Ordinary Thinking

Objective Questions

Preliminary Test

1. In borax bead test, which of the following compound is formed [CBSE PMT 2002]
   (a) Meta borate (b) Tetra borate
   (c) Double oxide (d) Ortho borate

2. The metal that does not give the borax-bead test is [MP PMT 1999]
   (a) Chromium (b) Nickel
   (c) Lead (d) Manganese

3. Which of the following is coloured compound? [BCECE 2005]
   (a) CuF_2 (b) CuI
   (c) $NaCl$ (d) $MgCl_2$

4. The composition of *'Golden spangles'* is [CBSE PMT 1990]
   (a) $PbCrO_4$ (b) PbI_2
   (c) As_2S_3 (d) $BaCrO_4$

5. The alkaline earth metal that imparts apple green colour to the bunsen flame when introduced in it in the form of its chloride is [EAMCET 1979]
   (a) Barium (b) Strontium
   (c) Calcium (d) Magnesium

6. Which gives violet coloured bead in borax bead test [BHU 1988; MP PET 1997]
   (a) Fe^{2+} (b) Ni^{2+}
   (c) Co^{2+} (d) Mn^{2+}

7. Sodium borate on reaction with H_2SO_4 (conc.) and C_2H_5OH gives a compound '*A*' which burns with green flame. The compound '*A*' is [MP PET 1994]
   (a) $H_2B_4O_7$ (b) $(C_2H_5)_2B_4O_7$
   (c) H_3BO_3 (d) $(C_2H_5)_3BO_3$

8. On mixing two colourless gases, a deep brown colour is observed. The gases are [CPMT 1977]
   (a) N_2O and O_2 (b) NO and O_2
   (c) N_2O_3 and O_2 (d) None of these

9. Which one of the following metals will give blue ash when its salt is heated with Na_2CO_3 solid and $Co(NO_3)_2$ on a charcoal piece [MNR 1987]
   (a) Cu (b) Mg
   (c) Al (d) Zn

10. The metal that does not give the borax bead test is [BHU 1987; AFMC 1995; MHCET 2003]
    (a) Cr (b) Ni
    (c) Na (d) Mn

11. When concentrated H_2SO_4 is added to dry KNO_3, brown fumes evolve. These fumes are [CPMT 1988; IIT 1987]
    (a) SO_2 (b) SO_3
    (c) NO (d) NO_2

12. Which one of the following salt give green coloured flame when the salt is tested by Pt wire
    (a) Barium salt (b) Calcium salt
    (c) Borate (d) Lead salt

13. A precipitate of calcium oxalate will not dissolve in [CPMT 1971]
    (a) HCl (b) HNO_3
    (c) Aqua-regia (d) Acetic acid

14. Sodium sulphite on heating with dilute HCl liberates a gas which [NCERT 1972
    (a) Turns lead acetate paper black
    (b) Turns acidified potassium dichromate paper green
    (c) Burns with a blue flame
    (d) Smells like vinegar

15. Starch-iodide paper is used for the test of
    (a) Iodine (b) Iodide ion
    (c) Oxidising agent (d) Reducing agent

16. Which of the following salt gives white precipitate with $AgNO_3$ solution and dil. H_2SO_4 solution and gives green flame test
    (a) $CuCl_2$ (b) $BaCl_2$
    (c) $PbCl_2$ (d) $Cu(NO_3)_2$

17. Two gases when mixed give white dense fumes, the gases are
    (a) NH_3 and SO_2 (b) SO_2 and steam
    (c) NH_3 and HCl (d) NH_3 and N_2O

18. Blue borax bead is obtained with [MADT Bihar 1982; MP PET 1995]
    (a) Zn (b) Cobalt
    (c) Chromium (d) Fe

19. Which of the following imparts green colour to the burner flame [DCE 2004]
    (a) $B(OMe)_3$ (b) $Na(OMe)$
    (c) $Al(O\,\mathrm{Pr})_3$ (d) $Sn(OH)_2$

20. In laboratory burners, we use [DCE 2004]
    (a) Producer gas (b) Oil gas
    (c) Gobar gas (d) Coal gas

21. A colourless gas with the smell of rotten fish is [AFMC 2005]
    (a) H_2S (b) PH_3
    (c) SO_2 (d) None of these

22. Which BLUE LIQUID is obtained on reacting equimolar amounts of two gases at −30°C? [IIT 2005]
    (a) N_2O (b) N_2O_3
    (c) N_2O_4 (d) N_2O_5

23. MnO_2 and H_2SO_4 added to $NaCl$, the greenish yellow gas liberated is [Orissa JEE 2005]
    (a) Cl_2 (b) NH_3
    (c) N_2 (d) H_2

Wet Test for acid radical

1. Which of the following statement(s) is(are) correct when a mixture of $NaCl$ and $K_2Cr_2O_7$ is gently warmed with conc. H_2SO_4 [IIT 1998; CP
   MP PMT 2002]
   (a) A deep red vapour is evolved
   (b) The vapour when passed into $NaOH$ solution gives a yellow solution of Na_2CrO_4
   (c) Chlorine gas is evolved
   (d) Chromyl chloride is formed

2. Starch can be used as an indicator for the detection of traces of [CPMT 1992]
   (a) Glucose in aqueous solution
   (b) Proteins in blood

(c) Iodine in aqueous solution
(d) Urea in blood

3. Which of the following combines with Fe (II) ions to form a brown complex **[AIIMS 1982, 87; AFMC 1988; CBSE PMT 2000; Pb. PMT 2000; MP PET 2000, 01]**

(a) N_2O (b) NO
(c) N_2O_3 (d) N_2O_5

4. Sodium nitroprusside, when added to an alkaline solution of sulphide ions, produces purple colour ion due to the formation of **[IIT 1995]**

(a) $Na[Fe(H_2O)_5 NOS]$ (b) $Na_2[Fe(H_2O)_5 NOS]$
(c) $Na_3[Fe(CN)_5 NOS]$ (d) $Na_4[Fe(CN)_5 NOS]$

5. In the chromyl chloride test, the reagent used is **[AMU 1983]**

(a) K_2CrO_4 (b) CrO_3
(c) $K_2Cr_2O_7$ (d) $(NH_4)_2Cr_2O_7$

6. Which of the following will not produce a precipitate with $AgNO_3$ solution **[MP PMT 1990]**

(a) F^- (b) Br^-
(c) CO_3^{2-} (d) PO_4^{3-}

7. When a mixture of solid $NaCl$, solid $K_2Cr_2O_7$ is heated with conc. H_2SO_4, orange red vapours are obtained of the compound **[CPMT 1974, 78, 81, 88; DPMT 1983, 89; NCERT 1977; AFMC 1982; AMU 1984]**

(a) Chromous chloride (b) Chromyl chloride
(c) Chromic chloride (d) Chromic sulphate

8. Chromyl chloride vapours are dissolved in $NaOH$ and acetic acid and lead acetate solution is added, then

(a) The solution will remain colourless
(b) The solution will become dark green
(c) A yellow solution will be obtained
(d) A yellow precipitate will be obtained

9. Which of the following gives black precipitate when H_2S gas is passed through its solution **[CPMT 1974]**

(a) Acidic $AgNO_3$ (b) $Mg(NO_3)_2$
(c) Ammonical $BaCl_2$ (d) Copper nitrate

10. A salt gives violet vapours when treated with conc. H_2SO_4. It contains **[DPMT 1981; CPMT 1971]**

(a) Cl^- (b) I^-
(c) Br^- (d) NO_3^-

11. When Cl_2 water is added to a salt solution containing chloroform, chloroform layer turns violet. Salt contains **[CPMT 1982]**

(a) Cl^- (b) I^-
(c) NO_3^- (d) S^{2-}

12. A salt is heated first with dil. H_2SO_4 and then with conc. H_2SO_4. No reaction takes place. It may be **[CPMT 1978]**

(a) Nitrate (b) Sulphide
(c) Oxalate (d) Sulphate

13. Phosphate radical with ammonium molybdate gives precipitate of which colour

(a) Violet (b) Pink
(c) Canary yellow (d) Green

14. Which compound is soluble in NH_4OH **[AFMC 1987]**

(a) $PbCl_2$ (b) $PbSO_4$
(c) $AgCl$ (d) $CaCO_3$

15. Nitrates of all the metals are **[DPMT 1983, 89]**

(a) Coloured (b) Unstable
(c) Soluble in water (d) Insoluble in water

16. Nitrate is confirmed by ring test. The brown colour of the ring is due to the formation of **[EAMCET 1979; AFMC 1981, 88, 90; RPET 1999; MP PMT 2000; MP PET 2002; CPMT 2004]**

(a) Ferrous nitrite (b) $FeSO_4NO$
(c) $FeSO_4NO_2$ (d) Ferrous nitrate

17. Which of the following precipitate does not dissolve even in large excess of NH_4OH **[MP PMT 1991]**

(a) $AgCl$ (b) $AgBr$
(c) AgI (d) None of these

18. Aqueous solution of a salt when treated with $AgNO_3$ solution gives a white precipitate, which dissolves in NH_4OH. Radical present in the salt is

(a) Cl^- (b) Br^-
(c) I^- (d) NO_3^-

19. When CO_2 is passed into lime water it turns milky. When excess of CO_2 is passed, milkyness disappears because

(a) Reaction is reversed
(b) Water soluble $Ca(HCO_3)_2$ is formed
(c) Vaporisable calcium derivative is formed
(d) None of these

20. A mixture when heated with conc. H_2SO_4 with MnO_2 brown fumes are formed due to

(a) Br^- (b) NO_3^-
(c) Cl^- (d) I^-

21. 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 **[IIT 1992]**

(a) CO_3^{2-} (b) S^{2-}
(c) SO_3^{2-} (d) NO_2^-

22. In the test of sulphate radical, the white precipitate of sulphate is soluble in

(a) Conc. HCl (b) Conc. H_2SO_4
(c) Conc. HNO_3 (d) None of these

23. To an inorganic mixture dil. H_2SO_4 is added in cold; colourless, odourless gas is evolved. The mixture contains **[AMU 1982]**

(a) Sulphite (b) Acetate
(c) Nitrite (d) Carbonate

24. Which reagent is used to remove SO_4^- and Cl^- **[Pb. PMT 2002]**

(a) $BaSO_4$ (b) $NaOH$
(c) $Pb(NO_3)_2$ (d) KOH

25. .... is formed when potassium iodide is heated with conc. H_2SO_4 **[CPMT 1971]**

(a) HI (b) I_2

(c) HIO_3 (d) KIO_3

26. Chromyl chloride test is performed for the confirmation of the presence of the following in a mixture **[CPMT 1990; KCET 1992; RPET 1999]**

(a) Sulphate (b) Chromium

(c) Chloride (d) Chromium and chloride

27. A reagent that can distinguish between a chloride and a peroxide is

(a) Water (b) Dil. H_2SO_4

(c) KOH solution (d) $NaCl$

28. Which reagent below would enable you to remove sulphate ions from a solution containing both sulphate and chloride ions **[NCERT 1975; CPMT 1979 81]**

(a) Sodium hydroxide (b) Barium hydroxide

(c) Barium sulphate (d) Potassium hydroxide

29. Ozone when reacts with potassium iodide solution liberates certain product, which turns starch paper blue. The liberated substance is....... **[Orrisa JEE 2002]**

(a) Oxygen (b) Iodine

(c) Hydrogen iodide (d) Potassium hydroxide

30. When KBr is treated with conc. H_2SO_4 a reddish-brown gas is evolved. The evolved gas is **[EAMCET 1978]**

(a) Bromine

(b) Mixture of bromine and HBr

(c) HBr

(d) NO_2

31. A solution of a salt in dilute sulphuric acid imparts deep blue colour with starch iodine solution it confirms the presence of which of the following **[MP PET 2003; NCERT 1974; CPMT 1977]**

(a) NO_2^- (b) I^-

(c) NO_3^- (d) CH_3COO^-

32. Ammonia reacts with excess of chlorine to form **[DPMT 2000]**

(a) N_2 and HCl (b) NH_4Cl and NCl_3

(c) NCl_3 and HCl (d) N_2 and NH_4Cl

33. A brown ring appears in the test for **[EAMCET 1978; KCET 1991; Bihar CEE 1995; AIIMS 1996; DCE 1999]**

(a) Nitrate (b) Nitrite

(c) Bromide (d) Iron

34. Which of the following anions would decolourise acidified $KMnO_4$ solution

(a) SO_4^{2-} (b) S^{2-}

(c) NO_3^- (d) CH_3COO^-

35. The gas which is absorbed by ferrous sulphate solution giving blackish brown colour is **[AMU 1999]**

(a) NO (b) CO

(c) N_2 (d) NH_2

36. Which one of the following anions is not easily removed from aqueous solutions by precipitation **[IIT 1995]**

(a) Cl^- (b) NO_3^-

(c) CO_3^{-2} (d) SO_4^{-2}

37. Na_2CO_3 cannot be used to identify **[BVP 2004]**

(a) CO_3^{2-} (b) SO_3^{2-}

(c) S^{2-} (d) SO_4^{2-}

38. The number of hydroxide ions, produced by one molecule of sodium carbonate (Na_2CO_3) on hydrolysis is **[Pb. CET 2002]**

(a) 2 (b) 1

(c) 3 (d) 4

39. Gas A is bubbled through slaked lime when a white precipitate is formed. On prolonged bubbling, the precipitate is dissolved. on heating **[EAMCET 1976]** solution, the white precipitate reappears with the evolution of gas B. The gases A and B respectively are

(a) CO_2 and CO (b) CO and CO_2

(c) CO and CO (d) CO_2 and CO_2

40. By passing H_2S gas in acidified $KMnO_4$ solution, we get **[MP PET 1997]**

(a) K_2S (b) S

(c) K_2SO_3 (d) MnO_2

41. Which of the following doesn't give a ppt. with silver nitrate solution. **[J & K 2005]**

(a) Ethyl bromide (b) Sodium bromide

(c) Calcium chloride (d) Sodium chloride

Wet Test for Basic radical

1. Which sulphide is soluble in $(NH_4)_2CO_3$

(a) SnS (b) As_2S_3

(c) Sb_2S_3 (d) CdS

2. When acetic acid and $K_4Fe(CN)_6$ is added to a copper salt, a chocolate precipitate is obtained of the compound

(a) Copper cyanide (b) Copper ferrocyanide

(c) Basic copper sulphate (d) Basic copper cyanide

3. A precipitate of the following would be obtained when HCl is added to a solution of stannous sulphide (SnS) in yellow ammonium sulphide **[CPMT 1977; NCERT 1974]**

(a) SnS (b) SnS_2

(c) Sn_2S_2 (d) $(NH_4)_2SnS_3$

4. When H_2S is passed through in II group sometimes solution becomes milky. It indicates the presence of **[MP PMT 1995]**

(a) Acidic salt (b) An oxidising agent

(c) Thiosulphate (d) A reducing agent

5. Conc. HNO_3 is added before proceeding to test for group III members. This is to **[NCERT 1974]**

(a) Oxidise any remaining H_2S

(b) Convert ferrous ion into ferric ion

(c) Form nitrates which give granular ppts

(d) Increase ionisation of ammonium hydroxide

6. A salt gives bright red colour to the flame. This colour indicates the presence of

(a) Ba^{2+} (b) Sr^{2+}

(c) Ca^{2+} (d) Cr^{3+}

7. The compound insoluble in acetic acid is **[CPMT 1989]**

(a) Calcium oxide (b) Calcium carbonate

(c) Calcium oxalate (d) Calcium hydroxide

8. Which of the following give white precipitate when HCl is added to its aqueous solution

(a) Hg^{+} (b) Mg^{++}

(c) Zn^{++} (d) Cd^{++}

9. Of the following sulphides which one is insoluble in dilute acids but soluble in alkalies **[CPMT 1990]**

(a) PbS (b) CdS

(c) FeS (d) Sb_2S_3

10. Reagent used in the qualitative analysis of IVth group is

(a) HCl (b) H_2S (alkaline)

(c) $(NH_4)_2S$ (d) None of these

11. Which of the following radicals will not be precipitated by passing H_2S in concentrated acid solution **[BHU 1986]**

(a) Copper (b) Antimony

(c) Arsenic (d) Cadmium

12. Which of the following pairs would be expected to form precipitate when solution are mixed **[NCERT 1984]**

(a) K^{+}, SO_4^{2-} (b) Na^{+}, S^{2-}

(c) Ag^{+}, NO_3^{-} (d) Al^{3+}, OH^{-}

13. H_2S will precipitate the sulphides of all the metals from the solution of chlorides of Cu, Zn and Cd, if **[MP PMT 1985]**

