

Salt Analysis(Qualitative Inorganic Chemistry)

1. Solubility & Colour of Compounds

- Q 1. Which one has the minimum solubility product?
 (A) AgCl (B) AlCl₃
 (C) BaCl₂ (D) NH₄Cl
- Q 2. Which of the following sulphate is insoluble in water?
 (A) CuSO₄ (B) CdSO₄
 (C) PbSO₄ (D) Bi₂(SO₄)₃
- Q 3. Mark the compound which is soluble in Hot water?
 (A) Lead Chloride (B) Mercurous chloride
 (C) Stronsium Sulphate (D) Silver chloride
- Q 4. Which of the following basic radical is most difficult to precipitate?
 (A) Fe³⁺ (B) Cu²⁺ (C) Ba²⁺ (D) NH₄⁺
- Q 5. Which of the following is most soluble in water?
 (A) AgCl (B) AgBr
 (C) AgI (D) AgF
- Q 6. PbCl₂ dissolves in
 (A) NH₃ (B) H₂O
 (C) Boiling H₂O (D) None of these
- Q 7. Colour of Nickel chloride solution is
 (A) Pink (B) Black
 (C) Colourless (D) Green
- Q 8. Which of the following is Coloured?
 (A) PbCl₂ (B) PbI₂
 (C) AgCl (D) AgI
- Q 9. Which of the following compound is red?
 (A) PbO (B) PbO₂
 (C) Pb₃O₄ (D) K₂Cr₂O₇
- Q 10. Ni – compound are generally green
 (A) Blue (B) Green
 (C) Red (D) Brown
- Q 11. Which of the following compound is Red?
 (A) Ni(DMG)₂ (B) Cu₂[Fe(CN)₆]
 (C) (NH₄)₂[Co(SCN)₄] (D) Fe(SCN)₃
- Q 12. Mercurous ion is represented as
 (A) Hg₂²⁺ (B) Hg²⁺
 (C) Hg + Hg²⁺ (D) Hg⁺
- Q 13. Which of the following metal form compounds with pink colour?
 (A) Ni (B) Cr (C) Co (D) Fe³⁺

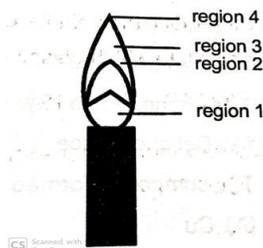
2. Properties of Gases & Compounds

- Q 1. Zn and Hg metals can be distinguished by using
 (A) NaOH (B) HCl
 (C) Both A & B (D) None of these
- Q 2. Which Metal dissolve in both NH₃ & NaOH ?
 (A) Zn (B) Fe
 (C) Al (D) Pb
- Q 3. Bromine is recognized by its
 (A) Pungent smelling dark red vapours
 (B) Ability to turn FeSO₄ solution black
 (C) Ability to turn starch iodide paper blue
 (D) Ability to dissolve in CS₂ to give an orange colour to the organic layer
- Q 4. Hydrochloric acid gas can be identified by its
 (A) Characteristic pungent smell.
 (B) Reaction with ammonia to give white fumes of NH₄Cl.
 (C) Reaction AgNO₃ to give white precipitate insoluble with in NH₄OH.
 (D) Reaction with MnO₂ to liberate Cl₂ gas.
- Q 5. When concentrated H₂SO₄ is added to dry KNO₃, brown fumes evolve. These brown fumes are of
 (A) SO₂ (B) SO₃
 (C) NO (D) NO₂
- Q 6. A gas X is passed through water to form saturated solution. The aqueous solution on treatment with silver Nitrate gives a white precipitate. The saturate aqueous solution also dissolves Magnesium ribbon with evolution of a colourless gas Y. Identify X & Y **[IIT JEE 2002]**
 (A) X = CO₂, Y = Cl₂ (B) X = Cl₂, Y = CO₂,
 (C) X = Cl₂, Y = H₂ (D) X = H₂, Y = Cl₂
- Q 7. Which gas has a fishy smell & turns red litmus paper blue?
 (A) NH₃ (B) PH₃
 (C) H₂S (D) N₂O
- Q 8. Which of the following gas has rotten fish smell?
 (A) NH₃ (B) PH₃
 (C) CO₂ (D) CO
- Q 9. CO₂ gas & SO₂ gas are distinguished by using
 (A) NaOH (B) NH₃
 (C) K₂Cr₂O₇ (D) HCl
- Q 10. Which of the following is called Tear gas?
 (A) CoCl₂ (B) CCl₃NO₂

- (C) N_2O (D) None of these
- Q 11. A gas having pungent smell, absorbs in alkaline Pyrogallol solution is
 (A) CO_2 (B) CO
 (C) O_2 (D) N_2
- Q 12. NH_3 & HCl gas can be distinguished by using
 (A) Litmus Paper (B) Base
 (C) Acid (D) All of these

3. Flame Test, Borax Bead & Phosphate Bead test

- Q 1. ZnO is white when cold & on heating, colour become
 (A) Red (B) Blue (C) Yellow (D) Black
- Q 2. Pb_3O_4 is in cold & is in hot
 (A) Red, Blue (B) Red, Yellow
 (C) Red, Chocolate (D) Red, Green
- Q 3. Ferrous salt in hydrated form is& in anhydrous form it is
 (A) Green, white (B) Green, Blue
 (C) Red, Green (D) Blue, white
- Q 4. The hottest region of Bunsen flame shown in the figure below is [JEE Main 2016]



- (A) Region 2 (B) Region 3
 (C) Region 4 (D) Region 1
- Q 5. The flame test is given by S block Metals due to
 (A) Low Ionisation Energy
 (B) Low excitation energy
 (C) High Ionisation energy
 (D) High excitation energy
- Q 6. The colour of Ca in flame test is
 (A) Brick Red (B) Crimson Red
 (C) Lilac (D) Apple Green
- Q 7. On occasion of marriage, the fireworks are used, which of the following gives green flame?
 (A) Ba (B) K (C) Be (D) Na

- Q 8. Which of the following can be detected by borax bead test?
 (A) Cu^{2+} (B) Zn^{2+}
 (C) Cr^{3+} (D) Fe^{3+}
- Q 9. The salt used for performing borax bead test in qualitative inorganic analysis is
 (A) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
 (B) $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$
 (C) $NaNH_4HPO_4 \cdot 4H_2O$
 (D) $Na_2B_4O_7 \cdot 10H_2O$
- Q 10. In borax bead test, a colourless bead becomes coloured on being heated with a colourless metal salt. It happens due to formation of
 (A) the borate & meta borate of the metal
 (B) Boric Acid
 (C) the orthoborate of the Metal
 (D) the hexaborate of the metal
- Q 11. Pick out the incorrect statement
 (A) BO_3^{2-} ion is triangular polar in which boron is sp^3 hybridised
 (B) Boric acid contains planar triangular BO_3^{2-} units which are bonded together through hydrogen bonds into two dimensional sheets
 (C) Borazine is isoelectronic with benzene. In both compounds, the π electrons are delocalised
 (D) The structure of boron nitride resembles that of diamond.

