in acidic medium. I_2 liberated required 100 cm^3 of 0.15 N $Na_2S_2O_3$ solution for titration. The percentage amount of $K_2Cr_2O_7$ in the mixture is

Toughnut

(a) 85.36% (b) 14.64%
(c) 58.63% (d) 26.14%

8. In Kjeldahl's method, $CuSO_4$ acts as
(a) oxidising agent (b) reducing agent
(c) hydrolysing agent (d) catalytic agent

9. In Lassaigne's test, the organic compound is fused with a piece of sodium metal in order to
(a) increase the ionisation of the compound.
(b) decrease the melting point of the compound.
(c) increase the reactivity of the compound.
(d) convert the covalent compound into a mixture of ionic compounds.

10. A white sodium salt dissolves readily in water to give a solution which is neutral to litmus. When silver nitrate solution is added to the solution, a white precipitate is obtained which does not dissolve in dil. HNO_3. The anion could be
(a) CO_3^{2-} (b) Cl^- (c) SO_4^{2-} (d) S^{2-}

11. An aqueous solution of a substance gives a white precipitate on treatment with dil. HCl which dissolves on heating. When H_2S is passed through the hot acidic solution, a black precipitate is obtained. The substance is a

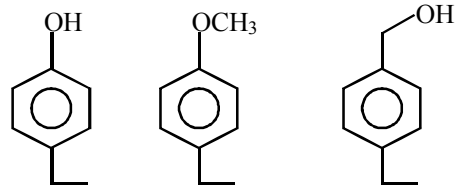
Tricky

(a) Hg_2^2 salt (b) Cu^{2+} salt
(c) Ag^+ salt (d) Pb^{2+} salt

12. A is a lighter phenol and B is an aromatic carboxylic acid. Separation of mixture of A and B can be carried out easily by using a solution of
(a) sodium hydroxide
(b) sodium sulphate
(c) calcium chloride
(d) sodium bicarbonate

13. A metal chloride dissolves appreciably in cold water. When placed on a platinum wire in Bunsen flame no distinctive colour is noticed, the cation would be
(a) Mg^{2+} (b) Ba^{2+} (c) Pb^{2+} (d) Ca^{2+}

14.



(*p*-ethyl phenol) (*p*-methyl anisole) (*p*-ethyl benzyl alcohol)

Above compounds can be differentiated by using the reagent:

(a) NaOH, Tollen's reagent, $FeCl_3$
(b) CrO_3, Tollen's reagent, $FeCl_3$
(c) Tollen's reagent, CrO_3, $FeCl_3$
(d) Na, Tollen's reagent, $FeCl_3$

15. Copper wire test for halogens is known as

(a) Duma's Test (b) Beilstein's Test
(c) Liebig's Test (d) Lassigne's Test

16. In the separation of Cu^{2+} and Cd^{2+} in 2nd group qualitative analysis of cations, tetrammine copper (II) sulphate and tetrammine cadmium (II) sulphate react with KCN to form the corresponding cyano complexes. Which one of the following pairs of the complexes and their relative stability enable the separation of Cu^{2+} and $Cd^{2+?}$

(a) $K_3[Cu(CN)_4]$ more stable and $K_2[Cd(CN)_4]$ less stable
(b) $K_2[Cu(CN)_4]$ less stable and $K_2[Cd(CN)_4]$ more stable
(c) $K_2[Cu(CN)_4]$ more stable and $K_2[Cd(CN)_4]$ less stable
(d) $K_3[Cu(CN)_4]$ less stable and $K_2[Cd(CN)_4]$ more stable

17. Sodium carbonate cannot be used in place of $(NH_4)_2CO_3$ for the identification of Ca^{2+}, Ba^{2+} and Sr^{2+} ions (in group V) during mixture analysis because :

(a) Mg^{2+} ions will also be precipitated.
(b) Concentration of CO_3^{2-} ions is very low.
(c) Sodium ions will react with acid radicals.
(d) Na^+ ions will interfere with the detection of Ca^{2+}, Ba^{2+}, Sr^{2+} ions.