(a) The solution is aqueous

(b) The solution is acidic

(c) The solution is dilute acidic

(d) Any of these solutions is present

14. Addition of solution of oxalate to an aqueous solution of mixture of Ba^{++}, Sr^{++} and Ca^{++} will precipitate **[MP PMT 1985]**

(a) Ca^{++} (b) Ca^{++} and Sr^{++}

(c) Ba^{++} and Sr^{++} (d) All the three

15. Which one among the following pairs of ions cannot be separated by H_2S in dilute hydrochloric acid **[IIT 1986]**

(a) Bi^{3+}, Sn^{4+} (b) Al^{3+}, Hg^{2+}

(c) Zn^{2+}, Cu^{2+} (d) Ni^{2+}, Cu^{2+}

16. Distinguishing reagent between silver and lead salts is **[MADT Bihar 1984]**

(a) H_2S gas

(b) Hot dilute HCl solution

(c) NH_4Cl (solid) + NH_4OH solution

(d) NH_4Cl (solid) + $(NH_4)_2CO_3$ solution

17. Group reagent for the precipitation of group II basic radicals for the qualitative analysis table is **[MADT Bihar 1982]**

(a) Dil. $HCl + H_2S$

(b) NH_4Cl (solid) + NH_4OH solution + H_2S

(c) $(NH_4)_2CO_3$ solution

(d) None of these

18. The ion that cannot be precipitated by both HCl and H_2S is **[IIT 1982; CPM**

(a) Pb^{2+} (b) Cu^{+}

(c) Ag^{+} (d) Sn^{2+}

19. $Pb(CH_3COO)_2$ gives....colour with H_2S **[DPMT 2000]**

(a) Orange (b) Red

(c) Black (d) White

20. Fe^{2+} ion can be distinguished by Fe^{3+} ion by **[DPMT 2000]**

(a) NH_4SCN (b) $AgNO_3$

(c) $BaCl_2$ (d) None of these

21. Which of the following change the colour of the aqueous solution of $FeCl_3$ **[Roorkee Qualifying 1998]**

(a) $K_4[Fe(CN)_6]$ (b) H_2S

(c) NH_4CNS (d) $KCNS$

22. Which of the following substances are soluble in concentrated HNO_3 **[Roorkee Qualifying 1998]**

(a) $BaSO_4$ (b) CuS

(c) PbS (d) HgS

23. Which of the following cannot give iodometric titrations **[AIIMS 1997]**

(a) Fe^{3+} (b) Cu^{2+}

(c) Pb^{2+} (d) Ag^{2+}

24. Which of the following mixture is chromic acid **[Pb. PMT 2000]**

(a) $K_2Cr_2O_7$ and HCl

(b) K_2SO_4 and conc. H_2SO_4

(c) $K_2Cr_2O_7$ and conc. H_2SO_4

(d) H_2SO_4 and HCl

25. Which of the following compounds is brown coloured **[AFMC 2001]**

(a) $Fe\,[Fe(CN)_4]$ (b) $Fe[Fe(CN)_6]$

(c) $Fe_4[Fe(CN)_6]$ (d) $K_2Fe[Fe(CN)_6]$

26. If Na^{+} ion and S^{2-} ion is larger than Cl^{-} ion, which of the following will be least soluble in water **[AMU (Engg.) 1999]**

(a) MgS (b) $NaCl$

(c) Na_2S (d) $MgCl_2$

27. An aqueous solution of an inorganic salt on treatment with HCl gives a white precipitate. This solution contains **[MP PMT 2001]**

(a) Hg_2^{+2} (b) Hg^{2+}

(c) Zn^{2+} (d) Cd^{2+}

28. Lead sulphate is soluble **[MP PET 1999]**

(a) In conc. nitric acid

(b) In conc. hydrochloric acid

(c) In a solution of ammonium acetate

(d) In water

29. Which one of the following sulphides is yellow **[MP PMT 1999]**

(a) Zinc sulphide (b) Cadmium sulphide

(c) Nickel sulphide (d) Lead sulphide

30. When H_2S gas is passed through the HCl containing aqueous solutions of $CuCl_2$, $HgCl_2$, $BiCl_3$ and $CoCl_2$, which does not precipitate out **[MP PMT 2002]**

(a) CuS (b) HgS

(c) Bi_2S_3 (d) CoS

31. Group reagent for analytic group IV is **[Kurukshetra CET 2002]**

(a) $NH_4Cl + NH_4OH$

(b) $NH_4Cl + NH_4OH + H_2S$

(c) $NH_4OH + (NH_4)_2CO_3$

(d) $HCl + H_2S$

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

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

(c) $Hg_2S + Hg$ (d) Hg_2S

33. How do we differentiate between Fe^{3+} and Cr^{3+} in group III **[AIEEE 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)

34. $[X] + H_2SO_4 \rightarrow [Y]$ a colourless gas with irritating smell

$[Y] + K_2Cr_2O_7 + H_2SO_4 \rightarrow$ green solution

$[X]$ and $[Y]$ is **[IIT-JEE (Screening) 2003]**

(a) SO_3^{2-}, SO_2 (b) CI^-, HCI

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

35. In the analysis of basic radicals, the group reagent H_2S gas is generally used in the groups **[MP PMT 2003]**

(a) I and II groups (b) II and III groups

(c) III and V groups (d) II and IV groups

36. A mixture of two salts is not water soluble but dissolves completely in dilute hydrochloric acid to form a colourless solution. The mixture could be **[Pb. PMT 1998]**

(a) $AgNO_3$ and KBr (b) $BaCO_3$ and ZnS

(c) $FeCl_3$ and $CaCO_3$ (d) $Mn(NO_3)_2$ and $MgSO_4$

37. Which of the following is not precipitated as sulphide by passing H_2S in presence of conc. HCl **[MP PMT 2000]**

(a) Copper (b) Arsenic

(c) Cadmium (d) Lead

38. Concentrated sodium hydroxide can separate a mixture of **[MP PMT 2000]**

(a) Zn^{2+} and Pb^{2+} (b) Al^{3+} and Zn^{3+}

(c) Cr^{3+} and Fe^{3+} (d) Al^{3+} and Cr^{3+}

39. $AgCl$ dissolves in ammonia solution giving **[MP PMT 1989; MP PET 2001]**

(a) Ag^+, NH_4^+ and Cl^- (b) $Ag(NH_3)^+$ and Cl^-

(c) $Ag_2(NH_3)^+$ and Cl^- (d) $Ag(NH_3)_2^+$ and Cl^-

40. What product is formed by mixing the solution of $K_4[Fe(CN)_6]$ with the solution of $FeCl_3$ **[Roorkee 1989]**

(a) Ferro-ferricyanide (b) Ferric-ferrocyanide

(c) Ferri-ferricyanide (d) None of these

41. In fifth group, $(NH_4)_2CO_3$ is added to precipitate out the carbonates. We do not add Na_2CO_3 because **[AIIMS 1982]**

(a) $CaCO_3$ is soluble in Na_2CO_3

(b) Na_2CO_3 increases the solubility of fifth group carbonates

(c) $MgCO_3$ will be precipitated out in fifth group

(d) None of these

42. Al^{3+}, Fe^{3+}, Zn^{2+} and Ni^{2+} ions are present in an acidic solution. Excess of ammonium chloride solution is added followed by addition of ammonium hydroxide solution. The available precipitate will contain **[MP PMT 1996]**

(a) $Zn(OH)_2$ and $Ni(OH)_2$

(b) $Al(OH)_3$ and $Fe(OH)_3$

(c) $Zn(OH)_2$ and $Al(OH)_3$

(d) $Ni(OH)_2$ and $Fe(OH)_3$

43. When H_2S is passed through a mixture containing Cu^{2+}, Ni^{2+}, Zn^{2+} in acidic solution then ion will precipitate **[RPMT 2002]**

(a) Cu^{2+}, Ni^{2+} (b) Ni^{2+}

(c) Cu^{2+}, Zn^{2+} (d) Cu^{2+}

44. In the precipitation of the iron group in qualitative analysis, ammonium chloride is added before adding ammonium hydroxide to**[AIIMS 198**
CPMT 1971, 73, 77,78, 80, 81, 83, 86; KCET 1999]

(a) Decrease concentration of OH^- ions

(b) Prevent interference by phosphate ions

(c) Increase concentration of Cl^- ions

(d) Increase concentration of NH_4^+ ions

45. Ferric ion forms a prussian blue coloured ppt. due to **[CPMT 1980; BHU 1980; MP PET 1995; Kurukshetra CEE 1998; RPET 1999; MP PMT 2001]**

(a) $K_4Fe(CN)_6$ (b) $Fe_4[Fe(CN)_6]_3$

(c) $KMnO_4$ (d) $Fe(OH)_3$

46. When H_2S gas is passed into a certain solution, it reacts to form a white precipitate. The solution referred to contains ions of**[EAMCET 1979]**

(a) Lead (b) Zinc

(c) Copper (d) Nickel

47. A precipitate of .... would be obtained on adding HCl to a solution of (Sb_2S_3) in yellow ammonium sulphide **[CPMT 1979]**

(a) Sb_2S_3 (b) Sb_2S_5

(c) SbS (d) SbS_2

48. A 0.3 *M* HCl solution contains the following ions Hg^{++}, Cd^{++}, Sr^{++}, Fe^{++}, Cu^{++} The addition of H_2S to above solution will precipitate **[CPMT 1973]**

(a) *Cd, Cu* and *Hg* (b) *Cd, Fe* and *Sr*

(c) *Hg, Cu* and *Fe* (d) *Cu, Sr* and *Fe*

49. Which of the following gives a ppt. with $Pb(NO_3)_2$ but not with $Ba(NO_3)_2$ **[CPMT 1979; MP PET 1997]**

(a) $NaCl$

(b) Sodium acetate

(c) Sodium nitrate

(d) Sodium hydrogen phosphate

50. On adding excess of ammonium hydroxide to a copper sulphate solution **[MP PMT 1995]**

(a) Blue precipitate of copper hydroxide is obtained

(b) Black precipitate of copper oxide is obtained

(c) A deep blue solution is obtained

(d) No change is observed

51. A black sulphide is formed by the action of H_2S on

[IIT 1978]

(a) Cupric chloride
(b) Cadmium chloride
(c) Zinc chloride
(d) Sodium chloride

52. An aqueous solution contains the ions as Hg_2^{2+}, Hg^{2+}, Pb^{2+}, and Cd^{2+}. The addition of dilute $HCl(6N)$ precipitates

(a) Hg_2Cl_2 only
(b) $PbCl_2$ only
(c) $PbCl_2$ and $HgCl_2$
(d) Hg_2Cl_2 and $PbCl_2$

53. In the group III radicals, in place of NH_4Cl which of the following can be used **[AIIMS 1980, 82; MP PMT 1985]**

(a) NH_4NO_3
(b) $(NH_4)_2SO_4$
(c) $(NH_4)_2CO_3$
(d) $NaCl$

54. When HCl gas is passed through saturated solution of $BaCl_2$, a white ppt. is obtained. This is due to

[CPMT 1979]

(a) Impurities in $BaCl_2$
(b) Impurities in HCl
(c) Precipitation of $BaCl_2$
(d) Formation of complex

55. Which compound does not dissolve in hot dilute HNO_3

[IIT 1996]

(a) HgS
(b) PbS
(c) CuS
(d) CdS

56. The ion that can be precipitated by HCl as well as H_2S is

[MP PET 1996; JIPMER (Med.) 2002]

(a) Pb^{2+}
(b) Fe^{3+}
(c) Zn^{2+}
(d) Cu^{2+}

57. Which of the following sulphate is insoluble in water

[MNR 1995]

(a) $CuSO_4$
(b) $CdSO_4$
(c) $PbSO_4$
(d) $Bi(SO_4)_3$

58. A solution when treated with dimethyl glyoxime gives a rose red complex. The metal present is **[AFMC 1982; BHU 1979]**

(a) Ni
(b) V
(c) Co
(d) Mn

59. When bismuth chloride is poured into a large volume of water, the white precipitate produced is

[MP PMT 1985; CPMT 1979]

(a) $Bi(OH)_3$
(b) Bi_2O_3
(c) $BiOCl$
(d) Bi_2OCl_3

60. Mark the compound which turns black with NH_4OH

[AFMC 1981; MP PMT 1995]

(a) Lead chloride
(b) Mercurous chloride
(c) Mercuric chloride
(d) Silver chloride

61. Colour of cobalt chloride solution is **[AFMC 1981]**

(a) Pink
(b) Black
(c) Colourless
(d) Green

62. Sodium carbonate cannot be used in place of ammonium carbonate for the precipitation of the fifth group radicals because

(a) Sodium ions interfere with the detection of fifth group radicals
(b) Concentration of carbonate ions is very low
(c) Sodium will react with acidic radicals
(d) Magnesium will be precipitated

63. Nessler's reagent is used to detect

[CPMT 1989; AIIMS 1997; MP PET 1999]

(a) CrO_4^{2-}
(b) PO_4^{3-}
(c) MnO_4^-
(d) NH_4^+

64. A light greenish coloured salt was soluble in water. On passing H_2S into the solution a black precipitate was obtained which dissolve readily in HCl **[IIT 1996]** The metal ion present is **[BHU 1981]**

(a) Co^{+2}
(b) Fe^{2+}
(c) Ni^{+2}
(d) Mn^{+2}

65. Yellow ammonium sulphide solution is a suitable reagent for the separation of **[BHU 1987]**

(a) HgS and PbS
(b) PbS and Bi_2S_3
(c) Bi_2S_3 and CuS
(d) CdS and As_2S_3

66. $Fe(OH)_3$ can be separated from $Al(OH)_3$ by addition of

[BHU 1981]

(a) Dil. HCl
(b) $NaCl$ solution
(c) $NaOH$ solution
(d) NH_4Cl and NH_4OH

67. The reagents NH_4Cl and aqueous NH_3 will precipitate

[IIT 1991]

(a) Ca^{2+}
(b) Al^{+3}
(c) Mg^{2+}
(d) Zn^{2+}

68. The aqueous solutions of the following salts will be coloured in the case of **[IIT 1990]**

(a) $Zn(NO_3)_2$
(b) $LiNO_3$
(c) $CrCl_3$
(d) Potash alum

69. A mixture containing Cu^{2+} and Ni^{2+} can be separated for identification by **[MP PMT 1994]**

(a) Passing H_2S in acid medium
(b) Passing H_2S in alkaline medium
(c) Passing H_2S in neutral medium
(d) Passing H_2S in dry mixture

70. Addition of $SnCl_2$ to $HgCl_2$ gives *ppt* **[BVP 2003]**

(a) White turning to red
(b) White turning to gray
(c) Black turning to white
(d) None of these

71. When dilute aqueous solution of $AgNO_3$ (excess) is added to KI solution, positively charged sol. Particles of AgI are formed due to adsorption of ion **[BHU 2003]**

(a) NO_3^-
(b) O_2^-
(c) Ag^+
(d) K^+

72. Heamoglobin is a complex of **[CPMT 2003]**

(a) Fe^{3+}
(b) Fe^{2+}
(c) Fe^{4+}
(d) Cu^{2+}

73. A colourless crystalline salt '*X*' is soluble in dilute *HCl*. On adding *NaOH* solution, it gives a white precipitate which is insoluble in excess of *NaOH*. '*X*' is **[KCET 2003]**

(a) $Al_2(SO_4)_3$ **[AIIMS 1980]**
(b) $ZnSO_4$
(c) $MgSO_4$
(d) $SnCl_2$

74. Precipitate of group IV cations takes place when H_2S is

[RPET 2003]

(a) Highly ionised
(b) Less ionised
(c) Not ionised
(d) None of these

75. In Nessler's reagent for the detection of ammonia the active species is [Kerala (Med.) 2003]

(a) Hg_2Cl_2 (b) Hg^{2+}

(c) Hg_2I_2 (d) HgI_4^{2-}

76. On addition of aqueous $NaOH$ to a salt solution, a white gelatinous precipitate is formed, which dissolves in excess alkali. The salt solution contains [MP PMT 1994]

(a) Chromium ions (b) Aluminium ions

(c) Barium ions (d) Iron ions

77. A solution prepared in conc. HCl sometimes gives white turbidity even in the absence of 1st group, when water is added to it. It is due to the presence of

(a) Hg^{2+} (b) Sb^{3+}

(c) Ag^{3+} (d) Sb^{3+} or Bi^{3+} or both

78. Which of the following pairs of ions when mixed in dilute solutions may give precipitate

[CPMT 1976; NCERT 1987; Kurukshetra CEE 1998]

