SOLVED EXAMPLES

Ex. 1 Pink colour of acidified $KMnO_4$ is decolourised but there is no evolution of any gas. This may happen with the compound containing the following acid radical.

(A) SO_3^{2-} **(B)** NO_2^- **(C)** S^{2-} **(D)** All of these

Ans. **(D)**

Sol. **(A)** $5SO_3^{2-} + 2MnO_4^- + 6H^+ \longrightarrow 2Mn^{2+} + 5SO_4^{2-} + 3H_2O$

(B) $2MnO_4^- + 5NO_2^- + 6H^+ \longrightarrow 2Mn^{2+} + 5NO_3^- + 3H_2O$

(C) $2MnO_4^- + H_2S + 6H^+ \longrightarrow 2Mn^{2+} + 5S\downarrow + 8H_2O$

Ex. 2 Which of the following gives a precipitate with $Pb(NO_3)_2$ but not with $Ba(NO_3)_2$?

(A) Sodium chloride **(B)** Sodium acetate

(C) Sodium nitrate **(D)** Disodium hydrogen phosphate

Ans. **(A)**

Ans. **(A)** $Pb^{2+} + 2Cl^- \longrightarrow PbCl_2\downarrow$ (white) ; $Ba^{2+} + 2Cl^- \longrightarrow BaCl_2$ (water soluble)

(B) $(CH_3COO)_2$ Pb and $(CH_3COO)_2Ba$ both are water soluble salts.

(C) Nitrates are mostly soluble in water

(D) $3Pb^{2+} + 2HPO_4^{2-} \longrightarrow Pb_3(PO_4)_2\downarrow$ (white) $+ 2H^+$; $Ba^{2+} + HPO_4^{2-} \longrightarrow BaHPO_4\downarrow$ (white)

Ex. 3 Colour of cobalt chloride solution is :

(A) pink **(B)** black **(C)** colourless **(D)** green

Ans. **(A)**

Sol. Anhydrous Co(II) salts are blue in colour while hydrated Co(II) salts are pink/red.

Ex. 4 $BaCl_2$ solution gives a white precipitate with a solution of a salt, which dissolves in dilute hydrochloric acid with the evolution of colourless, pungent smelling gas. The gas as well as the salt both are used as bleaching agent in the textile industries. The salt contains:

(A) sulphite **(B)** sulphide **(C)** acetate **(D)** carbonate

Ans. **(A)**

Sol. $Ba^{2+} + SO_3^{2-} \longrightarrow BaSO_3\downarrow$ (white)

$BaSO_3 + 2HCl \longrightarrow BaCl_2 + SO_2$(colourless pungent smelling gas) $+ H_2O$

SO_3^{2-} and SO_2 both act as bleaching agent.

Ex. 5 Which of the following precipitate(s) does / do not dissolve in excess of ammonia solution ?

(A) $Zn(OH)_2$ **(B)** $Ni(OH)_2$ **(C)** $Al(OH)_3$ **(D)** **(B)** and **(C)** both

Ans. **(C)**

Sol. **(A)** $Zn(OH)_2 + 4\,NH_3 \longrightarrow [Zn(NH_3)_4]^{2+}$ (colourless solution) $+ 2OH^-$

(B) $Ni(OH)_2\downarrow + 6NH_3 \longrightarrow [Ni(NH_3)_6]^{2+}$ (deep blue solution) $+ 2OH^-$

(C) $Al(OH)_3 + NH_3 \longrightarrow$ No reaction.

Ex. 6 Chocolate brown precipitate is formed with :

(A) Cu^{2+} ions and $[Fe(CN)_6]^{3-}$ **(B)** Cu^{2+} ions and $[Fe(CN)_6]^{4-}$

(C) Fe^{2+} ions and $[Fe(CN)_6]^{4-}$ **(D)** Fe^{2+} ions and dimethylglyoxime

Ans. **(B)**

Sol **(A)** $Cu_3[Fe(CN)_6]_2\downarrow$ (green) ; **(B)** $Cu_2[Fe(CN)_6]\downarrow$ (chocolate brown)

(C) $Fe_4[Fe(CN)_6]_3\downarrow$ (Prussian blue) ; **(D)** red solution of iron(II) dimethylglyoxime.

Ex. 7 A red colouration or precipitate is not obtained when :

(A) Fe^{3+} reacts with potassium thiocyanate **(B)** Fe^{2+} reacts with dimethylglyoxime.

(C) Hg^{2+} reacts with potassium iodide. **(D)** None

Ans. **(D)**

Sol. **(A)** $Fe^{3+} + 3SCN^- \longrightarrow Fe(SCN)_3$ (red solution)

(B) Red solution of iron(II) dimethylglyoxime.

(C) $Hg^{2-} + 2I^- \longrightarrow HgI_2\downarrow$ (red).

Ex. 8 When H_2S gas is passed through an ammoniacal salt solution X, a slightly white precipitate is formed. The X can be

(A) a cobalt salt **(B)** a lead salt **(C)** a zinc salt **(D)** a silver salt

Ans. **(C)**

Sol. $Zn^{2+} + H_2S \longrightarrow ZnS\downarrow$ (white) $+ 2H^+$

Ex. 9 Consider the following statement :

S_1 : Cu^{2+} ions are reduced to Cu^+ by potassium iodide and potassium cyanide both, when taken in excess

S_2 : H_2S will precipitate the sulphide of all the metals from the solutions of chlorides of Cu, Zn and Cd if the solution is aqueous.

S_3 : The presence of magnesium is confirmed in qualitative analysis by the formation of a white crystal line precipitate of $MgNH_4PO_4$.

S_4 : Calomel on reaction with potassium iodide gives red precipitate.

and arrange in the order of true /false.

(A) TTFF **(B)** TFTF **(C)** TTTT **(D)** TTTF

Ans. **(D)**

Sol. S_1, S_2 and S_3 are correct statements.

$S_4 : Hg_2^{2+} + 2I^- \longrightarrow Hg_2I_2\downarrow$(green)

Ex. 10 Which of the following pair (s) of ions would be expected to form precipitate when dilute solutions are mixed?

(A) $NH_4^+, [Co(NO_2)_6]^{3-}$ **(B)** NH_4^+, CO_3^{2-} **(C)** Fe^{3+}, OH^- **(D)** Ba^{2+}, SO_4^{2-}

Ans. (A,C,D)

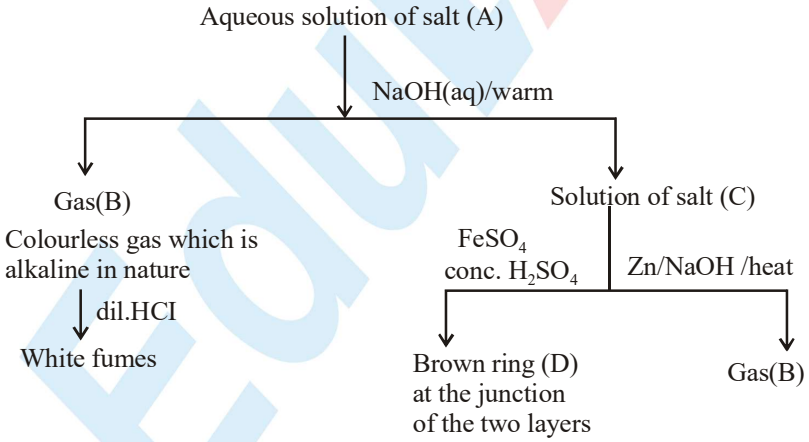
Sol. **(A)** $NH_4^+ + [Co(NO_2)_6]^{3-} \longrightarrow (NH_4)_3[Co(NO_2)_6]\downarrow$ (yellow)

(B) Ammonium and alkali metal carbonates are water soluble.

(C) $Fe^{3+} + OH^- \longrightarrow Fe(OH)_3\downarrow$(reddish - brown)

(D) $Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_4\downarrow$ (white)

Comprehension (Q.11 to Q.13)



Salt **(A)** on heating gives a colourless neutral gas which supports combustion.

From the aforesaid, flow diagram, answer the following questions.

Ex. 11 The compound **(A)** contains the following acid radical.

(A) NO_2^- **(B)** NO_3^- **(C)** Br^- **(D)** SO_3^{2-}

Ans. **(B)**

Sol. NO_3^- and NO_2^- both give brown ring test and reduction of NO_3^- and NO_2^- both give ammonia which with dilute HCl gives dense white fumes.

if $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$; N_2O supports the combustion

but $NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$; Nitrogen does not supports combustion.

Hence, the anion is NO_3^-.

Ex. 12 The basic radical of salt **(A)** and gas B both gives brown precipitate with Nessler's reagent. The composition of the brown precipitate is :

(A) $(NH_4)_2[HgI_4]$ **(B)** $Hg(NH_2)NO_3$ **(C)** HgO. $Hg(NH_2)I$ **(D)** $(NH_4)_3[Co(NO_2)_6]$

Ans. **(C)**

Sol. $NH_4^+ + 2[HgI_4]^{2-} + 4OH^- \longrightarrow HgO.\ Hg(NH_2)I\downarrow + 7I^- + 3H_2O$

Hence the cation is NH_4^+.

Ex. 13 1 Which of the following statement is correct ?

(A) Salt **(A)** gives yellow precipitate with chloroplatinic acid as well as with sodium cobaltinitrite.

(B) The brown ring is formed due to the formation of nitroso ferrous sulphate $[Fe(NO)]^{2+}SO_4^-$.

(C) Salt 'C' reacts with silver nitrate solution to form white precipitate.

(D) **(A)** and **(B)** both.

Ans. **(D)**

Sol. **(A)** $2NH_4^+ + [PtCl_6]^{4-} \longrightarrow (NH_4)_2[PtCl_6]\downarrow$ (yellow)

$3NH_4^+ + [Co(NO_2)]^{3-} \longrightarrow (NH_4)_3[Co(NO_2)_6]\downarrow$ (yellow)

(B) $2NO_3^- + 4H_2SO_4 + 6Fe^{2+} \longrightarrow 6Fe^{3+} + 2NO\uparrow + 4SO_4^{2-} + 4H_2O$

$SO_4^{2-} + Fe^{2+} + NO \longrightarrow [Fe(NO)]^{2+}SO_4^{2-}$

(C) $AgNO_3 + NaNO_3 \longrightarrow$ No reaction.