18. A solution containing As^{3+}, Cd^{2+}, Ni^{2+} and Zn^{2+} is made alkaline with dilute NH_4OH and treated with H_2S. The precipitate obtained will consist of

Toughnut

(a) As_2S_3 and CdS (b) CdS, NiS and ZnS
(c) NiS and ZnS (d) Sulphide of all ions

19. 3.92 g of ferrous ammonium sulphate react completely with 50 ml $\frac{N}{10}$ $KMnO_4$ solution. The percentage purity of the sample is

(a) 50 (b) 78.4 (c) 80 (d) 39.2

20. 1.25 g of a sample of Na_2CO_3 and Na_2SO_4 is dissolved in 250 ml solution. 25 ml of this solution neutralises 20 ml of 0.1N H_2SO_4. The % of Na_2CO_3 in this sample is

(a) 84.8% (b) 8.48% (c) 15.2% (d) 42.4%

21. An aqueous solution of $FeSO_4$, $Al_2(SO_4)_3$ and chrome alum is heated with excess of Na_2O_2 and filtered. The materials obtained are:-

(a) A colourless filtrate and a green residue.
(b) A yellow filtrate and a green residue.
(c) A yellow filtrate and a brown residue.
(d) A green filtrate and a brown residue.

22. The formula of gas is $[CO]_x$. If its vapour density is 140, the value of x will be:

(a) 2.5 (b) 3.0 (c) 5.0 (d) 6.0

23. If 0.2 gram of an organic compound containing carbon, hydrogen and oxygen on combustion, yielded 0.147 gram carbon dioxide and 0.12 gram water. What will be the content of oxygen in the substance ?

(a) 73.29% (b) 78.45%
(c) 83.23% (d) 89.50%

24. Which of the following statements is incorrect ?

(a) Fe^{2+} ion also gives blood red colour with SCN^- ion.
(b) Fe^{3+} ion also gives blood red colour with SCN^- ion.
(c) On passing H_2S into Na_2ZnO_2 solution a white ppt of ZnS is formed.
(d) Cupric ion reacts with excess of ammonia solution to give deep blue colour of $[Cu(NH_3)_4]^{2+}$ ion.

25. An aqueous solution of colourless metal sulphate M gives a white precipitate with NH_4OH. This was soluble in excess of NH_4OH. On passing H_2S through this solution a white ppt. is formed.

The metal M in the salt is

Critical Thinking

(a) Ca (b) Ba (c) Al (d) Zn

26. Volume of 3% solution of sodium carbonate necessary to neutralise a litre of 0.1 N sulphuric acid

(a) 176.66 ml (b) 156.6 ml
(c) 116.0 ml (d) 196.1 ml

27. The Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens because

Toughnut

(a) silver halides are soluble in HNO_3
(b) Na_2S and NaCN are decomposed by HNO_3
(c) Ag_2S is soluble in HNO_3
(d) AgCN is soluble in HNO_3

28. For preparing 250 mL of N/20 solution of Mohr's salt, the amount of Mohr's salt needed is

(a) 9.8 g (b) 4.9 g (c) 19.6 g (d) 3.2 g

29. Potassium chromate solution is added to an aqueous solution of a metal chloride. The precipitate thus obtained is insoluble in acetic acid. When precipitate is subjected to flame test the colour of the flame is

(a) lilac (b) apple green
(c) crimson red (d) golden yellow

30. Three separate samples of a solution of a single salt gave these results. One formed a white precipitate with excess ammonia solution, one formed a white precipitate with dil. NaCl solution and one formed a black precipitate with H_2S. The salt could be

(a) $AgNO_3$ (b) $Pb(NO_3)_2$
(c) $Hg(NO_3)_2$ (d) $MnSO_4$

31. Compound $CH_3-CH(OEt)_2$ and

(P) (Acetal)

$CH_3-CH_2-O-CH_2-CH_2$ can be

(Q)

differentiated by:

(a) $H_3O^{\oplus}$, Na (b) $H_3O^{\oplus}$, Tollens' test
(c) $H_3O^{\oplus}$, Fehling test (d) All of these

32. The best method for the separation of naphthalene and benzoic acid from their mixture is:

(a) Distillation (b) Sublimation
(c) Chromatography (d) Crystallisation

33. A salt on treatment with dil. HCl gives a pungent smelling gas and a yellow precipitate. The salt gives green flame when tested. The solution gives a yellow precipitate with potassium chromate. The salt is