(a) Na^+, SO_4^{2-} (b) NH_4^+, CO_3^{2-}

(c) Na^+, S^{2-} (d) Fe^{3+}, PO_4^{3-}

79. Which one of the following sulphides is only completely precipitated when the acidic solution is made dilute

[MP PET 2000]

(a) HgS (b) PbS

(c) CdS (d) CuS

80. A reagent used to test the presence of Fe^{2+} ion is

[KCET 1998]

(a) H_2S (b) NH_4CNS

(c) $K_4Fe(CN)_6$ (d) $K_3Fe(CN)_6$

81. Identify the statement which is not correct regarding copper sulphate [UPSEAT 2001]

(a) It reacts with KI to give iodine

(b) It reacts with KCl to give Cu_2Cl_2

(c) It reacts with $NaOH$ and glucose to give Cu_2O

(d) It gives CuO on strong heating in air

82. Mark the correct statement [MP PMT 2002]

(a) I group basic radicals precipitate as chlorides

(b) IV group basic radicals precipitate as sulphides

(c) V group basic radicals precipitate as carbonates

(d) All of these statement are correct

83. The following four solutions are kept in separate beakers and copper metal is put in each of them. Which solution will become blue after some time [MP PMT 2003]

(a) $AgNO_3$ solution (b) $Zn(NO_3)_2$ solution

(c) $Ba(NO_3)_2$ solution (d) $NaNO_3$ solution

84. Cu^{2+} ions will be reduced to Cu^+ ions by the addition of an aqueous solution of [AIIMS 1992]

(a) KF (b) KCl

(c) KI (d) KOH

85. Which radicals are precipitated in $(NH_4)_2CO_3$ in presence of alkali

(a) Ca, Ba, Sr (b) Mg

(c) Both (d) None

86. Which of the following is soluble in yellow ammonium sulphide

(a) CuS (b) CdS

(c) SnS (d) PbS

87. Which mixture is separated by conc. aqueous solution of sodium hydroxide [UPSEAT 1999]

(a) Al and Sn (b) Al and Fe

(c) Al and Zn (d) Zn and Pb

88. H_2S is passed through an acidified solution of Ag, Cu and Zn. Which forms precipitate [BHU 1998]

(a) Ag (b) Zn

(c) Cu (d) None of these

89. The presence of NH_4Cl in the test solution while precipitating group III-A hydroxides (in qualitative inorganic analysis) helps in

(a) Lowering $[OH^-]$ (b) Lowering $[NH_4OH]$

(c) Increasing $[OH^-]$ (d) Increasing $[NH_4OH]$

90. On saturating aqueous solution of Cu (II), Pb (II) and Zn (II) ions with H_2S will precipitate

(a) Only CuS (b) Only PbS

(c) Both CuS and PbS (d) CuS, PbS and ZnS

91. A chloride dissolves appreciably in cold water when placed on a platinum wire in Bunsen flame, no distinctive colour is noted, which cation could be present [Pb. PMT 1998]

(a) Mg^{2+} (b) Ba^{2+}

(c) Pb^{2+} (d) Ca^{2+}

92. A solid (A) which has photographic effect reacts with the solution of a sodium salt (B) to give a pale yellow ppt. (C). Sodium salt on heating gives brown vapour. Identify A, B and C.

(a) $AgNO_3, NaBr, AgBr$ (b) $AgNO_3, NaCl, AgCl_2$

(c) $AgNO_3, NaBr, AgCl_2$ (d) $AgCl, NaBr, AgBr_2$

93. In qualitative analysis, in order to detect second group basic radical, H_2S gas is passed in the presence of dilute HCl to

[KCET 2004]

(a) Increase in dissociation of H_2S

(b) Decrease the dissociation of salt solution

(c) Decrease the dissociation of H_2S

(d) Increase the dissociation of salt solution

94. H_2S gas when passed through a solution of a contains HCl precipitate the cations of group of qualitative analysis but not those belonging to the fourth group. It is because

[CBSE PMT 2005]

(a) Presence of HCl decreases the sulphide ion concentration

(b) Presence of HCl increases the sulphide ion concentration

(c) Solubility product of group II sulphides is more than that of group IV sulphides

(d) Sulphides of group IV Cations are in HCl

95. A metal nitrate reacts with KI to give a black precipitate which on addition of excess of KI convert into orange colour solution. The cation of the metal nitrate is

[IIT-JEE (Screening) 2005]

(a) Hg^{2+} (b) Bi^{3+}

(c) Pb^{2+} (d) Cu^+

96. Which of the following basic radicals will not be precipated by H_2S gas in the presence of NH_3 [Pb. PMT 2001] [Pb. CET 2003]

(a) Mn^{2+} (b) Ni^{2+}

(c) Cd^{2+} [MP PET 1994, 97] (d) Ca^{2+}

97. On passing H_2S black ppt. of II group is obtained. The mixture may not contain [CPMT 1989]

(a) Pb^{++} (b) Cd^{++}

(c) Hg^{++} (d) Cu^{++}

98. Ferrous and ferric ions in solution may be distinguished by using

(a) Silver nitrate solution
(b) Lead acetate solution
(c) Acidified solution of potassium permanganate
(d) Sodium chloride solution

99. Solution of II A group precipitate in dil. HNO_3 when treated with NH_4OH becomes blue because of the presence of

(a) Mg (b) Cd
(c) Bi (d) Cu

100. When calomel react with NH_4OH solution the compound formed is **[BCECE 2005]**

(a) $NH_2-Hg-Cl$ (b) $Hg_2Cl_2NH_3$
(c) $Hg(NH_3)_2Cl_2$ (d) $HgCl_2NH_3$

101. Copper sulphate solution react with *KCN* **[BCECE 2005]**

(a) $K_3[Cu(CN)_4]$ (b) $CuCN$
(c) $Cu(CN)_2$ (d) $K_2[Cu(CN)_4]$

102. A metal nitrate reacts with *KI* to give a black precipitate which on addition of excess of *KI* convert into orange colour solution. The cation of the metal nitrate is **[IIT 2005]**

(a) *Hg* (b) *Bi*
(c) *Pb* (d) *Cu*

103. H_2S gas when passed through a solution of a contains HCl precipitates the cations of group of qualitative analysis but not those belonging to the fourth group. It is because **[CBSE PMT 2005]**

(a) Presence of HCl decreases the sulphides ion concentration
(b) Presence of *HCl* increases the sulophide ion concentration
(c) Solubility product of group II sulphides is more than that of group IV sulphides
(d) Sulphides of group IV cations are in *HCl*.

104. Sodium nitroprusside when added to an alkaline solution of sulphide ions produce a **[AFMC 2005]**

(a) Red colouration (b) Blue colouration
(c) Purple colouration (d) Brown colouration

Volumetric Analysis

1. What weight of sodium hydroxide is required to neutralise 100 *ml* of 0.1 $N-HCl$ **[MP PMT 1994]**

(a) 4.0 *gm* (b) 0.04 *gm*
(c) 0.4 *gm* (d) 2.0 *gm*

2. The range of methyl orange as an indicator is in between pH

(a) 6 – 8 (b) 8 – 9
(c) 3 – 5 (d) 2 – 4

3. Phenolphthalein is not a good indicator for titrating **[NCERT 1977]**

(a) $NaOH$ against oxalic acid
(b) Ferrous sulphate against $KMnO_4$
(c) $NaOH$ against HCl
(d) $NaOH$ against H_2SO_4

4. 15 *ml* of $N/10$ $NaOH$ solution completely neutralises 12 *ml* of H_2SO_4 solution. The normality of H_2SO_4 solution will be

(a) $N/5$ (b) $N/10$
(c) $N/8$ (d) N

5. A 100 *ml* solution of 0.1 $N-HCl$ was titrated with 0.2 $N-NaOH$ solution. The titration was discontinued after adding 30 *ml* of $NaOH$ solution. The remaining titration was completed by adding 0.25 $N-KOH$ solution. The volume of KOH required for completing the titration is **[MP PMT 1997]**

(a) 16 *ml* (b) 32 *ml*
(c) 35 *ml* (d) 70 *ml*

6. In 1*gram* of a metal oxide, metal precipitated is 0.68*gram*. what is the equivalent weight of metal **[JIPMER 2002]**

(a) 17 (b) 34
(c) 68 (d) 52

7. If 20 *ml* of 0.25 *N* strong acid and 30 *ml* of 0.2 *N* of strong base are mixed, then the resulting solution is **[KCET 2002]**

(a) 0.25 *N* basic (b) 0.2 *N* acidic
(c) 0.25 *N* acidic (d) 0.2 *N* basic

8. What volume at *N.T.P.* of gaseous NH_3 will be required to be passed into 30 *ml* of NH_2SO_4 solution to bring down the acid strength of this solution to 0.2 *N* **[UPSEAT 2001]**

(a) 357.2 *ml* (b) 444.4 *ml*
(c) 537.6 *ml* (d) 495.6 *ml*

9. 8 *ml* of $\frac{N}{10}HCl$ are required to neutralize 20 *ml* solution of Na_2CO_3 in water. Normality of Na_2CO_3 solution is

(a) 0.40 *N* (b) 0.040 *N*
(c) 4.0 *N* (d) 1.4 *N*

10. Required amount of crystalline oxalic acid (eq. wt. = 63) to prepare $N/10$ 250 *ml* oxalic acid solution is **[MP PMT 1996]**

(a) 0.158 *g* (b) 1.575 *g*
(c) 15.75 *g* (d) 6.3 *g*

11. 15 *ml* of 0.2 *N* alkali is required to complete neutralization of 30 *ml* acid solution. Concentration of the acid solution is **[NCERT 1985; CPMT 1986]**

(a) 0.1 *N* (b) 0.3 *N*
(c) 0.15 *N* (d) 0.4 *N*

12. 200 *ml* 0.6 *N* H_2SO_4 and 100 *ml* of $0.3N$ HCl are mixed together. Acidic normality of the resultant solution is **[DPMT 1991]**

[CPMT 1984]

(a) 0.5 *N* (b) 0.9 *N*
(c) 0.3 *N* (d) 0.6 *N*

13. 10 *ml* of 10 *M* H_2SO_4 is mixed to 100 *ml* 1*M* $NaOH$ solution. The resultant solution will be **[NCERT 1971]**

(a) Acidic (b) Neutral
(c) Weakly alkaline (d) Strongly alkaline

14. Volume of 0.1 *M* H_2SO_4 required to neutralize 30 *ml* of 0.2 *N* $NaOH$ is **[EAMCET 1978; MP PMT 2001]**

(a) 30 *ml* (b) 15 *ml*
(c) 40 *ml* (d) 60 *ml*

15. $5N$ H_2SO_4 was diluted from 1 *litre* to 10 *litres*. Normality of the solution obtained is **[MP PET 1995]**

(a) 10 N (b) 5 *N*

(c) 1 *N* (d) 0.5 N

16. 0.45 *g* of an acid (mol wt. = 90) required 20 *ml* of 0.5 *N* KOH for complete neutralization. Basicity of acid is [CPMT 1979]

(a) 1 (b) 2

(c) 3 (d) 4

17. Equivalent weight of crystaline oxalic acid is [MP PMT 1995]

(a) 12 (b) 63

(c) 53 (d) 40

18. Volume of $\frac{N}{10} H_2SO_4$ required to neutralize 10 *ml* 5 *N* Na_2CO_3 is

(a) 100 *ml* (b) 50 *ml*

(c) 500 *ml* (d) 1000 *ml*

19. The equivalent weight of $KMnO_4$ in alkaline medium will be [MP PMT 2001]

(a) 31.60 (b) 52.66

(c) 79.00 (d) 158.00

20. An aqueous solution of 6.3*g* oxalic acid dehydrate is made up to 250 *ml*. The volume of 0.1*N NaOH* required to completely neutralize 10 *ml* of this solution is [IIT-JEE (Screening) 2001]

(a) 40 *ml* (b) 20 *ml*

(c) 10 *ml* (d) 4 *ml*

21. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is [IIT-JEE (Screening) 2001]

(a) (Molecular weight)/2

(b) (Molecular weight)/6

(c) (Molecular weight)/3

(d) Same as molecular weight

22. 25 *ml* of a solution of Na_2CO_3 having a specific gravity of 1.25 required 32.9 *ml* of a solution of *HCl* containing 109.5 *grams* of the acid per litre for complete neutralization. Calculate the volume of 0.84 *N* – H_2SO_4 that will be completely neutralized by 125 *grams* of the Na_2CO_3 solution[UPSEAT 2001]

(a) 460 *ml* (b) 540 *ml*

(c) 480 *ml* (d) 470 *ml*

23. The volume of 0.05 *M* H_2SO_4 required to neutralise 80 *ml* of 0.13 *N* $NaOH$ will be [CPMT 1989]

(a) 104 *ml* (b) 52 *ml*

(c) 10.4 *ml* (d) 26 *ml*

24. How many grams of $NaOH$ will be required to prepare 250 *ml* of 0.1 *M* solution [EAMCET 1978]

(a) 1 *gm* (b) 4 *gms*

(c) 40 *gms* (d) 10 *gms*

25. Molecular weight of oxalic acid is 126. The weight of oxalic acid required to neutralise 100 *cc* of normal solution of $NaOH$ is

(a) 6.3 *gm* (b) 126 *gm*

(c) 530 *gm* (d) 63 *gm*

26. Concentrated HCl is 10 *N*, 1000 *cc* of $1N$ HCl can be obtained by diluting [EAMCET 1978]

(a) 1 *cc* of conc. HCl to 1000 *cc*

(b) 10 *cc* of conc. HCl to 1000 *cc*

(c) 20 *cc* of conc. HCl to 1000 *cc*

(d) 100 *cc* of conc. HCl to 1000 *cc*

27. The equivalent weight of an acid is equal to [AIIMS 1998]

(a) Molecular weight × acidity

(b) Molecular weight × basicity

(c) Molecular weight / basicity

(d) Molecular weight / acidity

28. A metal oxide is reduced by heating it in a stream of hydrogen. It is found that after complete reduction, 3.15 *g* of the oxide have yielded 1.05 of the metal. We may deduce that

(a) The *eq.* weight of the metal is 8

(b) The atomic weight of the metal is 8

(c) The atomic weight of the metal is 4

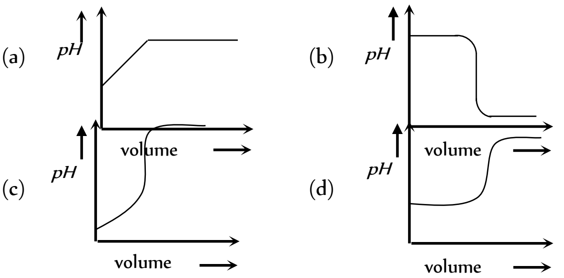
(d) The *eq.* weight of the metal is 4

29. The molecular weight of a tribasic acid is *M*. What will be its equivalent weight [CPMT 1974, 79; MP PMT 2003]

(a) $\frac{M}{2}$ (b) *M*

(c) $\frac{M}{3}$ (d) $\sqrt{\frac{M}{3}}$

30. Which of the following plot represents the graph of *pH* against volume of alkali added in the titration of *NaOH* and *HCl*



31. Phenolphthalein is not suitable for the titration of [MP PMT 2003]

(a) *NaOH vs* $(COOH)_2$ (b) *KOH vs* H_2SO_4

(c) K_2CO_3 *vs HCl* (d) None of these

32. In order to prepare one *litre* normal solution of $KMnO_4$ how many *gm* of $KMnO_4$ are required, if the solution is to be used in acid medium for oxidation [MP PET 2002]

(a) 158 *gm* (b) 31.60 *gm*

(c) 62.0 *gm* (d) 790 *gm*

33. 20 *ml* of a solution of a weak monobasic acid neutralizes 22.18 *ml* of a solution of *NaOH* and 20 *ml* of *N*/10 *HCl* neutralizes 21.5 *ml* of the same *NaOH* solution. The normality for the acid is nearly[MP PET 2002]

(a) 10 *N* (b) 1 *N*

(c) 0.10 *N* (d) 100 *N*

34. How many *ml* of 1 (*M*) H_2SO_4 is required to neutralise 10 *ml* of 1(*M*) $NaOH$ solution [NCERT 1973] [MP PET 1997; MP PMT 1999]

(a) 2.5 (b) 5.0

(c) 10.0 (d) 20.0

35. The maximum amount of $BaSO_4$ precipitated on mixing $BaCl_2$ (0.5*M*) with H_2SO_4 (1*M*) will correspond to [AIIMS 1997]