For the given passage

- (i) $A \xrightarrow{\Delta} \text{Glassy Transparent Bead}$ (B)
 $(B) + CuSO_4 \longrightarrow \text{Coloured Bead}$ (C)
- (ii) $A + H_2SO_4 (\text{conc.}) + CH_3CH_2OH \xrightarrow{\text{ignite}} \text{Green Flame}$ (D)
- (iii) Aqueous Solution of A is Alkaline

- Q 12. Identify A
 (A) $NaNH_4HPO_4 \cdot 4H_2O$ (B) $Na_2B_4O_7 \cdot 10H_2O$
 (C) $CuSO_4 \cdot 5H_2O$ (D) None of these
- Q 13. What is the formula of Glassy bead (B)?
 (A) $NaPO_3$ (B) $NaBO_2$
 (C) $NaBO_2 + B_2O_3$ (D) None of these
- Q 14. Identify C
 (A) $Cu_3(PO_4)_2$ (B) $CuSO_4$
 (C) $Cu(BO_2)_2$ (D) None of these
- Q 15. Identify D
 (A) $(CH_3)_3BO_3$ (B) $(C_2H_5)_3BO_3$
 (C) H_3BO_3 (D) None of these

4. Bead Test, Cobalt Nitrate & Charcoal test

- Q 1. The Salt used for performing 'bead test' in qualitative inorganic analysis is
 (A) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
 (B) $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$
 (C) $Na(NH_4)HPO_4 \cdot 4H_2O$
 (D) $CaSO_4 \cdot 2H_2O$
- Q 2. In phosphate bead test, colour obtained by Cr is
 (A) Blue (B) Green
 (C) Red (D) Yellow
- Q 3. In Phosphate bead test, the bead formed is
 (A) $NaPO_3$ (B) P_2O_3
 (C) P_2O_5 (D) $NaPO_4$
- Q 4. Which of the following metals have violet bead in phosphate bead test?
 (A) Violet (B) Green
 (C) Blue (D) Yellow
- Q 5. In cobalt Nitrate Test, the mixture is heated in
 (A) Oxidising Flame (B) Reducing Flame
 (C) Neutral Flame (D) None of these
- Q 6. In cobalt Nitrate test, the colour obtained by Al is
 (A) white (B) Blue
 (C) Green (D) Red
- Q 7. In cobalt Nitrate test, which metal zincate has pink colour?
 (A) Ca (B) Sn (C) Mg (D) Zn
- Q 8. In charcoal cavity test, the metal gives characteristics colour of
 (A) Metal cobalt oxide (B) Metal Zincate
 (C) Metal Oxide (D) Metal
- Q 9. Which metal has grayish white colour & doesn't mark on paper?
 (A) Pb (B) Sn (C) Cu (D) Ag
- Q 10. Which of the following compounds sublimes on heating?
 (A) NH_4Cl (B) Hg_2Cl_2
 (C) As_2O_3 (D) All of these
- Q 11. In charcoal cavity test, cupric Red fragments are obtained by
 (A) Ag (B) Pb (C) Cu (D) Sn

5. Class A(i) Anions

- Q 1. Class A(i) anions produces gas on action of
 (A) dilute HCl (B) Conc. HCl
 (C) Doesn't produce gas (D) on heating
- Q 2. Which of the following is class A(ii) anions?
 (A) Cl^- (B) Br^-
 (C) NO_3^- (D) All of these
- Q 3. Which salt would give SO_2 with hot and dil. H_2SO_4 and also decolorizes Br_2 water:
 (A) Na_2SO_3 (B) $NaHSO_4$
 (C) Na_2SO_4 (D) Na_2S
- Q 4. An inorganic compound 'A' is dissolved in dilute hydrochloric acid and warmed. A gas 'B' is produced. When a filter paper moistened with potassium iodate and the starch solution is exposed to the gas it turns blue. The gas B and the compound A are
 (A) SO_2 and Na_2SO_3 (B) SO_3 and Na_2SO_4
 (C) H_2S and Na_2S (D) H_2S and Na_2SO_3
- Q 5. A mixture contains Cl^- and I^- ions, which of the following tests exclusively confirm the presence of chloride ion?
 (A) Heating the mixture with Conc. H_2SO_4 .
 (B) Heating the mixture with $K_2Cr_2O_7$ & H_2SO_4 .
 (C) Add excess of $AgNO_3$ solution to the neutralised sodium carbonate extract. Wash the precipitate with dilute ammonia and add dilute nitric acid to the washing.
 (D) Add excess lead acetate to the neutralised sodium carbonate extract. Boil the precipitate with water and cool
- Q 6. Which of the following halides is almost insoluble in concentrated ammonia?
 (A) AgI (B) AgF
 (C) $AgBr$ (D) $AgCl$
- Q 7. The brown ring test for NO_3^- is due to formation of the complex ion with formula
 (A) $[Fe(H_2O)_6]^{2+}$ (B) $[Fe[NO(CN)_5]^{2-}$
 (C) $[Fe(H_2O)_5NO]^{2+}$ (D) $[Fe(H_2O)(NO)_5]^{2+}$
- Q 8. On treatment with dilute HCl, gives a pungent smelling gas and a yellow precipitate. The salt gives green flame when tested. The solution gives a yellow precipitate with potassium chromate. The salt is
 (A) $NiSO_4$ (B) BaS_2O_3

- Q 9. (C) PbS_2O_3 (D) $CuSO_4$
 A substance on treatment with dilute H_2SO_4 liberates a colourless gas which produces
 (i) turbidity with Baryta water
 (ii) turns acidified dichromate solution green
 The reaction indicates the presence of
 (A) $C_2O_3^{2-}$ (B) S^{2-}
 (C) SO_3^{2-} (D) NO_2^-
- Q 10. A salt which gives CO_2 with conc. H_2SO_4 & also decolourised acidified $KMnO_4$ on warming is
 (A) HCO_3^- (B) CO_3^{2-}
 (C) oxalate ion (D) Acetate ion
- Q 11. When conc. H_2SO_4 is added to dry KNO_3 , brown fumes evolve. These brown fumes are of
 (A) SO_2 (B) SO_3
 (C) NO (D) NO_2
- Q 12. A salt gives violet vapours when treated with conc. H_2SO_4 , it contains
 (A) Cl^- (B) I^-
 (C) Br^- (D) NO_3^-
- Q 13. The acidic solution of a salt produced a deep blue colour with starch solution. The salt may be
 (A) Chloride (B) Nitrite
 (C) Acetate (D) Iodide
- Q 14. $[X] + H_2SO_4 \longrightarrow [Y]$, a colourless gas with irritating smell
 $[X] + K_2Cr_2O_7 + H_2SO_4 \longrightarrow \text{Green Solution}$
 [X] & [Y] are
 (A) SO_3^{2-} , SO_2 (B) Cl^- , HCl
 (C) S^{2-} , HCl (D) CO_3^{2-} , CO_2
- Q 15. A sodium salt of an unknown anion when treated with $MgCl_2$ gives white precipitate only on boiling. The anion is
 (A) SO_4^{2-} (B) HCO_3^-
 (C) CO_3^{2-} (D) NO_3^-
- 6. Class A(i) & Class A(ii) Anions**
- Q 1. The species present in the solution when dissolved in water is
 (A) CO_2 , H_2CO_3 , HCO_3^- , CO_3^{2-}
 (B) H_2CO_3 , CO_3^{2-}
 (C) H_2CO_3 , HCO_3^- , CO_3^{2-}
 (D) CO_2 , H_2CO_3
- Q 2. A violet colour is obtained on adding Cl_2 water to a solution of Potassium Halide in presence of Chloroform and on adding excess of Cl_2 water, violet colour disappears and a colourless solution appears. This test shows the presence of
 (A) Iodide ion (B) Bromide ion
 (C) Chloride ion (D) Iodide & Bromide ion
- Q 3. Which of the following will not give positive chromyl chloride test?
 (A) Copper Chloride, $CuCl_2$
 (B) Mercuric Chloride, $HgCl_2$
 (C) Zinc Chloride, $ZnCl_2$
 (D) Anilinium Chloride, $C_6H_5NH_3Cl$
- Q 4. When a mixture of Solid $NaCl$, Solid $K_2Cr_2O_7$ is heated with conc. H_2SO_4 , orange – red vapours are obtained. Vapours are of
 (A) Chromous chloride (B) Chromyl chloride
 (C) Chromic Chloride (D) Chromic Sulphate
- Q 5. A gas is passed over $NaOH$ gives yellow solution which forms yellow ppt. after passing on lead acetate solution. The gas is
 (A) CrO_2 (B) $Cr_2O_7^{2-}$
 (C) CrO_2Cl_2 (D) CrO_4^{2-}
- Q 6. A white sodium salt dissolves readily in water to give a solution which is neutral to litmus. When silver Nitrate solution is added to the solution, a white precipitate is obtained which does not dissolve in dilute HNO_3 . The anion could be
 (A) CO_3^{2-} (B) Cl^-
 (C) SO_4^{2-} (D) S^{2-}
- Q 7. On adding excess of KI solution to $CuSO_4$ solution, we get a precipitate P and another liquor M. Select the correct pairs
 (A) P = Cu_2I_2 , M = I_2 solution
 (B) P = Cu_2I_2 , M = KI_3 solution
 (C) P = CuI_2 , M = I_2 solution