(a) $NiSO_4$ (b) BaS_2O_3
(c) PbS_2O_3 (d) $CuSO_4$

34. 0.24 g of a volatile liquid on vaporization gives 45 ml of vapours at NTP. What will be the vapour density of the substance ?
(Density of $H_2 = 0.089\ g\ L^{-1}$)

(a) 95.39 (b) 39.95 (c) 99.53 (d) 59.93

35. The salt used for performing 'bead' test in qualitative inorganic analysis is

Critical Thinking

(a) $K_2SO_4.Al_2(SO_4)_3.24H_2O$
(b) $FeSO_4.(NH_4)_2SO_4 4H_2O$
(c) $Na(NH_4)HPO_4.4H_2O$
(d) $CaSO_4.2H_2O$

36. A gas "X" is passed through water to form a saturated solution. The aqueous solutions on treatment with the $AgNO_3$ gives a white preciptate. The saturated aqueous solution also dissolves magnesium ribbon with evolution of a colourless gas "Y". Identify 'X' and 'Y'.

(a) $X = CO_2, Y = Cl_2$ (b) $X = Cl_2, Y = CO_2$
(c) $X = Cl_2, Y = H_2$ (d) $X = H_2, Y = Cl_2$

37. In Kjeldahl's method for the estimation of N_2, potassium sulphate and copper sulphate are used. On the basis of their functions which of the following statement(s) is/are correct?

I. Potassium sulphate raises the bpt. and ensures complete reaction.
II. Copper sulphate acts as catalyst.
III. Potassium sulphate acts as catalyst and copper sulphate raises the bpt.

(a) Only III is correct (b) I and II are correct
(c) Only II is correct (d) None is correct

38. Aniline is usually purified by

(a) chromatographic technique
(b) steam distillation
(c) by addition of oxalic acid
(d) fractional crystallization

39. Prussian blue is formed when

(a) ferrous sulphate reacts with $FeCl_3$
(b) ferric sulphate reacts with $K_4Fe(CN)_6$
(c) ferrous ammonium sulphate reacts with $FeCl_3$
(d) ammonium sulphate reacts with NO_2

40. 0.59 g of an organic substance when treated with caustic soda evolved ammonia which required 20 cc of N/2 sulphuric acid for neutralisation. The percentage of nitrogen is

(a) 26.32% (b) 40%

(c) 53.6% (d) 63.6%

41. An organic compound has C and H percentage in the ratio 6 : 1 and C and O percentage in the ratio 3:4 the compound is

(a) HCHO (b) CH_3OH

(c) CH_3CH_2OH (d) $(COOH)_2$

42. The presence of magnesium is confirmed in the qualitative analysis by the formation of a white crystalline precipitate of

(a) $Mg(HCO_3)_2$ (b) $MgNH_4PO_4$

(c) $MgNH_4(HCO_3)_3$ (d) $MgCO_3$

43. A salt which gives CO_2 with hot conc.H_2SO_4 and also decolourizes acidified $KMnO_4$ on warming is:

(a) HCO_3^- (b) CO_3^{2-}

(c) Oxalate (d) Acetate

44. 2.79 g of an organic compound when heated in Carius tube with conc. HNO_3 and H_3PO_4 formed is converted into $MgNH_4.PO_4$ ppt. The ppt. on heating gave 1.332 g of $Mg_2P_2O_7$. The percentage of P in the compound is

(a) 23.33% (b) 13.33%

(c) 33.33% (d) 26.66%

45. [X] + H_2SO_4 ⟶ [Y] a colourless gas with irritating smell,

[Y] + $K_2Cr_2O_7$ + H_2SO_4 ⟶ green solution.

[X] and [Y] is:

(a) SO_3^{2-}, SO_2 (b) Cl^-,HCl

(c) S^{2-}, H_2S (d) CO_3^{2-}, CO_2

46. 0.75 g platinic chloride of a mono- acidic base on ignition gives 0.245 g platinum. The molecular weight of the base is

(a) 75.0 (b) 93.5 (c) 100 (d) 80.0

47. The sodium extract prepared from sulphanilic acid, contains SCN^-. It gives blood red colouration with

(a) a mixture of Na_2S and CS_2

(b) $FeCl_3$

(c) $FeSO_4$

(d) Na_2SO_3

48. An orange precipitate of II group is dissolved in conc. HCl; the solution when treated with excess of water turns milky due to formation of

(a) Sn(OH)Cl (b) $Sb(OH)Cl_2$

(c) SbOCl (d) $Sb(OH)_2Cl$

49. A substance on treatment with dil.H_2SO_4 liberates a colourless gas which produces

(I) turbidity with baryta water and

(II) turns acidified dichromate solution green.