(a) 0.5 *M* (b) 1.0 *M*

(c) 1.5 *M* (d) 2.0 *M*

36. How many grams of $NaOH$ are equivalent to 100 *ml* of 0.1 *N* oxalic acid

(a) 0.2
(b) 2.0
(c) 0.4
(d) 4.0

37. How much of *NaOH* is required to neutralize 1500 cm^3 of 0.1 *N HCl* (At. *wt.* of *Na* = 23) **[KCET (Med.) 2001]**

(a) 4 *g*
(b) 6 *g*
(c) 40 *g*
(d) 60 *g*

38. 0.126 *g* of an acid requires 20 *ml* of 0.1 *N NaOH* for complete neutralization. The equivalent weight of the acid is

[MP PET 2001]

(a) 45
(b) 53
(c) 40
(d) 63

39. The ratio of amounts of H_2S needed to precipitate all the metal ions from 100 *ml* of 1 *M* $AgNO_3$ and 100 *ml* of 1 *M* $CuSO_4$ is

(a) 1 : 2
(b) 2 : 1
(c) Zero
(d) Infinity

40. The equivalent weight of a divalent metal is 31.82. The weight of a single atom is **[MH CET 2000]**

(a) 63.64
(b) $\frac{63.64}{6.02\times 10^{23}}$
(c) $32.77\times 6.02\times 10^{23}$
(d) $63.64\times 6.02\times 10^{23}$

41. For the preparation of sodium thiosulphate by "Springs reaction", the reactants used are **[EAMCET 2003]**

(a) $Na_2S + Na_2SO_3 + Cl_2$
(b) $Na_2S + SO_2$
(c) $Na_2SO_3 + S$
(d) $Na_2S + Na_2SO_3 + I_2$

42. Phenolphthalein is most suitable indicator for the titration of

[MP PMT 2000]

(a) CH_3COOH and NH_4OH
(b) CH_3COOH and $NaOH$
(c) HCl and NH_4OH
(d) H_2CO_3 and NH_4OH

43. The simplest formula of a compound containing 50% of element *X* (at. w*t.* 10) and 50% of element *Y* (at. *wt* =20) is

[DPMT 2000]

(a) X_2Y_3
(b) XY_2
(c) X_2Y
(d) XY

44. The equivalent weight of a metal is 4.0. The vapour density of its chloride is 59.25. Its atomic weight is **[DPMT 2000]**

(a) 12
(b) 8
(c) 36
(d) 24

45. Indicator for the titration of *HCl* and Na_2CO_3 would be

[RPMT 1999]

(a) $K_4Fe(CN)_6$
(b) $K_3Fe(CN)_6$
(c) Phenolphthalein
(d) Methyl orange

46. 20 *ml* of a *N* solution of $KMnO_4$ just reacts with 20 *ml* of a solution of oxalic acid. The weight of oxalic acid crystals in 1*N* of the solution is **[JIPMER 1999]**

(a) 31.5 *g*
(b) 126 *g*
(c) 63 *g*
(d) 6.3 *g*

47. 0.53 *gm* of Na_2CO_3 has been dissolved in 100 *ml* of a sodium carbonate solution. The normality of the solution will be

(a) $\frac{N}{5}$
(b) $\frac{N}{2}$
(c) $\frac{N}{10}$
(d) N

48. $2\ N-HCl$ will have the same molar concentration as

[CPMT 1996]

(a) 0.5 $N-H_2SO_4$
(b) 1.0 $N-H_2SO_4$
(c) 2 $N-H_2SO_4$
(d) 4 $N-H_2SO_4$

49. Which of the following pair does not distinguish by passing H_2S

(a) $Hg,\ Pb$
(b) $Cd,\ Pb$
(c) $As,\ Cu$
(d) $Zn,\ Mn$

50. If 100 *ml* of 1 *N* sulphuric acid were mixed with 100 *ml* of 1 *M* sodium hydroxide, the solution will be **[MP PET 1999]**

(a) Acidic
(b) Basic
[MP PET 2001]
(c) Neutral
(d) Slightly acidic

51. 100 cm^3 of 0.1 *N* HCl solution is mixed with 100 cm^3 of 0.2 N $NaOH$ solution. The resulting solution is

[MP PET 1996]

(a) 0.1 *N* and the solution is basic
(b) 0.05 *N* and the solution is basic
(c) 0.1 *N* and the solution is acidic
(d) 0.05 *N* and the solution is acidic

52. For preparing 0.1 *N* solution of a compound from its impure sample, of which the percentage purity is known, the weight of the substance required will be **[MP PET 1996]**

(a) More than the theoretical weight
(b) Less than the theoretical weight
(c) Same as theoretical weight
(d) None of these

53. The equivalent weight of $Zn(OH)_2$ in the following reaction is equal to its, $[Zn(OH)_2 + (NO_3) \rightarrow Zn(OH)(NO_3) + H_2O]$

[MH CET 1999]

(a) $\frac{\text{Formula wt.}}{2}$
(b) $\frac{\text{Formula wt.}}{1}$
(c) $3\times \text{formula wt.}$
(d) $2\times \text{formula wt.}$

54. In the titration of strong acid and weak base, the indicator used is

(a) Thymol blue
(b) Phenolphthalein
(c) Thymolphthalein
(d) Methyl orange

55. To neutralize 25 *ml* of 0.25 *M* Na_2CO_3 solution how much volume of 0.5 *M* HCl is required **[MP PET 1994]**

(a) 12.5 *ml*
(b) 25 *ml*
(c) 37.5 *ml*
(d) 50 *ml*

56. 0.16 *gm* of a dibasic acid required 25 *ml* of decinormal $NaOH$ solution for complete neutralization. The molecular weight of the acid is **[CPMT 1989; MP PET 1993]**

(a) 32
(b) 64
(c) 128
(d) 256

57. When 100 *ml* $N-NaOH$ solution and 10 *ml* of 10 *N* sulphuric acid solution are mixed together, the resulting solution will be**[DPMT 1982; MP P**

(a) Alkali
(b) Weakly acidic
(c) Strongly acidic
(d) Neutral

58. Cosin used to detect end point of precipitation titration by adsorption is called **[MP PMT 1996]** **[KCET (Med). 2000]**

(a) Absorption indicator
(b) Adsorption indicator
(c) Chemical indicator
(d) Normal indicator

59. 0.1914*g* of an organic acid is dissolved in approx. 20 *ml* of water. 25 *ml* of 0.12 *N NaOH* required for the complete neutralization of the acid solution. The equivalent weight of the acid is

(a) 65 (b) 64

(c) 63.80 (d) 62.50

60. Molecular weight of a tribasic acid is *W*, its equivalent weight is

(a) $2W$ (b) $W/3$

(c) $3W$ (d) $W-3$

61. Approximate atomic weight of an element is 26.89. If its equivalent weight is 8.9, the exact atomic weight of element would be

(a) 26.89 (b) 8.9

(c) 17.8 (d) 26.7

62. 1 *gm* of hydrogen is found to combine with 80 *gms* of bromine. 1 *gm* of calcium (valency 2) combines with 4 *gms* of bromine. The equivalent weight of calcium is

[NCERT 1982]

(a) 10 (b) 20

(c) 40 (d) 80

63. 4.0 *gram* caustic soda is dissolved in 100 *cc* solution. The normality of solution is **[MP PMT 1995]**

(a) 1.0 (b) 0.1

(c) 0.5 (d) 4.0

64. Which of the following is required to neutralize 1 *litre* $N-NaOH$

(a) 1 $l-N-H_2SO_4$ (b) 1 $l-M-H_2SO_4$

(c) 1 $l-2N-H_2SO_4$ (d) 1 $l-0.5N-H_2SO_4$

65. What will be the volume of CO_2 at S.T.P., obtained by heating 9.85 *g* of $BaCO_3$ (Atomic number of Ba = 137)

[MP PMT 2003]

(a) 1.12 *litre* (b) 0.84 *litre*

(c) 2.24 *litre* (d) 4.06 *litre*

66. Which indicator can be used in the titration of strong acid and strong base **[CBSE PMT 1988]**

(a) Only phenolphthalein (b) Only methyl orange

(c) Either of the two (d) Red litmus

67. The indicator used in titrating weak acid (*e.g.* oxalic acid) with a strong base (*e.g.* caustic soda) solution is

[IIT-JEE 1985; CPMT 1990; MNR 1980; NCERT 1973, 77; MP PMT 1994]

(a) Methyl orange (b) Methyl red

(c) Fluorescein (d) Phenolphthalein

68. The pink colour of phenolphthalein in alkaline medium is

[CPMT 1990]

(a) Due to negative form

(b) Due to positive form

(c) Due to OH^- ions

(d) Due to neutral form

69. Phenolphthalein does not act as an indicator for the titration between **[NCERT 1976]**

(a) KOH and H_2SO_4

(b) $Ba(OH)_2$ and HCl

(c) $NaOH$ and acetic acid

(d) Oxalic acid and $KMnO_4$

70. If we use phenolphthalein as an indicator in a titration of Na_2CO_3 with HCl, the usual result is **[CBSE PMT 1989]**

[MP PET 2000]

(a) No visible change will occur

(b) The indicator reacts with the acid

(c) The indicator reacts with the base

[CPMT 1974, 79]

(d) Sodium chloride and carbonic acid will be formed

71. Methyl orange gives red colour in **[NCERT 1972]**

(a) Sodium carbonate solution

(b) Sodium chloride solution

(c) Hydrochloric acid solution

[DPMT 1984]

(d) Potassium hydroxide solution

72. A 0.1 *N* solution of Na_2CO_3 is titrated with 0.1 *N* HCl solution. The best indicator to be used is

[NCERT 1971; DPMT 1983; AFMC 1992; CPMT 1983, 97]

(a) Potassium ferricyanide (b) Phenolphthalein

(c) Methyl red (d) Litmus paper

73. When $KMnO_4$ solution is titrated with a solution containing Fe^{2+} ion, the indicator used in this titration is

[CPMT 1989; AIIMS 1996]

(a) Phenolphthalein (b) Methyl orange

(c) $K_3[Fe(CN)_6]$ (d) None of these

74. The strength of a solution (*S*) in *gram/litre*, is related to its normality (*N*) and equivalent weight of solute (e) by the formula

(a) $S=\frac{N}{E}$ (b) $S=\frac{E}{N}$

(c) $S=N.E$ (d) All of these

75. The normality of 1 *M* solution of H_3PO_4 will be

[AIIMS 1983, 91]

(a) 1 *N* (b) 0.5 *N*

(c) 2 *N* (d) 3 *N*

76. In the reaction $I_2+2S_2O_3^- \rightarrow 2I^- + S_4O_6^{2-}$; the equivalent weight of iodine will be equal to

[MNR 1985; UPSEAT 2000]

(a) Molecular weight

(b) 1/2 the molecular weight

(c) 1/4 the molecular weight

(d) Twice the molecular weight

77. To what extent must a given solution of concentration of 40 *mg* silver nitrate per *ml* be diluted to yield a solution of concentration of 16 *mg* $AgNO_3$ per *ml* **[NCERT 1977]**

(a) Each *ml* must be diluted to 2.5 *ml*

(b) To each *ml* of solution 2.5 *ml* of water should be added

(c) To 2.5 *ml* of solution 2 *ml* of water should be added

(d) To 1.5 *ml* of solution 1.5 *ml* of water should be added

78. 10 *ml* of conc. H_2SO_4 (18 molar) is diluted to 1 *litre*. The approximate strength of dilute acid could be **[CPMT 1971]**

(a) 0.18 *N* (b) 0.36 *N*

(c) 0.09 *N* (d) 18.00 *N*

79. For preparing one litre $N/10$ solution of H_2SO_4, we need H_2SO_4 **[DPMT 1982]**

(a) 98 *gms* (b) 10 *gms*

(c) 100 *gms* (d) 4.9 *gms*

80. What is the concentration of nitrate ions if equal volumes of 0.1 *M* $AgNO_3$ and 0.1 *M* $NaCl$ are mixed together

[NCERT 1981; CPMT 1983]

(a) 0.1 *N* (b) 0.2 *M*

(c) 0.05 *M* (d) 0.25 *M*

81. To neutralise 10 *ml* of $M/5\ NaOH$ the volume of $M/20\ HCl$ required is **[EAMCET 1980]**

(a) 10 *ml* (b) 15 *ml*

(c) 40 *ml* (d) 25 *ml*

82. To change the strength of 25 *ml* of 0.15 *M* HCl to 0.1 *M* the quantity of water that is to be added is **[EAMCET 1979]**

(a) 37.5 *ml* (b) 12.5 *ml*

(c) 25.0 *ml* (d) 18.75 *ml*

83. The volume of 0.1 *M* H_2SO_4 that is needed to completely neutralise 40 *ml* of 0.2 *M* $NaOH$ is **[EAMCET 1979]**

(a) 10 *ml* (b) 20 *ml*

(c) 40 *ml* (d) 80 *ml*

84. What volume of water is to be added to 50 *ml* of 4 *N NaOH* solution to obtain a 1 *N* solution **[MP PET 2002]**

(a) 100 *ml* (b) 150 *ml*

(c) 200 *ml* (d) 250 *ml*

85. In alkaline condition $KMnO_4$ reacts as follows,

$2KMNO_4 + 2KOH \rightarrow 2K_2MnO_4 + H_2O + O.$

The *eq. wt.* of $KMnO_4$ is **[DPMT 2000]**

(a) 79 (b) 31.6

(c) 158 (d) 52.7

86. When a standard solution of *NaOH* is left in the air for a few hours,

(a) A precipitate will form.

(b) Strength will decrease.

(c) The concentration of Na^+ ions will decrease.

(d) All are wrong.

87. In the iodometric estimation in laboratory, which process is involved ? **[Orissa JEE 2004]**

(a) $Cr^2O_7^{2-} + H^+ + I^- \rightarrow 2Cr^{3+} + I_2,$

$I_2 + S_2O_3^{2-} \rightarrow S_4O_6^{2-} + I^-$

(b) $MnO_4^- + H^+ + I^- \rightarrow MnO_2 + I_2$

$I_2 + S_2O_3^{2-} \rightarrow S_4O_6^{2-} + I^-$

(c) $MnO_4^- + OH^- + I^- \rightarrow MnO_2 + I_2$

$I_2 + S_2O_3^{2-} \rightarrow S_4O_6^{2-} + I^-$

(d) $Cr_2O_7^{2-} + OH^- + I^- \rightarrow 2Cr^{3+} + I_2$

$I_2 + S_2O_3^{2-} \rightarrow S_4O_6^{2-} + I^-$

88. What is the volume of 0.1 *N-HCl* required to react completely with 1.0 *gm* of pure calcium carbonate.

[DPMT 2004]

(a) $100\,cm^3$ (b) $150\,cm^3$

(c) $250\,cm^3$ (d) $200\,cm^3$

89. The weight of a residue obtained by heating 2.76 *g* of silver carbonate is **[Pb. PMT 2004]**

(a) 2.76 *g* (b) 2.98 *g*

(c) 2.16 *g* (d) 2.44 *g*

90. What is the molarity of H_2SO_4 solution if 25 *ml* is exactly neutralised with 32.63 *ml* of 0.164 *M, NaOH* **[DCE 2003]**

(a) 0.107 *M* (b) 0.126 *M*

(c) 0.214 *M* (d) –0.428 *M*

91. Weight of $Ca(OH)_2$ needed to prepare 250 *ml* of solution with *pH* = 13 **[BVP 2004]**

(a) 0.925 *g* (b) 0.0125 *g*

(c) 0.25 *g* (d) 1 *g*

92. What will be the volume of a 12 *M* solution, if it is equivalent to 240 *ml* 18 *M* solution **[BVP 2004]**

(a) 6 *litre* (b) 600 *litre*

(c) 400 *litre* (d) 0.36 *litre*

93. The volume of $\frac{N}{10}$ *NaOH* require to neutralise 100 *ml* of $\frac{N}{25}$ *HCl* is **[Pb. CET 2000]**

(a) 30 *ml* (b) 100 *ml*

(c) 40 *ml* (d) 25 *ml*

94. The volume of 0.6 *M NaOH* required to neutralise 30 cm^3 of 0.4 *M HCl* is **[Pb. CET 2001]**

(a) 40 cm^3 (b) 30 cm^3

(c) 20 cm^3 (d) 10 cm^3

95. Solubility of iodine in water may be increased by adding

[DCE 2004]

