

QUALITATIVE ANALYSIS

ASSIGNMENTS

LEVEL - I

1. Which of the following salt on heating with conc. H_2SO_4 gives violet vapour ?
(A) iodide salt (B) nitrate salt (C) sulphate salt (D) bromide salt
2. The salt of which of the following metal gives blue colour in borax bead test ?
(A) Fe (B) Ni (C) Co (D) Mn
3. H_2S and SO_2 gas can be distinguished by :
(A) litmus paper (B) lime water
(C) lead acetate paper (D) HCl
4. Salts of which of the following metals are white ?
(A) zinc (B) cobalt (C) chromium (D) Fe
5. Which of the following salt is used in borax bead test ?
(A) $\text{K}_2\text{CO}_4\text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ (B) $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$
(C) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (D) none of these
6. An aqueous solution contains SO_4^{2-} and Cl^- ions. Which of the following aqueous solution will precipitate only SO_4^{2-} ion but not Cl^- ion ?
(A) NaOH (B) KOH (C) BaCl_2 (D) BaSO_4
7. When concentrated H_2SO_4 is added to dry KNO_3 , brown fumes are evolved. These fumes are due to :
(A) SO_2 (B) $\text{SO}_2 + \text{SO}_3$ (C) NO (D) NO_2
8. A moist salt is rubbed with oxalic acid between the fingers and smells like vinegar. It indicates the presence of :
(A) sulphur (B) nitrate (C) nitrite (D) acetate
9. Soda extract of the salt is prepared by :
(A) fusing mixture of baking soda and salt and then extracting with water
(B) dissolving NaHCO_3 and salt in dil HCl
(C) boiling Na_2CO_3 and salt in dil HCl
(D) boiling Na_2CO_3 and salt in distilled water
10. Aqueous solution of an acetate salt when treated with ferric chloride solution gives a black-red solution due to formation of :
(A) $\text{Fe}(\text{CNS})_3$ (B) $(\text{CH}_3\text{COO})_3\text{Fe}$ (C) $(\text{CH}_3\text{COO})_2\text{Fe}$ (D) $\text{Fe}(\text{OH})_3$
11. A solution of KI is added to CS_2 followed by addition of Cl_2 water. A violet colour appears in CS_2 layer. If excess of Cl_2 water is added the violet colour disappears. The disappearance of violet colour is due to the formation of :
(A) I_3^- ion (B) HIO_3 ion (C) ICl ion (D) I^- ion
12. In the precipitation of the radicals of iron group in qualitative analysis, NH_4Cl is added before adding NH_4OH . This causes :

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- (A) decrease in the concentration of OH^- ions (B) removal of PO_4^{3-} ions
 (C) increase in the concentration of Cl^- ions (D) increase in the concentration of NH_4^+ ions
- 13.** The aqueous solution of which of the following reagent will give Prussian blue coloured ppt. with an aqueous solution containing iron (III) ions :
 (A) potassium thiocyanate (B) potassium hexacyanoferrate (II)
 (C) potassium pyroantimonate (D) all of these
- 14.** When H_2S gas is passed through the aqueous solution of a salt a white precipitate is formed. The solution contains ions of –
 (A) Pb (B) Zn (C) Cu (D) Ni
- 15.** The aqueous solution of which salt is coloured ?
 (A) $\text{Zn}(\text{NO}_3)_2$ (B) LiNO_3 (C) $\text{Co}(\text{NO}_3)_2$ (D) potash alum
- 16.** Yellow ammonium sulphide solution can be used for the separation of which of the following pair of species ?
 (A) CuS and PbS (B) PbS and Bi_2S_3 (C) Bi_2S_3 and CuS (D) CdS and As_2S_3
- 17.** The reagent that can distinguish between silver and lead salt is –
 (A) H_2S gas (B) Hot dilute HCl solution
 (C) NH_4Cl (solid) + NH_4OH (solution) (D) NH_4Cl (solid) + $(\text{NH}_4)_2\text{CO}_3$ solution
- 18.** Group reagent for the precipitation of basic radicals of group II in the qualitative analysis is –
 (A) Dil. HCl + H_2S (B) NH_4Cl (solid) + NH_4OH (solution) + H_2O
 (C) $(\text{NH}_4)_2\text{CO}_3$ solution (D) dil HNO_3 + H_2S
- 19.** Which of the following gives black precipitate on passing H_2S through it –
 (A) acidified zinc nitrate solution (B) ammoniacal barium chloride solution
 (C) magnesium nitrate solution (D) copper nitrate solution
- 20.** Addition of solution containing $\text{C}_2\text{O}_4^{2-}$ ions to an aqueous solution containing Ba^{2+} , Sr^{2+} and Ca^{2+} will precipitate :
 (A) Ca^{2+} (B) Ca^{2+} and Sr^{2+} (C) Ba^{2+} and Sr^{2+} (D) all three
- 21.** Formation of a rose-red precipitate when a slightly alkaline solution of an inorganic salt is treated with dimethyl glyoxime confirms the presence of :
 (A) cobalt (B) zinc (C) iron (D) nickel
- 22.** A yellow turbidity, sometimes 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 oxidised by some acidic radicals present in solution
 (D) the third group radicals are precipitated
- 23.** If HCl is not added before passing H_2S in the second group, it may result in the :
 (A) incomplete precipitation of second group sulphides
 (B) precipitation of sulphides of cation belonging to the subsequent groups
 (C) precipitation of sulphur
 (D) precipitation of lead as lead sulphide
- 24.** An alkaline solution of potassium mercuric iodide is known as :

- (A) Nessler's reagent (B) Lassaigne's reagent
(C) Fenton's reagent (D) none of the above
25. Addition of KI to lead saturated in water gives precipitate, the colour of which is :
(A) yellow (B) black (C) white (D) red
26. Which of the following is insoluble in AcOH ?
(A) calcium oxide (B) calcium carbonate
(C) calcium oxalate (D) calcium hydroxide
27. Which pair of ions would be expected to form precipitated when their dilute aqueous solutions are mixed :
(A) Na^+ , SO_3^{2-} (B) NH_4^+ , CO_3^{2-} (C) Na^+ , S^{2-} (D) Fe^{3+} , PO_4^{3-}
28. Which of the following salts is insoluble in water at room temperature but dissolved in water on boiling ?
(A) CaCl_2 (B) BaCl_2 (C) SrCl_2 (D) PbCl_2
29. Turnbull's blue is a compound with name :
(A) ferricyanide (B) ferrous ferricyanide
(C) ferrous cyanide (D) ferriferrocyanide
30. On adding a solution of CrO_4^{2-} ions to an aqueous solution containing Ba^{2+} , Sr^{2+} and Ca^{2+} ions. The precipitate obtained first of all will be :
(A) CaCrO_4 (B) SrCrO_4 (C) BaCrO_4 (D) a mixture of all the three
31. A mixture containing Cu^{2+} and Ni^{2+} can be separated for identification by :
(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
32. Al^{3+} , Cr^{3+} , Fe^{3+} are grouped together for qualitative analysis because :
(A) their carbonates are insoluble in ammonia
(B) their hydroxides are insoluble in ammonia
(C) their sulphides are insoluble in acid
(D) they belong to same group of periodic table
33. Reaction of $\text{K}_2\text{Cr}_2\text{O}_7$ with NaCl and conc. H_2SO_4 gives :
(A) CrCl_3 (B) CrOCl_2 (C) CrO_2Cl_2 (D) Cr_2O_3
34. Which of the following will give precipitate with lead nitrate but not with barium nitrate ?
(A) sodium chloride (B) sodium acetate
(C) sodium nitrate (D) sodium hydrogen phosphate
35. Which of the following ion is detected by Nessler's reagent ?
(A) MnO_4^- (B) NH_4^+ (C) CrO_4^{2-} (D) PO_4^{3-}
36. Lead (II) sulphate is soluble in :
(A) conc. HNO_3 (B) conc. HCl (C) water (D) ammonium acetate
37. Stannous chloride reacts with excess of NaOH to form –
(A) Sn(OH)_2 (B) Na_2SnO_3 (C) H_2SnO_3 (D) Na_2SnO_2
38. A mixture of two salts is not soluble in water but dissolves completely in dil HCl to form a colourless solution. The mixture could be :

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- (A) $\text{AgNO}_3 + \text{KBr}$ (B) $\text{BaCO}_3 + \text{ZnS}$
 (C) $\text{FeCl}_3 + \text{CaCO}_3$ (D) $\text{Mn}(\text{NO}_3)_2 + \text{MgSO}_4$
39. Three separate samples of aqueous solution of X gave following results. One formed white ppt. with excess of ammonia solution, one formed white precipitate with dil NaCl solution and one formed a black precipitate with H_2S . the salt could be :
 (A) AgNO_3 (B) $\text{Pb}(\text{NO}_3)_2$ (C) $\text{Hg}(\text{NO}_3)_2$ (D) MnSO_4
40. Composition of borax bead is :
 (A) B_2O_3 (B) Na_2BO_3 (C) $\text{Na}_2\text{B}_4\text{O}_7$ (D) $\text{B}_2\text{O}_3 + \text{NaBO}_2$
41. A metal X on heating in nitrogen gas gives Y. Y on treatment with H_2O gives a colourless gas which when passed through CuSO_4 solution gives a blue colour. Y is :
 (A) $\text{Mg}(\text{NO}_3)_2$ (B) Mg_3N_2 (C) NH_3 (D) MgO
42. Which of the following is not preliminary test used to detect ions ?
 (A) dilute H_2SO_4 test (B) Charcoal cavity test
 (C) chromyl chloride test (D) flame test
43. In borax bead test which compound is formed ?
 (A) orthoborate (B) metaborate (C) double oxide (D) tetraborate
44. Consider the following observation, $\text{M}^{n+} + \text{HCl} \longrightarrow \text{white precipitate} \xrightarrow{\Delta} \text{water solution}$ the metal ion M^{n+} will be :
 (A) Hg^{2+} (B) Ag^+ (C) Pb^{2+} (D) Sn^{2+}
45. Potassium chromate solution is added to an aqueous solution of a metal chloride. The precipitate thus obtained are insoluble in acidic acid. These are subjected to flame test, the colour of the flame is :
 (A) Lilac (B) apple green (C) crimson red (D) golden yellow
46. What is incorrect about $\text{Al}_2(\text{SO}_4)_3$?
 (A) it is a white salt
 (B) its aqueous solution gives precipitate of compound Al with AgNO_3 solution.
 (C) on adding NaOH solution to its aqueous solution, a precipitate is formed which dissolved in excess of NaOH
 (D) it will give precipitate with lead acetate solution
47. Brown ring test for nitrate fails if the mixture of salts, contain along with nitrate, the :
 (A) NO_2^- ions (B) CO_3^{2-} ion (C) Br^- ions (D) SO_4^{2-} ions
48. Hydrogen sulphide is a group reagent for :
 (A) 2nd group radicals (B) group II radicals
 (C) group IV radicals (D) group V radicals
49. To an aqueous solution containing Hg_2^{2+} , Hg^{2+} , Pb^{2+} and Cd^{2+} . (dil.) HCl ($\approx 6 \text{ M}$) is added. This causes the precipitation of :
 (A) Hg_2Cl_2 only (B) Hg_2Cl_2 and PbCl_2
 (C) PbCl_2 only (D) PbCl_2 and HgCl_2

50. $K_4[Fe(CN)_6]$ is used in the detection of :
 (A) Fe^{2+} (B) Fe^{3+} (C) Cu^{2+} (D) Zn^{2+}