- (D) P = CuI₂, M = KI₃ solution
- Q 8. When I₂ is passed over KCl, KBr, KF
 (A) Cl₂ & Br₂ are evolved
 (B) Cl₂ is evolved
 (C) Cl₂, F₂ & Br₂ are evolved
 (D) None of these
- Q 10. A metal salt solution gives yellow ppt with potassium chromate in acetic acid, a white ppt with dilute sulphuric acid, but gives no ppt with sodium chloride or iodide, it is:
 (A) Lead carbonate (B) Basic Lead carbonate
 (C) Barium Nitrate (D) Strontium Nitrate
- Q 10. A metal salt solution gives yellow ppt with silver Nitrate. The ppt dissolves in dilute Nitric Acid as well as ammonium hydroxide. The solution contains
 (A) Bromide (B) Iodide
 (C) Phosphate (D) Chromate
- Q 11. When CuSO₄ is treated with excess of KCN, the product formed is
 (A) [Cu(CN)₄]²⁻
 (B) Cu²⁺ get reduced to form [Cu(CN)₄]³⁻
 (C) Cu(CN)₂
 (D) CuCN
- Q 12. A mixture on heating with conc. H₂SO₄ and MnO₂, liberates brown vapour of
 (A) Br₂ (B) NO₂ (C) HBr (D) I₂
- Q 13. Nitrate is confirmed by ring test. The brown colour of the ring is due to formation of
 (A) Ferrous Nitrite (B) Nitroso Ferrous Nitrate
 (C) Ferrous Nitrate (D) FeSO₄.NO₂
- Q 14. A pale yellow crystalline solid insoluble in water but soluble in CS₂ is allowed to react with nitric oxide to give X & Y. X is colourless gas with pungent colour. X is further allowed to react in aqueous medium with nitric oxide to yield Z & T. compound X, Z & T are
 (A) SO₃, H₂SO₃, N₂O (B) SO₂, H₂SO₄, N₂O
 (C) SO₂, H₂SO₄, N₂ (D) SO₃, H₂SO₃, N₂
- ### 7. Class B Anions
- Q 1. Which of the following on heating produces a gas which generates laughing hysteria?
 (A) NH₄NO₂ (B) NH₄NO₃
 (C) (NH₄)₂Cr₂O₇ (D) Pb(NO₃)₂
- Q 2. Which of the following reaction is used to test group B anions?
 (A) Precipitation Reaction (B) Redox Reaction
 (C) Acid – Base Reaction (D) Both A & B
- Q 3. The SO₄²⁻ ion gives yellow ppt with Hg(NO₃)₂. The ppt is
 (A) HgSO₄ (B) HgSO₄.2H₂O
 (C) HgO (D) BaSO₄
- Q 4. A compound produces deep blue colour with H₂O₂, which is unstable. The compound contains anions
 (A) CrO₄²⁻ (B) Cr₂O₇²⁻
 (C) MnO₄⁻ (D) S₂O₃²⁻
- Q 5. A solution gives white ppt with CaCl₂ solution & the ppt dissolve in dilute H₂SO₄ and decolourises acidic KMnO₄ solution. The solution contains
 (A) C₂O₄²⁻ ion (B) CO₃²⁻ ion
 (C) SO₄²⁻ ion (D) CH₃COO⁻ ion
- Q 6. Sodium Borates on reaction with conc. H₂SO₄ and C₂H₅OH gives a compound A which burns with a green edged flame. Compound A is
 (A) H₂B₄O₇ (B) (C₂H₅)₂B₄O₇
 (C) H₃BO₃ (D) (C₂H₅)₃BO₃
- Q 7. CrO₃ dissolves in aqueous NaOH to give
 (A) Cr₂O₇²⁻ (B) CrO₄²⁻
 (C) Cr(OH)₃ (D) Cr(OH)₂
- Q 8. (NH₄)₂Cr₂O₇ on heating gives a gas which is also given by
 (A) Heating NH₄NO₂ (B) Heating NH₄NO₃
 (C) Mg₃N₂ + H₂O (D) Na compound + H₂O₂
- Q 9. Which of the following dissolve glass ?
 (A) HCl (B) HBr
 (C) HI (D) HF
- Q 10. Which anion gives yellow precipitate with ammonium molybdate?
 (A) Borates (B) Phosphate
 (C) Arsenate (D) Both B & C

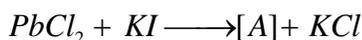
8. Classification of cations

- Q 1. A Solution of the mixture was prepared in conc. HCl; on diluting this solution with water a turbidity appeared. This indicates the presence of
(A) As^{3+} (B) Sb^{3+}
(C) Hg^{2+} (D) Bi^{3+}
- Q 2. An aqueous solution of substance give a white precipitate on treatment with dil. HCl, which dissolves on heating when hydrogen sulphide 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
- Q 3. The best explanation for the solubility of MnS in dil. HCl is that
(A) K_{SP} of $MnCl_2$ is less than that of MnS
(B) Conc. 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
- Q 4. Which of the cation(s) will(Shall) not be precipitated by H_2S is presence of ammonia?
(A) Co^{2+} (B) Mn^{2+}
(C) Cd^{2+} (D) Fe^{3+}
- Q 5. The reagents NH_4Cl and aqs NH_3 will ppt.
(A) Ca^{2+} (B) Al^{3+}
(C) Mg^{2+} (D) Zn^{2+}
- Q 6. A suspension contains ZnS, CdS, HgS, Ag_2S and FeS. It is treated with 2N HCl and filtrate contains mostly
(A) Zn and Hg ions (B) Ag and Fe ions
(C) Zn and Fe ions (D) Cu and Hg ions
- Q 7. The product/s got on passing H_2S through a solution of Hg_2^{2+} is
(A) HgS (B) $Hg_2S + HgS$
(C) $HgS + Hg$ (D) Hg_2S
- Q 8. If HCl is not added before passing H_2S in the second group, it may result in the
(A) incomplete precipitation of the II group sulphide
(B) precipitation of sulphides of cations belonging to subsequent groups
(C) precipitation of sulphur
(D) precipitation of lead as lead sulphide
- Q 9. A mixture contains manganese (II) sulphide and cobalt sulphide. Dilute hydrochloric acid is added. Which of the following statements is correct?
(A) Both are soluble in dil. HCl
(B) Both are insoluble in dil. HCl
(C) MnS is soluble in HCl while CoS is insoluble
(D) CoS is soluble in HCl while MnS is insoluble
- Q 10. Which of the following cations can be detected by passing H_2S in acid medium?
(1) Cu^{2+} (2) Pb^{2+}
(3) Bi^{2+} (4) Zn^{2+}
Select the correct answer using the codes given below :
(A) 1, 2, 3 and 4 (B) 1 and 2
(C) 3 and 4 (D) 1, 2 and 3
- Q 11. **Assertion (A)** : In acidic medium Zn^{2+} is not precipitated by S^{2-} ions.
Reason (R) : Common ion effect reduces the concentration of S^{2-} to a minimum level.
(a) Both A and are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true
- Q 12. The sulphides of which of the following groups of elements are soluble in yellow ammonium sulphide?
(A) As, Sb & Sn (B) As, Cd & Sn
(C) Cd, Cu & Bi (D) Hg, Cu & Cd
- Q 13. Which of the following pairs can not be separated by adding NH_4Cl & NH_4OH to the mixture?
(A) Fe^{3+} , Ca^{2+} (B) Cr^{3+} , Fe^{3+}
(C) Cr^{3+} , Ba^{2+} (D) Al^{3+} , Mg^{2+}
- Q 14. Which one of the following can be used in place of NH_4Cl for the identification of the third group radicals?
(A) NH_4NO_3 (B) $(NH_4)_2SO_4$
(C) $(NH_4)_2S$ (D) $(NH_4)_2CO_3$
- Q 15. When H_2S gas is passed through the HCl containing aqueous solution of $CuCl_2$, $HgCl_2$, $BiCl_3$ & $CoCl_2$, it does not precipitate out
(A) CuS (B) HgS
(C) Bi_2S_3 (D) CoS
- Q 16. Mark the correct statement