(a) Chloroform (b) Potassium iodide

(c) Carbon disulphate (d) Sodium Thiosulphate

96. If 30 *ml* of H_2 and 20 *ml* of O_2 reacts to form water, what is left at the end of the reaction **[AFMC 2005]**
[Kerala PMT 2004]

(a) 10*ml* of H_2 (b) 5*ml* of H_2

(c) 10*ml* of O_2 (d) 5*ml* of O_2

97. The primary standard solution for estimation of $Na_2S_2O_3$ is

(a) I_2 solution (b) $KMnO_4$

(c) $K_2Cr_2O_7$ (d) Oxalic acid

98. Acidic solution of $S_2O_3^{2-}$ is converted to ……. in presence of I_2

(a) $S_4O_6^{2-} + I^-$ (b) $SO_4^{2-} + I^-$

(c) $SO_3 + I^-$ (d) $S_4O_6^{2-} + I_3^-$

Critical Thinking

Objective Questions

1. A white solid '*A*' on heating gives off a gas which turns lime water milky. The residue is yellow when hot but turns white on cooling. This solid '*A*' is **[MP PMT 1999]**

(a) Zinc sulphate (b) Zinc carbonate

(c) Lead sulphate (d) Lead carbonate

2. A salt on treatment with dil. HCl gives a pungent smelling gas and a yellow precipitate. The salt gives green flame when tested. The salt solution gives a yellow precipitate with potassium chromate. The salt is **[MP PET 1996]**

(a) $NiSO_4$ (b) BaS_2O_3

(c) PbS_2O_3 (d) $CuSO_4$

3. The salt used for performing 'bead' test in qualitative inorganic analysis is **[UPSEAT 2001]**

(a) $K_2SO_4.Al_2(SO_4)_3.24H_2O$

(b) $FeSO_4.(NH_4)_2SO_4.6H_2O$

(c) $Na(NH_4)HPO_4.4H_2O$

(d) $CaSO_4\,2H_2O$

4. Where chlorine water is added to an aqueous solution of potassium halide in presence of chloroform, a violet colour is obtained. On adding more of chlorine water, the violet colour disappears, and a colourless solution is obtained. This test confirms the presence of the following in aqueous solution **[CPMT 1990]**

(a) Iodide (b) Bromide
(c) Chloride (d) Iodide and bromide

5. Upon the addition of a solution *A* to a strongly acidified solution of barium nitrate, a white precipitate was obtained which did not dissolve even after large addition of water. Solution *A* contained

(a) Sodium phosphate (b) Sodium carbonate
(c) Sodium sulphate (d) Sodium chloride

6. To an acid solution of an anion a few drops of $KMnO_4$ solution are added. Which of the following, if present will not decolourise the $KMnO_4$ solution **[MP PMT 1997]**

(a) NO_2^- (b) S^{2-}
(c) Cl^- (d) CO_3^{2-}

7. The brown ring test for NO_2 and NO_3^- is due to the formation of complex ion with the formula

[KCET (Eng./Med.) 2000; Kerala PMT 2004]

(a) $[Fe(H_2O)_6]^{2+}$ (b) $[Fe(NO)(CN)_5]^{2+}$
(c) $[Fe(H_2O)_5NO]^{2+}$ (d) $[Fe(H_2O)(NO)_5]^{2+}$

8. Mixture is heated with dil. H_2SO_4 and the lead acetate paper turns black by the evolved gases. The mixture contains

(a) Sulphite (b) Sulphide
(c) Sulphate (d) Thiosulphate

9. To a solution of a substance, gradual addition of ammonium hydroxide results in a black precipitate which does not dissolve in excess of NH_4OH. However, when HCl is added to the original solution, a white precipitate is formed. The solution contained**[BHU 1973]**

(a) Lead salt (b) Silver salt
(c) Mercurous salt (d) Copper salt

10. If $NaOH$ is added to an aqueous solution of zinc ions, a white precipitate appears and on adding excess $NaOH$, the precipitate dissolves. In this solution zinc exists in the

[NCERT 1981; MP PET 1993]

(a) Cationic part
(b) Anionic part
(c) Both in cationic and anionic parts
(d) There is no zinc in the solution

11. On performing a borax-bead test with a given inorganic mixture for qualitative analysis, the colour of the bead was found to be emerald green both in oxidising and reducing flame. It indicates the possibility of the presence of

[MP PMT 2001]

(a) Co^{2+} (b) Ni^{2+}
(c) Cr^{3+} (d) Cu^{2+}

12. A red solid is insoluble in water. However it becomes soluble if some *KI* is added to water. Heating the red solid in a test tube results in liberation of some violet coloured fumes and droplets of a metal appear on the cooler parts of the test tube. The red solid is**[AIEEE 2003]**

(a) $(NH_4)_2Cr_2O_7$ (b) HgI_2
(c) HgO (d) Pb_3O_4

13. 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 **[IIT 1996]**

(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

14. Phosphoric acid (H_3PO_4) is tribasic acid and one of its salts is sodium dihydrogen phosphate (NaH_2PO_4). What volume of 1 *M* $NaOH$ solution should be added to 12 *g* of sodium dihydrogen phosphate (mol. wt. 120) to exactly convert it into trisodium phosphate Na_3PO_4

[Kurukshetra CET 1998]

(a) 80 *ml* (b) 100 *ml*
(c) 200 *ml* (d) 300 *ml*

[NCERT 1971]

15. Three separate samples of a solution of a single salt gave these test 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**[Pb. PMT 1998**

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

16. 10 *ml* of concentrated HCl were diluted to 1 *litre*. 20 *ml* of this diluted solution required 25 *ml* of 0.1 *N* sodium hydroxide solution for complete neutralization, the normality of the concentrated hydrochloric acid will be

(a) 8.0 (b) 9.5
(c) 12.5 (d) 15.0

17. To a 25 *ml* of H_2O_2 solution, excess of acidified solution of *KI* was mixed. The liberated I_2 require 20*ml* of 0.3*M* hypo solution for neutralization. The volume strength of H_2O_2 will be **[MP PET 2003]**

(a) 1.34 *ml* (b) 1.44 *ml*
(c) 1.60 *ml* (d) 2.42 *ml*

18. A chemistry student trying to detect the metallic ion in a salt, makes a paste on a clean platinum wire loop of the salt with concentrated HCl. When he takes a small amount of this paste and keeps it in a non-luminous Bunsen flame, the colour of the flame changes to grassy green. He should, therefore, conclude that the metal is**[Manipal MEE 1995**

(a) Barium (b) Calcium
(c) Potassium (d) Strontium

19. A white crystalline substance dissolves in water. On passing H_2S in this solution, a black precipitate is obtained. The black precipitate dissolves completely in hot HNO_3. On adding a few drops of conc. H_2SO_4 a white precipitate is obtained. This precipitate is that of**[CPMT 1990]**

(a) $BaSO_4$ (b) $SrSO_4$
(c) $PbSO_4$ (d) $CdSO_4$

20. The best explanation for the solubility of *MnS* in dil. *HCl* is that**[UPSEAT 2001]**

(a) Solubility product of $MnCl_2$ is less than that of *MnS*
(b) Concentration of Mn^{2+} is lowered by the formation of complex ions with chloride ions
(c) Concentration of sulphide ions is lowered by oxidation to free sulphur
(d) Concentration of sulphide ions is lowered by formation of the weak acid H_2S

AR Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
(e) If assertion is false but reason is true.

1. Assertion : Lime water becomes turbid on passing CO_2 but becomes clear on passing more CO_2.

Reason : Lime water is calcium hydroxide, $Ca(OH)_2$.

[AIIMS 2000]

2. Assertion : Sb(III) is not precipitated as sulphide when in its alkaline solution H_2S is passed.

Reason : The concentration of S^{2-} ion in alkaline medium is inadequate for precipitation.

[AIIMS 2004]

3. Assertion : CuS will give H_2S in dilute acid test.

Reason : All sulphides react with dil. H_2SO_4, on heating, to give H_2S.

4. Assertion : $PbCl_2$ will give HCl in conc. H_2SO_4 test.

Reason : All chlorides react with conc. H_2SO_4, on heating, to give HCl

5. Assertion : $ZnCO_3$ will not give any gas when treated with conc. H_2SO_4.

Reason : CO_3^{2-} can only be detected in dil. acid test.

6. Assertion : CdS is yellow in colour.

Reason : Cd salts are yellow in colour.

7. Assertion : A brown gas which intensifies on adding Cu-turnings in conc. H_2SO_4 test is NO_2.

Reason : Copper reacts with conc. HNO_3 to give NO_2.

8. Assertion : CuS is blue in colour.

Reason : All Cu^{2+} salts are blue in colour.

9. Assertion : Acidified $K_2Cr_2O_7$ is turned green when SO_2 is passed through it.

Reason : In this reaction SO_2 acts as a reducing agent.

10. Assertion : White ppt. of $AgCl$ is soluble in NH_4OH.

Reason : It is due to the formation of soluble complex.

11. Assertion : All soluble sulphides gives white ppt. with $BaCl_2$ solution.

Reason : BaS is insoluble in water.

12. Assertion : A solution of $BiCl_3$ in conc. HCl when diluted with water gives white ppt.

Reason : $BiCl_3$ in insoluble in dil. HCl.

13. Assertion : Addition of NH_4OH to an aqueous solution of $BaCl_2$ in the presence of NH_4Cl (excess) precipitates $Ba(OH)_2$.

Reason : $Ba(OH)_2$ is insoluble in water.

[AIIMS 2005]

Answers

Preliminary Test

1	a	2	c	3	a	4	d	5	a
6	d	7	d	8	b	9	c	10	c
11	d	12	a	13	d	14	b	15	a
16	b	17	c	18	b	19	a	20	b
21	b	22	b	23	a				

Wet Test for Acid Radical

1	abd	2	c	3	b	4	d	5	c
6	a	7	b	8	d	9	a	10	b
11	b	12	d	13	c	14	c	15	c
16	b	17	c	18	a	19	b	20	a
21	c	22	d	23	d	24	c	25	b
26	c	27	b	28	b	29	b	30	a
31	a	32	c	33	a	34	b	35	a
36	b	37	a	38	a	39	d	40	b
41	a								

Wet Test for Basic Radical

1	b	2	b	3	b	4	b	5	b
6	b	7	c	8	a	9	d	10	b
11	d	12	d	13	c	14	d	15	a
16	b	17	a	18	b	19	c	20	a
21	abcd	22	bcd	23	c	24	c	25	b
26	a	27	a	28	a	29	b	30	d
31	b	32	c	33	d	34	c	35	d
36	b	37	c	38	c	39	d	40	b
41	c	42	b	43	d	44	a	45	b
46	b	47	b	48	a	49	a	50	c
51	a	52	d	53	a	54	c	55	a
56	a	57	d	58	a	59	c	60	b
61	a	62	d	63	d	64	b	65	d
66	c	67	b	68	c	69	a	70	b
71	c	72	b	73	c	74	d	75	d
76	b	77	d	78	d	79	c	80	d
81	b	82	d	83	a	84	c	85	a
86	c	87	b	88	c	89	a	90	d
91	c	92	a	93	c	94	a	95	b
96	a	97	b	98	c	99	d	100	a
101	a	102	b	103	a	104	c		

Volumetric Analysis

1	c	2	c	3	b	4	c	5	a
6	a	7	d	8	c	9	b	10	b
11	a	12	a	13	a	14	a	15	d
16	b	17	b	18	c	19	d	20	a
21	b	22	d	23	a	24	a	25	a
26	d	27	c	28	d	29	c	30	c
31	d	32	b	33	c	34	b	35	a
36	c	37	b	38	d	39	a	40	b
41	d	42	b	43	c	44	a	45	d
46	c	47	c	48	c	49	a	50	c
51	b	52	b	53	b	54	d	55	a
56	c	57	d	58	b	59	c	60	b
61	d	62	b	63	a	64	d	65	a
66	c	67	d	68	a	69	d	70	a
71	c	72	c	73	d	74	c	75	d
76	b	77	a	78	b	79	d	80	c
81	c	82	b	83	c	84	b	85	c
86	b	87	b	88	d	89	c	90	a
91	a	92	d	93	c	94	c	95	b
96	d	97	a	98	a				

Critical Thinking Questions

1	b	2	b	3	c	4	a	5	c
6	d	7	c	8	b	9	c	10	d
11	c	12	b	13	c	14	c	15	a
16	c	17	a	18	a	19	c	20	d

Assertion and Reason

1	b	2	c	3	d	4	d	5	e
6	c	7	a	8	d	9	a	10	a
11	e	12	c	13	b				

AS Answers and Solutions

Preliminary Test

1. (a) $Na_2B_4O_7.10H_2O \xrightarrow[-10\ H_2O]{} Na_2B_4O_7$

$$\xrightarrow{\Delta} 2NaBO_2 + B_2O_3$$

$CuO + B_2O_3 \rightarrow \underset{\text{(Copper meta borate blue)}}{Cu(BO_2)_2}$

2. (c) Borax bead test is generally given by transition elements.

5. (a) Ba^{2+} imparts green colour to the flame.

6. (d) As Mn^{+2} has all it's electrons (5) unpaired in it's *d*–orbital, so it's extra stable configuration requires high excitation energy and so it gives violet colour.

8. (b) $2NO + O_2 \rightarrow \underset{\text{(Deep brown gas)}}{2NO_2}$

9. (c) $CoAlO_2$ is formed which is blue. Follow cobalt nitrate-charcoal test.

10. (c) Metals which form basic compounds and have coloured salts give the borax bead test.

11. (d) $2KNO_3 + H_2SO_4 \rightarrow 2KHSO_4 + 2\underset{\text{(Brown gas)}}{NO_2} \uparrow$

12. (a) Barium salt gives green coloured flame as it has low ionization energy

13. (d) Calcium oxalate will not dissolve in acetic acid (weak acid) but only in strong acid

14. (b) $Na_2S + \text{dil.}2HCl \rightarrow 2NaCl + H_2S$

$$H_2S + H_2SO_4 + K_2Cr_2O_7 \xrightarrow{\text{acidic}} K_2SO_4 + \underset{\text{(green)}}{Cr_2(SO_4)_3} + S$$

15. (a) Starch Iodide paper is used for the test of Iodine, as

$$\text{Starch} + \text{Iodine} \rightarrow \underset{\text{(Blue)}}{\text{Starch Iodide}}$$

16. (b) Flame colour of *Ba* salt is green

$$2AgNO_3 + BaCl_2 \rightarrow \underset{\text{White ppt.}}{2AgCl} + Ba(NO_3)_2 .$$

17. (c) $NH_3 + HCl \rightarrow \underset{\text{dense white fumes}}{NH_4Cl}$

18. (b) $CoO + B_2O_3 \xrightarrow{\text{Heat}} \underset{\text{Copper metabrate (blue)}}{Co(BO_2)_2}$

20. (b) In laboratory burners, oil gas is generally used. Oil gas is mixture of $CH_4 + CO + CO_2 + H_2$

21. (b) $H_2S \rightarrow$ colourless gas with unpleasant odour of rotten eggs.

$SO_2 \rightarrow$ colourless gas with a pungent suffocating odour

$PH_3 \rightarrow$ colourless gas with unpleasant garlic like odour or rotten fish odour.