LEVEL - II

- $X + NH_3 + KOH \longrightarrow Y$ (Brown precipitate). X and Y are respectively :
 (A) Nessler's reagent, iodide of Million's base
 (B) Iodide of Million's base, Nessler's reagent
 (C) Iodide of Million's base, prussian blue
 (D) Nessler's reagent, golden spangles
- Sometimes, yellow turbidity appears on passing H_2S gas even in the absence of II group radicals. This is because of :
 (A) sometimes III group radicals are precipitated as their sulphates
 (B) IV group radicals are precipitated as sulphides
 (C) the oxidation of H_2S gas by some acid radicals
 (D) III group radicals are precipitated as hydroxides
- The reaction of an element A with water produces combustible gas B and an aqueous solution of C. When another substance D reacts with this solution C also produces the same gas B. D also produces the same gas even on reaction with dilute H_2SO_4 at room temperature. Element A imparts golden yellow colour to Bunsen flame. Then A, B, C and D may be identified as :
 (A) Na, H_2 , NaOH and Zn (B) K, H_2 , KOH and Zn
 (C) K, H_2 , NaOH and Zn (D) Ca, H_2 , $CaCOH_2$ and Zn
- (Yellow ppt.) T $\xleftarrow{K_2CrO_4}$ X $\xleftarrow{\text{dilute HCl}}$ Y (Yellow ppt.) + Z \uparrow (pungent smelling gas).
 If X gives green flame test, then X is :
 (A) $MgSO_4$ (B) $BaSO_3$ (C) $CuSO_4$ (D) $PbSO_3$
- Iron becomes passive by _____ due to formation of _____.
 (A) dilute HCl, Fe_2O_3 (B) aqua-regia, Fe_3O_4
 (C) conc. H_2SO_4 , Fe_3O_4 (D) conc. HCl, Fe_3O_4
- A metal M which is not affected by strong acids like conc. HNO_3 , conc. H_2SO_4 and conc. solution of alkalis like NaOH, KOH forms MCl_3 which finds use for toning in photography. The metal M is :
 (A) Ag (B) Hg (C) Au (D) Cu
- "Bordeaux mixture" is used as a fungicide. It is a mixture of :
 (A) $CaSO_4 + Cu(OH)_2$ (B) $CuSO_4 + Ca(OH)_2$
 (C) $CuSO_4 + CaO$ (D) $CuO + CaO$
- Colourless solutions of the following four salts are placed separately in four different test tubes and a strip of copper is dipped in each one of these. Which solution will turn blue ?
 (A) KNO_3 (B) $AgNO_3$ (C) $Zn(NO_3)_2$ (D) $ZnSO_4$
- [A] + HNO_3 (conc.) \longrightarrow Black brown [B]
 Red
 [B] + HCl \longrightarrow yellow green gas [C]
 [C] + $Ca(OH)_2 \longrightarrow$ [D]
 powder
 [D] + HCl \longrightarrow [C]
 yellow green gas

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- What is [D] :
- (A) Cl_2 (B) CaOCl_2 (C) $\text{Ca}(\text{ClO}_3)_2$ (D) $\text{Ca}(\text{OCl})_2$
10. Hypophosphorus acid when it combine with CuSO_4 solution will get red coloured compound X. What is X ?
 (A) Cu_2O (B) Cu_2H_2 (C) CuO (D) Cu_2S
11. $\text{K}_2\text{Cr}_2\text{O}_7$ gives blue colour with H_2O_2 & H_2SO_4 the blue colour will convert into green colour. Blue & green compounds are :
 (A) CrO_5 & Cr_2O_3 (B) $\text{Cr}_2\text{O}_7^{2-}$ & CrO_4^{2-} (C) CrO_5 & Cr (D) All the above
12. Microcosmic salt when it is heated with MnSO_4 , we will get :
 (A) brown bead (B) Red bead (C) Violet bead (D) Blue bead
13. The compound X on hydrolysis gives gas (y) which will not effect the litmus paper but it is basic in nature, when it is reacts with AgNO_3 solution we will get black precipitate of metal. What is the gas (y). Gas (y) is also obtained when white phosphorus combine with caustic soda solution :
 (A) Ca_3P_2 (B) $\text{Ca}(\text{OH})_2$ (C) PH_4Cl (D) PH_3
14.
$$\begin{array}{c}
 (\text{KCl} + \text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4) \xrightarrow{\text{Heat}} \text{Red gas} \\
 \text{Y} \xleftarrow{\text{Pb}(\text{Ac})_2} \text{X (Yellow sol)} \xleftarrow{\text{Dil NaOH}}
 \end{array}$$
 The formula and colour of X are respectively :
 (A) CrO_2Cl_2 , red (B) Pb CrO_4 , yellow
 (C) Na_2CrO_4 , yellow (D) $\text{Cr}_2(\text{SO}_4)_3$, green
15. A red solid is insoluble in water. However it becomes soluble if some KI is added to water. Heating red solid in a test tube produces violet coloured fumes and droplets of metal appears on the cooler parts of test tube. The red solid is :
 (A) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (B) HgI_2 (C) HgO (D) Pb_3O_4
16.
$$\begin{array}{c}
 (\text{KCl} + \text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4) \xrightarrow{\text{Heat}} \text{Red gas} \\
 \text{X} \xleftarrow{\text{Pb}(\text{Ac})_2} \text{(Yellow sol)} \xleftarrow{\text{Dil NaOH}}
 \end{array}$$
 The formula and colour of X are respectively :
 (A) CrO_2Cl_2 , red (B) Pb CrO_4 , yellow
 (C) BaCrO_4 , green (D) $\text{Cr}_2(\text{SO}_4)_3$, green
17.
$$\begin{array}{c}
 \text{Salt X} \xrightarrow[\text{Heat}]{\text{NaOH}} \text{Y. (Gas)} \text{ can be} \\
 \downarrow \qquad \qquad \qquad \uparrow \\
 \text{Gives brown ring test} \quad (\text{Mg}_3\text{N}_2 + \text{H}_2\text{O})
 \end{array}$$

 (A) NH_4NO_3 (B) NH_4Cl (C) KNO_3 (D) $\text{Ba}(\text{NO}_3)_2$
18. A pale green crystalline inorganic salt (A) dissolve freely in water. It gives brown precipitate on addition of aqueous solution NaOH . The solution of (A) also gives a black precipitate on bubbling H_2S in alkaline medium. An aqueous solution of (A) decolourized the pink colour of the

- permanganate solution . The metal in the salt solution is :
 (A) copper (B) aluminium (C) lead (D) iron
19. Certain yellow coloured solid gives reddish brown precipitate in group III of qualitative analysis. The solid does not react with dilute H_2SO_4 but when few drops of $KMnO_4$ solution is added to the hot suspension of salt in dilute H_2SO_4 , its pink colour is discharged with effervescence and evolution of CO_2 . the salt is likely to be :
 (A) iron (II) oxalate (B) ferrous sulphate
 (C) ferric carbonate (D) ferric chloride
20. An aqueous solution of $FeSO_4$, $Al_2(SO_4)_3$ and chrome alum is heated with excess of Na_2O_2 and filtered . The materials obtained are :
 (A) a colourless filtrate and a green residue (B) a yellow filtrate and a green residue
 (C) a yellow filtrate and a brown residue (D) a green filtrate and a brown residue
21. Certain yellow coloured solid gives reddish brown precipitate in group III of qualitative analysis. The solid does not react with dilute H_2SO_4 but when few drops of $KMnO_4$ solution is added to the hot suspension of salt in dilute H_2SO_4 , its pink colour is discharged with effervescence and evolution of CO_2 . the salt is likely to be :
 (A) iron (II) oxalate (B) ferrous sulphate
 (C) ferric carbonate (D) ferric chloride
22. The mixture of $FeSO_4$ & H_2O_2 is known as :
 (A) Nessler's reagent (B) Lassaigne's reagent
 (C) Fenton's reagent (D) none of the above
23. Sulphuric acid is not used for the preparation of original solution in the analysis of basic radical because :
 (A) It forms insoluble sulphates with some of the basic radicals
 (B) It is a strong oxidising agent
 (C) It is strong reducing agent
 (D) It decomposes many of the anions
24. In the qualitative analysis, NH_4Cl is added before NH_4OH to :
 (A) Decreases OH^- ions conc. (B) Increase OH^- ion conc.
 (C) Form HCl (D) Form complexes of group II radicals
25. A red solid is insoluble in water. However it becomes soluble if some KI is added to water. Heating red solid in a test tube produces violet coloured fumes and droplets of metal appears on the cooler parts of test tube. The red solid is :
 (A) $(NH_4)_2Cr_2O_7$ (B) HgI_2 (C) HgO (D) Pb_3O_4
26. A mixture containing $KBr + Ca(NO_3)_2$ is warmed with dilute H_2SO_4 :
 (A) no reaction will occur (B) evolution of Br_2 will take place
 (C) gas evolved will be NBr (D) mixture of NO_2 and Br_2 is evolved.
27. Which of the following salt will give evolution of SO_2 gas along with the formation of yellowish turbidity when treated with dilute sulphuric acid. :
 (A) sodium sulphide (B) sodium sulphite
 (C) sodium sulphate (D) sodium thiosulphate
28. $H_2S + SO_2 \longrightarrow S + H_2O$ is :
 (A) oxidation (B) reduction

- (C) a yellow filtrate and a brown residue (D) a green filtrate and a brown residue
41. Magnesium carbonate does not precipitate with the carbonates of group V radicals in presence of NH_4OH and NH_4Cl because :
 (A) MgCO_3 is soluble in water (B) MgCO_3 is soluble in NH_4OH
 (C) MgCO_3 is soluble in NH_4Cl (D) MgCO_3 is soluble in $(\text{NH}_4)_2\text{CO}_3$
42. One of the following compounds gives a white precipitate with aqueous AgNO_3 and a green flame test. The compound is :
 (A) NaCl (B) KCl (C) BaCl_2 (D) CaCl_2
43. Which one among the following pairs of ions cannot be separated by H_2S in dilute hydrochloric acid ?
 (A) $\text{Bi}^{3+}, \text{Sn}^{4+}$ (B) $\text{Al}^{3+}, \text{Hg}^{2+}$ (C) $\text{Zn}^{2+}, \text{Cu}^{2+}$ (D) $\text{Ni}^{2+}, \text{Cu}^{2+}$
44. When H_2S is passed through an ammonia salt solution X, a white precipitate is obtained. The X can be :
 (A) cobalt salt (B) nickel salt (C) manganese salt (D) zinc salt
45. The best explanation for the solubility of MnS in dil. HCl in salt :
 (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 .
46. Potassium ferricyanide [potassium hexacyanoferrate (III)] has :
 (A) Fe (II) (B) Fe(III) (C) Cu(II) (D) Cd(II)
47. The salt used for performing 'bead test' in qualitative inorganic analysis is :
 (A) $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ (B) $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$
 (C) $\text{Na}(\text{NH}_4)\text{HPO}_4 \cdot 4\text{H}_2\text{O}$ (D) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
48. Which of the following sulphate is insoluble in water ?
 (A) CuSO_4 (B) CdSO_4 (C) PbSO_4 (D) $\text{Bi}_2(\text{SO}_4)_3$
49. Calcium burns in nitrogen to produce a white powder which dissolves in sufficient water to produce a gas (A) and an alkaline solution. The solution on exposure to air produces a thin solid layer of (B) on the surface. Identify the compounds A and B .
 (A) $\text{C}_2\text{H}_2, \text{CaCO}_3$ (B) $\text{NH}_3, \text{CaCO}_3$ (C) $\text{NH}_3, \text{Ca(OH)}_2$ (D) $\text{CH}_4, \text{CaCO}_3$
50. A gas 'X' is passed through water to form a saturated solution. The aqueous solution on treatment with silver nitrate gives a white precipitate. The saturated aqueous solution also dissolves magnesium ribbon with the evolution of a colourless gas 'Y'. Identify 'X' and 'Y'.
 (A) $\text{X} = \text{CO}_2, \text{Y} = \text{Cl}_2$ (B) $\text{X} = \text{Cl}_2, \text{Y} = \text{CO}_2$
 (C) $\text{X} = \text{Cl}_2, \text{Y} = \text{H}_2$ (D) $\text{X}_2 = \text{H}_2, \text{Y} = \text{Cl}_2$
51. Which of the following give(s) canary yellow ppt. with ammonium molybdate ?
 (A) PO_4^{3-} (B) As^{3+} (C) Both (A) & (B) (D) None of these
52. An inorganic salt, when treated with conc. H_2SO_4 produced oily drops. The probable salt is