- (A) I group basic Radicals precipitate as chlorides
 (B) IV group basic radicals precipitates as sulphides
 (C) V group basic radicals precipitates as carbonates
 (D) All of the above statements are correct

9. Group I, Group II & Group III cations

- Q 1. In the given reaction below, compound A & B are



yellow ppt.



yellow ppt. Excess soluble

- (A) PbI_4 & $K_2[PbI_4]$ respectively
 (B) $K_2[PbI_4]$ & PbI_4 respectively
 (C) PbI_2 & $K_2[PbI_4]$ respectively
 (D) PbI_2 & $K_2[PbI_2]$ respectively
- Q 2. A salt on treatment with dilute HCl gives a pungent smelling gas & a yellow precipitate. The salt gives green flame when tested. The solution gives a yellow ppt. with K_2CrO_4 . The salt is
 (A) $NiSO_4$ (B) $BaSO_3$
 (C) $PbSO_3$ (D) $CuSO_4$
- Q 3. White substance dissolves in hot water. A black precipitate appears on passing H_2S gas in its aqueous solution. The black precipitate dissolves in hot HNO_3 . A white precipitate is obtained on adding concentrated H_2SO_4 in its solution. This white precipitate is
 (A) $BaSO_4$ (B) $SrSO_4$
 (C) $PbSO_4$ (D) $CdSO_4$
- Q 4. A metal salt solution forms a yellow precipitate with Potassium chromate in acetic acid, a white precipitate with dilute H_2SO_4 but gives no precipitate with NaCl or NaI. The salt is
 (A) Lead carbonate (B) Basic Lead Carbonate
 (C) Barium Carbonate (D) Strontium Carbonate
- Q 5. Identify the correct order of solubility of Na_2S , CuS & ZnS in aqueous solution
 (A) $CuS > ZnS > Na_2S$ (B) $ZnS > Na_2S > CuS$
 (C) $Na_2S > CuS > ZnS$ (D) $Na_2S > ZnS > CuS$

- Q 6. Of the following sulphides which one is insoluble in dilute acids but soluble in alkalies.

- (A) PbS (B) CdS
 (C) FeS (D) As_2S_3

- Q 7. A pale green crystalline metal salt of M dissolves freely in water. On standing it gives a brown ppt on addition of aqueous NaOH. The metal salt solution also gives a black ppt on bubbling H_2S in basic medium. An aqueous solution of the metal salt decolourises the pink colour of the permanganate solution. The metal in the metal salt solution is

- (A) Copper (B) Aluminium
 (C) Lead (D) Iron

- Q 8. A mixture of chloride of copper, cadmium, chromium, iron & Aluminium was dissolved in water with acidified with HCl & Hydrogen sulphide gas was passed for sufficient time. It was filtered, boiled & a few drops of Nitric Acid were added, while boiling to this solution ammonium chloride and sodium hydroxide were added in excess and filtered. The filtrate shall give test for

- (A) Sodium & Iron ion
 (B) Sodium, Chromium & Aluminum Ion
 (C) Aluminum & Iron Ion
 (D) Sodium, Iron, Cadmium & Aluminum Ion

- Q 9. Solution of chemical compound X reacts with $AgNO_3$ solution to form a white ppt. Y which dissolves in NH_4OH to give a complex Z. When Z is treated with dilute HNO_3 , Y reappears. The chemical compound X is

- (A) NaCl (B) CH_3Cl
 (C) NaBr (D) NaI

- Q 10. Which of the following compound on reaction with NaOH & Na_2O_2 gives yellow colour?

- (A) $Cr(OH)_3$ (B) $Zn(OH)_2$
 (C) $Al(OH)_3$ (D) None of these

- Q 11. Which of the following gives blood red colour with KCNS?

- (A) Cu^{2+} (B) Fe^{3+}
 (C) Al^{3+} (D) Zn^{2+}

- Q 12. Passing H_2S gas into a mixture of Mn^{2+} , Ni^{2+} , Cu^{2+} & Hg^{2+} ions in an acidified aqueous solution precipitates

- (A) CuS & HgS (B) MnS & CuS

- (C) MnS & NiS (D) NiS & HgS
- Q 13. An anion present in solution gives a white precipitate with $MgSO_4$ only on heating and not by mixing them in cold condition. The anion is
 (A) CO_3^{2-} (B) HCO_3^-
 (C) SO_3^{2-} (D) $C_2O_4^{2-}$

10. Group IV & Group V cations

- Q 1. On addition of a solution containing CrO_4^{2-} ions to the solution of Ba^{2+} , Sr^{2+} & Ca^{2+} ions, the first precipitate obtained will be
 (A) $CaCrO_4$ (B) $SrCrO_4$
 (C) $BaCrO_4$ (D) A mixture of all the three
- Q 2. Nessler's reagent is
 (A) K_2HgI_4 (B) $K_2HgI_4 + KOH$
 (C) $K_2HgI_2 + KOH$ (D) $K_2HgI_4 + KI$
- Q 3. Nessler's Reagent is used to detect
 (A) CrO_4^{2-} (B) PO_4^{3-}
 (C) MnO_4^- (D) NH_4^+
- Q 4. Dimethyl Glyoxime in a suitable solvent was refluxed for 10 minutes with pure pieces of nickel sheet. It results as
 (A) Red ppt. (B) Blue ppt.
 (C) yellow ppt. (D) No ppt.
- Q 5. Ferric ion forms a Prussian Blue coloured ppt of
 (A) $K_4[Fe(CN)_6]$ (B) $Fe_4[Fe(CN)_6]_3$
 (C) $KMnO_4$ (D) $Fe(OH)_3$
- Q 6. Prussian Blue is formed when
 (A) Ferrous Sulphate reacts with $FeCl_3$
 (B) Ferric Sulphate reacts with $K_4[Fe(CN)_6]$
 (C) Ammonium sulphate reacts with $FeCl_3$
 (D) Ferrous Ammonium sulphate reacts with $FeCl_3$
- Q 7. 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 colour less 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 brown residue
- Q 8. The group reagent for V group residue is $(NH_4)_2CO_3$; Na_2CO_3 cannot be used to precipitate these radicals because

- (A) $MgCO_3$ is soluble in Na_2CO_3
 (B) $MgCO_3$ will also be precipitated in V group
 (C) Na_2CO_3 is insoluble in water
 (D) Na_2CO_3 will decrease the K_{SP} of MCO_3
- Q 9. Magnesium carbonate is not precipitated 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 $(NH_4)_2CO_3$
- Q 10. The reagents NH_4Cl and aq. NH_3 will ppt.
 (A) Ca^{2+} (B) Al^{3+}
 (C) Mg^{2+} (D) Zn^{2+}
- Q 11. Magnesium gives a sky blue precipitate in alkaline medium using the reagent
 (A) DMG (B) o-phenanthroline
 (C) p-nitrobenzene azo resorcinol
 (D) cupferron
- Q 12. A scarlet coloured compound (I) on treatment with conc. HNO_3 gives achocolate brown ppt (II) and a filtrate. The filtrate on treatment with $NaOH$ followed by KI gives a yellow ppt (III). The compounds I, II and III are respectively
 (A) HgI_2 , HgO and Hg_2I_2
 (B) Pb_3O_4 , PbO_2 and PbI_2
 (C) $K_2Cr_2O_7$, Cr_2O_3 and K_2CrO_4
 (D) $Co(NO_3)_2$, CrO and CoI_2
- Q 13. NH_4SCN can be used to test, one or more out of Fe^{+3} , Co^{+2} and Cu^{+2}
 (A) Fe^{+3} only (B) Co^{+2} and Cu^{+2}
 (C) Fe^{+3} , Cu^{+2} (D) all
- Q 14. Colourless salt (A) + dil. H_2SO_4 + $KI \rightarrow$ Blue colour. A can be
 (A) $K_2Cr_2O_7$ (B) MnO_2
 (C) NH_4NO_2 (D) NH_4Cl
- Q 15. A light coloured crystalline solid A has 27.55% H_2O . A gives the following reactions.
 (i) $A \xrightarrow{BaCl_2} \text{white precipitate insoluble in conc. } HNO_3$
 (ii) $A \xrightarrow{K_3[Fe(CN)_6]} \text{a dark-blue precipitate}$
 (iii) $A \xrightarrow{K_2HgI_4} \text{Brown precipitate}$
 Identify A.
 (A) $Fe_2(SO_4)_3 \cdot (NH_4)_2 SO_4 \cdot 8H_2O$
 (B) $FeSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O$