The reaction indicates the presence of

(a) CO_3^{2-} (b) S^{2-} (c) SO_3^{2-} (d) NO_3^-

50. Which of the following gives a precipitate with $Pb(NO_3)_2$ but not with $Ba(NO_3)_2$?

(a) Sodium chloride

(b) Sodium acetate

(c) Sodium nitrate

(d) Sodium hyrogen phosphate

Answer KEYs

1	(b)	**6**	(a)	**11**	(d)	**16**	(a)	**21**	(b)	**26**	(a)	**31**	(d)	**36**	(c)	**41**	(a)	**46**	(b)
2	(c)	**7**	(b)	**12**	(d)	**17**	(a)	**22**	(c)	**27**	(b)	**32**	(b)	**37**	(b)	**42**	(b)	**47**	(b)
3	(c)	**8**	(d)	**13**	(a)	**18**	(d)	**23**	(a)	**28**	(b)	**33**	(b)	**38**	(b)	**43**	(c)	**48**	(c)
4	(b)	**9**	(d)	**14**	(b)	**19**	(a)	**24**	(a)	**29**	(b)	**34**	(d)	**39**	(b)	**44**	(b)	**49**	(c)
5	(c)	**10**	(b)	**15**	(b)	**20**	(a)	**25**	(d)	**30**	(b)	**35**	(c)	**40**	(a)	**45**	(a)	**50**	(a)

Hints & Solutions

1. (b) Fe^{3+}, radical gives blood red with CNS^-

$$Fe^{3+} + 3\,CNS^- \longrightarrow \underset{\substack{\text{Ferric sulphocyanide}\\ \text{(Blood red colouration)}}}{Fe(CNS)_3}$$

Fe^{3+} gives blue colour on treatment with $K_4[Fe(CN)_6]$

$$4Fe^{3+} + 3K_4[Fe(CN)_6] \longrightarrow \underset{\substack{\text{Ferricferrocyanide}\\ \text{(Prussian blue)}}}{12K^+ + Fe_4[Fe(CN)_6]_3}$$

Cl^- radical gives chromyl chloride test.

2. (c) Equiv. mass of $KMnO_4$

$$MnO_4^- \quad \frac{\text{molar mass}}{7-2} \quad \frac{\text{molar mass}}{5}.$$

Equiv. mass of oxalic acid

$$C_2O_4^{2-} \quad \frac{\text{molar mass}}{2(4-3)} \quad \frac{\text{molar mass}}{2}$$

Meq. of $KMnO_4 = 50 \times 5 \times 0.04 = 10 =$ meq of $H_2C_2O_4 = 50 \times 2 \times 0.1 = 10$. Hence (c).

3. (c) $Na_2S + \underset{\text{Sodium nitroprusside}}{Na_2[Fe(CN)_5NO]} \longrightarrow$

$$\underset{\text{Sodium thionitroprusside}}{Na_4[Fe(CN)_5NOS]}$$

4. (b) Eq. of acid = Eq of base,

$$\therefore \frac{0.45}{\text{E.wt}} \quad \frac{20\times0.5}{1000}, \quad \text{E.wt} \quad 45$$

$$\text{Basicity} = \frac{\text{M.wt}}{\text{E.wt}} \quad \frac{90}{45} \quad 2$$

5. (c) Co^{+2} ion is precipitated by H_2S in presence of NH_4OH which is a group reagent of group IV in cationic analysis.

6. (a) Zn^{2+} salts are white. Usually Fe^{2+} salts are rarely pink. Cu^{2+} salts are usually blue in hydrated form. Co^{2+} is pink in aqueous solution.

7. (b) Let the amount of the $K_2Cr_2O_7$ in the mixture be x g, then amount of $KMnO_4$ will be (0.5 – x) g

$$\therefore \left(\frac{x}{49} \quad \frac{0.5-x}{31.6}\right) = \frac{100\times0.15}{1000}$$

where 49 is Eq. wt. of $K_2Cr_2O_7$ and 31.6 is Eq. wt. of $KMnO_4$.