If the anion is NO_2^- then $Ag^+ + NO_2^- \longrightarrow AgNO_2\downarrow$ (white)

Reactions :

$NH_4NO_3 + NaOH \longrightarrow NH_3\uparrow + NaNO_3$

(A) **(B)** **(C)**

$NH_3 + HCl \longrightarrow NH_4Cl\uparrow$ (White)

$NO_3^- + 4Zn + 7OH^- + 6H_2O \longrightarrow NH_3 + 4[Zn(OH)_4]^{2-}$

Ex. 14 **Statement - 1 :** Addition of NH_4OH to an aqueous solution of $BaCl_2$ in presence of NH_4Cl (excess) precipitates $Ba(OH)_2$.

Statement - 2 : $Ba(OH)_2$ is water soluble.

(A) Both Statement-1 and Statement-2 are true and Statement-2 is the correct explanation of Statement-1.

(B) Both Statement-1 and Statement-2 are true but Statement-2 is not correct explanation of Statement-1.

(C) Statement-1 is true but Statement-2 is false.

(D) Statement-1 is false but Statement-2 is true

Ans. **(D)**

Sol. Ba^{2+} ions does not give any precipitate with NH_4OH solution in excess of NH_4Cl because product formed, $Ba(OH)_2$ is soluble in water

Ex. 15 **Statement - 1 :** Sodium meta aluminate on boiling with ammonium chloride produces white gelatinous precipitate.
Statement - 2 : Aluminium hydroxide is formed which is not soluble in water
(A) Both Statement-1 and Statement-2 are true and Statement-2 is the correct explanation of Statement-1.
(B) Both Statement-1 and Statement-2 are true but Statement-2 is not correct explanation of Statement-1.
(C) Statement-1 is true but Statement-2 is false.
(D) Statement-1 is false but Statement-2 is true

Ans. **(A)**

Sol. $[Al(OH)_4]^- \xrightarrow[\text{Boil}]{NH_4Cl} Al(OH)_3\downarrow + OH^-$

Ex. 16 Which of the following statement(s) is (are) incorrect?
(A) Fe^{2+} ions give a dark blue precipitate with potassium hexacyanidoferrate (III) solution.
(B) Fe^{3+} ions give intense blue precipitate with potassium hexacyanidoferrate (II) solution.
(C) Fe^{3+} ions give a brown colouration with potassium hexacyanidoferrate (III) solution.
(D) Fe^{2+} ions give a deep red colouration with ammonium thiocyanate.

Ans. **(D)**

Sol. **(A)** $Fe^{2+} + [Fe(CN)_6]^{3-} \longrightarrow Fe^{3+} + [Fe(CN)_6]^{4-}$

$4Fe^{3+} + 3\,[Fe(CN)_6]^{4-} \longrightarrow Fe_4[Fe(CN)_6]_3$ (turnbull's blue)

(B) $4Fe^{3+} + 3[Fe(CN)_6]^{4-} \longrightarrow Fe_4[Fe(CN)_6]_3\downarrow$ (intense blue)

(C) $Fe^{3+} + [Fe(CN)_6]^{3-} \longrightarrow Fe[Fe(CN)_6]$ (brown colouration)

(D) $Fe^{3+} + 4SCN^- \longrightarrow Fe(SCN)_3$ (deep red colouration)

$Fe^{2+} + 4\,SCN^- \longrightarrow$ No reaction

Subjective :

Ex. 17 What happens when ?
(A) Aqueous solution of $CrCl_3$ is added to ammonia solution.
(B) Ammonium carbonates reacts with $MgCl_2$ (i) in absence of ammonium salts and (ii) in presence of ammonium salts

Sol. **(A)** $Cr^{3+} + 3NH_3 + 3H_2O \longrightarrow Cr(OH)_3\downarrow$ (green) $+ 3NH_4^+$

$Cr(OH)_3$ precipitate formed becomes slightly soluble in excess of precipitant in cold forming a violet or pink solution containing $[Cr(NH_3)_6]^{3+}$ complex ions.

$Cr(OH)_3\downarrow + 6\,NH_3 \longrightarrow [Cr(NH_3)_6]^{3+} + 3OH^-$

(B) (i) $5Mg^{2+} + 6\,CO_3^{2-} + 7H_2O \longrightarrow 4MgCO_3.Mg(OH)_2.5\,H_2O\downarrow + 2HCO_3^-$

White precipitate of basic magnesium carbonate is formed.

(ii) In presence of ammonium salts no precipitation occurs, because the equilibrium

$NH_4^+ + CO_3^{2-} \longrightarrow NH_3 + HCO_3^-$

is shifted towards the formation of HCO_3^- ions.

Ex. 18 Salts given in column (I) reacts with the excess of reagents given in column (II) and form white /coloured precipitates. Select the correct options for the salts given in column (I) with the reagent(s) given in the column (II)

	Column - I		Column - II
(A)	$Zn(NO_3)_2$	**(p)**	Sodium hydroxide
(B)	$Cu(NO_3)_2$	**(q)**	Ammonia solution
(C)	$Fe(NO_3)_3$	**(r)**	Disodium hydrogen phosphate
(D)	$Ag(NO_3)_2$	**(s)**	Potassium ferrocyanide

Ans. (A - r, s) ; (B - p, r, s) ; (C - p, q, r) ; (D - p, q, r, s)

Sol. **(A)** $Zn^{2+} + 2OH^- \longrightarrow Zn(OH)_2 \downarrow$ (white) ;

$Zn(OH)_2 + 2OH^- \longrightarrow [Zn(OH)_4]^{2-}$ (colourless soluble complex)

$Zn^{2+} + 2NH_3 + 2H_2O \longrightarrow Zn(OH)_2 \downarrow$ (white) $+ 2NH_4^+$

$Zn(OH)_2 \downarrow + 4NH_3 \longrightarrow [Zn(NH_3)_4]^{2+}$ (colour less soluble complex) $+ 2OH^-$

$3Zn^{2+} + 2HPO_4^{2-} \longrightarrow Zn_3(PO_4)_2 \downarrow$ (white) $+ 2H^+$

$3Zn^{2+} + 2K^+ + 2[Fe(CN)_6]^{4-} \longrightarrow K_2Zn_3[Fe(CN)_6]_2 \downarrow$ (bluish white)

(B) $Cu^{2+} + 2OH^- \longrightarrow Cu(OH)_2 \downarrow$ (blue)

$Cu^{2+} + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+}$ (deep blue soluble complex)

$Cu^{2+} + 2HPO_4^{2-} \longrightarrow Cu_3(PO_4)_2 \downarrow$ (blue) $+ 2H^+$

$Cu^{2+} + [Fe(CN)_6]^{4-} \longrightarrow Cu_2[Fe(CN)_6] \downarrow$ (chocolate brown)

(C) $Fe^{3+} + 3OH^- \longrightarrow Fe(OH)_3 \downarrow$ (reddish brown)

$Fe^{3+} + 3NH_3 + 3H_2O \longrightarrow Fe(OH)_3 \downarrow$ (reddish brown) $+ 3NH_4^+$

$Fe^{3+} + HPO_4^{2-} \longrightarrow FePO_4 \downarrow$ (yellowish-white) $+ H^+$

$4Fe^{3+} + 3[Fe(CN)_6]^{4-} \longrightarrow Fe_4[Fe(CN)_6]_3 \downarrow$ (intense blue) $\xrightarrow[K_4[Fe(CN)_6]]{\text{excess}}$ $KFe[Fe(CN)_6]$.

(soluble prussian blue)

(D) $2Ag^+ + 2OH^- \longrightarrow Ag_2O \downarrow$ (brown) $+ H_2O$

$2Ag^+ + 2NH_3 + H_2O \longrightarrow Ag_2O \downarrow$ (brown) $+ 2NH_4^+$

$4Ag^+ + HPO_4^{2-} \longrightarrow Ag_3PO_4 \downarrow$ (yellow) $+ H^+$

$4Ag^+ + 3[Fe(CN)_6]^{4-} \longrightarrow Ag_4[Fe(CN)_6] \downarrow$ (white)

True/False :

Ex. 19 Magnesium is precipitated from its salt solution as only magnesium ammonium phosphate by adding disodium hydrogen phosphate solution in absence of ammonium chloride and aqueous ammonia.

Sol. **(False)** Precipitation is carried out in presence of ammonium chloride and aqueous ammonia as they prevent precipitation of magnesium hydroxide.

$Mg^{2+} + NH_3 + HPO_4^{2-} \longrightarrow Mg(NH_4)PO_4 \downarrow$ (white)

Ex. 20 When a solution of nitrite acidified with dilute hydrochloric acid is treated with solid urea, the nitrite is decomposed, and nitrogen and carbon dioxide are evolved.

Sol. **(True)** $CO(NH_2)_2 + HNO_2 \longrightarrow 2N_2 \uparrow + CO_2 \uparrow + 3H_2O$.

Ex. 21 Solution of alkali metal cyanide containing freshly prepared iron (II) sulphate solution and dilute H_2SO_4 on exposure to air produces prussian blue precipitate

Sol. **(True)** $Fe^{2+} + 2CN^- \longrightarrow Fe(CN)_2 \downarrow$; $Fe(CN)_2 \downarrow + 4CN^- \longrightarrow [Fe(CN)_6]^{4-}$

$4Fe^{2+} + O_2 + 4H^+ \longrightarrow 4Fe^{3+} + 2H_2O$; $Fe^{3+} + [Fe(CN)_6]^{4-} \longrightarrow Fe_4[Fe(CN)_6]_3 \downarrow$

Exercise # 1 [Single Correct Choice Type Questions]

1. Zinc pieces are added to acidified solution of SO_3^{2-}. Gas liberated can :
(A) turn lead acetate paper black **(B)** turn lime water milky
(C) give white precipitate with $AgNO_3$ solution **(D)** decolourize acidified $KMnO_4$ solution

2. A mixture when rubbed with dilute acid smells like vinegar. It contains :
(A) sulphite **(B)** nitrate **(C)** nitrite **(D)** acetate

3. A substance on treatment with dilute H_2SO_4 liberates a colourless gas which produces (i) turbidity with baryta water and (ii) turns acidified dichromate solution green. The reaction indicates the presence of :
(A) CO_3^{2-} **(B)** S^{2-} **(C)** SO_3^{2-} **(D)** NO_2^-

4. The carbonate of which of the following cation is soluble in water ?
(A) Na^+ **(B)** K^+ **(C)** NH_4^+ **(D)** Ca^{2+}

5.. SO_2 and CO_2 both turn lime water (X) milky, SO_2 also turns $K_2Cr_2O_7/H^+$ (Y) green while O_2 is soluble in pyrogallol (Z) turning it black. These gases are to be detected in order by using these reagents. The order is:
(A) (X), (Y), (Z) **(B)** (Y), (X), (Z)
(C) (X), (Z), (Y) **(D)** The correct order cannot be predicted.