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- (A) an oxalate (B) a fluoride (C) a nitrite (D) an iodide
53. An inorganic mixture was treated with excess of dil. H_2SO_4 . Effervescences were produced. The solution was heated till effervescences ceased. After this a small pinch of MnO_2 was added. Fresh effervescence was produced. Select the correct statements :
- (A) Mixture contains CO_3^{2-} ions (B) Mixture contains $\text{C}_2\text{O}_4^{2-}$ ions
 (C) Mixture contains SO_3^{2-} ions (D) Mixture contains both CO_3^{2-} & $\text{C}_2\text{O}_4^{2-}$ ions
54. In third group of qualitative analysis, the precipitate employed is a mixture of NH_4Cl and NH_4OH . If NH_4Cl is not available in the laboratory and the mixture does not contain Mn^{2+} , we can use :
- (A) $(\text{NH}_4)_2\text{SO}_4$ (B) $(\text{NH}_4)_2\text{CO}_3$ (C) NH_4NO_3 (D) all of these
55. Which of the following pairs of ions cannot be separated by H_2S in dil. HCl ?
- (A) Bi^{3+} , Sn^{4+} (B) Al^{3+} , Hg^{2+} (C) Zn^{2+} , Cu^{2+} (D) Ni^{2+} , Cu^{2+}
56. Na_2CO_3 cannot be used in place of $(\text{NH}_4)_2\text{CO}_3$ for the precipitation of fifth group radicals, since :
- (A) magnesium will be precipitated
 (B) concentration of carbonate ions is very low
 (C) sodium ions will react with acidic radicals
 (D) Na^+ ions interfere with the detection of fifth group
47. A compound produced blue mass in cobalt nitrate test and formed a brown ring with FeSO_4 and conc. H_2SO_4 . The probable compound is :
- (A) $\text{Al}(\text{NO}_3)_3$ (B) $\text{Zn}(\text{NO}_3)_2$ (C) $\text{Cu}(\text{NO}_3)_2$ (D) MgCl_2
58. A solution of $\text{Na}_2\text{C}_2\text{O}_4$, when added to a solution containing Ba^{2+} , Sr^{2+} and Ca^{2+} ions, will precipitate :
- (A) Ca^{2+} ions (B) Ca^{2+} and Sr^{2+} ions
 (C) Ba^{2+} , Sr^{2+} and Ca^{2+} ions (D) none of these
59. An inorganic salt in its aqueous solution produced a white ppt. with NaOH which dissolves in excess of NaOH . Also its aqueous solution produced light yellow ppt., with AgNO_3 sparingly soluble in NH_4OH . The probable salt is :
- (A) AlBr_3 (B) AlI_3 (C) AlCl_3 (D) ZnCl_2
60. A compound (A) forms a unstable pale blue colour solution in water. The solution decolourised Br_2 water and an acidified solution of KMnO_4 . The possible compound (A) is:
- (A) HNO_2 (B) HNO_3 (C) N_2O_5 (D) None of these

WRITE UPS

Write-up-I

Pyrolusite on heating with KOH in the presence of air gives a dark green compound (A). The solution of (A) on treatment with H_2SO_4 gives a purple coloured compound (B), which gives following reactions:

- (i) KI on reaction with alkaline solution of (B) changes into a compound (C)
- (ii) The colour of compound (B) disappears on treatment with the acidic solution of FeSO_4 .
- (iii) With conc. H_2SO_4 compound (B) gives (D) which can decompose to yield (E) and oxygen.

1. The compound (C) is
 (A) I_2 (B) I_2O_5 (C) KIO_3 (D) KIO_4
2. The compound (E) is:
 (A) MnO (B) MnO_2 (C) Mn_2O_3 (D) Mn_3O_4
3. Oxidation state of manganese of the compound (A) is
 (A) +2 (B) +4 (C) +7 (D) +6

Write-up-II

A light green salt (A) on heating gives a black residue (B) and gas (C) & (D). The salt (A) gives white precipitate (E) on reaction with BaCl_2 . The precipitate (E) is insoluble in conc. HCl or HNO_3 . The gas (D) also gives white ppt (E) with BaCl_2 .

4. Which of the following compound does not decolourize acidified KMnO_4 .
 (A) Salt A (B) Gas C (C) Gas D (D) Both (A) and (C)
5. $\text{Gas (C)} + \text{H}_2\text{O} \xrightarrow[\text{Under Pressure}]{\Delta} \text{Product}$. The product is:
 (A) H_2S (B) H_2SO_4 (C) S (D) Both (A) and (B)
6. $\text{The gas (C)} + \text{S} + \text{NaOH} \xrightarrow{\Delta} \text{Product}$. The product is:
 (A) Na_2SO_3 (B) $\text{Na}_2\text{S}_2\text{O}_3$ (C) Na_2SO_4 (D) Na_2S_5

Write-up-III

A is a colourless crystalline salt which is soluble in water to form a super saturated solution. Salt (A) reacts with salt (B) (which is sensitive to light & gets photo reduction to give its metal) it gives a white ppt (C) and with excess of salt (A), (C) gives a soluble complex (D). (C) in exposure in air and (D) on heating both produces same black coloured ppt (E). (A) is used in medicine and also in extraction of gold and decoloured I_2 in KI solution.

7. When salt (A) reacts with HCl solution it decompose to give
 (A) brown coloured gas (B) rotten eggs smelled gas
 (C) white turbidity (D) violet coloured gas
8. When salt (A) is heated to 223°C the product obtained are
 (A) Na_2SO_4 , Na_2S_5 (B) PbO , SO_2
 (C) CuO , SO_2 (D) FeCl_2 , Cl_2

QUALITATIVE ANALYSIS

9. Identify (E)
 (A) Hg_2O (B) Ag_2S (C) PbO_2 (D) CuS

✎ **Write-up-IV**

Blue vitriol (A) have sigma, pie, ionic, coordinate as well as hydrogen bond. In anhydrous state this compound is white in colour but in hydrated state it is blue in colour and on heating at 720°C it gives black compound (B) which on reaction with glucose gives red compound (C).

10. How many σ (including coordinate bond), π bonds, Hydrogen bonds and hybridisation of central metal are presents respectively in the structure of blue vitriol :

- (A) 14σ , 2π , 2, sp^3 (B) 18σ , 2π , 4, sp^3
 (C) 22σ , 4π , 2, sp^2 (D) 18σ , 4π , 4, sp^3

11. The colour of the compound C is due to :

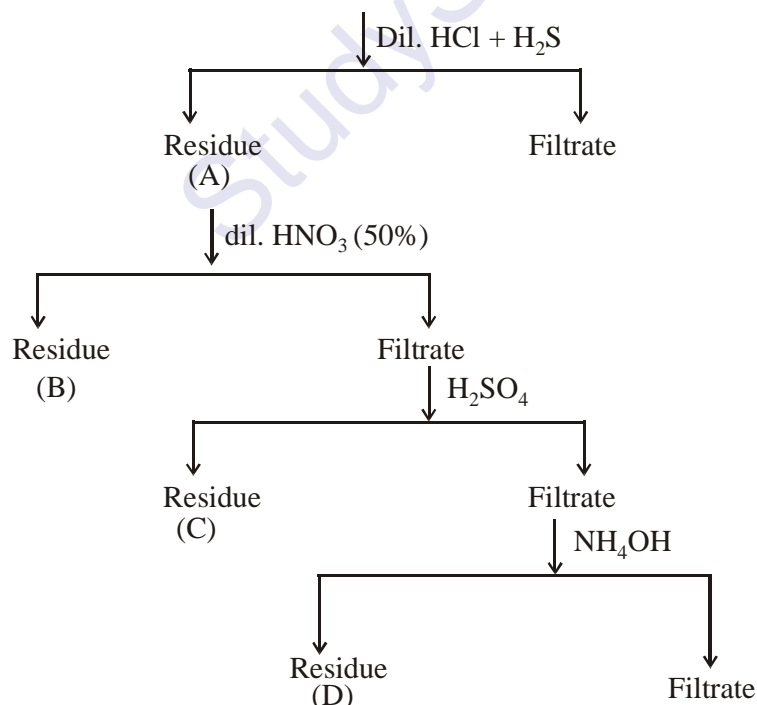
- (A) Charge transfer
 (B) Partially filled d-orbital
 (C) Due to more covalent character of compound C
 (D) None of these

12. Which of the following statement is correct for blue vitriol. [State T for true and F for false]

- (i) The hybridisation is present in the copper is sp^3
 (ii) The 7 oxygen atom are sp^3 and another two oxygen atom is sp^2 hybridize
 (iii) The oxidation state of is copper +2 in blue vitriol
 (iv) The number of hydrogen bonds are present in the structure of blue vitriol is 4
 (A) T T T F (B) T F T F (C) F F T T (D) T T T T

✎ **Write-up-V**

A salt mixture of Hg^{+2} , Cu^{+2} , Pb^{+2} , Cu^{+2} , Bi^{+3} , Zn^{+2} , Mn^{+2} , CO^{+2} and Ni^{+2}



13. The residue (B) is:
 (A) CuS (B) CdS (C) Bi_2S_3 (D) HgS

14. The residue (C) is:
 (A) HgSO_4 (B) $\text{Bi}_2(\text{SO}_4)_3$ (C) PbSO_4 (D) CdSO_4

15. The residue (D) is:
 (A) $\text{Hg}(\text{OH})_2$ (B) $\text{Pb}(\text{OH})_2$ (C) $\text{Cu}(\text{OH})_2$ (D) $\text{Bi}(\text{OH})_3$

Write-up-VI

- (i) A certain inorganic compounds (X) shows the following reactions on passing H_2S through acidified solution of (X) a brown ppt is obtained.
 (ii) The ppt. obtained in (i) is dissolved in excess of yellow $(\text{NH}_4)_2\text{S}_2$.
 (iii) On adding an aqueous solution of NaOH of solution of (X) first white ppt. is obtained, which dissolves in excess of NaOH .
 (iv) the compound X reduces FeCl_3 solution.
16. The soluble complex which is obtained with excess of NaOH on oxidation produces -
 (A) Na_2SnO_3 (B) Na_2MnO_4 (C) Na_2ZnO_2 (D) Na_2AlO_2
17. When salt X reacts with AuCl_3 we get –
 (A) purple of cassius (B) liquid gold (C) gold rush (D) candy fluid
18. The salt (X) gives grey mass and another compound (Z) with corrosive sublimate. (Z) on reaction with NH_4Cl gives (Y). Which is the correct statement about (Y).
 (i) it is known as pink salt (ii) it is used as mordant
 (iii) it is used as moderator in nuclear reactors
 (iv) it is known as scheele's salt
 (A) i, ii (B) i, iii (C) ii, iv (D) iii, iv

Write-up-VII

- (i) A white solid (A) on heating with NaOH gives an alkaline gas (B) and solid (C). Both (A) and (C) gives ring test while (C) gives golden yellow flame. (A) on strong heating it decomposed to give a gas (D) & H_2O . (D) is a neutral oxide which does not burn but helps more than air in burning. (D) on heating at 920°C which gives two gases (E) and (F). The gas (E) when mixed with hydrogen at high temperature and pressure give gas (B). Gas (F) is essential for living system. (D) combines with 'C', 'S', 'P' to form their acidic oxides. (D) on heating with sodamide gives sodium azide & water.
19. What is compound (A) -
 (A) N_3H (B) NH_4NO_2 (C) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (D) NH_4NO_3
20. The compound D is -
 (A) N_2O (B) N_2 (C) CO (D) None of these
21. Hybridisation of central atom in cation and anion present in compound (A) respectively -
 (A) sp^3 , sp^2 (B) sp^3 , sp^3 (C) sp^2 , sp^3 (D) sp^3 , sp

Write-up-VIII

- The yellow coloured precipitate of compound (A) is formed on passing H_2S through a neutral solution of salt (B). Compound (A) is soluble in hot dilute HNO_3 but insoluble in yellow ammonium sulphide. The solution of (B) on treatment with small quantity of aq. NH_3 gives white precipitate which becomes soluble in excess of it forming a compound (C). The solution of (B) gives white precipitate with small concentration of KCN which becomes soluble in excess of this reagent forming a compound (D). The solution of (D) on treatment with H_2S gives (A), The solution of BaCl_2 gives white precipitate of compound (E) with 'B' which is insoluble in conc. HNO_3 .
22. What is compound A
 (A) CdS (B) CdSO_4 (C) SnS_2 (D) CrCl_3

QUALITATIVE ANALYSIS

23. The hybridisation in compound C is:
 (A) dsp^2 (B) sp^3 (C) d^2sp^3 (D) sp^3d^2
24. The compound E is insoluble in water because:
 (A) Lattice energy is greater than hydration energy
 (B) Lattice energy is less than hydration energy
 (C) the presence of polar bond in compound E
 (D) it can't predicted

Write-up-IX

When killed salt reacts with potassium ferro cyanide then white ppt (X) is obtained along with silvine (Y). If (Y) reacts with fluorine gas, yellow green coloured gas (C) is evolved. If yellow green coloured gas (C) reacts with excess of ammonia colourless gas (Z) & compound Z' is formed. When this gas (Z) reacts with Mg gives a white solid (A). (A) on hydrolysis gives gas (B) and gas (B) on reaction with bleaching powder produces gas (Z).