- (C) $(\text{NH}_4)_2 \text{FeSO}_4 \cdot 6\text{H}_2\text{O}$
 (D) $\text{FeSO}_4 (\text{NH}_4)_2 \text{SO}_4 \cdot 5\text{H}_2\text{O}$

11. Identification of Cations

- Q 1. Which of the following gives black ppt. with NH_4OH ?
 (A) Ag_2S (B) AgCl
 (C) HgCl_2 (D) Hg_2Cl_2
- Q 2. Which of the following ion gives white ppt with SnCl_2 , which turn black?
 (A) Hg^{2+} (B) Cu^{2+}
 (C) Sb^{3+} (D) Bi^{3+}
- Q 3. With $\text{K}_4[\text{Fe}(\text{CN})_6]$, chocolate ppt is given by
 (A) Cu^+ (B) Cu^{2+}
 (C) Hg^+ (D) Ag^+
- Q 4. Which of the following give white ppt with H_2O ?
 (A) BiCl_3 (B) Hg_2Cl_2
 (C) AgCl (D) SnCl_2
- Q 5. Which of the following gives blue colour with NH_4CNS ?
 (A) Co^{2+} (B) Bi^{3+}
 (C) Ni^{2+} (D) Mn^{2+}
- Q 6. Which of the following gives pink ppt with NaOH , which turns black on heating?
 (A) Mn^{4+} (B) Cu^{2+}
 (C) Co^{2+} (D) Mn^{2+}
- Q 7. Ammonium salt with Nessler's reagent gives brown ppt of
 (A) I-Hg-O-Hg-NH_2 (B) I-Hg-NH_2
 (C) I-Hg-Hg-O-NH_2 (D) None of these
- Q 8. Which of the following ions give white gelatinous precipitate with NaOH ?
 (A) NH_4^+ (B) K^+
 (C) Mg^{2+} (D) Cu^{2+}
- Q 9. With aquaregia, which of the compounds give white turbidity?
 (A) NiS (B) CoS
 (C) CuS (D) All of these
- Q 10. Which of the following ions give apple green colour with KHCO_3 in presence of $\text{Br}_2 + \text{H}_2\text{O}$?
 (A) Co^{2+} (B) Ni^{2+}
 (C) Mn^{2+} (D) Zn^{2+}
- Q 11. A greenish coloured group II solution gave a black precipitate with H_2S which was extracted with $(\text{NH}_4)_2\text{S}$ and the remaining solid was found to be soluble in 3M HNO_3 . The $(\text{NH}_4)_2\text{S}$ extract produced an orange precipitate when acidified. The cations probably present are
 (A) Cu^{+2} , Pb^{+2} , Bi^{+2} , Sb^{+3}
 (B) Cu^{+2} and Sb^{+3}
 (C) Hg^{+2} , Cu^{+2} , Pb^{+2} , Bi^{+2} , Sb^{+2}
 (D) Sn^{+2} , Sb^{+3} , As^{+3}
- Q 12. To a solution containing divalent metal cations A & B, K_2CrO_4 is added separately. When A gives a chocolate coloured precipitate while B gave a yellow precipitate. A and B are
 (A) Cu^{+2} , Pb^{+2} (B) Ag^+ , B^{+2}
 (C) Zn^{+2} , Cu^{+2} (D) Pb^{+2} , Cu^{+2}
- Q 13. When metallic Cu is heated with conc. H_2SO_4 , in addition to copper sulphate and sulphur dioxide, some is also formed. It is
 (A) Copper oxide (B) copper sulphide
 (C) sulphur (D) sulphur trioxide

12. Passage Type questions

Passage 1:

In second group analysis, the group reagent is H_2S in presence of HCl . This is because of the high solubility product of the sulphides of subsequent group metals. The identification of the metals of second group depends upon the factors like their Solubility in acids, alkali yellow ammonium sulphide and their ability to form complexes and their relative stabilities.

- Q 1. In second group, precipitation of some sulphides take place only of dilution of the acid. The sulphides that are precipitated only on dilution are
 (A) CdS and PbS (B) Sb_2S_3 , Bi_2S_3
 (C) SnS_2 (D) SnS
- Q 2. In the separation of Cu and Cd, the addition of KCN is render
 (A) copper as blue coloured $\text{Cu}(\text{CN})_2$
 (B) copper as chocolate coloured $\text{Cu}_2 [\text{Fe}(\text{CN})_6]$
 Precipitate

- (C) copper as stable colourless $K_3[Cu(CN)_4]$
 (D) copper as blue coloured $K_2[Cu(CN)_4]$
- Q 3. Which of the following statements is not true of II group cations?
 (A) HgS is insoluble in dilute HNO_3
 (B) Sodium stannite reduces $BiCl_3$ to black Bi
 (C) Sb and Sn sulphides are insoluble, but As_2S_3 is soluble in HCl
 (D) Sb_2S_3 is precipitated in presence of oxalic acid

Passage 2:

In third group analysis, the cations are precipitated as their hydroxide, the group reagent being NH_4OH in presence of NH_4Cl . Before proceeding to add the group reagents, the second group filtrate is boiled with conc. HNO_3 .

- Q 4. A statement that is not true regarding third group precipitation is
 (A) $(NH_4)_2SO_4$ cannot be used in place of NH_4Cl along with NH_4OH
 (B) NH_4NO_3 can be used in place of NH_4Cl along with NH_4OH
 (C) NH_4Cl must be added in excess before adding NH_4OH
 (D) $NaOH$ dissolves only $Al(OH)_3$ but $Cr(OH)_3$ & $Fe(OH)_3$ are insoluble
- Q 5. II group filtrate is boiled with conc. HNO_3 before adding NH_4Cl & NH_4OH because/in order to
 (A) solubility product of $Fe(OH)_2$ is low compared to that of $Fe(OH)_3$ so that the solubility product of $Fe(OH)_2$ can be easily exceeded at the low concentration of OH^- ions
 (B) solubility product of $Fe(OH)_2$ is high compared to that of $Fe(OH)_3$ so that the solubility product of $Fe(OH)_3$ is easily exceeded.
 (C) oxidize Cr^{3+} to CrO_4^{2-}
 (D) oxidize Mn^{2+} to Mn^{3+}
- Q 6. The use of bromine water and $NaOH$ to 3rd group precipitate Facilitates
 (A) rendering Fe into $Fe(OH)_2$
 (B) rendering Al into sodium metaaluminate
 (C) conversion of Cr into soluble sodium chromate
 (D) elimination of III group cations completely before precipitating IV group cations as their sulphides.

Passage 3:

The colour of residues left in charcoal cavity test and borax test inform about the cation present in the salt. The colour of the residue left behind on heating also helps in identification of the cation present.

- Q 7. A substance on heating in a reducing flame in a charcoal cavity gives a red brown residue in hot and yellow residue in the cold. The cation present in the substance is
 (A) Fe^{3+} (B) Bi^{2+} (C) Pb^{2+} (D) Cd^{2+}
- Q 8. Blue borax bead is obtained in oxidizing flame for
 (A) Cu and Fe (B) Ni and Cu
 (C) Mn and Co (D) Cu and Co
- Q 9. On heating Nickel salt the colour change that is noticed is
 (A) Green to brown (B) green to yellow
 (C) Blue to brown (D) green to white

Passage 4.