22. (b) $NO(g) + NO_2(g) \xrightarrow{-30°C} \underset{\text{(BLUE)}}{N_2O_3(l)}$

23. (a) Yellowish-green gas of chlorine with sufocating odour is evolved when the solid chloride mixed with manganese dioxide is heated with concentrated H_2SO_4.

$$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$$

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

Wet Test for Acid Radical

1. (abd) Chromyl chloride test

$$4NaCl + K_2Cr_2O_7 + 3H_2SO_4 \xrightarrow{\text{heat}} K_2SO_4 + 2Na_2SO_4 + \underset{\text{chromyl chloride (orange red)}}{2CrO_2Cl_2} + 3H_2O$$

$$4NaOH + CrO_2Cl_2 \rightarrow 2NaCl + \underset{\text{Sod. chromate (Yellow)}}{Na_2CrO_4} + 2H_2O$$

$$Na_2CrO_4 + (CH_3COO)_2Pb \rightarrow 2CH_3COONa + \underset{\substack{\text{Lead chromate}\\ \text{(yellow ppt.)}}}{PbCrO_4} \downarrow$$

2. (c) Starch is colourless but

$$\text{Starch} + \underset{\text{(violet)}}{\text{Iodine}} \rightarrow \underset{\text{(blue-black)}}{\text{Starch Iodine}}$$

3. (b) Brown ring test with ($FeSO_4 NO$)

4. (d) $Na_4[Fe(CN)_5NO] + S^{2-} \rightarrow \underset{\substack{\text{Sodium thio-nitroprusside}\\ \text{(violet)}}}{Na_4[Fe(CN)_5NOS]}$

6. (a) With F^-, no precipitate is obtained because of low lattice energy of *AgF*, so it remains in ionized state

7. (b) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

$$K_2Cr_2O_7 + 2H_2SO_4 \rightarrow 2KHSO_4 + 2CrO_3 + H_2O$$

$$CrO_3 + 2HCl \rightarrow \underset{\text{(orange red vapour)}}{CrO_2Cl_2}$$

8. (d) $CrO_2Cl_2 \xrightarrow{NaOH} Na_2CrO_4 \xrightarrow[CH_3COOPb]{CH_3COOH}$

$$[(CH_3COO)_2Pb] \xrightarrow{CrO_2Cl_2} \rightarrow \underset{\text{yellow ppt.}}{PbCrO_4}$$

9. (a) $2AgNO_3 + H_2S \rightarrow \underset{\text{Black ppt.}}{Ag_2S} + 2HNO_3$

10. (b) Iodine vapours are violet $\therefore$ the salt must contain I^- as

$$KI + H_2SO_4 \rightarrow KHSO_4 + HI$$

$$2HI + H_2SO_4 \rightarrow \underset{\text{violet vapour}}{I_2} + 2H_2O + SO_2$$

11. (b) As Cl^- is more electronegative than Br^- and I^- $\therefore$ it replaces them from their salt as

$$2I^- + Cl_2 \rightarrow I_2 + 2Cl^- \Rightarrow \text{Violet vapour}$$

$$2Br^- + Cl_2 \rightarrow Br_2 + 2Cl^- \Rightarrow \text{Brown vapour}$$

12. (d) The salt must have SO_4^{2-} group which is also present in the acid so reaction is not takes place.

13. (c) Phosphates give canary yellow precipitate with ammonium molybdate in the presence of conc. HNO_3

$$H_3PO_4 + 12(NH_4)_2MoO_4 + 21HNO_3$$

$$\underset{\substack{\text{ammonium phosphomo lybdate}\\ \text{(canary yellow ppt.)}}}{(NH_4)_3PO_4.12MoO_3} + 21NH_4NO_3 + 12H_2O$$

15. (c) Nitrates and acetates of all metals are water soluble.

16. (b) When NO_3^- is passed through $FeSO_4$ (neutral) and then few drops of conc. H_2SO_4 is added then the brown ring is obtained.

$$FeSO_4 + NO \rightarrow \underset{\substack{\text{(Brown ring)}\\ \text{Nitroso Ferrousulp hate}}}{Fe(NO)SO_4}$$

17. (c) *AgCl* and *AgBr* dissolve in NH_4OH and form complexes but *AgI* doesn't react with NH_4OH. *e.g.*

$$AgCl + 2NH_4OH \rightarrow \underset{\text{complex}}{[Ag(NH_3)_2]Cl} + 2H_2O$$

18. (a) When Cl^-, Br^- and F^- are treated with $AgNO_3$ solution in presence of dilute HNO_3, corresponding silver halide is obtained which is soluble in NH_4OH, *NaCN*, and $Na_2S_2O_3$

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

$$AgCl + \text{dil.}2NH_4OH \longrightarrow \underset{\text{complex}}{[Ag(NH_3)_2]Cl} + 2H_2O$$

19. (b) $\underset{\text{lime water}}{Ca(OH)_2} + CO_2 \longrightarrow \underset{\substack{\text{white}\\ \text{precipitate}}}{CaCO_{3(S)}} + H_2O$

$$CaCO_3 + CO_2(\text{excess}) + H_2O \longrightarrow \underset{\text{soluble}}{Ca(HCO_3)_2}$$

20. (a) It is a lab method for the preparation of Br_2 *e.g.*

$$2KBr + MnO_2 + H_2SO_4 \rightarrow \underset{\text{Brown gas}}{Br_2} + 2KHSO_4 + MnSO_4$$

21. (c) $Na_2SO_3 + 2HCl(\text{dil}) \rightarrow 2NaCl + H_2O + SO_2$,

$$K_2Cr_2O_2 + H_2SO_4 + 3SO_4 \rightarrow K_2SO_4 + \underset{\text{(Green)}}{Cr_2(SO_4)_3} + H_2O$$

22. (d) As the sulphate radical is a strong oxidising agent, it is insoluble in acids and so detection of sulphate radicle requires no other reagent.

23. (d) Sulphite radicle will give a burning sulphur odour. Acetate radical will give a sweet, venegar odour. Nitrite will give a reddish brown gas. Carbonate will give a colourless, odourless gas, *i.e.* CO_2

24. (c) $PbSO_4$ and $PbCl_2$ are insoluble in cold water hence the reagent $Pb(NO_3)_2$ is used to remove SO_4^{2-} and Cl^-

25. (b) $2KI + 2H_2SO_4$ (Conc.) $\rightarrow 2KHSO_4 + 2HI$

$$MnO_2 + H_2SO_4 \rightarrow MnSO_4 + H_2O + (O)$$

$$2HI + (O) \rightarrow H_2O + I_2$$

$$2KI + MnO_2 + 3H_2SO_4 \rightarrow I_2 + MnSO_4 + 2H_2O + 2KHSO_4$$

26. (c) It is a test for chloride ion.

27. (b) Dil. H_2SO_4 doesn't react with chloride but reacts with peroxide

28. (b) $Ba(OH)_2$ is not highly basic and bond is not easily broken

29. (b) Ozone react with KI solution to liberate I_2 gas.

30. (a) $$2KBr + MnO_2 + 3H_2SO_4 \rightarrow MnSO_4 + 2KHSO_4 + 2H_2O + \underset{\text{(reddish brown gas)}}{Br_2 \uparrow}$$

32. (c) $NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$

33. (a) At the junction of salt solution and $FeSO_4$ solution with conc. H_2SO_4 a brown ring is obtained $\underset{\text{Brown ring}}{(FeSO_4.NO)}$

34. (b) $$2KMnO_4 + 3H_2SO_4 + 5H_2S \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5S$$

35. (a) $$3FeSO_4 + NO_2 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + \underset{\text{(Black brown)}}{FeSO_4.NO} + H_2O$$

36. (b) As most of the nitrates are soluble in water.

37. (a) SO_3^{2-}, S^{2-} and SO_4^{2-} salts from comparatively stronger acids (than H_2CO_3) in solution hence evolve CO_2 with Na_2CO_3 solution and give effervesence. While CO_3^{2-} does not react with Na_2CO_3 solution

38. (a) $Na_2CO_3 + 2H_2O \rightarrow 2NaOH + H_2CO_3$

and $2NaOH \underset{\text{(ionisation)}}{\rightleftharpoons} 2Na^+ + 2OH^-$

Hence, it is clear that $2OH^-$ ions will be formed on hydrolysis of one molecule of sodium corbonate.

39. (d) According to the equation,

$$Ca(OH)_2 + CO_2 \xrightarrow{\Delta} CaCO_3 + H_2O$$

$$CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$$

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaO + H_2O + 2CO_2$$

Hence, the gas A and B are CO_2 and CO_2 respectively

40. (b) $2KMnO_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 5S + 8H_2O$

41. (a) It doesn't provide free Br^- ions to react with $AgNO_3$.

Wet Test for Basic Radical

1. (b) As_2S_3 forms complex with $(NH_4)_2CO_3$

2. (b) $$Cu(NH_3)_4(NO_3)_2 + 4CH_3COOH \rightarrow Cu(NO_3)_2 + 4CH_3COONH_4$$

$$2Cu(NO_3)_2 + K_4[Fe(CN)_6] \rightarrow \underset{\text{chocolate ppt}}{Cu_2Fe(CN)_6} + 4KNO_3$$

3. (b) $SnS + (NH_4)_2S_2 \xrightarrow{HCl} (NH_4)_2S + SnS_2$

4. (b) For the solution to become milky H_2S must be oxidised to SO_2

5. (b) HNO_3 oxidises Fe^{2+} to Fe^{3+} otherwise Fe^{2+} is not completely precipitated as hydroxide

6. (b) Sr^{2+} give bright red colour to the flame

7. (c) Calcium oxalate will not dissolve in acetic acid (weak acid) but only in strong acid

8. (a) $2Hg + 2HCl \rightarrow \underset{\text{white ppt.}}{Hg_2Cl_2} + H_2 \uparrow$

9. (d) It is an acidic salt

10. (b) In presence of NH_4OH, dissociation of H_2S is remarkably high so increases the solubility product of IVth group sulphides

$$H_2S \square 2H^+ + S^{2-}$$

$$NH_4OH \rightarrow NH_4^+ + OH^-$$

$$OH^- + H^+ \rightarrow H_2O$$

11. (d) As cadmium belongs to the IInd group and is precipitated as sulphide and not as chloride.

12. (d) Aluminium is in IIIrd group and is precipitated as hydroxide $[Al(OH)_3]$.

13. (c) Due to common ion effect as

$$HCl \rightarrow H^+ + Cl^-; \quad H_2S \rightarrow 2H^+ + S^{2-}.$$

14. (d) Oxalate of these metals are insoluble

15. (a) Both will precipitate as sulphide.

16. (b) Both Pb and Ag form white ppt. of their chlorides. But $PbCl_2$ is soluble in hot water while $AgCl$ does not dissolve in hot water.

19. (c) $(CH_3COO)_2Pb + H_2S \rightarrow 2CH_3COOH + \underset{\text{blackppt.}}{PbS \downarrow}$

20. (a) $(NH_4)SCN$ is a red colour substance.

21. (abcd) $FeCl_3 + K_4[Fe(CN)_6] \rightarrow \underset{\text{Ferri ferrocyanide (Blue)}}{Fe_4[Fe(CN)_6]_3}$

$$2FeCl_3 + 3H_2S \rightarrow Fe_2S_3 + 6HCl$$

$$3NH_4CNS + FeCl_3 \rightarrow \underset{\text{(Blood red)}}{Fe(CNS)_3} + 3NH_4Cl$$

$$FeCl_3 + 3KCNS \rightarrow \underset{\text{(Blood red)}}{Fe(CNS)_3} + 3KCl$$

24. (c) (Conc. $H_2SO_4 + K_2Cr_2O_7$) mixture is called as chromic acid.

26. (a) $$\underset{\text{Solubility decreasing order}}{\underrightarrow{NaCl > MgCl_2 > Na_2S > MgS}}$$

30. (d) Cobalt sulphide does not ppt. in second group.

36. (b) $BaCO_3 + 2HCl \rightarrow BaCl_2 + H_2O + CO_2$

$$ZnS + 2\underset{\text{(dil.)}}{HCl} \rightarrow ZnCl_2 + H_2S$$

37. (c) Cd^{2+} is not precipitated by H_2S in concentrated acid solution that is why the solution is diluted before passing H_2S through it.

39. (d) $AgCl + 2NH_3 \rightarrow \underset{\text{complex}}{[Ag(NH_3)_2]Cl} \rightleftharpoons [Ag(NH_3)_2]^+ + Cl^-$

40. (b) $Fe^{3+} + K_4[Fe(CN)_6] \rightarrow \underset{\text{Prussian blue}}{K[Fe[Fe(CN)_6]]} + 3K^+$

41. (c) As Na_2CO_3 is a strong electrolyte it will cause the precipitation of $MgCO_3$. So $(NH_4)_2CO_3$ is used as it's a weaker electrolyte than Na_2CO_3.

42. (b) As the concentration of OH^- ions is less due to common ion effect but enough to precipitate the IIIrd group radicals as hydroxides, as the solubility product of III group hydroxides is lower than IV, V and VI group hydroxides.

44. (a) As NH_4Cl is a strong electrolyte. It supresses the ionization of NH_4OH, so the concentration of OH^- ions in the solution is decreased, but it is sufficient to precipitate the III group basic radicals because the solubility product of III group hydroxides is lower than IV, V and VI group hydroxides. As

$$NH_4OH \rightleftharpoons NH_4^+ + OH^-$$

$$NH_4Cl \rightarrow \boxed{NH_4^+} + Cl^-$$

Common ion effect

45. (b) $4FeCl_3 + 3K_4[Fe(CN)_6] \rightarrow \underset{\text{Prussian Blue colour}}{Fe_4[Fe(CN)_6]_3} + 12KCl$

46. (b) ZnS is white.

47. (b) $Sb_2S_3 + 2(NH_4)_2S_2 \rightarrow 2(NH_4)_2S + Sb_2S_5$

48. (a) The second group radicals will precipitate because their solubility product is very low so sulphates will be precipitated.

49. (a) As $Pb(NO_3)_2$ is an ionic compound so the reaction is easy.

$Pb(NO_3)_2 + 2NaCl \rightarrow 2NaNO_3 + PbCl_2$, but $Ba(NO_3)_2$ has a higher lattice energy, so no reaction takes place.

50. (c) $\underset{\text{(excess)}}{4NH_4OH} + CuSO_4 \rightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$

51. (a) $CuCl_2 + H_2S \rightarrow \underset{\text{(Black ppt)}}{CuS} + 2HCl$

52. (d) As they have low K_{sp} value.

53. (a) NH_4^+ ions are required to supress the ionization of NH_4OH but sufficient to precipitate the III group radicals. $(NH_4)_2SO_4$ can't be used as SO_4^{2-} ions will precipitate Ba^{2+} as $BaSO_4$

54. (c) White precipitate obtained is of $BaCl_2$, as the Cl^- ion's concentration increases due to the addition of HCl, the ionic product becomes more than solubility product and thus, $BaCl_2$ is precipitated

55. (a) $HgS + HNO_3 \rightarrow \text{No reaction}$

56. (a) Pb^{2+} as it's precipitated as chloride and sulphide in Ist and IInd group respectively

57. (d) As $Bi(SO_4)_3$ is a covalent compound with high lattice energy and hence it is insoluble in water.

58. (a) The solution must contain Ni^{+2} as it forms a complex with DMG giving $[Ni(DMG)_2]$ which is red in colour.

59. (c) $BiCl_3 + H_2O \rightarrow \underset{(white\ ppt)}{BiOCl} + 2HCl$

60. (b) $Hg_2Cl_2 + 2NH_4OH \rightarrow \underbrace{NH_2 - Hg - Cl}_{} + \underset{\text{(Black ppt)}}{Hg}$

$$+ NH_4Cl + 2H_2O$$

61. (a) Colour of anhydrous $COCl_2$ is blue and when it comes in contact with moisture then it turns in pink.

62. (d) When $(NH_4)_2CO_3$ is used then the concentration of CO_3^{2-} is comparatively low but when Na_2CO_3 is added then concentration of CO_3^{2-} increases so Mg^{2+} will be precipitated along with other 5th group radicals

63. (d) Nessler's reagent gives red precipitate with NH_4^+

$$NH_4Cl + 2K_2[HgI_4] + 4KOH \rightarrow$$

$$\underset{\text{Iodide of Millon's base (Brown ppt)}}{NH_2 - Hg - O - Hg - I} + 7KI + KCl + 3H_2O$$

64. (b) FeS is soluble in HCl. Also Fe^{2+} salts are green.

65. (d) Cd^{+2} belongs to II A group while As^{+3} to II B. All the sulphides of II B are soluble in yellow ammonium sulphide but those of II A are insoluble.

66. (c) As $Fe(OH)_3$ is soluble in $NaOH$ whereas $Al(OH)_3$ is not.

67. (b) $NH_3 + H_2O \rightarrow NH_4OH$ due to common ion effect NH_4^+ ion concentration increases which leads to the precipitation of $Al(OH)_3$.

68. (c) $CrCl_3$, as $Cr^{+3} \Rightarrow 3d^3$, has unpaired electron in d-orbital as a result it will show paramagnetism and thus forms coloured complexes.

69. (a) Cu^{2+} will be precipitated as CuS in acidic medium where as Ni^{2+} is not precipitated.

70. (b) Even $SnCl_2$ added into $HgCl_2$ solution to give white gray colour.

76. (b) $Al^{+3} + (OH^-)_3 \rightarrow \underset{\text{(white ppt.)}}{Al(OH)_3}$

which is soluble in excess alkali.

77. (d) As the ionic product of Sb^{3+} and Bi^{3+} is very low and Cl^- is present in high concentration, therefore Sb and Bi get precipitated, as

$$Sb^{3+} + 3Cl^- \rightarrow SbCl_3$$

78. (d) $Fe_3(PO_4)_2$ is insoluble in water.