25. What is killed salt ?
 (A) $ZnCl_2$ (B) $CoCl_2$ (C) $FeCl_3$ (D) $CuCl_2$
26. What is the oxidation state and hybridisation of central metal ion present in the white ppt (X) :
 (A) +2, d^2sp^3 (B) +3, sp^3 (C) +3, dsp^2 (D) +2, sp^3d^2
27. Write the correct option for the following statements -
[State T for True and F for False statement]
 (i) the hydrated form of killed salt is known as butter of zinc
 (ii) butter of zinc is used to increase the weight of silk
 (iii) the nature of killed salt is hygroscopic.
 (iv) if the killed salt is heated then philopher's wool is obtained.
 (A) TFTF (B) FTFT (C) TTTF (D) TTTT

Write-up-X

A colourless poisonous liquid (A) shows following reaction . It respond to chromyl chloride test and fieltmann's test. When H_2S gas is passed into HCl solution of (A) a lemon yellow solid (B) get ppt. and HCl is liberated. Compound (B) soluble in yellow $(NH_4)_2S_2$ to give (C). (B) is insoluble in dil. and conc. HCl. Compound (C) on heating with dil. HCl regenerates (B). Compound (B) dissolves in conc. HNO_3 and the solution on treatment with $(NH_4)_2MoO_4$ give yellow ppt D.

28. The compound D is
 (A) $(NH_4)_3AsO_4 \cdot 12MoO_3$ (B) CdS
 (C) H_3AsO_4 (D) $(NH_4)_3AsO_4 \cdot 12MoO_4$
29. When compound B reacts with concentrate HNO_3 , turbidity is obtained alongwith another products. The turbidity is
 (A) $AsCl_3$ (B) $BiOCl$ (C) S (D) NO_2
30. The compound A is

(A) AsCl_3

(B) As_2S_3

(C) CrCl_3

(D) None of these

ASSERTION-REASONS

Each question in this section contains **STATEMENT - 1 (Assertion)** and **STATEMENT - 2 (Reason)**. Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- (A) **Statement - 1** is True, **Statement - 2** is True, **Statement - 2** is a correct explanation for **Statement - 1**
 (B) **Statement - 1** is True, **Statement - 2** is True ; **Statement - 2** is **NOT** a correct explanation for **Statement - 1**
 (C) **Statement - 1** is True, **Statement - 2** is False
 (D) **Statement - 1** is False, **Statement - 2** is True

1. **Statement - 1 (A) :** CO_2 is a acidic oxide.
Statement - 2 (R) : The reaction of CO_2 with water produces H_2CO_3 .
2. **Statement - 1 (A) :** AgCl dissolves in NH_4OH
Statement - 2 (R) : AgCl reacts with NH_4OH and forms AgOH , which is soluble in water.
3. **Statement - 1 (A) :** The solubility of sulphates decreases on moving down the 2nd group of modern periodic table.
Statement - 2 (R) : The solubility product values of sulphates increases on moving down the 2nd group of modern periodic table.
4. **Statement - 1 (A) :** Sulphates are usually estimated as BaSO_4 and not as MgSO_4
Statement - 2 (R) : MgSO_4 water soluble while BaSO_4 is insoluble
5. **Statement - 1 (A) :** Aqueous solution of FeCl_3 is acidic.
Statement - 2 (R) : The hydrated form of FeCl_3 consist of six H_2O molecules as, $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$.
6. **Statement - 1 (A) :** $\text{Na}_2\text{Cr}_2\text{O}_7$ is not a primary standard in volumetric analysis
Statement - 2 (R) : $\text{Na}_2\text{Cr}_2\text{O}_7$ is hygroscopic.
7. **Statement - 1 (A) :** The species $[\text{CuCl}_4]^{2-}$ exists while $[\text{CuI}_4]^{2-}$ does not.
Statement - 2 (R) : I^- is stronger reducing agent than Cl^-
8. **Statement - 1 (A) :** On addition of FeCl_3 solution in NH_4SCN solution become deep red colour.
Statement - 2 (R) : Red coloration developed due to formation of $\text{Fe}(\text{SCN})_3$ complex.
9. **Statement - 1 (A) :** KMnO_4 is coloured.
Statement - 2 (R) : The colour of a compound appears due to charge transfer and electronic transition.
10. **Statement - 1 (A) :** Conc. H_2SO_4 reacts with KCl to give Cl_2 gas.

Statement - 2 (R) : HCl can not be oxidized by conc. H_2SO_4

MATCH THE COLUMN

This section contains match type questions . Each question contains statements given in two columns which have to be matched. Statements (A,B,C,D) in Column I have to be matched with statements (p,q,r,s) in Column II .

1. **Salt**

<p>(A) Copper</p> <p>(B) Cobalt</p> <p>(C) Chromium</p> <p>(D) Manganese</p>	<p>Color in Borax Bead test</p> <p>(p) Blue</p> <p>(q) Green</p> <p>(r) Red</p> <p>(s) Violet</p>
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2. **Column-I (Reagents)**

<p>(A) Nessler's reagent</p> <p>(B) $K_2Cr_2O_7$</p> <p>(C) $NaOH / \Delta$</p> <p>(D) $K_4[Fe(CN)_6]$</p>	<p>Column-II</p> <p>(p) chromyl chloride test</p> <p>(q) prussian blue test of Fe^{3+}</p> <p>(r) chocolate brown test of Cu^{2+}</p> <p>(s) NH_4^+ ion</p>
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3. **Column-I (sulphide)**

<p>(A) HgS</p> <p>(B) NiS</p> <p>(C) MnS</p> <p>(D) ZnS</p>	<p>Column-II (colour/group)</p> <p>(p) 2nd group of basic radical</p> <p>(q) Buff colour</p> <p>(r) Dirty white</p> <p>(s) Black</p>
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4. List I contains compounds which on heating gives the compounds in List II

<p>List I</p> <p>(A) $(NH_4)_2CO_3$</p> <p>(B) $Ca(NO_3)_2$</p> <p>(C) $(NH_4)_2Cr_2O_7$</p> <p>(D) NH_4NO_3</p>	<p>List II</p> <p>(p) N_2</p> <p>(q) N_2O</p> <p>(r) NO_2</p> <p>(s) NH_3</p>
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5. **Column I**

<p>(A) NaCl</p> <p>(B) AgCl</p> <p>(C) $CdCl_2$</p> <p>(D) $FeSO_4$</p>	<p>Column II</p> <p>(p) Soluble in water</p> <p>(q) Lattice energy > Hydration energy</p> <p>(r) Lattice energy < Hydration energy</p> <p>(s) Cation has Pseudo inert ($18e^-$ in valence shell) gas configuration</p>
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6. **Salt**

<p>(A) $NaNH_4HPO_4$</p> <p>(B) $Na(NH_4)_2PO_4$</p> <p>(C) NaH_2PO_2</p>	<p>Production on heating</p> <p>(p) NH_3</p> <p>(q) $NaPO_3$</p> <p>(r) $Na_2P_4O_7$</p>
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7. List I contains compounds which on heating gives the compounds in List II

List I	List II
(A) $(\text{NH}_4)_2\text{CO}_3$	(p) N_2
(B) $\text{Ca}(\text{NO}_3)_2$	(q) N_2O
(C) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	(r) NO_2
(D) NH_4NO_3	(s) NH_3

8. List I contains compounds which on heating gives the compounds in List II

List I	List II
(A) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	(p) NO_2
(B) $\text{K}_2\text{Cr}_2\text{O}_7$	(q) Cr_2O_3
(C) NH_4NO_2	(r) O_2
(D) AgNO_3	(s) N_2

9. List I contains compounds which on heating gives the compounds in List II

List I	List II
(A) $(\text{NH}_4)_2\text{CO}_3$	(p) N_2
(B) $\text{Ca}(\text{NO}_3)_2$	(q) N_2O
(C) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	(r) NO_2
(D) NH_4NO_3	(s) NH_3

10. Match the items in column I with those in column II

Column I	Column II
(A) SO_2	(p) basic oxide
(B) N_2O	(q) amphoteric oxide
(C) Na_2O	(r) acidic oxide
(D) ZnO	(s) neutral oxide

11. List I contains compounds which on heating gives the compounds in List II

List I (Compound)	List II (Structure)
(A) $\text{NH}_4\text{NO}_3 \xrightarrow{\Delta}$	(p) linear molecule
(B) $(\text{NH}_4)_2\text{CO}_3 \xrightarrow{\Delta}$	(q) triangular planar molecule
(C) $\text{NH}_4\text{NO}_2 \xrightarrow{\Delta}$	(r) bent shape molecule



(s) pyramidal molecule

IIT-JEE PROBLEMS

OBJECTIVES

- If metal ions of group III are precipitated by NH_4Cl and NH_4OH without prior oxidation by concentrated HNO_3 _____ is not completely precipitated . [1984]
- The formula of the deep red liquid formed on warming dichromate with KCl in concentrated sulphuric acid is _____. [1993]
- Addition of ammonium chloride to a solution containing ferric and magnesium ions is essential for selective precipitation of ferric hydroxide by aqueous ammonia . [T/F] [1985]
- From the solution containing copper (+ 2) and zinc (+ 2) ions , copper can be selectively precipitated using sodium sulphide . [T/F] [1987]
- The ion that cannot be precipitated by both HCl and H_2S is :
 (A) Pb^{2+} (B) Cu^+ (C) Ag^+ (D) Sn^{2+} [1982]
- Which one among the following pairs of ions cannot be separated by H_2S in dilute hydrochloric acid ?
 (A) Bi^{3+} , Sn^{4+} (B) Al^{3+} , Hg^{2+} (C) Zn^{2+} , Cu^{2+} (D) Ni^{2+} , Cu^{2+} [1986]
- Read the following statement and explanation and answer as per the options given below .
Assertion : A very dilute acidic solution of Cd^{2+} and Ni^{2+} gives yellow precipitate of CdS on passing hydrogen sulphide .
Statement : Solubility product of CdS is more than that of NiS
 (A) If both assertion and statement are correct and statement is an explanation of assertion.
 (B) If assertion is correct and statement is wrong, statement is not an explanation of assertion.
 (C) If assertion is wrong and statement is correct, statement is not an explanation of assertion.
 (D) If both assertion and statement are wrong and statement is not an explanation of assertion. [1989]
- The reagents, NH_4Cl and aqueous NH_3 will precipitate :
 (A) Ca^{2+} (B) Al^{3+} (C) Bi^{3+} (D) Mg^{2+} (E) Zn^{2+} [1991]
- An aqueous solution contains , Hg^{2+} , Hg_2^{2+} , Pb^{2+} and Cd^{2+} . The addition of HCl (6 N) will precipitate :
 (A) Hg_2Cl_2 only (B) PbCl_2 only
 (C) PbCl_2 & Hg_2Cl_2 (D) PbCl_2 & HgCl_2 [1995]
- The only cations present in a slightly acidic solution are Fe^{3+} , Zn^{2+} and Cu^{2+} . The reagent that when added in excess to this solution would identify the separate Fe^{3+} in one step is :
 (A) 2 M HCl (B) 6 M HCl (C) 6 M NaOH (D) H_2S gas [1997]
- Which of the following statement(s) is/are correct when a mixture of NaCl and $\text{K}_2\text{Cr}_2\text{O}_7$ is gently warmed with concentrated H_2SO_4 ?
 (A) A deep red vapour is evolved
 (B) The vapours when passed into NaOH solution gives a yellow solution of Na_2CrO_4