A chemist opened a cupboard to find four bottles containing water solutions, each of which had lost its label. Bottles 1, 2, 3 contained colourless solutions, whilst Bottle 4 contained a blue solution. The labels from the bottles were lying scattered on the floor of the cupboard. They were:

copper (II) sulphate
 lead nitrate
 hydrochloric acid
 sodium carbonate

By mixing samples of the contents of the bottles, in pairs, the chemist made the following observations

Bottle 1 + Bottle 2	white precipitate
Bottle 1 + Bottle 3	white precipitate
Bottle 1 + Bottle 4	white precipitate
Bottle 2 + Bottle 3	colourless gas evolved
Bottle 2 + Bottle 4	no visible reaction
Bottle 3 + Bottle 4	blue precipitate

Answer the following Questions on the basis of above observations.

- Q 10. Bottle no. (1) contains
 (A) $Pb(NO_3)_2$ (B) HCl
 (C) Na_2CO_3 (D) $CuSO_4$

- Q 11. Bottle no. (2) contains
 (A) $\text{Pb}(\text{NO}_3)_2$ (B) HCl
 (C) Na_2CO_3 (D) CuSO_4
- Q 12. Bottle no. (3) contains
 (A) $\text{Pb}(\text{NO}_3)_2$ (B) HCl
 (C) Na_2CO_3 (D) CuSO_4
- Q 13. Bottle no. (4) contains
 (A) $\text{Pb}(\text{NO}_3)_2$ (B) HCl
 (C) Na_2CO_3 (D) CuSO_4
- Q 14. Colourless gas evolved when contents of
 Bottle (2) and Bottle (3) are mixed, will be
 (A) O_2 (B) CO_2
 (C) N_2 (D) N_2O

Passage 5:

p-Amino-N,N-dimethylaniline is added to a strongly acidic solution of X. The resulting solution is treated with a few drops of aqueous solution of Y to yield blue coloration due to the formation of methylene blue. Treatment of the aqueous solution of Y with the reagent potassium hexacyanoferrate (II) leads to the formation of an intense blue precipitate. The precipitate dissolves on excess addition of the reagent. Similarly, treatment of the solution of Y with the solution of potassium hexacyanoferrate(III) leads to a brown coloration due to the formation of Z. [IIT 2009]

- Q 15. The compound X is
 (A) NaNO_3 (B) NaCl
 (C) Na_2SO_4 (D) Na_2S
- Q 16. The compound Y is
 (A) MgCl_2 (B) FeCl_2
 (C) FeCl_3 (D) ZnCl_2
- Q 17. The compound Z is
 (A) $\text{Mg}_2[\text{Re}(\text{CN})_6]$ (B) $\text{Fe}[\text{Fe}(\text{CN})_6]$
 (C) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ (D) $\text{K}_2\text{Zn}_3[\text{Fe}(\text{CN})_6]_2$

13. Subjective Problems on Salt Analysis

- Q 1. On treatment with cold water an element A reacts quietly, liberating a colorless odorless gas B and a solution C. Lithium reacted with B yielding a solid product D which effervesced with water to give a strongly basic solution E. When carbon dioxide was bubbled through solution C an initial white ppt. F was formed, but this dissolved forming solution G when more CO_2 is added. Ppt. F effervesced when moistened with concentrated hydrochloric acid and gives a deep red coloration to a Bunsen flame. Name the compound A to G.
- Q 2. A colorless solid A on heating gives a white solid B and a colorless gas C. B gives off reddish brown fumes on treatment with dilute acids. Also when B is heated with NH_4Cl , a colorless gas D and a residue E are obtained. When A is heated with $(\text{NH}_4)_2\text{SO}_4$, a colorless gas F is obtained along with a white residue G. Both E and G impart yellow color to the Bunsen flame. The gas C reacts with heated Mg and forms white powder which on hydrolysis produces magnesium hydroxide. The colorless gas D reacts with heated calcium and the product on hydrolysis gives NH_3 , identify A to G.
- Q 3: A colorless poisonous gas A on heating in air gives only two compounds B & C. The compound B is a strong white dehydrating agent and the compound C is a liquid at room temperature. Aqueous solution of compound A and liquid C is neutral to moist litmus paper. Whenever the gas A is passed through copper sulphate solution a black ppt. D is formed which gets reduced to copper. Identify A to D and give the reactions involved.
- Q 4. Substance A is a gas with vapor density 8.5. On oxidation at high temperature with a platinum catalyst it gives a colorless gas B, which rapidly turned brown in air, forming a gas C. B and C were condensed together to give substance D, which reacted with water, forming an acid E. On treatment of E with an acidified solution of KI, a gas B was evolved, but when E was treated with a solution of NH_4Cl , a stable colorless gas F was evolved, F did not support combustion, but magnesium continued to burn in it. However, F reacted with calcium carbide in an electric furnace, forming a solid G, which was slowly hydrolyzed by water, forming a solution of substance A, which turned Nessler's reagent yellow. Identify substance A to G and

- explain the reaction involved.
- Q 5. A is a binary compound with univalent metal. 1.422 g of A reacts completely with 0.321 gm of sulfur in an evacuated and sealed tube to give 1.743 gm of white crystalline solid, b that forms a hydrated salt C with $\text{Al}_2(\text{SO}_4)_3$. Identify A, B and C.
- Q 6. A salt A on warming with NaOH solution gives out a pungent smelling gas B, which when passed through a solution of copper sulphate gives a deep blue coloration. To the alkaline solution form the above when aluminum powder is added, a further quantity of gas B results. The salt A when heated carefully to a temperature above 240°C decomposes completely without leaving any residue into two gases C and D. D exists as a liquid below 100°C and C can be liquefied under pressure at room temperature. The gas C if moderately inhaled induces laughter. Identify A, B, C & D. name the analytical reagent E formed by addition of mercuric chloride to excess KI solution. Indicate the color of the ppt. that gas B would formed with the reagent.
- Q 7. 0.347 gm of metal A was dissolved in dilute HNO_3 . Thus solution gives a red coloration to a non-luminous Bunsen burner flame, and on treatment give 0.747 gm of metal oxide B. A also reacted with nitrogen forming a compound C and with hydrogen forming D. on reacting 0.1590 gm of D with water, a gas E was evolved and a sparingly soluble compound F is formed, which gave a strongly basic reaction and required 200 ml of 0.1 M hydrochloric acid to neutralize it. Identify the substances A to F and explain the reaction involved.
- Q 8. A bluish colored compound A on heating gives two products B and C. The compound B whenever treated with gas D evolves another gas E, a metal F and a liquid G. the gas E when heated with calcium followed by hydrolysis produces the gas D and an alkaline solution. The solution on exposure to air produces the gas D & an alkaline solution. The solution on exposure to air produces a thin solid layer H on the surface. The same compound H can be obtained by passing gas C through the same alkaline solution. Future the solution B in HCl on treatment with $\text{K}_4[\text{Fe}(\text{CN})_6]$ gives a chocolate brown coloured ppt. of compound I. identify A to I and give the chemical reactions.
- Q 9. 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. Indentify A, B, X, Y, and Z.
- Q 10. A lewis gas A on addition of NH_4Cl and NH_4OH gives a precipitate which dissolves in NaOH solution. A on reaction with excess of B gives an important reducing agent C. compound B on reaction with some other lewis acid D gives a compound E which is electron deficient. Moreover E on reaction with NaH gives another reducing agent F which on reaction with a gas G gives the compound E. Identify A to E.
- Q 11. A white colored inorganic salt gives following reactions.
- When exposed to H_2S it becomes black
 - It is decomposed by dil HCl evolving a gas with effervescences, the gas turns lime water milky
 - When heated strongly to about 450°C it decomposes to give three gases and leaves a red colored residue used by housewives. Identify compound X and the four gases evolved during reactions giving necessary chemical reactions.
- Q 12. An inorganic compound(X) gives a brick red flame on performing flame test . This compound also Gives the following tests
- Smells of chlorine when placed in moist air.
 - If KI and CH_3COOH are added to its suspension in water a brown colour is obtained. Identify(X) and write down equations
- Q 13. A white solid (A) when heated loses 16.25% of its weight & converted into a yellow solid B; while B when heated in presence of air gains its weight and converted into a red coloured solid C. C is partly soluble in dil. HNO_3 leaving a brown residue D. A is not complete soluble in dil. HCl or H_2SO_4 but dissolves in dilute HNO_3 with effervescences forming a clear solution E. E reacts with sodium hydroxide solution followed by chlorine water to give D. identity A to E.