6. Colourless salt **(A)** + dil. H_2SO_4 or $CH_3COOH + KI \longrightarrow$ blue colour with starch. **(A)** can be
(A) K_2SO_3 **(B)** Na_2CO_3 **(C)** NH_4NO_2 **(D)** NH_4Cl

7. Which of the following combines with Fe(II) ions to form a brown complex?
(A) N_2O **(B)** NO **(C)** N_2O_3 **(D)** N_2O_4

8. Which of the following statements is/are incorrect ?
(A) A filter paper moistened with cadmium acetate solution turns yellow, when brought in contact with H_2S gas.
(B) Both carbonate ions as well as bicarbonate ions in the solutions, give reddish-brown precipitate with mercury(II) chloride.
(C) Sulphites in presence of zinc, reacts with dilute H_2SO_4 to liberate SO_3 gas.
(D) A filter paper moistened with KIO_3 and starch turns blue in contact with SO_2 vapours.

9. A mixture upon adding conc. H_2SO_4 gives deep red fumes. It may contain the anions pair :
(A) $Cr_2O_7^{2-}$ and Cl^- **(B)** Br^- and $Cr_2O_7^{2-}$ **(C)** NO_3^- and Cl^- **(D)** CrO_4^{2-} and NO_3^{2-}

10. A solution of a salt in concentrated sulphuric acid H_2SO_4 acid produced a deep blue colour with starch iodide solution. The salt may be
(A) chloride **(B)** carbonate **(C)** acetate **(D)** bromide

11. A colourless solution of a compound gives a precipitate with $AgNO_3$ solution but no precipitate with a solution of Na_2CO_3 . The action of concentrated H_2SO_4 on the compound liberates a suffocating reddish brown gas. The compound is :
(A) $Ba(CH_3COO)_2$ **(B)** $CaCl_2$ **(C)** NaI **(D)** NaBr

12. Which of the following reagents turns white precipitate of AgCl yellow ?
(A) $NaNO_3$ **(B)** Na_3AsO_3 **(C)** Na_3AsO_4 **(D)** NaCN

13. When a mixture of solid NaCl and solid $K_2Cr_2O_7$ is heated with concentrated H_2SO_4, deep red vapours are obtained. This is due to the formation of :
(A) chromous chloride **(B)** chromyl chloride **(C)** chromic chloride **(D)** chromic sulphate

14. AgCl dissolves in ammonia solution giving :
(A) Ag^+, NH_4^+ and Cl^- **(B)** $Ag(NH_3)^+$ and Cl^- **(C)** $Ag_2(NH_3)^{2+}$ and Cl^- **(D)** $Ag(NH_3)_2^+$ and Cl^-

15. Nitrate is confirmed by ring test. The brown colour of the ring is due to formation of :
(A) ferrous nitrite **(B)** nitroso ferrous sulphate
(C) ferrous nitrate **(D)** $FeSO_4.NO_2$.

16. Nitrates of all the metals except mercury and bismuth are :
(A) coloured **(B)** unstable **(C)** soluble in water **(D)** insoluble in water

17. Which of the following reagents can be used for making the distinction between AgCl and AgI ?
(A) Sodium arsenite solution. **(B)** Dilute ammonia solution.
(C) Potassium cyanide solution. **(D)** Dilute HNO_3.

18. When chlorine (Cl_2) water in excess is added to a salt solution containing chloroform, chloroform layer turns pale yellow. Salt contains :
(A) Br^- **(B)** I^- **(C)** NO_3^- **(D)** S^{2-}

19. An aqueous solution of salt containing an acidic radical X^- reacts with sodium hypochlorite in neutral medium. The gas evolved produces blue black colour spot on the starch paper. The anion X^- is :
(A) CH_3COO^- **(B)** Br^- **(C)** I^- **(D)** NO_2^-

20. When chlorine water is added to an aqueous solution of potassium halide in the presence of chloroform, a colour is developed but on adding more of chlorine water the colour disappears, and a colourless solution is obtained. This test confirms the presence of the following in aqueous solution.
(A) Iodide **(B)** Bromide **(C)** Chloride **(D)** Iodide and bromide

21. Precipitate of $PbSO_4$ is soluble in :
(A) ammonium acetate (6M) **(B)** dilute HCl
(C) dilute H_2SO_4 **(D)** none

22. There are four test tubes containing dilute HCl, $BaCl_2$, $CdCl_2$ and KNO_3 solutions. Which of the following reagents will help in the identification of $BaCl_2$?
(A) NaOH **(B)** K_2CrO_4 **(C)** $AgNO_3$ **(D)** both **(B)** and **(C)**

23. Ammonia/ammonium ion gives yellow precipitate with :
(A) H_2PtCl_6 **(B)** $HgCl_2$ **(C)** $Na_3[Co(NO_2)_6]$ **(D)** **(A)** and **(C)** both

24. Nessler's reagent is :
(A) K_2HgI_4 **(B)** $K_2HgI_4 + KOH$ **(C)** $K_2HgI_2 + KOH$ **(D)** $K_2HgI_4 + KI$

25. Ammonium salts on heating with slaked lime liberates a colourless gas (X). Identify the correct statement for gas (X).
(A) (X) turns red litmus blue and produces dense white fumes in contact with dilute HCl.
(B) (X) turns filter paper moistened with mercurous nitrate black and gives intense blue coloured solution with $CuSO_4$(aq).
(C) (X) when passed through Nessler's reagent produces a brown colour precipitate.
(D) All of these.

26. Cu^{2+} and Ag^+ are both present in the same solution . To precipitate one of the ions and leaves the other in solution, add
(A) H_2S (aq) **(B)** HCl (aq) **(C)** HNO_3(aq) **(D)** NH_4NO_3(aq)

27. Consider the following observation :

M^{n+} + HCl (dilute) $\longrightarrow$ white precipitate $\xrightarrow{\Delta}$ water soluble $\xrightarrow{CrO_4^{2-}}$ yellow precipitate.

The metal ion M^{n+} will be :

(A) Hg^{2+} **(B)** Ag^{+} **(C)** Pb^{2+} **(D)** Sn^{2+}

28. A white crystalline substance dissolves in water. On passing H_2S in this solution, a black precipitate is obtained. The black precipitate dissolves completely in hot HNO_3. On adding a few drops of concentrated H_2SO_4 , a white precipitate is obtained. This precipitate is that of

(A) $BaSO_4$ **(B)** $SrSO_4$ **(C)** $PbSO_4$ **(D)** $CdSO_4$

29. A metal nitrate reacts with KI solution to give yellow precipitate which on addition of excess of more concentrated solution (6 M) of KI dissolves forming a solution. The cation of metal nitrate is :

(A) Hg_2^{2+} **(B)** Ag^{+} **(C)** Pb^{2+} **(D)** Cu^{2+}

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

(A) $AgNO_3$ **(B)** $Pb(NO_3)_2$ **(C)** $Hg(NO_3)_2$ **(D)** $Mn(NO_3)_2$

31. White precipitate of silver chloride is soluble in :

(A) KCN solution (excess) **(B)** sodium thiosulphate solution (excess)

(C) ammonia solution **(D)** concentrated solution of KCl

32. In which of the following pairs the precipitates are red and black coloured respectively and both precipitates are soluble in excess KI solution ?

(A) HgI_2 , Hg_2I_2 **(B)** HgI_2 , BiI_3 **(C)** Cu_2I_2 , AgI **(D)** CdI_2 , PbI_2

33. Which one of the following salts will produce clear and transparent original solution in 2M HCl ?

(A) Ag_2CO_3 **(B)** $Pb(CO_3)_2$ **(C)** Hg_2CO_3 **(D)** $CuCO_3$

34. A metal chloride original solution (i.e. O.S) on mixing with K_2CrO_4 solution gives a yellow precipitate soluble in aqueous sodium hydroxide. The metal may be :

(A) mercury **(B)** iron **(C)** silver **(D)** lead

35. Sometimes yellow turbidity appears while passing H_2S gas even in slightly acidic medium in the absence of II group radicals. This is because :

(A) sulphur is present in the mixture as impurity.

(B) IV group radicals are precipitated as sulphides.

(C) of the oxidation of H_2S gas by some acid radicals.

(D) III group radicals are precipitated as hydroxides.

36. H_2S in the presence of HCl precipitates II group but not IV group because :

(A) HCl activates H_2S **(B)** HCl increases concentration of Cl^-

(C) HCl decreases concentration of S^{2-} **(D)** HCl lowers the solubility of H_2S in solution

37. Yellow ammonium sulphide solution is a suitable reagent for the separation of :

(A) HgS and PbS **(B)** PbS and Bi_2S_3 **(C)** Bi_2S_3 and CuS **(D)** CdS and As_2S_3

38. Which of the following is insoluble in dil. HNO_3 but dissolves in aqua regia ?

(A) HgS **(B)** PbS **(C)** Bi_2S_3 **(D)** CuS.

39. When small amount of $SnCl_2$ is added to a solution of Hg^{2+} ions, a silky white precipitate is obtained. The silky white precipitate is due to the formation of :

(A) Hg_2Cl_2 **(B)** $SnCl_4$ **(C)** Sn **(D)** Hg

40. Which of the following reagents gives white precipitate with $Hg(NO_3)_2$ solution ?
(A) Cobalt (II) thiocyanate **(B)** Tin (II) chloride (excess)
(C) Ammonia solution **(D)** Potassium cyanide solution

41. When bismuth chloride is poured into a large volume of water the white precipitate produced is of :
(A) BiO.OH **(B)** Bi_2O_3 **(C)** BiOCl **(D)** $Bi(OH)_3$

42. Which of the following is/are correctly matched ?
(A) $BiI_3\downarrow$ ⟶ Black **(B)** $Cu_2I_2\downarrow$ ⟶ White precipitate
(C) $PbI_2\downarrow$ ⟶ Yellow precipitate **(D)** $HgI_2\downarrow$ ⟶ Red precipitate

43. When excess of dilute NH_4OH is added to an aqueous solution of copper sulphate an intense blue colour is developed. This is due to the formation of :
(A) $[Cu(NH_3)_6]^{2+}$ **(B)** $Cu(OH)_2$ **(C)** $[Cu(NH_3)_4]^{2+}$ **(D)** $(NH_4)_2SO_4$

44. A black sulphide is formed by the action of H_2S on :
(A) cupric chloride **(B)** cadmium chloride **(C)** zinc chloride **(D)** ferric chloride.