79. (c) Sulphide having high ionic product are completely precipitated in acidic medium. CdS has maximum ionic product hence it is completely precipitated.

80. (d) $3FeCl_2 + 2K_3[Fe(CN)_6] \rightarrow \underset{\text{blue colour}}{Fe_3[Fe(CN)_6]_2} + 6KCl$

83. (a) $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

84. (c) $2CuSO_4 + 4KI \rightarrow \underset{\text{Cuprous iodide}}{2CuI} + 2K_2SO_4 + I_2$.

85. (a) Ca, Ba, Sr these radicals are precipitated in basic medium.

88. (c) $Cu^{2+} + H_2S \rightarrow \underset{\text{black ppt.}}{CuS} \downarrow$

89. (a) $NH_4OH \rightleftharpoons NH_4^+ + OH^-$

$$NH_4Cl \rightarrow NH_4^+ + Cl^-$$

NH_4Cl decreases the dissociation of NH_4OH by common ion effect

93. (c) HCl suppresses ionisation of weakly dissociated H_2S, with the result only the ionic product of the sulphides of group II radicals exceed their corresponding solubility product and hence only these are precipitated.

97. (b) $Cd^{++} + H_2S \rightarrow \underset{\text{Yellow ppt}}{CdS} + H_2O$

98. (c) Acidified solution of potassium permanganate.

$$Fe^{+2} \xrightarrow{KMnO_4} Fe^{+3}$$

$$Fe^{+3} \xrightarrow{KMnO_4} \text{No reaction}$$

99. (d) $CuCl_2 + 2HNO_3 \rightarrow Cu(NO_3)_2 + 2HCl$

$Cu(NO_3)_2$ reacts with NH_4OH and gives $Cu(NH_3)_4^{2+}$ which has deep blue colour.

102. (b) $Bi(NO_3)_3(aq) + 3KI(aq) \longrightarrow \underset{\text{Black}}{BiI_3(s)} + 3KNO_3(aq)$

$$BiI_3(s) + KI(aq) \longrightarrow \underset{\text{Orange colour}}{K[BiI_4]}$$

103. (a) HCl suppresses ionisation of weakly dissociated H_2S, with the result only the ionic product of the sulphides of group II radicals exceed their corresponding solubility product and hence only these are precipitated.

104. (c) $\underset{\text{sodium nitroprusside}}{Na_2S + Na_2[Fe(NO)(CN)_5]} \rightarrow$

$\underset{\text{violet coloured complex}}{Na_3[Fe(ONSNa)(CN)_5]}$ or $\underset{\text{purple colour complex}}{Na_4[Fe(CN)_5 NOS]}$

Volumetric Analysis

1. (c) $0.1 = \dfrac{x \times 1000}{40 \times 100} \Rightarrow x = 0.45\ gms$.

2. (c) As methyl orange is a weak base.

3. (b) Phenolphthalein is an indicator for strong base and weak acid, but $KMnO_4$ oxidises it.

4. (c) $N_1V_1 = N_2V_2$, $\dfrac{1}{10} \times 15 = N_2 \times 12 \Rightarrow N_2 = \dfrac{1}{8}N$

5. (a) In the neutralization of acid and base $N \times V$ of both must be equivalent

$N \times V$ of HCl = 0.1 × 100 = 10

$N \times V$ of $NaOH$ = 0.2 × 30 = 6

as to obtain 10 $N \times V$ of base

4 $N \times V$ of base is required

$N \times V$ of KOH = 0.25 × 16 = 4

$N_1V_1 = \underset{NaOH}{N \times V} + \underset{KOH}{N \times V}$

0.1 × 100 = 0.2 × 30 + 0.25 × V

10 = 6 + 0.25 V

$V = \dfrac{400}{0.25} \Rightarrow V = 16\ ml$

6. (a) $1 - 0.68 = 0.32\,g$ oxygen

$\dfrac{0.68}{eq.wt.} = \dfrac{0.32}{8} \Rightarrow eq.wt. = \dfrac{0.68 \times 8}{0{,}32} = 17$

7. (d) $V_1 = 20\ ml,\ N_1 = 0.25N,\ V_2 = 30\ ml$

$N_2 = 0.2N$

$\therefore N = \dfrac{N_1V_1 + N_2V_2}{V_1 + V_2} = \dfrac{20(0.25) + 30(0.2)}{20 + 30}$

$= \dfrac{5+6}{50} = \dfrac{11}{50} = 0.2N$ basic

9. (b) $N_1V_1 = N_2V_2 \Rightarrow \dfrac{1}{10} \times 8 = N_2 \times 20, \quad \therefore N_2 = 0.04N$

10. (b) $N = \dfrac{W_B \times 1000}{E \times V} \Rightarrow \dfrac{N}{10} = \dfrac{x \times 1000}{63 \times 250}$

$\therefore x = 1.575 grams$

11. (a) $N_1V_1 = N_2V_2$

15 × 0.2 = 30 × x $\quad \therefore x = 0.1\ N$

12. (a) $N_1V_1 + N_2V_2 = N_3V_3$

$200 \times 0.6 + 100 \times 0.3 = N_3V_3$ and $V_3 = V_2 + V_1 = 300\ ml$

$\therefore N_3 = 0.5\ N$

13. (a) $10\ M\ H_2SO_4 \Rightarrow 20\ N\ H_2SO_4$

$\therefore 20 \times 10 = 200$ for H_2SO_4 and

$100 \times 1 = 100$ for $NaOH$

$\therefore$ Acidity > Basicity

14. (a) $0.1M$ of $H_2SO_4 \Rightarrow 0.2\,N$ of H_2SO_4

$\therefore N_1V_1 = N_2V_2$ $\quad [N = 2m$ for $H_2SO_4]$

0.2 × V_1 = 30 × 0.2

$\therefore V_1 = 30\ ml$

15. (d) $N_1V_1 = N_2V_2$ $\quad 5N \times 1\ lit = x \times 10\ lit.$

$\therefore x = 0.5\ N$

16. (b) Normality = $N = \dfrac{W_B \times 1000}{Eq.wt \times V}$

$\therefore \text{Eq. Wt} = \dfrac{0.45 \times 1000}{0.5 \times 20} = 45$

$\therefore \text{Basicity} = \dfrac{\text{Molec. Wt}}{\text{Eq. Wt}} = \dfrac{90}{45} = 2$

17. (b)  $\begin{matrix}COOH\\ |\\ COOH\end{matrix}\ .\ 2H_2O \rightarrow 126$ is molecular wt.

$\therefore \text{Equivalent wt.} = \text{Molecular wt.} / 2 = 63$

18. (c) $N_1V_1 = N_2V_2 \Rightarrow 5 \times 10 = \dfrac{1}{10x} \times x \quad \therefore x = 500ml$

19. (d) $K\overset{+7}{Mn}O_4 \rightarrow K_2\overset{+6}{Mn}O_4$

$\dfrac{\text{Molecular weight}}{1} = \dfrac{158}{1} = 158$

21. (b) Hyposolution are used as the reducing agent with potassium dicromate solution

$K_2\overset{+6}{Cr_2}O_7 = \dfrac{\text{Molecular weight}}{6}$

22. (d) $N_1V_1 = N_2V_2$

$N \times 25 = \dfrac{109.5 \times 32.9}{36.5} \Rightarrow \quad N = \dfrac{109.5 \times 32.9}{36.5 \times 25}$

$N_3V_3 = N_4V_4 \qquad (V_3 = \dfrac{m}{d},\ V_3 = \dfrac{125}{1.25})$

$\dfrac{109.5 \times 32.9}{36.5 \times 25} \times 100 = 0.84 \times V \Rightarrow \quad V = 470\,ml$

23. (a) $N_1V_1 = N_2V_2$

$0.1 \times V_1 = 0.13 \times 80 \Rightarrow V_1 = 104\,ml$

24. (a) $\text{Molarity} = \dfrac{wt. \times 1000}{\text{Eq.wt.} \times \text{vol.}}$

$0.1 = \dfrac{wt. \times 1000}{40 \times 250}$

$\therefore$ wt. required = 1 gm

25. (a) $1 = \dfrac{x \times 1000}{63 \times 100} \Rightarrow x = 6.3\ gms$

26. (d) 10 × x = 1 × 1

x = 0.1 $liter$ = 100 cc

32. (b) In acidic medium 2 molecules of $KMnO_4$ gives 5 atoms of oxygen

$$2KMnO_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5(O)$$

$2 \times 158 = \dfrac{316 \times 8}{80} = 31.6$.

So, equivalent wt. of $KMnO_4$ in acidic medium is = 31.6 gm

33. (c) $N_1V_1 = N_2V_2$

$N_1 \times 20 = N_2 \times 22.18$

$N_1 = \dfrac{N_2 \times 22.18}{20}$ ....(i)

$NaOH$ solution = HCl solution

$$N_2 \times 21.5 = \frac{1}{10} \times 20$$

$$N_2 = \frac{20}{10 \times 21.5} \qquad \text{.......(ii)}$$

by *eq.* (i) and (ii)

$$N_1 = \frac{20 \times 22.18}{20 \times 10 \times 21.5} = \frac{22.18}{215} = 0.1N$$

34. (b) $1M\ H_2SO_4 = 2N\ H_2SO_4$

$$\overset{H_2SO_4}{N_1V_1} = \overset{NaOH}{N_2V_2}$$

$2 \times V_1 = 10 \times 1, \quad V_1 = \frac{10 \times 1}{2} = 5\ ml$

36. (c) $N = \frac{W_B \times 1000}{\text{Eq.}wt. \times V}; W_B = \frac{N \times Eq.wt \times V}{1000}$

$$= \frac{0.1 \times 40 \times 100}{1000} = 0.4$$

38. (d) 20 *ml* of 0.1*N* $NaOH$ neutralize 20 *ml* of 0.1*N* acid

Weight of acid $= 0.126\ g$

Volume = 20 *ml* $= \frac{20}{1000}\ litre$

Normality = 0.1 *N*

Equivalent weight = ?

$$\text{Equivalent weight} = \frac{\text{weight of acid}}{N \times V}$$

$$= \frac{0.126 \times 1000}{0.1 \times 20} = 63$$

40. (b) 2×31.82, $\therefore$ wt of one atom $= \frac{2 \times 31.82}{N} = \frac{63.64}{N}$

41. (d) $Na_2S + I_2 + Na_2SO_3 \rightarrow Na_2S_2O_3 + 2NaI$

43. (c) $X = \frac{50}{10} = 5\,;\quad Y = \frac{50}{20} = 2.5$

Ratio of *g* atoms of *X* and *Y* = 2 : 1

47. (c) $N = \frac{0.53 \times 1000}{53 \times 100} \Rightarrow N = \frac{1}{10}$

So normality of the solution will be $\frac{N}{10}$.

51. (b) Acid = 0.1 × 100 = 10

Base = 0.2 × 100 = 20

$\therefore$ solution will be basic. 0.1*N* of *HCl* is neutralised by 0.1 *N* of *NaOH* and the remaining 0.1*N* of *NaOH* is in 200 cm^3 of solution.

$\therefore$ resulting normality = 0.05 *N*, basic.

53. (b) Equivalent weight of

$$Zn(OH)_2 = \frac{\text{Molecular weight}}{\text{acidity}} = \frac{M}{1}$$

Acidity of $Zn(OH)_2 = 1$, only one OH is replaced.

55. (a)

$$\begin{aligned} M_1V_1 &= M_2V_2 \\ (Na_2CO_3) &= (HCl) \\ 0.25M \times 25 &= 0.5M \times V_2 \end{aligned}$$

$$V_2 = \frac{0.25M \times 25}{0.5M} = 12.5\ ml$$

56. (c) $\frac{0.16}{x} \times \frac{1000}{25} = \frac{1}{10} \quad \Rightarrow \frac{6.4}{x} = \frac{1}{10} \quad \therefore x = 64$

Mol. *wt.* = 64 × 2 = 128

57. (d) If $N_1V_1 = N_2V_2$ then the solution will be neutral

$\therefore$ 1 × 100 = 10 × 10

100 = 100 $\Rightarrow$ solution in neutral

59. (c) $\text{Volume} = 25\ ml = \frac{25}{1000}\ litre$

$$\text{Normality} = \frac{wt}{eq.wt \times \text{Volume}} \Rightarrow 0.12 = \frac{0.1914 \times 1000}{E \times 25}$$

$$eq.wt. = \frac{0.1914 \times 1000}{0.12 \times 25} = 63.8$$

60. (b) $\text{Eq.wt} = \frac{\text{Molecular Wt.}}{\text{basicity}} = \frac{W}{3}$

61. (d) $\text{Valency} = \frac{26.89}{8.9} = 3$

at. mass = $\text{Eq.wt} \times \text{valency} = 8.9 \times 3 = 26.7$

62. (b) $\because$ 4 *gms* of Br_2 combines with 1 *gm* of *Ca*

$\therefore$ 80 *gms* of *Br* combines with $\frac{1}{4} \times 80 = 20$

Therefore,

equivalent wt of *Ca* = 20

63. (a) $N = \frac{4 \times 1000}{40 \times 100} = 1N$

64. (d) $N_1V_1 = N_2V_2$

1 × 1 = 0.5 × 2 × 1

as 0.5 *N* will give double the amount of *H* ions

65. (a) $BaCO_3 \rightarrow BaO + CO_2 \uparrow$

$\therefore 197\,g\ BaCO_3$ on decompose gives = 22.4 *litre* CO_2

$\therefore 1\,g\ BaCO_3$ will give $= \frac{22.4}{197} = litre\,CO_2$

$$= \frac{22.4 \times 9.85}{197} = 1.12\ litre\,CO_2$$

66. (c) As the resultant solution will be neutral so either of them can be used.

67. (d) Phenolphthalein is used as it is colourless and becomes pink only in basic medium.

69. (d) Here $KMnO_4$ itself works as an indicator.

70. (a) The resulting solution is colourless.

71. (c) As it is a weak aromatic base so it gives colour in acidic medium.

72. (c) As the resulting solution is acidic.

73. (d) Here $KMnO_4$ is used as an indicator as well as a reactant.

74. (c) $\text{Strength} = \frac{W}{V} = NE$

75. (d) As H_3PO_4 can donate 3 H^+ in the solution, as a result the normality of solution is 3*N*, as Molarity × basicity = Normality

76. (b) $\underset{(O)}{I_2} + 2S_2O_3^- \rightarrow \underset{(-2)}{2I^-} + S_4O_6^{2-}$

$\therefore$ Eq. wt. = $\frac{1}{2} \times \text{molecular wt.}$

77. (a) 40 × 1 = 16 × x $\Rightarrow$ $\qquad x = \frac{40}{16} = 2.5\ ml$

78. (b) 18 *M* of $H_2SO_4 = 36\ N$ of H_2SO_4

$N_1V_1 = N_2V_2 \Rightarrow$ 36 × 10 = N_2 × 1000

$\therefore$ N_2 = 0.36 *N*

79. (d) $\frac{1}{10} = \frac{W \times 1000}{\text{eq.wt} \times \text{vol.}} = \frac{W \times 1000}{49 \times 1000} \Rightarrow W = 4.9\ gms$

80. (c) $M_1V_1 = M_2V_2$

$$0.1 \times V = M_2 \times 2V \Rightarrow\ M_2 = \frac{1 \times V}{2V} = 0.05M$$

81. (c) $N_1V_1 = N_2V_2 \Rightarrow \frac{1}{5}\times 10 = \frac{1}{20}\times V_2 \Rightarrow V_2 = 40\ ml$

82. (b) $N_1V_1 = N_2V_2$

$0.15\times 25 = 0.1V_2 \Rightarrow V_2 = 37.5\,ml$

Water to be added = 37.5 – 25 = 12.5 *ml*

83. (c) $N_1V_1 = N_2V_2 \Rightarrow\ 0.2\times V_1 = 0.2\times 40 \Rightarrow V_1 = 40\,ml$

85. (c) $Mn^{+7} \to Mn^{+6} = \frac{158}{1} = 158$

88. (d) Given, $N = 0.1$, w = 1.0 *gm*, equivalent weight = 50, V = ?

$$V = \frac{w\times 1000}{Eq.wt.\times N} = \frac{1\times 1000}{50\times 0.1} = 200\ cm^3$$

89. (c) $2Ag_2CO_3 \xrightarrow{\Delta} 4Ag + 2CO_2 + O_2$

[(2 × 108) + 12 + 48]   4 × 108

2(216 + 12 + 48)   4 × 108

2 × 276 = 552   4 × 108

$\because$ 552 *gm* silver carbonate gives silver = 432 *gm.*

$\therefore$ 2.76 *gm* silver carbonate gives $\frac{432\times 2.76}{552} 2.16gm$

90. (a) $0.164\ M\ NaOH \cong 0.164\ N\ NaOH$

We know, $N_1V_1 = N_2V_2$; $N_1 \times 25 = 0.164\times 32.63$

$0.214\ N\ H_2SO_4 \cong \frac{0.214}{2} M\ H_2SO_4$

($\because$ basicity of $H_2SO_4\ is\ 2$)

$\cong 0.107\ M\ H_2SO_4$

91. (a) We know, $[H^+] = 10^{-pH} = 10^{-13}$;

$\therefore [OH^-] = \frac{10^{-14}}{10^{-13}} = 10^{-1}$

Hence, normality of solution = 0.1

We know, w = $\frac{NEV}{1000} = \frac{0.1\times 74\times 250}{2\times 1000} = 0.925\ gm$

92. (d) $N_1V_1 = N_2V_2$ or $M_1V_1 = M_2V_2$

$\therefore$ 12 × V_1 = 18 × 240

$V_1 = \frac{18\times 240}{12} 260\ ml = 0.36\ litre$

93. (c) For complete neutralisation,
milli equivalent of base = milli equivalent of acid

$N_1V_1 = N_2V_2 \Rightarrow \frac{1}{10}\times V_1 = \frac{1}{25}\times 100$; $V_1 = 40\ ml.$

94. (c) Normality = molarity × basicity or acidity (for *HCl*)

$N_2 = 0.4\times 1 = 0.4N$ basicity =1 (for *NaOH* acidity =1)

$N_1 = 0.6\times 1 = 0.6N\quad V_1 = ?\ V_2 = 30\ cm^3$

From the equation, $N_1V_1 = N_2V_2$

$$0.6\times V_1 = 0.4\times 30$$

$$V_1 = \frac{0.4\times 30}{0.6} = 20\ cm^3$$

95. (b) The solubility of I_2 in water increases by the addition of *KI* due to ormation of polyhaldie ion, *i.e.*, I_3^-

$$KI + I_2 \to KI_3$$

96. (d) $H_2 + \frac{1}{2}O_2 \to H_2O$

1 mole $\frac{1}{2}$ mole   1 mole

1 volume $\frac{1}{2}$ volume

1*ml* H_2 reacts with $\frac{1}{2}$ *ml* O_2

30*ml* of H_2 reacts with $= \frac{1}{2}\times 30 = 15ml\ \ O_2$

(20–15) = 5*ml* of O_2 will left at the end of the reaction.