14. Subjective Problems on Salt Analysis

- Q 1. An inorganic mixture containing one or more of the following cation is given is given to you Ag^+ , Hg_2^{2+} , Hg^{2+} , Cu^{2+} , Fe^{2+} , Cr^{3+} , and Zn^{2+} . Identify the inorganic salt A whose aqueous solution given following reactions.
- Yellow precipitate with silver nitrate solution, soluble in dil. HNO_3
 - White precipitate with NH_4OH and also NaOH and also with sodium hydroxide solution. However, the precipitate dissolves in excess of NH_4OH and NaOH respectively.
- Q 2. An inorganic sodium Salt (A) gives two colourless gases (B) and (C) leaving a residue (D). (B) turns white copper sulphate blue, while (C) turns lime water first milky and then colourless. The residual solid (D) when heated strongly gives substances (E) & (F). (E) gives white precipitate with BaCl_2 (F) when treated with dil. HCl gives a gas (G) which when passed through a solution of sulphur dioxide gives a yellow precipitate due to (H). Identify (A) to (H) with proper reasoning.
- Q 3. (1) An aqueous solution of white compound A on reaction with HCl gives a white ppt. B.
 (2) B becomes soluble in chlorine water the formation of C.
 (3) C reacts with KI to give a ppt. which becomes soluble in excess of it forming a compound D. The compound D is used for detecting ammonium salts.
 (4) B and C both, on treatment with SnCl_2 give a grey ppt. of E.
 (5) When conc. H_2SO_4 is added slowly into a mixture of cold solutions of A & FeSO_4 , a brown ring of compound F is formed. Identify A to F & give chemical equations for reaction at steps 1 to 5.
- Q 4. A metallic chloride A when treated with NaOH and H_2O_2 gives a yellow solution due to the formation of compound B. The color of this solution changes to orange color when dilute sulphuric acid is added to it. It is due to the formation of compound C. whenever the compound D is heated along with C in the presence of concentrated H_2SO_4 a red volatile liquid E is formed. E dissolves in NaOH giving yellow solution B, which changes to yellow ppt F is formed. E dissolves in NaOH giving yellow solution B, which changes to yellow ppt F on treatment with lead acetate. Compound C when treated with ammonium chloride forms a compound G which decomposes in heating giving a colorless gas H, water and a green residue I. when mg is burnt in the presence of gas H, it gives a white solid J which on hydrolysis forms a gas K which gives white fumes with HCl gas. Also the compound D gives golden yellow color to the flame. Identify A to K giving the involved reaction.
- Q 5. A yellow solid is unaffected by the acids and bases. It is not soluble in water dissolves slowly in hot conc. HNO_3 and a brown gas B is evolved. The solid A dissolves slowly in a boiling solution of Na_2SO_3 to give a clear solution of C. Acidification of C causes evolution of a colorless gas D leaving behind a milky precipitate E in the solution. Identify A to E and give the reactions involved.
- Q 6. A colorless solid A on hydrolysis produces a heavy white ppt. B solid A gives a clear solution in conc. HCl however when added to large amount of water, it again gives ppt. of B. When H_2S is passed through a suspension of A and B, a brown black ppt. of C is obtained. Compound A liberates a gas D on heating with H_2SO_4 . The gas D is water soluble and gives white ppt. E with solution of mercurous salt but not with mercuric salt. Identify A to E. Also report A, B, C if C is orange ppt.
- Q 7. A metallic chloride A does not respond to the chromyl chloride test but on treatment with B give a scarlet – ppt C which dissolves in excess of B forming an important laboratory reagent D. the compound B on acidification and on treatment with another compound X, which removes black stains from paintings, gives iodine which dissolves in excess of B giving a yellow solution. Identify A, B, C, D and X. Also give the chemical equation.
- Q 8. (1) A white ppt B is formed when a mineral A is boiled with Na_2CO_3 solution.
 (2) The precipitate is filtered and the filtrate contains two compounds C and D. The compound C is removed by crystallization and when CO_2 is passed through the mother liquor left, D changes to C.
 (3) The compound C on strong heating gives two compounds D and E.

- (4) E on heating with cobalt oxide produces blue coloured substance F. Identify A to F and give chemical equations for the reactions at steps (1) to (4).
- Q 9. A black mineral A on treatment with dilute sodium chloride solution in presence of air gives a clear solution of B and C. The solution of B on reaction with zinc gives ppt. of a metal D. D is dissolved in dil. HNO_3 and the resulting solution gives a white ppt E with dil HCl. E on fusion with sodium carbonate gives D. E dissolves in aq solution of ammonia giving a colourless solution of F. Identify A to F.
- Q 10. A soluble compound of a poisonous element M when heated with $\text{Zn}/\text{H}_2\text{SO}_4$ gives a colorless and extremely poisonous gaseous compound N which on passing through a heated tube gives a silvery mirror of element M. Identify M and N.
- Q 11. On mixing the aqueous solution of compound A and B an insoluble compound C is formed along with another water soluble compound D. compound A on heating gives NO_2 gas with a cracking noise. An aqueous solution of compound A gives black ppt with H_2S . Compound A also gives white ppt with dilute HCl which is soluble in hot water and reappears on cooling. The hot water extract of compound A gives yellow ppt with K_2CrO_4 solution. Compound B gives a white ppt with BaCl_2 solution. This white ppt is insoluble in concentrated HCl and is also in concentrated HNO_3 . Filtrate containing compound D gives following reactions.
- (1) Deep blue colored solution with $\text{K}_3[\text{Fe}(\text{CN})_6]$.
 - (2) Yellow coloured solution with a little Conc. HNO_3 which gives brown ppt with NH_4OH .
 - (3). It also gives brown ring test.
- Identify A, B, C and D.
- Q 12. An inorganic salt A is water – soluble in nature. On treatment with conc. H_2SO_4 , A gives a colorless pungent smelling gas B which has bleaching properties. When an aqueous solution of A is boiled with sulphur and then evaporated, compound C is obtained. When C reacts with iodine solution, the brown color of the halogen is discharged forming D and E. Compound C on treatment with HCl forms a pale yellow insoluble solid F and B which is a gas capable of decolorizing acidic KMnO_4 solution. A solution of C becomes purple in color when aq FeCl_3 is added. compound E forms a yellow ppt G with AgNO_3 solution which is insoluble in HNO_3 as well as in NH_4OH . Compound A imparts a golden yellow colour to the Bunsen flame. Identify the compound A to G.
- Q 13. There is a substance S. It dissolves completely in HCl resulting in the formation of a solution A. The solution A on addition of NH_4Cl followed by NH_4OH gives ppt B. When B is treated with NaOH a part of it dissolves to give solution C while rest of it remains as residue D. The solution C on addition of solid NH_4Cl and boiling gives gelatinous ppt E. Residue D on treatment with Na_2O_2 and heat gives a solution F and residue G. F on acidification with acetic acid followed by addition of $(\text{CH}_3\text{COO})_2\text{Pb}$ gives yellow ppt. H residue G when dissolved in HCl and treated with $\text{K}_4[\text{Fe}(\text{CN})_6]$ gives blue ppt I. identify A to I and write in terms of their chemical formula.
- Q 14. 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 an acidified solution of a compound E gives a ppt F soluble in dil. HNO_3 . After boiling this solution when an excess of NH_4OH is added, a blue colored compound G is formed. To this solution on addition of acetic acid and aq $\text{K}_4[\text{Fe}(\text{CN})_6]$ a chocolate ppt H is obtained. On addition of an aq solution of BaCl_2 to an aq solution of E, a white ppt insoluble in HNO_3 is obtained. Identify the compounds from A to H.
- Q 15. An iodide (A) on heating with alkali (KOH) gives a gas (B) and a compound (C). The gas (B) burns in air to give compound (D). When (B) is passed through a solution of copper sulphate, it is finally reduced to the metal. A solution of (C) reacts with CuSO_4 to give a white ppt (E). Identify (A) to (E) giving reactions.