45. Cu^{2+} ions will be reduced to Cu^+ ions by the addition of an aqueous solution of :
(A) KI **(B)** KCl **(C)** KSCN **(D)** KCN

46. Turnbull's blue is a ..... .
(A) ferricyanide **(B)** ferrous ferricyanide
(C) ferrous cyanide **(D)** ferri ferrocyanide

47. $Fe(OH)_3$ and $Cr(OH)_3$ precipitates can be completely separated by :
(A) Aq. NH_3 **(B)** HCl **(C)** $NaOH/H_2O_2$ **(D)** H_2SO_4

48. Ferric alum gives deep red colour with NH_4SCN due to the formation of :
(A) $Al(SCN)_3$ **(B)** $[Fe(SCN)_3]^-$ **(C)** $Fe(SCN)_3$ **(D)** None of these.

49. When NH_4Cl is added to a solution of NH_4OH :
(A) the dissociation of NH_4OH increases. **(B)** the concentration of OH^- increases.
(C) the concentrations of both OH^- an NH_4^+ increase. **(D)** the concentration of OH^- ion decreases.

50. An original solution of an inorganic salt in dilute HCl gives a brown colouration with potassium hexacyanidoferrate (III) and reddish brown colouration with sodium acetate solution. The cation of the salt is :
(A) Ni^{2+} **(B)** Fe^{3+} **(C)** Cu^{2+} **(D)** none

51. Intense blue precipitate of $Fe_4[Fe(CN)_6]_3$ and potassium hydroxide solution when mixed gives :
(A) $K_2Fe[Fe(CN)_6]$ - white precipitate **(B)** $Fe(OH)_3$ - reddish–brown precipitate
(C) $Fe(CN)_3$ – reddish–brown precipitate **(D)** $KFe[Fe(CN)_6]$ - Turnbull's blue

52. NH_4SCN can be used to test one or more out of Fe^{3+} , Co^{2+} ,Cu^{2+} :
(A) Fe^{3+} only **(B)** Co^{2+} , Cu^{2+} only **(C)** Fe^{3+} Cu^{2+} only **(D)** All

53. $K_4[Fe(CN)_6]$ can be used to detect one or more out of Fe^{2+} , Fe^{3+}, Zn^{2+}, Cu^{2+}, Ag^+ , Ca^{2+} :
(A) only Fe^{2+}, Fe^{3+} **(B)** only Fe^{3+},Zn^{2+},Cu^{2+} **(C)** all but not Ca^{2+} **(D)** all of these.

54. An aqueous solution of colourless metal sulphate M, gives a white precipitate with NH_4OH. This was soluble in excess of NH_4OH. On passing H_2S through this solution a white precipitate is formed. The metal M in the salt is:
(A) Ca **(B)** Ba **(C)** Al **(D)** Zn

55. Which one of the following ions does not give borax bead test ?
(A) Cr^{3+} **(B)** Cu^{2+} **(C)** Mn^{2+} **(D)** Zn^{2+}

56. Which of the following compound is formed in borax bead test ?
(A) Orthoborate **(B)** Metaborate **(C)** Double oxide **(D)** Tetraborate

57. To increase significantly the concentration of free Zn^{2+} ion in a solution of the complex ion $[Zn(NH_3)_4]^{2+}$
$Zn^{2+}(aq) + 4NH_3(aq) \rightleftharpoons [Zn(NH_3)_4]^{2+}(aq)$
add to the solution some :
(A) H_2O **(B)** HCl (aq) **(C)** NH_3(aq) **(D)** NH_4Cl (aq)

58. CoS (black) obtained in group IV of salt analysis is dissolved in aqua regia and is treated with an excess of $NaHCO_3$ and then Br_2 water. An apple green coloured stable complex is formed. It is :
(A) sodium cobaltocarbonate **(B)** sodium cobaltibromide
(C) sodium cobalticarbonate **(D)** sodium cobaltobromide

59. A metal salt solution when treated with dimethyl glyoxime and NH_4OH gives a rose red complex. The metal is -
(A) Ni **(B)** Zn **(C)** Co **(D)** Mn.

60. White precipitate of $Zn(OH)_2$ dissolves in :
(A) sodium hydroxide solution **(B)** acid solution
(C) ammonia solution **(D)** solution of ammonium salts

61. If crimson flame is given when an inorganic mixture is tested by flame test, it may be due to the presence of
(A) potassium **(B)** strontium **(C)** barium **(D)** calcium

62. A brick red colour is imparted to Bunsen flame by a :
(A) Ca salt **(B)** Sr salt **(C)** Na salt **(D)** Co salt

63. The presence of magnesium is confirmed in the qualitative analysis by :
(A) titan yellow solution + 2M NaOH solution **(B)** disodium hydrogen phosphate $+NH_4Cl + NH_3$ (aq.)
(C) magneson(I) reagent **(D)** all of these

64. Aqueous Solution of $BaBr_2$ gives yellow precipitate with :
(A) K_2CrO_4 **(B)** $AgNO_3$ **(C)** $(CH_3COO)_2Pb$ **(D)** **(A)** and **(B)** both

65. The addition of K_2CO_3 (aq) to the following solution is expected to produce a precipitate in every case but that one which does not produce precipitate is :
(A) $BaCl_2$(aq) **(B)** $CaBr_2$(aq) **(C)** Na_2SO_4(aq) **(D)** $Pb(NO_3)_2$ (aq)

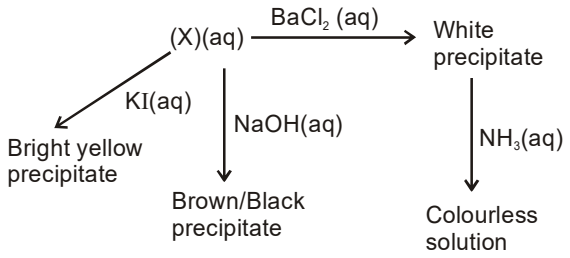
66. An aqueous solution of salt gives white precipitate with $AgNO_3$ solution as well as with dilute H_2SO_4. It may be
(A) $Pb(NO_3)_2$ **(B)** $Ba(NO_3)_2$ **(C)** $BaCl_2$ **(D)** $CuCl_2$

67. Which of the following solutions give white precipitate with $Pb(NO_3)_2$ as well as with $Ba(NO_3)_2$?
(A) Sodium chloride **(B)** Sodium sulphate
(C) Disodium hydrogen phosphate **(D)** Sodium chromate

68. Mg is not precipitated in V group because :
(A) $MgCO_3$ is soluble in water. **(B)** K_{sp} of $MgCO_3$ is high.
(C) $MgCO_3$ is soluble in NH_4OH. **(D)** None.

69. An aqueous solution of compound 'A' gives white precipitate with 2M HCl. The precipitate becomes black on addition of aqueous NH_3 due to formation of 'B'. 'B' dissolves in aquaregia. 'A' and 'B' are :
(A) Hg^{2+} and $Hg\,Cl_2$ **(B)** Hg_2^{2+} and Hg_2Cl_2
(C) Hg^{2+} and Hg (NH_2) Cl + Hg **(D)** Hg_2^{2+} and Hg (NH_2) Cl + Hg

70. A compound (X) reacts in the following ways.



The compound (X) is likely to be

(A) $Pb(NO_3)_2$ **(B)** $CaCrO_4$ **(C)** $Hg(NO_3)_2$ **(D)** $AgNO_3$

71. To a solution of a substance, gradual addition of ammonium hydroxide results in a brownish black precipitate which does not dissolve in excess of NH_4OH. However, when KI (not in excess) is added to the original solution, a green precipitate is formed. The solution contained :

(A) Lead salt **(B)** Silver salt **(C)** Mercurous salt **(D)** Copper salt.

72. $Na_2SO_4 + BaCl_2 \longrightarrow$ White precipitate $\xrightarrow{\text{Fuse this precipitate on charcoal with } Na_2CO_3 \text{ and extract the soluble substance with } H_2O}$ Aqueous solution.

Add dil H_2SO_4 and heat the solution

Gas 'G' is evolved

The gas 'G' will show which of the following property ?

(A) It turns lead acetate filter paper black.

(B) It turns acidified $K_2Cr_2O_7$ filter paper green.

(C) It produces purple colouration on filter paper moistened with sodium nitroprusside already made alkaline with sodium hydroxide.

(D) All of these

73. Consider following reaction ; Nitrite + Acetic acid + Thiourea $\longrightarrow N_2\uparrow + SCN^- + 2H_2O$. Formation of the product in the above reaction can be identified by :

(A) $FeCl_3$ / dilute HCl, when blood red colour appears.

(B) $FeCl_3$ / dilute HCl, when blue colour appears.

(C) $K_2Cr_2O_7$ / HCl, when green colour appear.

(D) $KMnO_4$ / HCl, when colourless solution is formed.

74. White precipitate of AgCl turns to greyish or black when :

(A) reacts with Na_3AsO_4 **(B)** exposed to sunlight

(C) reacts with K_2CrO_4 **(D)** reacts with concentrated HCl

75. Black precipitate of copper sulphide dissolves in :

(A) KCN solution. **(B)** sodium sulphide solution.

(C) sodium hydroxide. **(D)** boiling dilute (M) sulphuric acid.

76. Which of the following metal salts gives a red and opaque borax bead in the reducing flame (in cold) ?

(A) Ni **(B)** Fe **(C)** Cu **(D)** Mn

77. 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+}

78. Which one of the following metal salts produces a blue coloured bead in cobalt nitrate charcoal cavity test ?
(A) Zn^{2+} **(B)** Mg^{2+} **(C)** Sn^{2+} **(D)** Al^{3+}

79. Which of the following is correct ?
(A) $AgCl(s) + Na_3AsO_3 \rightarrow$ colourless solution **(B)** $FeCl_3(aq) + K_4Fe(CN)_6 \rightarrow$ brown precipitate.
(C) $FeCl_3(aq) + K_3Fe(CN)_6 \rightarrow$ brown colouration. **(D)** $CuSO_4(aq) + KCN$ (excess) $\rightarrow$ blue colouration.

80. Fe^{2+} does not give prussian blue colour with $K_4[Fe(CN)_6]$ but on its reaction with (X), prussian blue colour appears (X) can be :
(A) MnO_4^-/H^+ **(B)** Zn/NaOH **(C)** NH_3 (aq) **(D)** all true

81. The reagents, NH_4Cl and aqueous NH_3 will precipitate :
(A) Ca^{2+} **(B)** Al^{3+} **(C)** Mg^{2+} **(D)** Zn^{2+} .