On solving, we get x = 0.073 g

Percentage of $K_2Cr_2O_7$

$$= \frac{0.0732\times100}{0.5} \quad 14.64\%$$

8. (d) Kjeldahl's method depends upon the fact that most of the organic compounds containing nitrogen are quantitatively decomposed to give $(NH_4)_2SO_4$ when heated strongly with conc. H_2SO_4. In this method $CuSO_4$ acts as catalytic agent.

9. (d) To convert covalent compounds into ionic compounds such as NaCN, Na_2S, NaX, etc.

10. (b) NaCl is a salt of strong acid and strong base hence on dissolution will give neutral solution.

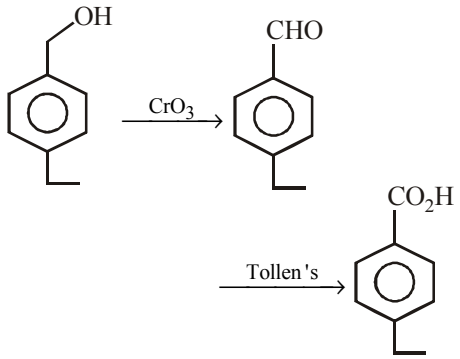
$$NaCl + AgNO_3 \longrightarrow AgCl\downarrow + HNO_3$$

11. (d) $PbCl_2$ is insoluble in cold water, soluble in hot water and PbS is black ppt in acidic medium.

12. (d) Carboxylic acids dissolve in sodium bicarbonate, while phenol does not.

13. (a) $MgCl_2$ is soluble in water and does not give flame test. Other give flame test.

14. (b)



15. (b) Beilstein's test: Organic compounds containing halogens when heated over Cu wire loop give blue or green colour flame due to formation of volatile copper halides.

16. (a) $K_3[Cu(CN)_4]$ is more stable whereas $K_2[Cd(CN)_4]$ is less stable.

17. (a) If Na_2CO_3 is used in place of $(NH_4)_2CO_3$. It will precipitate group V radicals as well as magnesium radicals. The reason for this is the high ionization of Na_2CO_3 in water into Na^+ and CO_3^{2-}. Now the higher concentration of CO_3^{2-} is available which exceeds the solubility product of group V radicals as well as that of magnesium radicals.

18. (d) As^{3+} and Cd^{2+} are the radicals of group II, whereas Ni^{2+} & Zn^{2+} are the radicals of group IV. The solubility product of group IV radicals is higher as compared to group II. NH_4OH increases the ionisation of H_2S by removing H^+ of H_2S as unionisable water.

$H_2S \rightleftharpoons 2H^+ + S^{2-}$;

$H \quad OH^- \longrightarrow H_2O$

Thus excess of sulphide ions are present which leads to the precipitation of all the four ions.

Note : HCl decreases ionisation of H_2S whereas NH_4OH increases the ionisation of H_2S.

19. (a) Eq of $KMnO_4$ used $= \dfrac{50 \times 1}{1000 \times 10} = 0.005$

$\therefore$ Eq of FAS reacted = 0.005

$\therefore$ weight of FAS needed

$= 0.005 \times 392 = 1.96$ g

20. (a) Let the amount of Na_2CO_3 present in the mixture be x g . Na_2SO_4 will not react with H_2SO_4. Then

$\dfrac{x}{53} = \dfrac{20 \times 0.1 \times 10}{1000} \therefore x \quad 1.06\text{g}$

$\therefore$ Percentage of Na_2CO_3

$= \dfrac{1.06 \times 100}{1.25} \quad 84.8\%$

21. (b) Green residue is due to $Fe(OH)_2$ and yellow filtrate is due to chromate ions CrO_4^{2-}

22. (c) $28 \times x = 140 \Rightarrow x = 5$

23. (a) % of C $\quad \dfrac{12}{44} \times \dfrac{0.147}{0.2} \times 100 \quad 20.045\,\%$

% of H $\quad \dfrac{2}{18} \times \dfrac{0.12}{0.2} \times 100 \quad 6.666\,\%$

% of O $\quad 100 - (20.045 \quad 6.666) \quad 73.29\%$

24. (a) Only Fe^{3+} ions give blood red colouration with SCN^- ions.