Answer Key

1. Solubility & Colour of Compounds

- (1). A (2). C (3). B
(4). D (5). D (6). D
(7). D (8). A, B, D (9). C
(10). B (11). A (12). A
(13). C

2. Properties of Gases & Compounds

- (1). C (2). A (3). A, C, D
(4). A, B, D (5). D (6). C
(7). A (8). B (9). C
(10). B (11). A (12). D

3. Flame Test, Borax Bead & Phosphate Bead test

- (1). C (2). C (3). A
(4). B (5). B (6). A
(7). A (8). B (9). D
(10). A (11). B (12). C
(13). C (14). C (15). C

4. Bead Test, Cobalt Nitrate & Charcoal cavity test

- (1). C (2). B (3). A
(4). A (5). A (6). B
(7). C (8). D (9). A
(10). D (11). C

5. Class A(i) Anions

- (1). A (2). D (3). A
(4). A (5). C (6). B
(7). C (8). C (9). C
(10). C (11). D (12). C
(13). D (14). A (15). B

6. Class A(i) & Class A(ii) Anions

- (1). A (2). A (3). B
(4). B (5). C (6). B
(7). A (8). D (9). C
(10). B (11). B (12). A
(13). B (14). B

7. Class B Anions

- (1). B (2). D (3). B
(4). B (5). A (6). D
(7). B (8). A (9). D
(10). D

8. Classification of cations

- (1). B, D (2). D (3). D
(4). D (5). B (6). C
(7). C (8). A (9). C
(10). D (11). B (12). A
(13). B (14). C (15). D
(16). D

9. Group I, Group II & Group III cations

- (1). C (2). C (3). C
(4). A (5). D (6). A
(7). A (8). C (9). A
(10). B (11). B (12). A
(13). B

10. Group IV & Group V cations

- (1). C (2). A (3). D
(4). A (5). B (6). B
(7). C (8). B (9). C
(10). B (11). C (12). B
(13). D (14). C (15). D

11. Identification of Cations

- (1). D (2). A (3). B
(4). A (5). A (6). D
(7). A (8). C (9). D
(10). A (11). D (12). A
(13). B

12. Passage Type questions

- (1). A (2). C (3). C
(4). B (5). B (6). C
(7). C (8). D (9). B
(10). B (11). B (12). C
(13). D (14). B (15). D
(16). C (17). B

13. Subjective Problems on Salt Analysis

- (1).
 $\begin{matrix} \text{Ca} & \text{H}_2 & \text{Ca(OH)}_2 \\ \text{LiH} & \text{LiOH} & \text{CaCO}_3 \\ \text{Ca(HCO}_3)_2 \end{matrix}$
- (2).
 $\begin{matrix} \text{NaNO}_3 & \text{NaNO}_2 & \text{O}_2 \\ \text{N}_2 & \text{NaCl} & \text{N}_2\text{O} \\ \text{Na}_2\text{SO}_4 \end{matrix}$
- (3).
 $\begin{matrix} \text{A} = \text{PH}_3 & \text{B} = \text{P}_4\text{O}_{10} & \text{C} = \text{H}_2\text{O} \\ \text{D} = \text{Cu}_3\text{P}_2 \end{matrix}$
 $4\text{PH}_3 + 8\text{O}_2 \rightarrow \text{P}_4\text{O}_{10} + 6\text{H}_2\text{O}$
 (A) (B) (C)
 $2\text{PH}_3 + 3\text{CuSO}_4 \rightarrow \text{Cu}_3\text{P}_2 + 3\text{H}_2\text{SO}_4$
 (A) Black ppt. (D)
- (4).
 (i) $4\text{NH}_3 + 5\text{O}_2 \xrightarrow{\text{Pt}} 4\text{NO} + 6\text{H}_2\text{O}$
 (A) (B)
 (ii) $4\text{NO} + 5\text{O}_2 \rightarrow 4\text{NO}_2$
 (B) (C)
 (iii) $\text{NO} + \text{NO}_2 \rightarrow \text{N}_2\text{O}_3$
 (D)
 (iv) $\text{N}_2\text{O}_3 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_2$
 (E)
 (v) $4\text{HNO}_2 + 2\text{KI} \rightarrow \text{I}_2 + 2\text{H}_2\text{O} + \text{NO}$
 (E)
 (vi) $\text{HNO}_2 + \text{NH}_4\text{Cl} \rightarrow \text{N}_2$
 (E) (F)
 (vii) $\text{CaC}_2 + \text{N}_2 \rightarrow \text{CaNCN} + \text{C}$
 (F) calcium Cyanamide (G)
 (viii) $\text{CaNCN} + 5\text{H}_2\text{O} \rightarrow \text{CaCO}_3 + 2\text{NH}_4\text{OH}$
 (G) (A)
 \downarrow Nessler's reagent
 Yellow
- (5).
 $\begin{matrix} \text{A} = \text{KO}_2 & \text{B} = \text{K}_2\text{SO}_4 \\ \text{C} = \text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O} \end{matrix}$
- (6).
 $\begin{matrix} \text{A} = \text{NH}_4\text{NO}_3 & \text{B} = \text{NH}_3 \\ \text{C} = \text{N}_2\text{O} & \text{D} = \text{H}_2\text{O} \\ \text{E} = \text{Nessler's Reagent, Brown} \end{matrix}$
- (7).
 $\begin{matrix} \text{A} = \text{Li} & \text{B} = \text{Li}_2\text{O} & \text{C} = \text{Li}_3\text{N} \\ \text{D} = \text{LiH} & \text{E} = \text{H}_2 & \text{D} = \text{LiOH} \end{matrix}$
- (8).
 $\text{MCO}_3 \xrightarrow{\text{dil. HCl}} \text{MCl}_2 + \text{CO}_2$
 (A) (B)
 $\text{CO}_2 + \text{Ca(OH)}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \xrightarrow{\Delta} \text{Ca(HCO}_3)_2$
 (C) (D)
- $\text{MCO}_3 \xrightarrow{\Delta} \text{MO} + \text{CO}_2$
 (A) (E)
 M may be Barium, as we get green colour in Bunsen Flame.
 $\text{meq}_A = \text{meq}_E = \text{meq}_{\text{HCl}}$
 $\frac{1.9735 \times 2 \times 1000}{\text{Mol.wt.}} = \frac{20.30 \times 250 \times 0.0985}{25}$
 Molar weight = 196.3
 Which confirms that M is Ba
- (9).
 $\begin{matrix} \text{X} = \text{KHCO}_3 & \text{A} = \text{CO}_2 & \text{B} = \text{H}_2\text{O} \\ \text{Y} = \text{K}_2\text{CO}_3 & \text{Z} = \text{BaCO}_3 \end{matrix}$
- (10).
 $\begin{matrix} \text{A} = \text{AlCl}_3 & \text{B} = \text{LiH} & \text{C} = \text{LiAlH}_4 \\ \text{D} = \text{BF}_3 & \text{E} = \text{B}_2\text{H}_6 & \text{F} = \text{NaBH}_4 \\ \text{G} = \text{I}_2 \end{matrix}$
- (11).
 $\text{X} = \text{PbSO}_4 \cdot 2\text{H}_2\text{O}$
 Four gases are SO_3 , SO_2 , O_2 & H_2O
- (12). $\text{X} = \text{Ca(OCl)Cl}$
 (i) $\text{Ca(OCl)Cl} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{Cl}_2$
 (ii) $\text{Ca(OCl)Cl} + \text{CH}_3\text{COOH} \rightarrow \text{Ca(CH}_3\text{COO)}_2 + \text{H}_2\text{O} + \text{Cl}_2$
 $\text{Cl}_2 + \text{KI} \rightarrow \text{KCl} + \text{I}_2$
- (13).
 $\begin{matrix} \text{A} = \text{PbCO}_3 & \text{B} = \text{PbO} & \text{C} = \text{Pb}_3\text{O}_4 \\ \text{D} = \text{PbO}_2 & \text{E} = \text{Pb(NO}_3)_2 \end{matrix}$