- (C) Chlorine gas is evolved
(D) Chromyl chloride is formed [1998]
12. Which of the following statement(s) is/are correct with reference to the ferrous and ferric ions ?
(A) Fe^{3+} gives brown colour with potassium ferricyanide
(B) Fe^{3+} gives blue precipitate with potassium ferricyanide
(C) Fe^{3+} gives red colour with potassium thiocyanate
(D) Fe^{3+} gives brown colour with ammonium thiocyanate [1998]
13. Read the following statement and explanation and answer as per the options given below .
Assertion : Sulphate is estimated as BaSO_4 and not as MgSO_4 .
Reason : Ionic radius of Mg^{2+} is smaller than that of Ba^{2+}
(A) If both assertion and reason are correct , and reason is the correct explanation of the assertion.
(B) If both assertion and reason are correct , but reason is not the correct explanation of the assertion.
(C) If assertion is correct but reason is incorrect.
(D) If assertion is incorrect but reason is correct. [1998]
14. Identify the correct order of solubility of Na_2S , CuS and ZnS in aqueous medium .
(A) $\text{CuS} > \text{ZnS} > \text{Na}_2\text{S}$ (B) $\text{ZnS} > \text{Na}_2\text{S} > \text{CuS}$
(C) $\text{Na}_2\text{S} > \text{CuS} > \text{ZnS}$ (D) $\text{Na}_2\text{S} > \text{ZnS} > \text{CuS}$ [2002]
15. An aqueous solution of a substance gives a white precipitate on treatment with dilute hydrochloric acid , which dissolved on heating . When hydrogen sulfide is passed through the hot acidic solution , a black precipitate is obtained . The substance is a :
(A) Hg_2^{2+} salt (B) Cu^{2+} salt (C) Ag^+ salt (D) Pb^{2+} salt [2002]
16. A gas 'X' is passed through water to form a saturated solution . The aqueous solution on treatment with silver nitrate gives a white precipitate . The saturated aqueous solution also dissolves magnesium ribbon with evolution of a colourless gas 'Y' . Identify 'X' and 'Y' .
(A) $\text{X} = \text{CO}_2$, $\text{Y} = \text{Cl}_2$ (B) $\text{X} = \text{Cl}_2$, $\text{Y} = \text{CO}_2$
(C) $\text{X} = \text{Cl}_2$, $\text{Y} = \text{H}_2$ (D) $\text{X} = \text{H}_2$, $\text{Y} = \text{Cl}_2$ [2002]
17. $[\text{X}] + \text{H}_2\text{SO}_4 \longrightarrow [\text{Y}]$ a colourless gas with irritating smell .
 $[\text{Y}] + \text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4 \longrightarrow$ green solution . [X] and [Y] respectively are :
(A) SO_3^{2-} , SO_2 (B) Cl^- , HCl (C) S^{2-} , H_2S (D) CO_3^{2-} , CO_2 [2003]
18. A solution which is 10^{-3} M each in Mn^{2+} , Fe^{2+} , Zn^{2+} and Hg^{2+} is treated with 10^{-16} M sulphide ion . If K_{sp} of MnS , FeS , ZnS and HgS are 10^{-15} , 10^{-23} , 10^{-20} and 10^{-54} respectively , which one will precipitate first ?
(A) FeS (B) MgS (C) HgS (D) ZnS [2003]
19. A metal nitrate reacts with KI to give a black precipitate which on addition of excess of KI is converted into orange colour solution . The cation of the metal nitrate is :
(A) Hg^{2+} (B) Bi^{3+} (C) Pb^{2+} (D) Cu^+ [2005]
20. A solution when diluted with H_2O and boiled , gives a white precipitate . On addition of excess $\text{NH}_4\text{Cl}/\text{NH}_4\text{OH}$, the volume of precipitate decreases leaving behind a white gelatinous

QUALITATIVE ANALYSIS

precipitate. Identify the precipitate which dissolves in $\text{NH}_4\text{Cl}/\text{NH}_4\text{OH}$.

- (A) $\text{Al}(\text{OH})_3$ (B) $\text{Zn}(\text{OH})_2$ (C) $\text{Ca}(\text{OH})_2$ (D) $\text{Mg}(\text{OH})_2$

[2006]

SUBJECTIVES

21. When 16.8 g of white solid X were heated, 4.4 g of acid gas A that turned lime water milky was driven off together with 1.8 g of a gas B which condensed to a colourless liquid. The solid that remained, Y dissolved in water to give an alkaline solution, which with excess barium chloride solution gave a white precipitate Z. The precipitate effervesced with acid giving off carbon dioxide. Identify A, B and Y and write down the equation for the thermal decomposition of X. [1984]

22. A mixture of two salts was treated as follows :
- (i) The mixture was heated with manganese dioxide and concentrated sulphuric acid when yellowish green gas was liberated.
 - (ii) The mixture on heating with sodium hydroxide solution gave a gas which turned red litmus blue.
 - (iii) Its solution in water gave blue precipitate with potassium ferricyanide and red colouration with ammonium thiocyanate.
 - (iv) The mixture was boiled with potassium hydroxide and the liberated gas was bubbled through an alkaline solution of K_2HgI_4 to give brown precipitate.
- Identify the two salts. Give ionic equations for reactions involved in the tests (i), (ii) and (iii). [1987]

23. A hydrated metallic salt A, light green in colour, on careful heating gives a white anhydrous residue B. B is soluble in water and its aqueous solution reacts with NO to give a dark brown compound C. B on strong heating gives a brown residue D and a mixture of two gases E and F. The gaseous mixture when passed through acidified permanganate, discharges the pink colour and when passed through acidified BaCl_2 solution gave a white precipitate. Identify A, B, C, D, E and F. [1988]

24. When 20.02 g of a white solid X is heated 4.4 g of an acid gas A and 1.8 g of a neutral gas B are evolved, leaving behind a solid residue Y of weight 13.8 g. A turns lime water milky and B condenses into a liquid which changes anhydrous copper sulphate blue. The aqueous solution of Y is alkaline to litmus and gives 19.7 g of white precipitate Z with barium chloride solution. Z gives carbon dioxide with an acid. Identify A, B, X, Y and Z. [1989]

25. The gas liberated on heating a mixture of two salts with NaOH, gives a reddish brown precipitate with an alkaline solution of K_2HgI_4 . The aqueous solution of the mixture on treatment with BaCl_2 gives a white precipitate which is sparingly soluble in concentrated HCl. On heating the mixture with $\text{K}_2\text{Cr}_2\text{O}_7$ and concentrated H_2SO_4 , red vapours A are produced. The aqueous solution of the mixture gives a deep blue colouration B with potassium ferricyanide solution. Identify the radicals in the given mixture and write the balanced equations for the formation of A and B. [1991]

26. A light bluish green crystalline compound responds to the following tests.
- (i) Its aqueous solution gives a brown precipitate or colour with alkaline $\text{K}_2[\text{HgI}_4]$ solution.
 - (ii) Its aqueous solution gives a blue colour with $\text{K}_3[\text{Fe}(\text{CN})_6]$ solution.
 - (iii) Its solution in hydrochloric acid gives a white precipitate with BaCl_2 solution.
- Identify the ions present and suggest the formula of the compound [1992]

27. An orange solid (A) on heating gave a green residue (B), a colourless gas (C) and water

- vapour . The dry gas (C) on passing over heated Mg gave a white solid (D) . (D) on reaction with water gave a gas (E) which formed dense white fumes with HCl . Identify (A) to (E) and give reactions involved . [1993]
- 28.** A is a binary compound of a univalent metal . 1.422 g of A reacts completely with 0.321 g of sulphur in a evacuated and sealed tube to give 1.743 g of a white crystalline solid B , that forms a hydrated double salt C with $\text{Al}_2(\text{SO}_4)_3$. Identify A , B and C . [1994]
- 29.** A scarlet compound A is treated with concentrated HNO_3 to give a chocolate brown precipitate B . The precipitate is filtered and the filtrate is neutralised with NaOH . Addition of KI to the resulting solution gives a yellow precipitate C . The precipitate B on warming with concentrated HNO_3 in the presence of $\text{Mn}(\text{NO}_3)_2$ produces a pink coloured solution due to the formation of D . Identify A , B , C and D . Write the reaction sequence . [1995]
- 30.** Calcium burns in nitrogen to produce a white powder which dissolves in sufficient water to produce a gas (A) and an alkaline solution . The solution on exposure to air produces a thin solid layer of (B) on the surface . Identify the compounds (A) and (B) . [1996]
- 31.** A colourless inorganic salt (A) decomposes completely at about 250°C to give only two products (B) and (C) , leaving no residue . The oxide (C) is a liquid at room temperature and neutral to moist litmus paper while the gas (B) is a neutral oxide . White phosphorus burns in excess of (B) to produce a strong white dehydrating agent . Write balanced equations for the reactions involved in the above process . [1996]
- 32.** During the qualitative analysis of a mixture containing Cu^{2+} and Zn^{2+} ions , H_2S gas is passed through an acidified solution containing these ions in order to test Cu^{2+} alone . Explain briefly . [1998]
- 33.** A white solid is either Na_2O or Na_2O_2 . A piece of red litmus paper turns white when it is dipped into a freshly made aqueous solution of the white solid .
(a) Identify the substance and explain with balanced equation .
(b) Explain what would happen to the red litmus if the white solid were the other compound. [1999]
- 34.** An aqueous solution containing one mole of HgI_2 and two moles of NaI is orange in colour . On addition of excess NaI , the solution becomes colourless . The orange colour reappears on subsequent addition of NaOCl . Explain with equations . [1999]
- 35.** An aqueous blue coloured solution of a transition metal sulphate reacts with H_2S in acidic medium to give a black precipitate A , which is insoluble in warm aqueous solution of KOH . The blue solution on treatment with KI in weakly acidic medium, turns yellow and produces a white precipitate B . Identify the transition metal ion . Write the chemical reactions involved in the formation of A and B . [2000]
- 36.** Write the chemical reactions associated with the “borax bead test” of cobalt (II) oxide . [2000]
- 37.** A white substance (A) reacts with dilute H_2SO_4 to produce a colourless gas (B) and a colourless solution (C) . The reaction between (B) and acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution produces a green solution and a slightly coloured precipitate (D) . The substance (D) burns in air to produce a gas (E) which reacts with (B) to yield (D) and a colourless liquid . Anhydrous copper sulphate is turned blue on addition of this colourless liquid . Addition of aqueous NH_3 or NaOH to (C) produces first a precipitate , which dissolves in the excess of the respective

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reagent to produce a clear solution in each case . Identify (A) , (B) , (C) , (D) and (E) . Write the equations of the reactions involved . **[2001]**

- 38.** When a white crystalline compound X is heated with $K_2Cr_2O_7$ and concentrated H_2SO_4 , a reddish brown gas A is evolved . On passing A into caustic soda solution , a yellow coloured solution of B is obtained . Neutralizing the solution B with acetic acid and on subsequent addition of lead acetate , a yellow precipitate C is obtained . When X is heated with NaOH solution , a colourless gas is evolved and on passing this gas into K_2HgI_4 solution , a reddish brown precipitate D is formed . Identify A , B , C , D and X . Write the equations of reactions involved . **[2002]**

- 39.** A mixture consists of A (yellow solid) and B (colourless solid) which gives lilac colour in flame.
- (a) Mixture gives black precipitate C on passing $H_2S_{(g)}$ through its aqueous solution .
 - (b) C is soluble in aqua-regia and on evaporation of aqua-regia and adding $SnCl_2$ gives greyish black precipitate D .
- The salt solution with NH_4OH gives a brown precipitate .
- (i) The sodium extract of the salt with $CCl_4/FeCl_3$ gives a violet layer .
 - (ii) The sodium extract gives yellow precipitate with $AgNO_3$ solution which is insoluble in

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NH_3 . Identify A and B and the precipitates C and D.