82. In the precipitation of the iron group in qualitative analysis, ammonium chloride is added before adding ammonium hydroxide to :
(A) decrease concentration of OH^- ions **(B)** prevent interference by phosphate ions
(C) increase concentration of Cl^- ions **(D)** increase concentration of NH_4^+ ions

83. 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)** $(NH_4)_2CO_3$ **(D)** NaCl.

84. When HNO_3 is added to sodium ferrocyanide, which of the following observation is observed ?
(A) $NaFe[Fe(CN)_6]$ is produced. **(B)** $Fe_4[Fe(CN)_6]_3$ is formed.
(C) $Fe_3[Fe(CN)_6]_2$ is formed. **(D)** $Na_2[Fe(CN)_5(NO)^+]^{2-}$ is formed.

85. What product is formed by mixing the solution of $K_4[Fe(CN)_6]$ with the solution of $FeCl_2$ in complete absence of air ?
(A) Ferro ferricyanide **(B)** Ferric ferrocyanide
(C) Ferric ferricyanide **(D)** None

86. Select the correct statement with respect to Fe^{3+} ions.
(A) Iron (III) ions react with H_2S in acidic solution to give a black precipitate of Fe_2S_3.
(B) Iron (III) ions react with ammonium sulphide to give the black precipitate of Fe_2S_3.
(C) Iron (III) ions react with ammonium thiocyanate solution to produce deep red colouration.
(D) All of these

87. A suspension containing insoluble substances ZnS, MnS, HgS, Ag_2S and FeS, is treated with 2N HCl. On filtering, the filtrate contains appreciable amounts of which one of the following?
(A) Zinc and mercury **(B)** Silver and iron
(C) Manganese and mercury **(D)** Zinc, manganese and iron

88. An aqueous solution contains both Al^{3+} & Zn^{2+}.To this solution NH_4OH is added in excess.
(A) Only $Al(OH)_3$ will be precipitated. **(B)** Only $Zn(OH)_2$ will be precipitated.
(C) Both will be precipitated. **(D)** No precipitate will appear.

89. A metal M and its compound can give the following observable changes in a sequence of reactions,

$$M \xrightarrow[HNO_3]{\text{very dilute}} \left[\begin{array}{l}\text{Colourless solution}\\ \text{and no gas is evolved}\end{array}\right] \xrightarrow[NaOH]{\text{aqueous}} \left[\begin{array}{l}\text{White}\\ \text{precipitate}\end{array}\right] \xrightarrow[NaOH(aq.)]{\text{excess}} \left[\begin{array}{l}\text{Colourless}\\ \text{solution}\end{array}\right] \xrightarrow{H_2S/OH^-} \left[\begin{array}{l}\text{White}\\ \text{precipitate}\end{array}\right]$$

The metal M can be :
(A) Mg **(B)** Pb **(C)** Zn **(D)** Sn

90. Which one of the following compounds on reaction with Na_2O_2 in alkaline medium gives yellow colour solution?
(A) $Cr(OH)_3$ **(B)** $Zn(OH)_2$ **(C)** $Al(OH)_3$ **(D)** None of these.

91. A dark green bead in the borax bead test (in oxidising flame) indicates the presence of :
(A) Cr^{3+} **(B)** Mn^{2+} **(C)** Co^{2+} **(D)** Ni^{2+}

92. Which of the following cation does not give red colour precipitate/solution with dimethylglyoxime (DMG) in alkaline solution ?
(A) Zn^{+2} **(B)** Ni^{+2} **(C)** Fe^{2+} **(D)** both **(A)** and **(C)**

93. In fifth group, $(NH_4)_2CO_3$ is added to precipitate out the carbonates. We do not add Na_2CO_3 because :
(A) $CaCO_3$ is soluble in Na_2CO_3 **(B)** Na_2CO_3 increases the solubility of fifth group carbonates
(C) $MgCO_3$ will be precipitated out in fifth group **(D)** none

94. A metal salt solution forms a yellow precipitate with potassium chromate in acetic acid, a white precipitate with dilute sulphuric acid, but gives no precipitate with sodium chloride or iodide, it is :
(A) lead carbonate **(B)** basic lead carbonate
(C) barium carbonate **(D)** strontium carbonate

95. An inorganic salt when heated with concentrated H_2SO_4 evolves a colourless pungent smelling gas but with concentrated H_2SO_4 and MnO_2 evolves a coloured pungent smelling gas which bleaches moist litmus paper. The coloured gas is :
(A) NO_2 **(B)** Cl_2 **(C)** Br_2 **(D)** I_2

96. Chromyl chloride vapours are dissolved in water and acetic acid and barium acetate solution is added, then:
(A) the solution will remain colourless. **(B)** the solution will become dark green.
(C) a yellow solution will be obtained. **(D)** a yellow precipitate will be obtained.

97. When CS_2 layer containing both Br_2 and I_2 (2 : 1) is shaken with excess of chlorine (Cl_2) water, the violet colour due to I_2 disappears and a pale yellow colour appears in the solution. The disappearance of violet colour and appearance of pale yellow colour is due to the formation of :
(A) I_3^- and Br_2 respectively. **(B)** HIO_3 and BrCl respectively.
(C) ICl and BrCl respectively. **(D)** I^- and Br^- respectively.

98. When a salt is heated with dilute H_2SO_4 and $KMnO_4$ solution, the pink colour of $KMnO_4$ is discharged, the salt is :
(A) a sulphite **(B)** a carbonate **(C)** a nitrate **(D)** a bicarbonate

99. Solution of a salt in dilute H_2SO_4 or acetic acid produces deep blue colour with starch iodide solution. The salt contains :
(A) Br^- **(B)** I^- **(C)** NO_3^- **(D)** NO_2^-

100. A test tube containing a nitrate and another containing a bromide and MnO_2 are treated with concentrated H_2SO_4. The reddish brown fumes evolved are passed through water. The water will be coloured by :
(A) the nitrate **(B)** the bromide **(C)** both **(D)** none of the two

101. A metal salt solution gives a yellow precipitate with silver nitrate. The precipitate dissolves in dilute nitric acid as well as in dilute ammonia solution. The solution contains :
(A) bromide ions **(B)** iodide ions **(C)** phosphate ions **(D)** chromate ions

102. 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 $C_6H_5NH_3Cl$.

103. A white sodium salt dissolves 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 is
(A) CO_3^{2-} **(B)** Cl^- **(C)** SO_3^{2-} **(D)** S^{2-}

104. The composition of golden spangles is :
(A) $PbCrO_4$ **(B)** PbI_2 **(C)** As_2S_3 **(D)** $BaCrO_4$

105. In which of the following solvents, AgBr will have the highest solubility ?
(A) 10^{-3} M NaBr **(B)** 10^{-3} M NH_4OH **(C)** Pure water **(D)** 10^{-3} M HBr

106. A metal nitrate solution reacts with dilute hydrochloric acid to give a white precipitate which is soluble in concentrated potassium chloride. White precipitate on passing of hydrogen sulphide gas is converted into black precipitate. The black precipitate on boiling with hydrogen peroxide (3%) is converted again to a white precipitate which is soluble in ammonium acetate. The cation of the metal nitrate is :
(A) Pb^{2+} **(B)** Ag^+ **(C)** Hg^{2+} **(D)** Bi^{3+}

107. A one litre flask is full of reddish brown bromine fumes. The intensity of brown colour of vapour will not decrease appreciably on adding to the flask some :
(A) pieces of marble **(B)** animal charcoal powder
(C) carbon tetrachloride **(D)** carbondisulphide

108. Identify the compound which turns black with ammonia solution.
(A) Lead chloride **(B)** Mercurous chloride **(C)** Mercuric chloride **(D)** Silver chloride

109. A white crystalline substance dissolves in water. On passing H_2S in this solution, a black precipitate is obtained. The black precipitate dissolves completely in hot HNO_3. On adding a few drops of concentrated H_2SO_4, a white precipitate is obtained which is soluble in ammonium acetate. The white precipitate is that of:
(A) $BaSO_4$ **(B)** $SrSO_4$ **(C)** $PbSO_4$ **(D)** Ag_2SO_4

110. A metal nitrate solution does not give white precipitate with concentrated hydrochloric acid but on dilution with water produces a white precipitate. The metal nitrate solution with K_2CrO_4 and Na_2HPO_4 reagents gives red and yellow precipitates respectively which are soluble in ammonia solution. The cation of the metal nitrate is :
(A) Pb^{2+} **(B)** Ag^+ **(C)** Cu^{2+} **(D)** Bi^{3+}

111. Which of the following pairs comprises the red precipitates ?
(A) Ag_2CrO_4 and Hg_2CrO_4 **(B)** HgI_2 and Pb_2SCl_2
(C) BiOI and $Cu_2[Fe(CN)_6]$ **(D)** **(A)** and **(B)** both

112. Which one among the following pairs of ions can not be separated by H_2S in presence of dilute hydrochloric acid?
(A) Cd^{2+}, Sn^{2+} **(B)** Al^{3+}, Hg^{2+} **(C)** Zn^{2+}, Cu^{2+} **(D)** Ni^{2+}, Bi^{3+}

113. Which of the following reagents gives a yellow precipitate with a hot faintly acidic solution of Bi^{3+} ions ?
(A) Ammonia solution (excess).
(B) Freshly prepared 10% solution of pyrogallol.
(C) Potassium iodide solution.
(D) Freshly prepared 0.125 M alkaline sodium tetrahydroxidostannate (II) solution.

114. Select the incorrect statement.
(A) Marsh's test involves the reduction of soluble arsenic compound to arsine by nascent hydrogen in acidic solution and its subsequent decomposition into hydrogen and metallic arsenic as a brownish-black mirror on heating in a glass tube mixed with hydrogen.
(B) Ammonical silver nitrate gives metallic silver mirror with saturated solution of hydrazine sulphate.
(C) Red precipitate of silver (I) chromate is soluble in dilute nitric acid and ammonia solution.
(D) None of these

115. Which one of the following cations will give a green coloured ash when a piece of filter paper dipped in a solution containing its salt and $Co(NO_3)_2$ is burned ?

(A) Cu^{2+} **(B)** Mg^{2+} **(C)** Al^{3+} **(D)** Zn^{2+}

116. Which of the following is not precipitated as sulphide by passing H_2S in the presence of concentrated HCl ?

(A) Copper **(B)** Arsenic **(C)** Cadmium **(D)** Lead

117. Which of the following metal cation is reduced from its higher oxidation state (+2) to (+1) by both KI solution and excess of KCN solution ?