$Fe^{3+} + SCN^- \longrightarrow \underset{\text{(dark red)}}{[Fe(SCN)]^2}$

25. (d) $Zn^{2+} + 2NH_4OH \longrightarrow \underset{\text{White ppt.}}{Zn(OH)_2} + 2NH_4^+$

$Zn(OH)_2 + 2NH_4OH \longrightarrow$

$(NH_4)_2ZnO_2 + 2H_2O$

Soluble

$(NH_4)_2ZnO_2 + H_2S \longrightarrow \underset{\text{White ppt.}}{ZnS} + 2NH_4OH$

26. (a) Normality of 3% Na_2CO_3.

$N \quad \dfrac{3 \times 100}{53 \times 100} \quad 0.566N$

For H_2SO_4 sol. $N_1 = 0.1$, $V_1 = 100$ mL

For Na_2CO_3 sol. $N_2 = 0.566$. N_2 ?

Now apply $N_1V_1 = N_2V_2$

$V_2 = \dfrac{N_1V_1}{N_2} = \dfrac{0.1 \times 100\,\text{mL}}{0.566} \quad 176.66\,\text{mL}$

27. (b) Na_2S and NaCN, formed during fusion with metallic sodium, must be removed before adding $AgNO_3$, otherwise black ppt. due to Na_2S or white precipitate due to AgCN will be formed and thus white precipitate of AgCl will not be identified easily.

$Na_2S + 2AgNO_3 \longrightarrow 2NaNO_3 + \underset{\text{Black}}{Ag_2S}\downarrow$

$NaCN + AgNO_3 \longrightarrow NaNO_3 + \underset{\text{White}}{AgCN}\downarrow$

$NaCl \quad AgNO_3 \longrightarrow NaNO_3 \quad \underset{\text{white}}{AgCl}\downarrow$

$Na_2S \quad 2HNO_3 \xrightarrow{\text{boil}} 2NaNO_3 \quad H_2S\uparrow$

$NaCN \quad HNO_3 \xrightarrow{\text{boil}} NaNO_3 \quad HCN\uparrow$

28. (b) The ionic equation for oxidation of Mohr's salt is

$Fe^{2} \longrightarrow Fe^{3} \quad e^{-}$

Now Eq. of Mohr's salt $= \frac{392}{1}$ 392

Strength = Normality × Eq. mass

$= \frac{1}{20} \times 392$ 19.6g / lit

Thus for preparing 250 ml of N/20 Mohr's salt solution, Mohr's salt needed

$= \frac{19.6}{1000} \times 250$ 4.9 g

29. (b) $BaCl_2 + K_2CrO_4 \rightarrow BaCrO_4 + 2KCl$. $BaCrO_4$ is insoluble in acetic acid and Ba gives apple green colour in flame test.

30. (b) $Pb(NO_3)_2 + 2NH_4OH \rightarrow$

$Pb(OH)_2\downarrow + 2NH_4NO_3$

(white ppt)

$Pb(NO_3)_2 + 2HCl \rightarrow PbCl_2\downarrow + 2HNO_3$

(white ppt)

$Pb(NO_3)_2 + H_2S \rightarrow PbS\downarrow + 2HNO_3$

(black)

31. (d) $CH_3 - CH(OEt)(OEt) \xrightarrow{H_3O^{\oplus}}$

(P) (Acetal)

CH_3CHO; differentiated by Na, Fehling Tollen's test

$CH_3 - CH_2 - O - CH_2 - CH_3$

(Q)

$\xrightarrow{H_3O^{\oplus}} EtOH$

32. (b) Among the given compounds naphthelene is volatile but benzoic acid is non-volatile (it forms a dimer). So, the best method for their separation is sublimation,

33. (b) Gas evolved is SO_2

34. (d) V.D. $\frac{\text{Wt. of 45 ml. of vapours at NTP}}{\text{Wt. of 45 ml. of } H_2 \text{ at NTP}}$

$\frac{0.24\,g}{45\,ml. \times 0.000089\,g\,ml^{-1}}$ 59.93

35. (c) Microcosmic salt. $Na(NH_4)HPO_4.4H_2O$ is used for bead test

$Na.(NH_4)HPO_4 \rightarrow NaPO_3 \quad NH_3 \quad H_2O$

$NaPO_3 \quad CoO \rightarrow NaCo.PO_4$ (blue)

36. (c) $Cl_2 + H_2O \rightarrow HCl + HClO$

$HCl + AgNO_3 \rightarrow AgCl\downarrow + HNO_3$

White ppt

$Mg + 2HCl \rightarrow MgCl_2 + H_2\uparrow$

Hence X is Cl_2 and Y is H_2

37. (b) K_2SO_4 raises the bpt. and ensure complete reaction and $CuSO_4$ acts as catalyst.