[2003]

MISCELLANEOUS PROBLEMS

LEVEL I

- A certain inorganic compound (X) shows the following reactions:
 - On passing H_2S through an acidified solution of (X) a brown precipitate is obtained.
 - The precipitate obtained at step (i) dissolves in excess of yellow ammonium sulphide.
 - On adding an aqueous solution of NaOH to a solution of (X), first a white precipitate is obtained which dissolves in excess of NaOH .
 - The aqueous solution of (X) reduces ferric chloride.
 Identify the cation of (X) and give chemical equations for reactions at steps (i), (iii) and (iv)
- A mixture of the three gases A, B and C is passed first into an acidified dichromate solution when A is absorbed turning the solution green. The remainder of the gas is passed through an excess of lime water which turns milky, resulting in the absorption of B. The residual gas C is absorbed by an alkaline pyrogallol solution. However, the original gaseous mixture does not turn lead acetate paper black. Identify A, B and C.
- You are given unlabelled four packets of white substances of zinc, namely ZnO , $\text{Zn}(\text{OH})_2$, ZnCO_3 and ZnS . How will you proceed to identify each of them ?
- Identify compounds A to G from the following reactions

$$\begin{array}{l} \text{A (white crystals)} \xrightarrow{\text{heat}} \underset{\text{solid}}{\text{B}} + \underset{\text{gas}}{\text{C}}; \quad \text{C} \xrightarrow[\text{solution}]{\text{KI}} \text{I}_2 \text{ A} \\ \text{B} \xrightarrow{\text{HNO}_3} \text{Solution D} \xrightarrow{\text{NaOH}} \underset{\text{brown}}{\text{E}} \downarrow \xrightarrow{\text{NH}_3} \text{Solution F} \xrightarrow{\text{HCOOH}} \text{Black precipitate} \end{array}$$
- Complete the following
 - $\text{PbS} + \underset{\text{(A)}}{\text{Acid}} \longrightarrow \underset{\text{(B)}}{\text{Gas}} \xrightarrow[\text{C}]{\text{Acid}} \underset{\text{(D)}}{\text{Yellow ppt.}}$
 - $\text{A} + \text{H}_2\text{S} \xrightarrow{\text{NH}_4\text{OH}} \underset{\text{(B)}}{\text{White ppt.}} + 2\text{HCl}$
 $\text{A} + \text{NaOH} \xrightarrow{\text{(C)}} \text{ppt.} \xrightarrow[\text{(D)}]{\text{NaOH}} \text{solution}$
 - $\text{PbS} \xrightarrow{\text{heat in air}} \text{A} + \text{PbS} \xrightarrow{\text{B}} \text{Pb} + \text{SO}_2$
- Explain the following:
 - Lead (Pb^{2+}) is placed in the first as well as second group of qualitative analysis.
 - The colour of mercurous chloride, Hg_2Cl_2 , changes from white to black when treated with ammonia.
 - During the qualitative analysis of a mixture containing Cu^{2+} and Zn^{2+} ions, H_2S gas is passed through an acidified solution containing these ions in order to test Cu^{2+} alone. Explain briefly.
- A compound on heating with an excess of caustic soda solution liberates a gas (B), which gives white fumes on exposure to HCl . Heating is continued to expel the gas completely. The resultant

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- alkaline solution again liberates the same gas (B), when heated with zinc powder. However, the compound (A), when heated alone, does not give nitrogen. Identify (A) and (B).
8. A certain metal (A) is boiled in dilute nitric acid to give a salt (B) and an oxide of nitrogen (C). An aqueous solution of (B) with brine gives a precipitate (D) which is soluble in ammonium hydroxide. On adding aqueous solution of (B) to hypo solution, a white precipitate (E) is obtained. (E) on standing turns to a black compound (F). Identify (A) to (F).
 9. A yellow solid (A) is unaffected by acids and bases. It is not soluble in water. It dissolves slowly in hot conc. HNO_3 and a brown gas (B) is released. The solid (A) dissolves only in a boiling solution of sodium sulphite giving a clear solution (C). Acidification of solution (C) causes a colourless gas (D) to be liberated, accompanied by an appearance of a milky precipitate (E) in the solution. Identify (A) to (E).
 10. A certain salt (X) gives the following tests:
 - (i) Its aqueous solution is alkaline to litmus
 - (ii) On strongly heating it swells to give glassy material
 - (iii) When concentrated H_2SO_4 is added to a hot concentrated solution.
 Identify the salt (X) and give the equations for the reaction.

LEVEL II

1.
 - (i) An ore (A) on roasting with sodium carbonate and lime in the presence of air gives two compounds, (B) and (C).
 - (ii) The solution of (B) in conc. HCl on treatment with potassium ferrocyanide gives a blue colour or precipitate of compound (D).
 - (iii) The aqueous solution of (C) on treatment with conc. H_2SO_4 gives a yellow coloured compound (E).
 - (iv) Compound (E) when treated with KCl gives an orange-red compound (F) which is used as an oxidizing reagent.
 - (v) The solution of (F) on treatment with oxalic acid and then with an excess of potassium oxalate gives blue crystals of compound (G).
 Identify (A) to (G) and give balanced chemical equations for reactions at steps (i) to (v)
2.
 - (i) A black mineral (A) on heating in presence of air gives a gas (B).
 - (ii) The mineral (A) on reaction with dilute H_2SO_4 gives a gas (C) and solution of a compound (D).
 - (iii) On passing gas (C) into an aqueous solution of (B) a white turbidity is obtained.
 - (iv) The aqueous solution of compound (D) on reaction with potassium ferricyanide gives a blue compound (E).
 Identify (A) to (E) and give chemical equations for reactions at steps (i) to (iv).
3. A white substance A reacts with dilute H_2SO_4 to produce a colourless gas B and a colourless solution C. The reaction between B and acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution produces a green solution and a slightly coloured precipitate D. The substance D burns in air to produce a gas E which reacts with B to yield D and a colourless liquid. Anhydrous copper sulphate is turned blue on addition of this colourless liquid. Addition of aqueous NH_3 or NaOH to C produces first a precipitate which dissolves in the excess of the respective reagent to produce a clear solution in each case. Identify A, B, C, D and E. Write the equation of the

reactions involved.

4. A black coloured compound (A) on reaction with dilute sulphuric acid gives a gas (B) which on passing in a solution of an acid (C) gives a white turbidity (D). Gas (B) when passed in acidified solution of a compound (E) gives a precipitate (F) soluble in dilute nitric acid. After boiling this solution when an excess of ammonium hydroxide is added, a blue coloured compound (G) is formed. To this solution on addition of acetic acid and aqueous potassium ferrocyanide a chocolate precipitate (H) is obtained. On addition of an aqueous solution of barium chloride to an aqueous solution (E), a white precipitate insoluble in HNO_3 is obtained. Identify from (A) to (H).

5.
 - (i) A black coloured compound (B) is formed on passing hydrogen sulphide through the solution of a compound (A) in NH_4OH .
 - (ii) (B) on treatment with hydrochloric acid and potassium chlorate gives (A).
 - (iii) (A) on treatment with potassium cyanide gives a buff coloured precipitate which dissolves in excess of this reagent forming a compound (C).
 - (iv) The compound (C) is changed into a compound (D) when its aqueous solution is boiled.
 - (v) The solution of (A) was treated with excess of sodium bicarbonate and then with bromine water. On cooling and shaking for some time, a green colour of compound (E) is formed. No change is observed on heating.
 Identify (A) to (E) and give chemical equations for the reactions at steps (i) to (v).

6. A substance X dissolves in hot conc. HCl to give solution which when treated with caustic soda solution gives a white precipitate which however dissolves in excess of caustic soda solution giving a strongly solution.
 On heating X with sulphur, a brown powder Y is formed which dissolved on warming with yellow ammonium sulphide solution. The solution gives a grey precipitate with HCl.
 When X is heated in air, a white powder Z is obtained which can be dissolved only in conc. H_2SO_4 . When Z is fused with NaOH, extracted with hot water, then treated with mineral acid, white gelatinous precipitate is obtained. Identify X, Y, Z and give the reactions involved.

7. A colourless solid A on heating gives a white solid B and a colourless gas, C; B gives off reddish brown fumes on treatment with dilute acids. On heating with NH_4Cl , B gives a colourless gas D and a residue E.
 The compound A also gives a colourless gas F on heating with ammonium sulphide and white residue G. Both E and G impart bright yellow colour to Bunsen fumes. The gas C forms white powder with strongly heated magnesium metal. The white powder forms magnesium hydroxide with water. The gas D, on the other hand, is absorbed by heated calcium which gives off ammonia on hydrolysis.
 Identify the substance A to G and give reactions for the changes involved.

8. An inorganic compound (A) shows the following reactions.
 - (i) It is white solid and exists as dimer; gives fumes of (B) with wet air.
 - (ii) It sublimes on 180°C and forms monomer if heated to 400°C .
 - (iii) Its aqueous solution turns blue litmus to red.
 - (iv) Addition of NH_4OH and NaOH separately to a solution of (A) gives white precipitate

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which is however soluble in excess of NaOH.

9. (i) Solution salt of an acid (A) is formed on boiling white phosphorus with NaOH solution.
 (ii) On passing chlorine through phosphorus kept fused under water, another acid (B) is formed which on strong heating gives metaphosphorus acid.
 (iii) Phosphorus on treatment with conc. HNO_3 gives an acid (C) which is also formed by the action of dilute H_2SO_4 on powdered phosphorite rock.
 (iv) (A) on treatment with a solution of HgCl_2 first gives a white precipitate of compound (D) and then a grey precipitate (E).

Identify (A) to (E) and write balanced chemical equations for the reactions at step (i) to (iv)

10. A gaseous mixture containing (X), (Y) and (Z) gases, when passed into acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution, gas (X) was absorbed and the solution was turned green. The remainder gas mixture was then pass through lime water, which turns milky by absorbing gas (Y). The residual gas when passed thorough alkaline pyrogallol solution, it turned black .
 Identify gas (X), (Y) and (Z) and explain the reaction involved .

11. An aqueous solution of a gas (X) shows the following reactions.
 (i) It turns red litmus blue.
 (ii) When added in excess to copper sulphate solution deep blue colour is obtained.
 (iii) On addition to a ferric chloride solution a brown precipitate soluble in dilute nitric acid is obtained.

Identify (X) and give equations for the reactions at steps (ii) and (iii).

12. An inorganic Lewis acid (X) shows the following reactions:
 (i) It fumes in moist air.
 (ii) The intensity of fumes increases when a rod dipped in NH_4OH is brought near to it.
 (iii) An acidic solution of (X) on addition of NH_4Cl and NH_4OH gives a precipitate which dissolves in NaOH solution.
 (iv) An acidic solution of (X) does not give a precipitate with H_2S . Identify (X) and give chemical equations for reactions at steps (i) to (iii).

13. An unknown inorganic compound (X) loses its water of crystallization on heating and its aqueous solution gives the following reactions.
 (i) It gives a white turbidity with dilute hydrochloric acid solution.
 (ii) It decolourises a solution of iodine in potassium iodide.
 (iii) It gives a white precipitate with silver nitrate solution which turns black on standing.
 Identify the compound (X) and give chemical equations for the reactions at steps (i), (ii) and (iii).

14. A certain compound (X) shows the following reactions.
 (i) When KI is added to an aqueous suspension of (X) containing acetic acid, iodine, is liberated.
 (ii) When CO_2 is passed through an aqueous suspension of (X) the turbidity transforms to a precipitate.
 (iii) When a paste of (X) in water is heated with ethyl alcohol a product of anesthetic use is

obtained.

Identify (X) and write down chemical equation for reactions at steps (i), (ii) and (iii).