(A) Zn^{2+} **(B)** Hg^{2+} **(C)** Cu^{2+} **(D)** None

118. A coloured solution of an inorganic salt reacts with potassium thiocyanate to give first a black precipitate, which slowly turns white. The salt solution also gives black precipitate with H_2S gas in slightly acidic medium. The black precipitate dissolves in potassium cyanide forming a colourless solution. The basic radical present in the inorganic salt is :

(A) Bi^{3+} **(B)** Cu^{2+} **(C)** Hg^{2+} **(D)** None

119. To avoid the precipitation of hydroxides of Ni^{2+}, Co^{2+}, Mn^{2+} along with those of the third group cations, the solutions should be :

(A) heated with few drops of concentrated HNO_3. **(B)** boiled with excess of ammonium chloride.

(C) concentrated to small volume. **(D)** none of these.

120. A solution containing SCN^- ions can be used to test one or more out of : Fe^{3+}, Co^{2+} , Cu^{2+}, Ag^+ and Hg^{2+}.

(A) Fe^{3+} and Co^{2+} only **(B)** Co^{2+}, Cu^{2+}, Ag^+ and Hg^{2+}

(C) Fe^{3+} , Cu^{2+}, Co^{2+} and Hg^{2+} **(D)** all

121. A blue colouration (in solution or precipitate) is not obtained when :

(A) ammonium hydroxide dissolves in copper sulphate.

(B) cobalt chloride reacts with NH_4SCN in presence of amyl alcohol.

(C) ferric chloride reacts with sodium ferrocyanide.

(D) aqueous ammonia reacts with white precipitate of silver (I) chloride.

122. $CrO_4^{2-} + H^+ + H_2O_2 \xrightarrow{\text{ether}} X + H_2O$

Identify the correct statement with respect to X.

(A) It is an acid anhydride of chromic acid.

(B) It is a red colour compound which can be extracted easily into the etherial phase.

(C) It is chromium peroxide which produces blue colouration in etherial layer on gentle shaking.

(D) It is Cr_2O_3 which is used as a green pigment.

123. In the fourth group, white precipitate of $Mn(OH)_2$ on heating with PbO_2 and concentrated HNO_3 gives red-violet (purple) colour due to the formation of :

(A) $HMnO_4$ **(B)** Mn_2O_7 **(C)** $MnO(OH)_2$ **(D)** $PbMnO_4$

124. A coloured solution of a salt gives following reactions.

(i) It gives white precipitate with sodium hydroxide which becomes brown on exposure to air.

(ii) It gives white precipitate with ammonia solution which is soluble in ammonium salts.

(iii) Its acidified solution containing a few drops of dilute $AgNO_3$ on boiling with ammonium peroxodisulphate gives a reddish violet solution. The cation of the salt is :

(A) Mn^{2+} **(B)** Zn^{2+} **(C)** Al^{3+} **(D)** Ni^{2+}

125. A mixture of chlorides of copper, cadmium, chromium, iron and aluminium was dissolved in water. It was acidified with dilute HCl and then hydrogen sulphide gas was passed for sufficient time. It was filtered, boiled and a few drops of nitric acid were added, while boiling. To this solution ammonium chloride and ammonium hydroxide were added. To this excess of sodium hydroxide was added and then filtered. The filtrate shall give test for :

(A) sodium and iron **(B)** sodium, chromium and aluminium

(C) aluminium and iron **(D)** sodium, iron, cadmium and aluminium

126. Which of the following compounds on reaction with NaOH and Na_2O_2 gives yellow colour solution?

(A) $Cr(OH)_3$ **(B)** $Zn(OH)_2$ **(C)** $Al(OH)_3$ **(D)** $Fe(OH)_3$

127. $FeCl_3 + K_3[Fe(CN)_6] + H_2O_2 \longrightarrow$ Precipitate. The colour of the precipitate is :

(A) sky blue **(B)** brown **(C)** prussian blue **(D)** white

128. $Zn(OH)_2\downarrow$ is soluble in :

(A) excess of sodium hydroxide **(B)** excess of ammonia solution

(C) solutions of ammonium salts **(D)** all of these

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

(A) lilac **(B)** apple green **(C)** crimson red **(D)** brick red

130. A mixture of two salts is not water soluble but dissolves completely in dilute HCl to form a colourless solution. The mixture could be :

(A) $AgNO_3$ and KBr **(B)** $BaCO_3$ and ZnS **(C)** $FeSO_4$ and Na_2CO_3 **(D)** $Mn(NO_3)_2$ and $MgSO_4$

131. Select the correct statement with respect to Ca^{2+} ions.

(A) K_2CrO_4 gives white precipitate in the presence of acetic acid.

(B) Potassium hexacyanidoferrate (II) solution gives white precipitate.

(C) It gives lilac colour in Bunsen flame.

(D) Prolonged passage of carbon dioxide gas through its aqueous solution produces white precipitate.

Exercise # 2 Part # I [Multiple Correct Choice Type Questions]

1. Cu^{2+} ions give white precipitate with :
(A) potassium iodide solution.
(B) potassium thiocyanate and saturated solution of SO_2.
(C) excess potassium cyanide solution.
(D) potassium hydroxide solution.

2. Which of the following statements is/are true ?
(A) Ag^+ ions do not give white precipitate with excess of concentrated HCl.
(B) Cu^{2+} ions produce a white precipitate when KCN solution is added in a small quantity.
(C) Hg^{2+} ions give deep blue precipitate with cobalt acetate and ammonium thiocyanate.
(D) Black precipitate of BiI_3 turns orange when heated with water.

3. KI solution is the reagent for :
(A) Hg^{2+} **(B)** Pb^{2+} **(C)** Ag^+ **(D)** Cu^{2+}

4. Na_2SO_4 and Na_2S can be distinguished from each other by using :
(A) dilute H_2SO_4
(B) acidified $KMnO_4$ solution
(C) sodium nitroprusside solution
(D) cadmium acetate solution

5. Which of the following anion(s) evolve(s) reddish brown gas with concentrated H_2SO_4?
(A) Br^- **(B)** NO_3^- **(C)** SO_3^{2-} **(D)** I^-

6. Ammonium molybdate test is used for the estimation of :
(A) PO_4^{3-} **(B)** Mg^{2+} **(C)** As_4^{3-} **(D)** CH_3COO^-

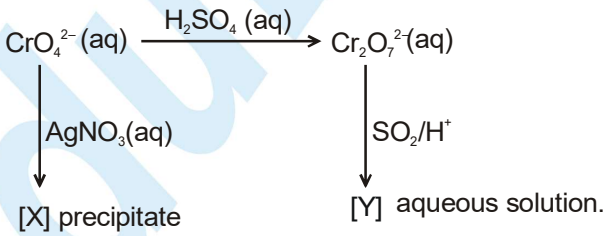
7. Which of the following cations form(s) black precipitate(s) with H_2S (g) ?
(A) Cu^{2+} **(B)** Sb^{3+} **(C)** Pb^{2+} **(D)** Bi^{3+}

8. Borax bead test is given by :
(A) Co^{2+} **(B)** Zn^{2+} **(C)** Cu^{2+} **(D)** Ni^{2+}

9. Concentrated aqueous ammonia dissolve(s) which of the following completely ?
(A) AgCl **(B)** AgBr **(C)** Ag_2CrO_4 **(D)** AgI

10. Which of the following is/are correct for potassium ferrocyanide ?
(A) It gives a brown precipitate with Cu^{2+} ions.
(B) It gives a white precipitate of mixed salt with Ca^{2+} ions.
(C) It in excess gives a bluish white/white precipitate with Zn^{2+}.
(D) It develops a deep red colouration with Fe^{3+}.

11. Consider the reactions shown below ;



Which of the following statement (s) is/are correct ?
(A) [X] is a yellow coloured precipitate.
(B) [X] is soluble in ammonia solution.
(C) [Y] gives green coloured solution with excess of sodium hydroxide solution.
(D) The conversion of $Cr_2O_7^{2-}$ to [Y] is an redox reaction.

12. $Hg_2I_2\downarrow$ (green) $\xrightarrow[\text{with } H_2O]{\text{boiled}}$ products

Which of the following statement is correct with respect to the products ?

(A) Black precipitate of mercury(I) oxide is formed.

(B) Violet colour gas is evolved.

(C) Red precipitate of HgI_2 is formed.

(D) Mercury is obtained

13. Which of the following statement(s) is /are false ?

(A) Fe^{3+} gives red precipitate with dimethyl glyoxime in alkaline solution.

(B) Cu^{2+} ion with potassium iodide solution gives a dirty brownish white precipitate which turns white on adding hypo solution.

(C) A filter paper soaked in mercurous nitrate turns black in contact with ammonia gas.

(D) Ag_2O does not dissolve in nitric acid and ammonia solution.

14. Which of the following statement(s) is/are true?

(A) Titan yellow solution gives red colouration with a neutral solution containing Mg^{2+} ions

(B) Solution of nitrite is decomposed by sulphamic acid.

(C) Fe^{2+} ions give brown colour precipitate with $[Fe(CN)_6]^{3-}$ ions solution.

(D) Green precipitate of $Cr(OH)_3$ is soluble in Na_2O_2.

15. White precipitate of $PbSO_4$ gets dissolved in :

(A) concentrated H_2SO_4 on heating **(B)** concentrated NaOH

(C) $(NH_4)_2CO_3$ **(D)** dilute HNO_3

16. What final product(s) is/are formed in the following series of reactions ?

Concentrated borax solution + silver nitrate solution $\longrightarrow$ Precipitate $\xrightarrow[\text{boiling}]{H_2O}$ Products (final)

(A) Ag_3BO_3 **(B)** Ag_2O **(C)** H_3BO_3 **(D)** $AgBO_2$

17. Which of the following sulphides do not dissolve in 50% HNO_3 but dissolve in aquaregia ?

(A) CoS **(B)** NiS **(C)** CuS **(D)** HgS

18. Which of the following statement(s) is/are correct with respect to bromide ions ?

(A) KBr on heating with MnO_2 and concentrated H_2SO_4 liberates Br_2 and SO_2 gases.

(B) KBr on heating with concentrated H_2SO_4 liberates Br_2 and SO_2 gases.

(C) KBr forms HBr with concentrated H_3PO_4.

(D) KBr(s) liberates Br_2 on gentle warming with concentrated H_2SO_4 and $K_2Cr_2O_7$(s).

19. Select the incorrect statement(s).

(A) Ammonium ions produce yellow colour solution with sodium hexanitrito-N-cobaltate (III).