38. (b) Aniline is miscible in steam and has b.p. lower than water, hence it is collected as distillate along with steam.

39. (b) $2Fe_2(SO_4)_3 \quad 3K_4[(Fe(CN)_6] \rightarrow$

$Fe_4[Fe(CN)_6]_3 \quad 6K_2SO_4$

prussian blue

40. (a) Percentage of nitrogen by Kjeldahl's method

$= \frac{1.4 \times N \times V}{\text{Wt. of organic compound}}$

$= \frac{1.4 \times 20}{0.532} \times \frac{1}{2} = 26.32\%$

41. (a) % ratio of C : H is 6 : 1 and C : O is 3 : 4 or 6 : 8

$\therefore$ % ratio of C : H : O is 6 : 1 : 0

(Total = 15)

% of $C = \frac{6}{15} \times 100$ 40

$40 / 12 = 3.33 = 1$

% of $H = \frac{1}{15} \times 100$ 6.6

$6.6 / 1 = 6.6 = 2$

% of $O = \frac{8}{15} \times 100$ 53.3

$53.3 / 16 = 3.3 = 1$

simple ratio: CH_2O

$\therefore$ The compound is HCHO

42. (b) $MgCl_2 \quad Na_2HPO_4 \quad NH_4OH \rightarrow$

$Mg(NH_4)PO_4 \quad 2NaCl \quad H_2O$

white ppt.

43. **(c)** $Na_2C_2O_4 + H_2SO_4 \rightarrow$

$Na_2SO_4 \quad H_2O \quad CO \quad CO_2$

CO burns with blue flame $2CO \quad O_2 \rightarrow 2CO_2$

$Na_2C_2O_4 + H_2SO_4(dil) \rightarrow$

$Na_2SO_4 \quad H_2C_2O_4$

$2KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \rightarrow$

$K_2SO_4 \quad 2MnSO_4 \quad 8H_2O \quad 10CO_2$

44. **(b)** Percentage of P

$$= \frac{62}{222} \times \frac{\text{wt.of } Mg_2P_2O_7}{\text{wt.of compound}} \times 100$$

$$= \frac{62}{222} \times \frac{1.332}{2.79} \times 100 = 13.33\%$$

45. **(a)** SO_2 and H_2S both being reducing agents, can turn acidified dichromate solution green. SO_2 can be obtained by the action of acid upon sulphite while H_2S is evolved by the action of acid upon sulphide. However, SO_2 has a burning sulphur smell which is irritating. H_2S has rotten egg like smell.

46. **(b)** Apply the formula M.wt

$$= \frac{\text{Acidity}}{2}\left(\frac{\text{wt of Pt salt} \times 195}{\text{wt of Pt}} - 410\right)$$

$$\therefore \text{M.wt} = \frac{1}{2}\left(\frac{0.75 \times 195}{0.245} - 410\right) \quad 93.5$$

47. **(b)** $SCN^- + Fe^3 \longrightarrow \underset{\text{blood red ppt.}}{Fe(SCN)_3}$

48. **(c)** $Sb_2S_3 \quad 6HCl \rightarrow 2SbCl_3 \quad 3H_2S$

$SbCl_3 \quad 6H_2O \rightarrow \underset{\text{ppt (White)}}{SbOCl} \quad 2HCl$

49. **(c)** $Na_2SO_3 \quad 2HCl(dil) \rightarrow$

$2NaCl \quad H_2O \quad SO_2$

$K_2Cr_2O_7 \quad H_2SO_4 \quad 3SO_2 \rightarrow$

$K_2SO_4 \quad \underset{\text{Green}}{Cr_2(SO_4)_3} \quad H_2O$

50. **(a)** $Pb(NO_3)_2 + 2NaCl \rightarrow PbCl_2\downarrow + 2NaNO_3$;
$BaCl_2$ is soluble in water