97. (a) Standard solution of I_2 is used to estimate sulphite, thiosulphite, arsenite etc.

98. (a) $I_2 + Na_2S_2O_3 \to 2NaI + Na_2S_4O_6$

$I_2 + S_2O_3^{2-} \to 2I^- + S_4O_6^{2-}$

Critical Thinking Questions

1. (b) $ZnCO_3 \xrightarrow{\Delta} ZnO + \underset{\text{Turns lime water milky}}{CO_2}$

$\text{(Hot)}\ \underset{\text{yellow}}{ZnO}\ \square\ \underset{\text{White}}{ZnO}\text{(Cool)}$

2. (b) $Ba^{+2} + 2CH_3COO^- \to (CH_3COO)_2Ba$

BaS_2O_3 gives SO_2 gas with dil. HCl and also yellow ppt. of Barium chromate.

$(CH_3COO)Ba + K_2CrO_4 \to 2CH_3COOK + \underset{\text{(yellow ppt.)}}{BaCrO_4\downarrow}$

3. (c) $\underset{\text{Microcosmic salt}}{Na(NH_4)HPO_4} \xrightarrow{\Delta} \underset{\text{Sodium meta phosphate (transparent)}}{NaPO_3 + NH_3 + H_2O}$

4. (a) It is a test for iodide.

5. (c) $Ba(NO_3)_2 + Na_2SO_3 \to Ba(NO_2)_2 + Na_2SO_4$

Na_2SO_4 is insoluble in water.

6. (d) Except CO_3^{--} all other ions are reduced by $KMnO_4$ solution.

7. (c) The brown ring test for NO_2^- and NO_3^- is due to formation of $[Fe(H_2O)_5NO]^{2+}$

8. (b) It must be sulphide as

$Pb(CH_3COO)_2 + H_2S \to \underset{\text{(Black ppt.)}}{PbS} + 2CH_3COOH$

9. (c) Hg_2Cl_2 is white insoluble salt.

$$Hg_2Cl_2 + 2NH_4OH \to Hg + Hg\underbrace{(NH_2)Cl + NH_4}_{\text{Black}}Cl + 2H_2O$$

10. (d) $Zn^{2+} + 2NaOH \to Zn(OH)_2 + 2Na^+$

$Zn(OH)_2 + 2NaOH \to Na_2ZnO_2 + 2H_2O.$

11. (c) Chromium ion gives in hot and cold. Oxidising and reducing flame green-colour.

12. (b) $\underset{\text{Red solid}}{HgI_2} + 2KI \to K_2(HgI_4)$ soluble

$HgI_2 \to Hg + I_2$ violet foams.

13. (c) Yellow filtrate is due to chromate ions (CrO_4^{--}) and green residue is due to $Fe(OH)_2$.

14. (c) $1\times V = \frac{12}{120}\times 2 = 200ml$.

15. (a) $AgNO_3$ react with all conditions and gives corresponding result.

$AgNO_3 + 2NH_3 \to \underset{\text{White ppt}}{[Ag(NH_3)_2]NO_2} + H_2O$

$AgNO_3 + NaCl \to \underset{\text{White ppt}}{AgCl} + NaNO_3$

$$2AgNO_3 + H_2S \rightarrow \underset{\text{Black ppt}}{Ag_2S} + 2HNO_3.$$

16. (c) $HCl \qquad NaOH$

$N_1V_1 \;=\; N_2V_2$

$N_1 \times 20ml = 0.1 \times 25$

$N_1 = \frac{0.1 \times 25}{20} = 0.125.$

If one *litre HCl* present in 0.125

Therefore in 10 *ml* $\frac{0.125}{1000} \times 10$ = 12.5

The normality of conc. *HCl* is 12.5*N*.

17. (a) 20 *ml* of $0.3N \;\; Na_2S_2O_3$

$= 20ml$ of $0.3N\, I_2$ Solution

$= 20\,ml$ of $0.3N\, H_2O_2$ solution

$\equiv 25\,ml$ of $0.08N\, H_2O_2$ solution

Mass of H_2O_2 $100ml$ solution = $\frac{0.08 \times 17 \times 100}{1000}$

$= 0.136\,gm$

% = 0.136

$68\,gm\; H_2O_2$ evolve oxygen at NTP $= 22400ml$

$0.00136\,gm\, H_2O_2$ evolve oxygen at NTP

$= \frac{22400}{68} \times 0.00136 = 0.448$

For $0.1N$, the solution is of 0.448 volume.

$\therefore$ $3N$, volume $= 0.448 \times 3 = 1.344\,ml$.

18. (a) '*Ba*' gives characteristic green flame in Bunsen burner.

19. (c) $Pb^{+2} + H_2S \xrightarrow[\text{acidic}]{} \underset{\text{(Black ppt)}}{PbS \downarrow} + H_2 \uparrow$

$$3PbS + 8HNO_3 \rightarrow 3Pb(NO_3)_2 + 2NO + 3S + 4H_2O$$

$$Pb(NO_3)_2 + H_2SO_4 \rightarrow \underset{\text{(white ppt.)}}{PbSO_4} \downarrow + 2HNO_3 \uparrow$$

20. (d) It is a characteristic property of IV group concentration of sulphide ions is lowered by formation of the weak acid H_2S .

Assertion and Reason

1. (b) Lime water become turbid on passing CO_2 into it because both reacts to produce insoluble calcium carbonate.

$$\underset{\text{Lime Water}}{Ca(OH)_2} + CO_2 \rightarrow \underset{\substack{\text{Calcium Carbonate} \\ \text{(Insoluble)}}}{CaCO_3} + H_2O$$

If more CO_2 is passed than soluble calcium bicarbonate is formed which clear the solution

$$\underset{\text{Insoluble}}{CaCO_3} + H_2O + CO_2 \rightarrow \underset{\substack{\text{Calciumbi Carbonate} \\ \text{(Soluble)}}}{Ca(HCO_3)_2}$$

The reason that lime water is $Ca(OH)_2$ is also correct. Here, both assertion and reason are correct but reason is not a correct explanation of assertion.

2. (c) Assertion is true but reason is false.

$Sb(III)$ is a basic radical of IIB group for which group reagent is H_2O is presence of dilute *HCl*. It is necessary to maintain the proper hydrogen ion concentration for the precipitation of IV group cations.

3. (d) *CuS* is one such exception which is not decomposed by dil. H_2SO_4

4. (d) $PbCl_2$ does not react with conc. H_2SO_4 as $PbSO_4$ is insoluble in water.

5. (e) $ZnCO_3$ will react with conc. H_2SO_4 to give CO_2

Radicals of dil. acid test are decomposed by conc. H_2SO_4 in cold.

6. (c) Cd^{2+} salts are generally white in colour, however, *CdS* is yellow in colour.

7. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.

8. (d) Cu^{2+} salts are generally blue in colour, however, *CuS* is black in colour.

9. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.

10. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.

11. (e) Sulphides do not give any test with $BaCl_2$ (*aq.*) as *BaS* is soluble in water.

12. (c) It is due to the formation of insoluble *BiOCl* on hydrolysis.

$$BiCl_3 + H_2O \rightarrow \underset{\text{White ppt.}}{BiOCl} + 2HCl$$

Chemical Analysis

SET Self Evaluation Test - 21

1. What volume of a solution of hydrochloric acid containing 73 *g* of acid per litre would sufficient for the exact neutralization of sodium hydroxide obtained by allowing 0.46 *g* metallic sodium to act upon water

(Cl = 35.5, Na = 23.0, 0 = 16) **[UPSEAT 2001]**

(a) 10 *ml* (b) 15 *ml*

(c) 20 *ml* (d) 8 *ml*

2. 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 formed which does not dissolve in dilute nitric acid. The anion could be

(a) SO_4^{2-} (b) CO_3^{2-}

(c) S^{2-} (d) Cl^-

3. Sometimes yellow turbidity appears on passing H_2S gas even in the absence of the second group radicals. This happens because

(a) Sulphur is present in the mixture as an impurity

(b) The fourth group radicals are precipitated as sulphides

(c) The H_2S is oxidized by some acid radicals

(d) The third group radicals are precipitated

4. The colour of $CuCr_2O_7$ solution in water is green because

[Bihar CEE 1995]

(a) $Cr_2O_7^{2-}$ ions are green

(b) Cu^{++} ions are green

(c) Both ions are green

(d) Cu^{++} ions are blue and $Cr_2O_7^{2-}$ ions are yellow

5. Pb^{++}, Cu^{++}, Zn^{++}, and Ni^{++} ions are present in a given acidic solution. On passing hydrogen sulphide gas through this solution the available precipitate will contain

[MP PMT 1996; MP PET/PMT 1998]

(a) PbS and NiS (b) PbS and CuS

(c) CuS and ZnS (d) CuS and NiS

6. In acidic medium, dichromate ion oxidises ferrous ion to ferric ion. If the *gram* molecular weight of potassium dichromate is 294 *grams*, its *gram* equivalent weight is......*grams*

(a) 294 (b) 127

(c) 49 (d) 24.5

7. Metallic tin in the presence of HCl is oxidise $K_2Cr_2O_7$ to stannic chloride. What volume of decinormal dichromate solution would be reduced by 1 *g* of tin

[UPSEAT 2001]

(a) 168.49 *ml* (b) 175.49 *ml*

(c) 170.50 *ml* (d) 162.38 *ml*

8. 50 *ml* 10 $N-H_2SO_4$, 25 *ml* 12N–HCl and 40 *ml* 5 $N-HNO_3$ were mixed together and the volume of the mixture was made 1000 *ml* by adding water. The normality of the resultant solution will be

[MP PET/PMT 1998; MP PMT 2002]

[Pb. PMT 1998]

(a) 1 *N* (b) 2 *N*

(c) 3 *N* (d) 4 *N*

9. An aqueous solution of colourless metal sulphate *M*, gives a white precipitate with $NaOH$. This was soluble in excess of $NaOH$. On passing H_2S through this solution a white precipitate is formed. The metal *M* in the salt is **[AIIMS 1982]**

[KCET 1990]

(a) Ca (b) Ba

(c) Al (d) Zn

10. A compound is soluble in water. If ammonia is added, a red precipitate appears which is soluble in dilute HCl. The compound has **[CPMT 1974]**

(a) Aluminium (b) Zinc

(c) Iron (d) Cadmium

11. Nessler's reagent is

[CPMT 1997; MP PET/PMT 1998]

(a) $KHgI_4$ (b) $K_2HgI_4 + NH_4OH$

(c) $K_2HgI_4 + KOH$ (d) $KHgI_4 + NH_4OH$

12. Neutral ferric chloride is added to the aqueous solution of acetate. The blood red colour is obtained, it is due to the compound

(a) $Fe(OH)_2$ (b) $Fe(OH)_3$

(c) $Fe(CH_3COO)_3$ (d) $Fe(OH)_2(CH_3COO)$

13. Mark the gas which turns lime water milky

(a) H_2S (b) SO_2

(c) Cl_2 (d) CO_2

[EAMCET 2003]

14. Which of the following reactions with H_2S does not produce metallic sulphide **[AIIMS 1997]**

(a) $ZnCl_2$ (b) $CdCl_2$

(c) $COCl_2$ (d) $CuCl_2$

AS Answers and Solutions

(SET -21)

1. (a) $\frac{0.46}{23} = \frac{73}{36.5} \times V(l)$

$V = 10\,ml$

2. (d) $\underset{(aq)}{NaCl + H_2O \rightarrow NaCl}$

$\underset{(aq)}{NaCl} + \underset{(aq)}{AgNO_3} \rightarrow \underset{\text{white ppt}}{AgCl} \xrightarrow[\text{dil}]{HNO_3} \text{Insoluble}$

3. (b) This is due to the precipitation of fourth group radical as sulphides due to high concentration of S^{2-} in the solution as a result yellow turbidity is obtained

4. (d) Cu^{++} ions are blue and $Cr_2O_7^{--}$ ions are yellow, yellow and blue combination gives-green colour.

5. (b) As both Pb^{2+} and Cu^{2+} require acidic medium and low concentration of S^{2-} to be precipitated as sulphide and low concentration of S^{2-} is provided by common ion effect of HCl and H_2S.

6. (c) In acidic medium potassium dicromate shows + 6 oxidation state $\frac{M}{6} = \frac{294}{6} = 49$

7. (a) $0.1 \times V = \frac{2}{119}$

$V = 168.06\,ml$.

8. (a) $H_2SO_4 \quad HCl \quad HNO_3 \quad \text{Total volume}$

$N_1V_1 + N_2V_2 + N_3V_3 = N \times 1000ml$

$$N = \frac{N_1V_1 + N_2V_2 + N_3V_3}{1000}$$

$$= \frac{50 \times 10 + 25 \times 12 + 40 \times 5}{1000}$$

$$N = \frac{500 + 300 + 200}{1000} = \frac{1000}{1000} = 1N$$

9. (d) $Zn^{+2} + 2NaOH \rightarrow \underset{\text{(white ppt.)}}{Na_2ZnO_2} + 2H_2O$

$Na_2ZnO_2 + H_2S \rightarrow \underset{\text{(White ppt.)}}{ZnS} + 2NaOH$

10. (c) $FeCl_3 + 3NH_4OH \rightarrow \underset{\text{(red)}}{Fe(OH)_3} + 3NH_4Cl$

$2Fe(OH)_3 + 6HCl \rightarrow \underset{\substack{\text{(soluble}\\\text{in HCl)}}}{2FeCl_3} + 6H_2O$

11. (c) Nessler's reagent $= K_2HgI_4 + KOH$.

12. (c) $3CH_3COONa + FeCl_3 \rightarrow \underset{\text{Blood red ppt.}}{Fe(CH_3COO)_3} + 3\,NaCl$

13. (bd) CO_2 and SO_2 turns lime water milky, as

$Ca(OH)_2\ (aq.) + CO_2 \rightarrow \underset{\text{(milky)}}{CaCO_3} \downarrow + H_2O$

$Ca(OH)_2 + SO_2 \rightarrow \underset{\text{(milky)}}{CaSO_3} \downarrow + H_2O$

14. (c) In $COCl_2$ metal is not present.