(B) Ammonia gas develops a brown colour on filter paper moistened with a solution of $MnCl_2$ and H_2O_2.

(C) Ammonium ions produce white precipitate with saturated sodium hydrogen tartrate solution.

(D) Ammonium salts in presence of sodium hydroxide solution produces red precipitate with 4-nitrobenzene diazonium chloride reagent.

20. Original solution of salt or mixture should not be prepared in concentrated HNO_3 because it :

(A) is highly corrosive. **(B)** oxidises H_2S to S in IInd group.

(C) undergoes disproportionation reaction. **(D)** converts sulphide of Ba, Sr and Pb into insoluble sulphates.

21. Which of the following statement(s) is/are correct ?

(A) Yellow precipitated of silver arsenite is soluble in both nitric acid and ammonia.

(B) Potassium cyanide when added in very small quantity to copper sulphate solution, produces first yellow precipitate which quickly converts in to white precipitate.

(C) Black precipitate of BiI_3 turns orange on heating with water.

(D) White precipitate of $Bi(OH)_3$ turns yellowish brown, when boiled.

22. The following can be used to regulate the concentration of OH^- ions for the scheme of basic radical analysis (III group).

(A) NH_4NO_3 **(B)** NH_4Cl **(C)** $(NH_4)_2SO_4$ **(D)** $(NH_4)_2CO_3$

23. Select the correct statement(s).

(A) In group III, Fe^{3+} and Cr^{3+} can be differentiated by increasing NH_4^+ ion concentration

(B) In V^{th} group, Na_2CO_3 is added to precipitate out only the carbonates of Ba^{2+}, Sr^{2+} and Ca^{2+}.

(C) Like brown ring test, diphenylamine test is given only by salts containing NO_3^-.

(D) Sodium chloride on heating with aqueous solution of $K_2Cr_2O_7$ and concentrated H_2SO_4 produces deep red vapours.

24. Co^{2+} + KCN (not in excess) $\longrightarrow$ precipitate.

Select the correct statement(s) with respect to the precipitate.

(A) It is yellow in colour.

(B) It is reddish-brown in colour.

(C) It dissolves in excess of the reagent forming a brown solution.

(D) It is obtained when brown solution (option **(C)** is acidified with dilute HCl in the cold.

25. Potassium ferrocyanide is used for testing

(A) Cu^{2+} and Zn^{2+} **(B)** Fe^{3+} and Ca^{2+} **(C)** Ag^+ and Zn^{2+} **(D)** Th^{4+} and Cu^{2+}

26. Which of the following statements is/are correct ?

(A) An aqueous solution of Co(II) thiocyanate (10% freshly prepared) and mercuric nitrate solution taken in equal volumes on stirring the wall of the vessel with a glass rod produce deep-blue precipitate.

(B) White precipitate of $Al(OH)_3$ is soluble in sodium hydroxide as well as in ammonia solution.

(C) Green precipitate of $Cr(OH)_3$ readily dissolves in excess of sodium hydroxide forming a green solution.

(D) Chromium (III) salts give green coloured borax bead in both oxidising and reducing flame.

27. Which of the following statement(s) is/are not correct ?

(A) Nickel salts give rosy red precipitate with dimethyl glyoxime in excess of NH_4OH.

(B) Fe (III) salts give red colour with potassium sulphocyanide.

(C) In nitroprusside, the iron and NO exist as Fe(III) and NO.

(D) Mn (II) salts give white precipitate with NaOH which turns brown on adding Br_2 water.

28. Which of the following will give the same colour in oxidising flame as well as in the reducing flame in borax bead test (when cold) ?

(A) Chromium **(B)** Copper **(C)** Cobalt **(D)** Nickel

29. Ni + H_2SO_4 (hot and concentrated) $\longrightarrow$ X(g).

The liberated gas (select the correct statement) :

(A) develops blue colour spots on the filter paper moistened with potassium iodate and starch solution.

(B) turns acidified $K_2Cr_2O_7$ solution green.

(C) produces black precipitate with lead acetate solution.

(D) reacts with Cl_2 water to produce an acid which gives white fumes with ammonia.

30. Which of the following imparts green/apple green colour to the Bunsen flame ?

(A) Calcium chloride **(B)** Volatile boron trifluoride

(C) Barium chloride **(D)** Ethyl borate

31. $CoCl_2 + KNO_2 + CH_3COOH \longrightarrow [X] + H_2O + KCl + CH_3COOK + NO$

(Unbalanced equation)

(A) X is a yellow crystalline solid insoluble in water.

(B) X is a green coloured compounds known as kinman's green.

(C) IUPAC name of X is potassium hexanitrito –N– cobaltate (II)

(D) The compound X is an inner orbital complex.

Part # II [Assertion & Reason Type Questions]

Each question has 5 choices (A), (B), (C), (D) and (E) out of which only one is correct.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement-2 is true and Statement-2 is not correct explanation for Statement-1

(C) Statement-1 is true,Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

(E) Both Statements are false

1. **Statement-1 :** A solution containing S^{2-} ions gives purple / violet colour with sodium nitroprusside solution in alkaline medium.

Statement-2 : Sodium sulphide gives black precipitate with silver nitrate solution.

2. **Statement-1 :** Baryta water becomes turbid on passing CO_2 gas through it but turbidity becomes clear on passing more CO_2 gas.

Statement-2 : Carbonates give yellowish white precipitate with silver nitrate solution. The precipitate becomes yellow or brown on heating.

3. **Statement-1 :** White crystalline precipitate of silver sulphite dissolves, if sulphite ions are added in excess.

Statement-2 : Sulphite ions decolourise the pink colour of acidified $KMnO_4$.

4. **Statement-1 :** Acidified $K_2Cr_2O_7$ solution becomes green when SO_2 gas is passed through it.

Statement-2 : This is an redox reaction.

5. **Statement-1 :** When H_2S gas is passed into an aqueous solution of $ZnCl_2$, Zn^{2+} ions are completely precipitated as zinc sulphide

Statement-2 : Zinc sulphide is soluble in solutions of caustic alkali as well as in dilute HCl.

6. **Statement-1 :** An original solution containing excess of Ni^{2+} ions gives a yellow coloured solution with potassium cyanide solution.

Statement-2 : A solution of Ni^{2+} ions gives red precipitate with dimethylglyoxime solution just made alkaline with ammonia.

7. **Statement-1 :** V group basic radicals are precipitated as their carbonates by $(NH_4)_2CO_3$ in presence of ammonia or ammonium chloride.

Statement-2 : Aqueous ammonia maintains the pH of the solution basic.

8. **Statement-1 :** Nessler's reagent gives a brown precipitate with aqueous ammonia as well as with ammonium salts.

Statement-2 : Aqueous ammonia gives a brown precipitate with a solution of manganese (II) chloride and hydrogen peroxide.

9. **Statement-1 :** Cu^{2+} and Cd^{2+} ions form complexes with excess of potassium cyanide solution.
Statement-2 : On passing H_2S gas, complex $[Cu(CN)_4]^{3-}$ is not effected but $[Cd(CN)_4]^{2-}$ gives yellow precipitate.

10. **Statement-1 :** A solution of $BiCl_3$ in concentrated HCl when diluted with water gives white precipitate.
Statement-2 : $BiCl_3$ forms insoluble BiO^+Cl^- when diluted with a large quantity of water.

11. **Statement-1 :** In dilute solution of strontium ions, yellow precipitate of $SrCrO_4$ is formed with CrO_4^{2-} ions.
Statement-2 : The $SrCrO_4$ precipitate is appreciably soluble in water, therefore, no precipitation occurs when water is taken in large quantity.

12. **Statement-1 :** White precipitate of $Mg(OH)_2$ is insoluble in excess of sodium hydroxide but readily soluble in solution of ammonium salts.
Statement-2 : $Mg(OH)_2$ is very sparingly soluble in water.

13. **Statement-1 :** White precipitate of zinc phosphate is soluble in ammonia.
Statement-2 : Zinc phosphate forms a soluble complex with ammonia.

Exercise # 3 Part # I [Matrix Match Type Questions]

1. Match the precipitates listed in column-I with their suitable solvents listed in column-II.

Column I (precipitate)	Column II (solvent)
(A) $AgCl\downarrow$ (white)	(p) Concentrated HCl.
(B) $CuS\downarrow$ (black)	(q) Dilute ammonia solution (excess).
(C) $Zn(OH)_2\downarrow$ (white)	(r) Potassium cyanide solution.
(D) $Ba(CO_3)\downarrow$ (white)	(s) Hot 50% nitric acid.

2. Match the colour of the precipitates listed in column-I with the suitable reagent(s) in column-II.

Column-I	Column-II
(A) Bi^{3+} give(s) black precipitate with	(p) H_2S (saturated solution in water)
(B) Cu^{2+} give(s) black precipitate with	(q) Potassium thiocyanate solution
(C) Zn^{2+} give(s) white precipitate with	(r) Potassium iodide solution
(D) Ag^{+} give(s) white precipitate with	(s) Potassium ferrocyanide solution
	(t) Sodium hydroxide solution.

3. Match the basic radicals listed in column-I with the properties listed in column-II.

Column-I (Basic radical)	Column-II (Properties)
(A) Mn^{2+}	(p) Forms coloured metaborate in oxidising flame in borax bead test.
(B) Cr^{3+}	(q) Forms white precipitate with sodium hydroxide but on exposure to air turns rapidly brown.
(C) Al^{3+}	(r) With both potassium cyanide (not in excess) and ammonia solution separately forms reddish brown precipitate.
(D) Fe^{3+}	(s) With excess of sodium hydroxide forms soluble complex but on adding acid to soluble complex, a precipitate is obtained which redissolves on adding excess of acid.