- 15.** Identify the unknown species and complete the following
- (i) $(A) + \text{dil. H}_2\text{SO}_4 + \text{K}_2\text{Cr}_2\text{O}_7 \longrightarrow (B) \text{ green coloured}$
 $(A) + \text{dil. H}_2\text{SO}_4 + (C) \longrightarrow \text{MnSO}_4$
 $(A) + \text{O}_2 \xrightarrow{\text{H}_2\text{O}} (D)$
 $(D) + \text{BaCl}_2 \longrightarrow \text{White ppt.}$
- (ii) $(A)_{\text{aq.}} + \text{Zn} \xrightarrow{\text{heat}} (B)_{\text{gas}}$
 $(A)_{\text{aq.}} + (C) \xrightarrow{\text{heat}} \text{PH}_3$
 $(A)_{\text{aq.}} + \text{NH}_4\text{Cl} \longrightarrow (D)_{\text{gas}}$
- 16.** Identify the unknown species and complete the following
- (i) $(A) + \text{NaOH} \xrightarrow{\text{heat}} \text{NaCl} + \text{NH}_3 + \text{H}_2\text{O}$
(ii) $\text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} \longrightarrow (B)$
(iii) $(B) + \text{NaCl} \longrightarrow (C) + \text{NH}_4\text{Cl}$
(iv) $(C) \xrightarrow{\text{heat}} \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + (D)$
- 17.** Element A burns in nitrogen to give an ionic compound B. Compound B reacts with water to give C and D. A solution of C becomes 'milky' on bubbling carbon dioxide. Identify A, B, C and D.
- 18.** An aqueous solution of a salt (A) gives a white crystalline precipitate (B) with NaCl solution. The filtrate gives a black precipitate (C) when H_2S is passed into it. Compound (B) dissolves in hot water and the solution gives yellow precipitate (D) on treatment with sodium iodide and cooling. The compound (A) does not give any gas with dilute HCl but liberates a reddish brown gas on heating. Identify the compounds (A) to (D) and give an equation for the liberation of the reddish brown gas.
- 19.**
- (i) An aqueous solution of a compound (A) is acidic towards litmus and (A) is sublimed at about 300°C .
(ii) (A) on treatment with an excess of NH_4SCN gives a red coloured compound (B) and on treatment with a solution of $\text{K}_4[\text{Fe}(\text{CN})_6]$ gives a blue coloured compound (C).
(iii) (A) on heating with excess of $\text{K}_2\text{Cr}_2\text{O}_7$ in presence of concentrated H_2SO_4 evolves deep red vapours of (D).
(iv) On passing the vapours of (D) into a solution of NaOH and then adding the solutions of acetic acid and lead acetate, a yellow precipitate of compound (E) is obtained.
Identify (A) to (E) and give chemical equations for the reactions at steps (ii) to (iv).
- 20.** Identify (A) to (D) in following steps giving chemical equations.
- (i) A white amorphous powder (A) on strongly heating gives a colourless non combustible gas (B) and solid (C).
(ii) The gas (B) turns lime water milky and turbidity disappears with the passage of excess of gas.
(iii) The solution of (C) in dilute HCl gives a white precipitate with an aqueous solution of $\text{K}_4\text{Fe}(\text{CN})_6$.

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- (iv) The solution of (A) in dilute HCl gives a white precipitate (D) on passing H_2S in presence of excess of NH_4OH .

LEVEL III

1. An aqueous solution of gas (X) gives the following reactions.
 - (i) It decolourizes on acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution
 - (ii) On boiling it with H_2O_2 , cooling it and then adding an aqueous solution of BaCl_2 a precipitate insoluble in dilute hydrochloric acid is obtained.
 - (iii) On passing H_2S in the solution, a white turbidity is obtained.
 Identify (X) and give equations for the reactions at steps (i), (ii) and (iii)

2. At aqueous solution of a salt (A) gives a white crystalline precipitate (B) with NaCl solution. The filtrate gives a black precipitate (C) when H_2S is passed into it. Compound (B) dissolves in hot water and the solution gives yellow precipitate (D) on treatment with sodium iodide and cooling. The compound (A) does not give any gas with dilute HCl but liberates a reddish brown gas on heating. Identify the compounds (A) to (D) and give an equation for the liberation of the reddish brown gas.

3. A colourless solid A, when placed into water, produces a heavy white precipitate B. Solid A gives a clear solution in conc. HCl; however when added to large amount of water, it again gives precipitate of B which dissolves in dilute HCl. When H_2S is passed through a suspension of A or B, a brown black precipitate (C) is obtained. Compound A liberates a gas D with conc. H_2SO_4 , the gas D is water soluble and gives white precipitate E with solution of mercurous salts but not with mercuric salts. Identify A to E.

4.
 - (i) A blue coloured compound (A) on heating gives two products, (B) and (C).
 - (ii) A metal (D) is deposited on passing hydrogen through heated (B).
 - (iii) The solution of (B) in HCl on treatment with $\text{K}_4\text{Fe}(\text{CN})_6$ gives a chocolate brown coloured precipitate of compound (E).
 - (iv) (C) turns lime water milky which disappears on continuous passage of (C) forming a compound (F).
 Identify (A) to (F) and give chemical equations for the reactions at steps (i) to (iv)

5.
 - (i) An inorganic compound (A) is formed on passing a gas (B) through a concentrated liquor containing sodium sulphide and sodium sulphite.
 - (ii) On adding (A) into a dilute solution of silver nitrate, a white precipitate appears which quickly changes into a black coloured compound (C).
 - (iii) On adding two or three drops of ferric chloride into the excess of solution of (A), a violet coloured compound (D) is formed. This colour disappears quickly.
 - (iv) On adding a solution of (A) into the solution of cupric chloride, a white precipitate is first formed which dissolves on adding excess of (A) forming a compound (E).
 Identify (A) to (E) and give chemical equations for the reactions at steps (i) to (iv).

6. A metal chloride (X) shows the following reactions:
 - (i) When H_2S is passed in an acidified aqueous solution of (X), a black precipitate is obtained.
 - (ii) The precipitate obtained at step (i) is not soluble in yellow ammonium sulphide.
 - (iii) When a solution of stannous chloride is added to an aqueous solution of (X) a white precipitate is obtained which turns grey on addition of more of stannous chloride.
 - (iv) When an aqueous solution of KI is added to an aqueous solution of (X) a red

precipitate is obtained which dissolves on addition of excess of KI.

Identify (X) and write down the equations for the reactions at steps (i), (iii) and (iv).

7. Identify (A) to (D) in following steps giving chemical equations:
 - (i) A white amorphous powder (A) on strongly heating gives a colourless non combustible gas (B) and solid (C).
 - (ii) The gas (B) turns lime water milky and turbidity disappears with the passage of excess of gas.
 - (iii) The solution of (C) in dilute HCl gives a white precipitate with an aqueous solution of $K_4Fe(CN)_6$.
 - (iv) The solution of (A) in dilute HCl gives a white precipitate (D) on passing H_2S in presence of excess of NH_4OH .

8. A well known orange crystalline compound (A) when burnt imparts violet colour to flame. (A) on treating with (B) and conc. H_2SO_4 gives red gas (C) which gives red yellow solution (D) with alkaline H_2SO_4 gives red gas (C) which gives red yellow solution (D) with alkaline water. (D) on treating with acetic acid and lead acetate gives yellow precipitate (E). (B) sublimes on heating. Also on heating (B) with NaOH, gas (F) is formed which gives white fumes with HCl. What are (A) to (F) ?

9. An aqueous solution of salt (A) gives white crystalline ppt. (B) with NaCl solution. The filtrate gives a black ppt. (C) when H_2S is passed in it. Compound (B) is dissolved in hot water and the solution gives a yellow ppt. (D) on treating with NaI and cooling. The compound (A) does not give any gas with dil. HCl but liberated reddish brown gas on heating. Identify the compound (A), (B), (C) and (D).

10. Complete and balance the following chemical equations:
 - (i) $Au + HCl + HNO_3 \longrightarrow \dots + \dots + H_2O$
 - (ii) $C + HNO_3 \text{ (conc.)} \longrightarrow CO_2 + \dots + H_2O$
 - (iii) $Sn + KOH \text{ (hot)} + H_2O \longrightarrow \dots$
 - (iv) $Cu(OH)_2 + NH_4NO_3 + NH_4OH_{(aq)} \longrightarrow \dots + H_2O$

11. A pale yellow inorganic compound (A) is insoluble in mineral acid but partially soluble in aqueous ammonia forming (B). A dissolves in $Na_2S_2O_3$ solution and gives (C) on boiling the aqueous solution of (C) and a black ppt (D) is obtained. When (D) is dissolve in HNO_3 and HCl is added a white ppt (E) is obtained (A) on heating with conc. H_2SO_4 and MnO_2 yield brown fumes of (F). Identify (A) to (F) .

12. Salt A combines with $BaCl_2$ solution gives white ppt. which is insoluble in conc. HCl & conc. HNO_3 . Salt A gives alkaline gas B with NaOH that gas 'B' is oxidised by $CaOCl_2$ gives gas C. Gas C when combines with 'Ca' gives compound D compound D on hydrolysis give gas B and compound E. Compound E on exposure gives white solid F. Identify A to F

13.
 - (i) The yellow coloured precipitate of compound (A) is formed on passing H_2S through a neutral solution of salt (B).
 - (ii) A is soluble in hot dilute HNO_3 but insoluble in yellow ammonium sulphide
 - (iii) The solution of (B) on treatment with small quantity of NH_3 gives white precipitate which becomes soluble in excess of it forming a compound (C).
 - (iv) The solution of (B) gives white precipitate with small concentration of KCN which becomes soluble in excess of this reagent forming a compound (D)
 - (v) The solution of (D) on treatment with H_2S gives (A),
 - (vi) The solution of $BaCl_2$ gives white precipitate of compound (E) which is insoluble in conc.

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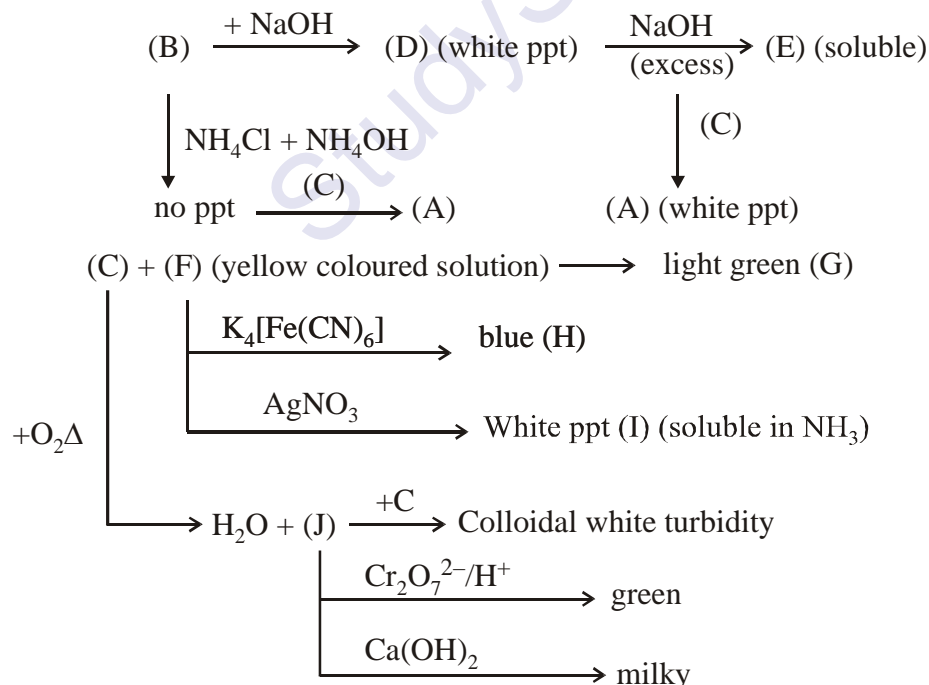
Identify (A) to (E) and give chemical equations for the reactions at steps (i) to (iii) to (vi) .

- 14.** (i) A black mineral (A) on treatment with dil NaCN solution in presence of air gives clear solution of (B) and (C).
 (ii) Solution of (B) on reaction with Zn gives a ppt of metal (D).
 (iii) (D) dissolve in dil. HNO_3 and resulting solution gives white ppt. (E) with dil. HCl .
 (iv) (E) on fusion with Na_2CO_3 gives (D).
 (v) E dissolves aq. solution of Ammonia giving a colourless solution of (F).
 Identify (A) to (F) .

- 15.** (A) is scarlet (reddish-orange) inorganic salt insoluble in H_2O . (A) on reaction with HNO_3 gives blackish-brown residue (B) and colourless solution of (C). (C) gives yellow ppt with KI solution as well as with K_2CrO_4 . (C) also gives black ppt (D) with H_2S in HCl solution; pt (D) dissolves in dil. HNO_3 . (B) on heating with conc. HNO_3 and $\text{Mn}(\text{NO}_3)_2$ forms pink coloured solution (E). Identify (A), (B), (C) (D) and (E).

- 16.** Chromite are (A) (FeCr_2O_4) is fused with NaOH in presence of H_2O_2 when yellow coloured solution (B) and residue (C) are obtained. (C) is separated by filtration and dissolved in conc. HCl forming a yellow coloured solution (D). (D) gives red colour with NH_4CNS and blue colour with $\text{K}_4[\text{Fe}(\text{CN})_6]$. (D) changes to green (E) when Zn is added into it, however, H_2 gas if passed into (D) has no effect. (B) changes to orange (F) on reaction with dil. H_2SO_4 and again (F) changes to (B) on adding NaOH . (F) on reaction with NH_4Cl and subsequent heating gives G (green) and H (gas). Identify (B) to (H) and explain reactions.

- 17.** Colourless salt (A) (insoluble in water) + dil $\text{H}_2\text{SO}_4 \longrightarrow (\text{B}) + \text{C}(\text{g})$



- 18.** (A) is binary orange coloured compound of a univalent cation. 1.422 g of (A) reacts completely with 0.321 g of sulphur in an evacuated and sealed tube to give 1.743 g of a white crystalline solid (B) that forms hydrated double salt (C) with $\text{Al}_2(\text{SO}_4)_3$; what are (A), (B) and (C) and explain

reactions .

19. A solution may contain any of the following ions : Fe^{3+} , Ni^{2+} , Cr^{3+} , Zn^{2+} , Mn^{2+} . Based on the following experiment nd results therein, indicate which of the ions would be present? Indicate any wrong information, if any.
- (i) The original solution is treated with $(\text{NH}_4)_2\text{S}$ (a substitute of H_2S) in a buffered basic solution. A dark precipitate is obtained.
 - (ii) The ppt for (a) dissolves in aqua regia.
 - (iii) The filtrate after separating ppt in (a) is treated with NaOH and H_2O_2 . A dark ppt is separated. Filtrate is colourless.
 - (iv) The ppt from (c) dissolves in HCl (aq) giving a coloured solution.
 - (v) The solution from (d) is treated with aqueous NH_3 . A dark ppt forms.
 - (vi) The ppt form (e) is soluble in HCl (aq) and solution develops an intense red colour when treated with SCN^- (aq.)
20. Two solid laboratory reagents 'A' and 'B' give the following reactions :
- Compound A :**
- (i) On strongly heating it gives two oxides of sulphur.
 - (ii) On adding aqueous NaOH solution to its aqueous solution a dirty green precipitate is obtained, which starts turning brown on exposure to air
- Compound B :**
- (iii) It imparts green colour to the flame
 - (iv) Its solution does not give a precipitate on passing H_2S .
 - (v) When it is heated with solid $\text{K}_2\text{Cr}_2\text{O}_7$ and concentrated H_2SO_4 , a red gas is evolved. The gas when passed in an aqueous solution of NaOH , turns it yellow.
21. A light green crystalline compound responds to the following test :
- (i) Its aqueous solution gives a brown precipitate or coloration with alkaline $\text{K}_2[\text{HgI}_4]$ solution.
 - (ii) Its aqueous solution gives a blue colour with $\text{K}_3\text{Fe}(\text{CN})_6$ solution.
 - (iii) Its solution in hydrochloric acid gives a white precipitate with BaCl_2 solution. Identify the ions present and suggest the formula of the compound.
22. An aqueous solution of gas (X) shows the following reactions :
- (i) It turns red litmus blue
 - (ii) When added in excess to a copper sulphate solution, a deep blue colour is obtained
 - (iii) On addition of FeCl_3 solution, a brown precipitate, soluble in dilute HNO_3 is obtained.
- Identify (X) and give equation for the reactions at steep (ii) and (iii).
23. A certain compound (X) is used in laboratory for analysis, its aqueous solution gives the following reactions.
- (i) On adding copper sulphate, a brown precipitate is obtained which turns white on addition of excess of $\text{Na}_2\text{S}_2\text{O}_3$ solution.
 - (ii) On addition of Ag^+ ion solution a yellow curdy precipitate is obtained which is insoluble in ammonium hydroxide.
- Identify (X) and give equations for the reactions at step (i) and (ii).
24. A compound on heating with an excess of caustic soda solution liberates a gas (B) which gives white fumes on exposure of HCl . Heating it continued to expel the gas completely. The resultant alkaline solution again liberates the same gas (B) when heated with zinc powder. However the

QUALITATIVE ANALYSIS

compound (A), when heated alone does not give nitrogen. Identify (A) and (B).

25. An unknown solid mixture contains one or two of the following : CaCO_3 , BaCl_2 , AgNO_3 , Na_2SO_4 , ZnSO_4 and NaOH . The mixture is completely soluble in water and the solution gives pink colour with phenolphthalein. When dilute hydrochloric acid is gradually added to above solution, a precipitate is formed which dissolves with further addition of the acid. What is/are present in the solid ?

26. A colorless solid (A) liberates a brown gas (B) on acidification, a colourless alkaline gas (C) on treatment with NaOH , and a colourless non-reactive gas (D) on heating. If heating of the solid continued, it completely disappears. Identify (A) to (D).

27. An aqueous solution of gas (X) gives the following reactions :
 - (i) It decolorizes an acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution
 - (ii) On boiling it with H_2O_2 , cooling it and then addition an aqueous solution of BaCl_2 a precipitate insoluble in dil. HCl is obtained.
 - (iii) On passing H_2S in the solution, a white turbidity is obtained.
 Identify (X) and give equations for the reactions at steps (i), (ii), (iii).

28. A black colored compound (A) on reaction with dil. H_2SO_4 gives a gas (B) which on passing in a solution of an acid (C) gives a white turbidity (D). Gas (B) when passed in acidified solution of (E) gives a precipitate (F) soluble in dilute HNO_3 . After boiling this solution when excess of NH_4OH is added, a blue coloured compound (G) is formed. To this solution on adding of acetic acid and aqueous potassium ferrocyanide a chocolate coloured precipitate (H) is obtained. On addition of an aqueous solution of BaCl_2 to an aqueous solution of (E), a white precipitate insoluble in HNO_3 is obtained. Identify (A) to (H).

29.
 - (i) The yellow coloured precipitate of compound (A) is formed on passing H_2S through a neutral solution of salt (B).
 - (ii) A is soluble in hot dilute HNO_3 but insoluble in yellow ammonium sulphide
 - (iii) The solution of (B) on treatment with small quantity of NH_3 gives white precipitate which becomes soluble in excess of it forming a compound (C).
 - (iv) The solution of (B) gives white precipitate with small concentration of KCN which becomes soluble in excess of this reagent forming a compound (D)
 - (v) The solution of (D) on treatment with H_2S gives (A),
 - (vi) The solution of BaCl_2 gives white precipitate of compound (E) which is insoluble in concentrated HNO_3 .

ANSWERS

LEVEL - I

- | | | | | | | |
|---------|-------|-------|-------|--------|-------|-------|
| 1. A | 2. C | 3. C | 4. A | 5. B | 6. C | 7. D |
| 8. D | 9. D | 10. B | 11. C | 12. A | 13. B | 14. B |
| 15. C | 16. D | 17. B | 18. A | 19. D | 20. D | 21. D |
| 22. C | 23. B | 24. A | 25. A | 26. C | 27. D | 28. D |
| 29. B | 30. C | 31. A | 32. B | 33. C | 34. A | 35. B |
| 36. D | 37. D | 38. B | 39. B | 40. D | 41. B | 42. C |
| 43. B | 44. C | 45. B | 46. B | 47. AC | 48. D | 49. B |
| 50. BCD | | | | | | |

LEVEL - II

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|-------|-------|-------|-------|-------|-------|-------|
| 1. A | 2. C | 3. A | 4. B | 5. B | 6. C | 7. B |
| 8. B | 9. B | 10. B | 11. A | 12. C | 13. D | 14. C |
| 15. B | 16. B | 17. A | 18. D | 19. A | 20. B | 21. A |
| 22. C | 23. A | 24. A | 25. B | 26. D | 27. D | 28. D |
| 29. B | 30. B | 31. B | 32. B | 33. B | 34. A | 35. D |
| 36. A | 37. D | 38. D | 39. A | 40. C | 41. C | 42. C |
| 43. A | 44. D | 45. D | 46. A | 47. C | 48. C | 49. B |
| 50. C | 51. C | 52. B | 53. D | 54. C | 55. A | 56. A |
| 57. A | 58. C | 59. A | 60. A | | | |

WRITE UPS

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|-------|-------|-------|-------|-------|-------|-------|
| 1. C | 2. B | 3. D | 4. C | 5. D | 6. B | 7. C |
| 8. A | 9. B | 10. B | 11. A | 12. D | 13. D | 14. C |
| 15. D | 16. A | 17. A | 18. B | 19. D | 20. A | 21. A |
| 22. A | 23. B | 24. A | 25. A | 26. A | 27. C | 28. A |
| 29. C | 30. A | | | | | |

ASSERTION-REASONS

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|------|------|-------|------|------|------|------|
| 1. A | 2. C | 3. C | 4. A | 5. B | 6. A | 7. A |
| 8. A | 9. A | 10. D | | | | |

QUALITATIVE ANALYSIS

MATCH THE COLUMN

- | | | | |
|--------------|-------------|-------------|----------|
| 1. A → p, r | B → p | C → q | D → s |
| 2. A → s | B → p | C → s | D → q, r |
| 3. A → p, s | B → s | C → q | D → r |
| 4. A → s | B → r | C → p | D → q |
| 5. A → p, r | B → q, s | C → p, r, s | D → p, r |
| 6. A → p, q | B → p, q | C → p, q | D → p, r |
| 7. A → s | B → r | C → p | D → q |
| 8. A → q, s | B → q, r | C → s | D → p, r |
| 9. A → s | B → r | C → p | D → q |
| 10. A → r | B → s | C → p | D → q |
| 11. A → p, r | B → p, r, s | C → p, r | D → q, r |

IIT-JEE

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|--|--|---------|---------|
| 1. Fe^{3+} | 2. CrO_2Cl_2 | 3. True | 4. True |
| 5. D | 6. A | 7. B | 8. AB |
| 9. C | 10. B | | |
| 11. ABD | 12. BC | 13. B | 14. D |
| 15. D | 16. C | 17. A | |
| 18. C | 19. B | 20. B | |
| 21. $\text{CO}_2, \text{H}_2\text{O}, \text{Na}_2\text{CO}_3$ | 22. $\text{FeCl}_2, \text{NH}_4\text{Cl}$ | | |
| 23. $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}, \text{FeSO}_4, \text{FeSO}_4 \cdot \text{NO}, \text{Fe}_2\text{O}_3, \text{SO}_2, \text{SO}_3$ | | | |
| 24. $\text{CO}_2, \text{H}_2\text{O}, \text{KHCO}_3, \text{K}_2\text{CO}_3, \text{BaCO}_3$ | 25. $\text{NH}_4^+, \text{Fe}^{2+}, \text{SO}_4^{2-}, \text{Cl}^-$ | | |
| 26. $\text{NH}_4^+, \text{Fe}^{2+}, \text{SO}_4^{2-}, \text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ | | | |
| 27. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \cdot \text{Cr}_2\text{O}_3, \text{N}_2, \text{Mg}_3\text{N}_2, \text{NH}_3$ | 28. $\text{KO}_2, \text{K}_2\text{SO}_4, \text{Al}_2(\text{SO}_4)_3$ | | |
| 29. $\text{Pb}_3\text{O}_4, \text{PbO}_2, \text{PbI}_2$ | 30. $\text{NH}_3, \text{CaCO}_3$ | | |
| 33. (a) Na_2O_2 (b) turns blue | 35. Cu^{2+} | | |
| 37. $\text{ZnS}, \text{H}_2\text{S}, \text{ZnSO}_4, \text{S}, \text{SO}_2$ | | | |
| 38. $\text{CrO}_2\text{Cl}_2, \text{Na}_2\text{CrO}_4, \text{PbCrO}_4, \text{iodide of millon's base}, \text{NH}_4\text{Cl}$ | | | |
| 39. $\text{HgI}_2, \text{KI}, \text{HgS}, \text{Hg}$ | | | |