4. **Match the following**

Column–I	Column–II
(A) $Fe(SCN)_3 + KF$ (aq) excess	(p) Produce coloured product (s)
(B) $CrO_2Cl_2 + NaOH$ (aq)	(q) diamegnatic product
(C) $Ni^{+2} + dmg \xrightarrow[CH_3COONa]{CH_3COOH}$	(r) Hydrogen bonded product
(D) $Na_2SO_3 + Cr_2O_7^{-2} \xrightarrow{H^+}$	(s) Tetrahedral geometry around metal

Note :- dmg = dimethyl glyoxime

5. **Match the following**

Column–I	Column–II
(A) $CrCl_3$ (aq)	(p) Produce ppt with excess of NaOH
(B) $CuSO_4$ (aq)	(q) Produce coloured Solution with excess of amonia
(C) $(NH_4)_2CO_3$ (aq)	(r) Produce gases product when heated with KOH (aq)
(D) $AgNO_3$ (aq)	(s) Produce gas with dil. H_2SO_4

6. Match the following

Column–I	Column–II
(A) Colourless gas evolved on addition of dil. H_2SO_4	**(p)** $S_2O_3^{2-}$
(B) White ppt. on addition of $AgNO_3$	**(q)** S^{2-}
(C) Black ppt. obtained when $HgCl_2$ is added in little amount	**(r)** NO_2^-
(D) The ppt. obtained on addition of $AgNO_3$ followed by NH_3 solution	**(s)** $CH_3CO_2^-$

7. Match the following

Column–I	Column–II
(A) Soluble in a concentrated NH_3 solution	**(p)** Ag_2S
(B) Soluble in excess KCN solution	**(q)** $Cu(OH)_2$
(C) Soluble in excess hypo solution	**(r)** AgBr
(D) Soluble in conc. HCl	**(s)** AgCl

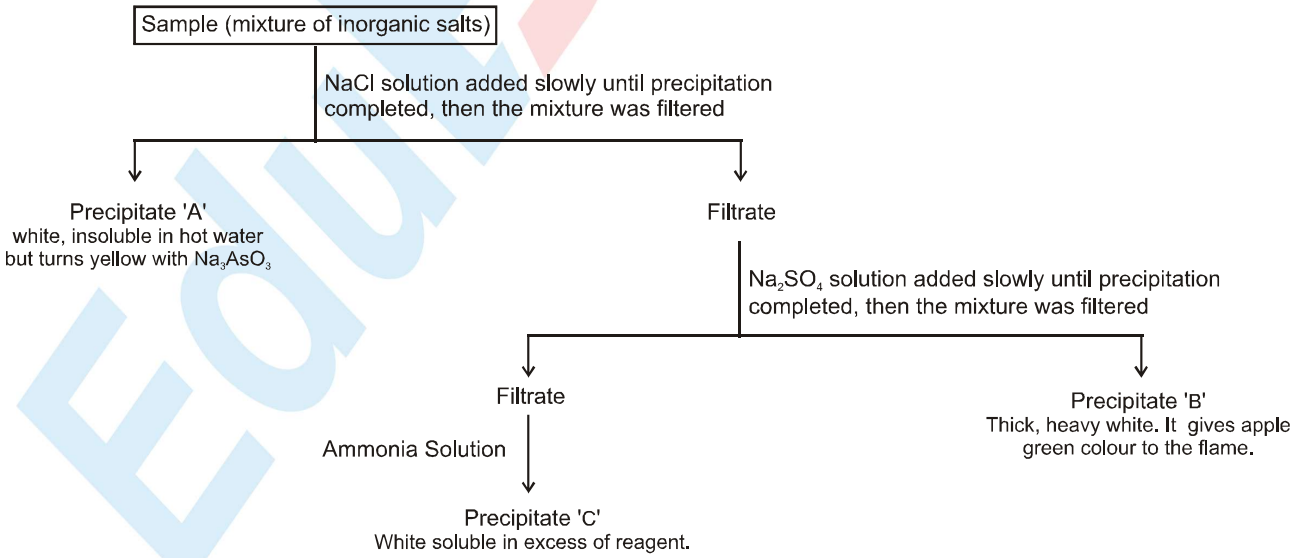
8. Match the following

Column–I	Column–II
(A) $H_3P_3O_9$	**(p)** S–O–S bond is present
(B) $H_2S_2O_7$	**(q)** Di-basic acid
(C) $H_2S_4O_6$	**(r)** P–O–P bond is present
(D) $H_4P_2O_5$	**(s)** Central atom (S or P) in maximum oxidation state

Part # II [Comprehension Type Questions]

Comprehension # 1

A student was given a sample of colourless solution containing three cations and was asked to identify the cations. Student carried out a series of reactions as given below.



1. Precipitates 'A', 'B' and 'C' are respectively :
(A) $Al(OH)_3$, $BaSO_4$ and AgCl (B) AgCl, $BaSO_4$ and $Zn(OH)_2$
(C) AgCl, $Ca(OH)_2$ and $ZnSO_4$ (D) $ZnCl_2$, $BaSO_4$ and $Al(OH)_3$

2. White precipitate 'A' is not soluble in :
(A) NH_3 (B) 2M HCl (C) KCN (D) $Na_2S_2O_3$

3. Which of the following statement is correct ?
(A) Precipitate 'C' gives Rinmann's green test.
(B) Precipitate 'B' is appreciably soluble in boiling concentrated H_2SO_4.
(C) Precipitate (A) on exposure to sunlight or ultraviolet radiations turns black.
(D) All of these.

Comprehension # 2

Aqueous solution of 'A' $\xrightarrow{H_2S\ (g)}$ Black precipitate 'B', soluble in 50% HNO_3 forming 'C'.

$\downarrow$ NH_3 solution

White precipitate dissolves in hydrochloric acid but on dilution with water again white turbidity appears 'E'.

$\downarrow$ Alkaline Na_2SnO_2

Black precipitate 'D'

Moreover, the salt 'A' on heating with solid $K_2Cr_2O_7$ and concentrated H_2SO_4 produces deep red vapours which dissolve in sodium hydroxide solution forming a yellow solution. This yellow solution gives yellow precipitate with $Ba(NO_3)_2$ solution.
On the basis of the aforesaid characteristic informations answer the following questions :

1. Acidified solution of 'A', on treatment with KI gives black precipitate 'F' which dissolves in excess of reagent forming the coloured compound 'G'. The chemical composition of 'F' and 'G' are respectively :
(A) HgI_2 and $[HgI_4]^{2-}$ (B) PbI_2 and $[PbI_4]^{2-}$ (C) BiI_3 and $[BiI_4]^-$ (D) Cu_2I_2 and CuI_2.

2. The black precipitate 'F' on heating with water produces :
(A) $Hg(OH)_2$ (B) BiOI (C) BiO.OH (D) CuO.OH

3. Which of the following statements is incorrect?
(A) The black precipitate 'D' is of bismuth.
(B) The black precipitate 'D' is of Hg + $Hg(NH_2)NO_3$.
(C) Aqueous solution of 'A' gives yellow precipitate with freshly prepared 10% solution of pyrogallol.
(D) Aqueous solution of 'A' gives red precipitate with 8-hydroxyquinoline (5%) and potassium iodide (6M) in acidic medium.

4. Select the correct statement.
(A) Aqueous solution of 'A' reacts with $AgNO_3$ solution to give white precipitate which turns yellow on treatment with sodium arsenite.
(B) Aqueous solution of 'A' produces white precipitate with sodium hydroxide which turns yellowish-white on boiling.
(C) White turbidity 'E' is soluble in dilute mineral acids.
(D) All of these.

Reaction involved in comprehension :

$2Bi^{3+}$ **(A)** $+ 3H_2S \xrightarrow{H^+} Bi_2S_3\downarrow$ (black) **(B)** $+ 6H^+$

$Bi_2S_3 + 8HNO_3 \longrightarrow 2Bi(NO_3)_3$ **(C)** $+ 2NO + 3S + 4H_2O$

$Bi^{3+} + 3OH^- \xrightarrow{NaOH} Bi(OH)_3\downarrow$ (white) ; $2Bi(OH)_3\downarrow$ (white) $+ 3[Sn(OH)_4]^{2-} \longrightarrow 2Bi\downarrow$ **(D)** $+ 3[Sn(OH)_6]^{2-}$

$Bi^{3+} + 3OH^- \xrightarrow{NH_4OH} Bi(OH)_3\downarrow$ (white) ; $Bi(OH)_3\downarrow$ (white) $+ 3HCl \longrightarrow BiCl_3 + 3H_2O$

$BiCl_3 + H_2O \longrightarrow BiOCl\downarrow$ (bismuth oxychloride) (E) $+ 2HCl$

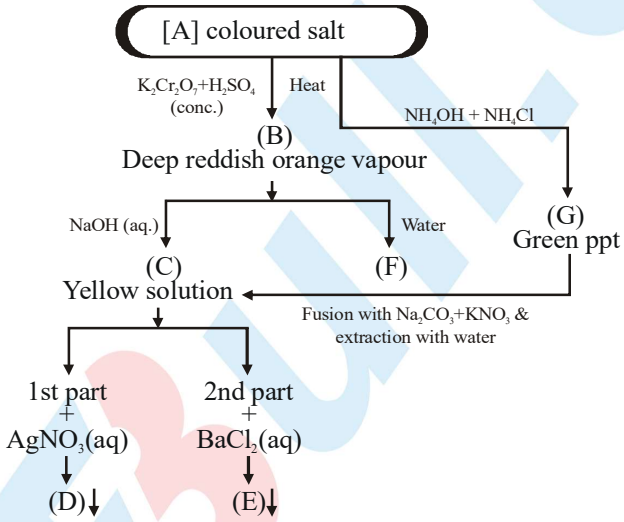
$4NaCl + K_2Cr_2O_7 + 3H_2SO_4$ (conc.) $\longrightarrow 2CrO_2Cl_2$ (deep red vapours) $+ 2Na_2SO_4 + K_2SO_4 + 3H_2O$

$CrO_2Cl_2 + 4OH^- \longrightarrow CrO_4^{2-} + 2Cl^- + 2H_2O$

$CrO_4^{2-} + Ba^{2+} \longrightarrow BaCrO_4\downarrow$ (yellow).

Comprehension # 3

Read the following comprehension carefully and answer the following questions.



1. The colour of the ppt **(D)** & **(E)** are :

(A) white & yellow **(B)** yellow **(C)** brick red & yellow **(D)** yellow and brick red

2. Yellow solution **(C)** is an important laboratory reagent and is used in the estimation of :

(A) Pb^{2+} **(B)** Fe^{3+} **(C)** Cd^{2+} **(D)** None of these

3. The compound **(A)** is :

(A) $CrCl_3$ **(B)** $CrBr_3$ **(C)** $Cr(CH_3COO)_3$ **(D)** $Cr(NO_3)_3$

4. [A] (s) + MnO_2 + H_2SO_4 (conc.) $\longrightarrow$ X Greenish yellow gas.

Select the correct choice for [X] :

(A) It gives yellow ppt. with $AgNO_3$

(B) It liberates I_2 from KI solution

(C) It turns starch paper orange red

(D) It turns titan yellow solution red

Comprehension # 4

A chemist opened a cupboard to find four bottles containing water solutions, each of which has 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

Sodium carbonate

Lead nitrate

hydrochloric acid

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

(i) Bottle 1 + Bottle 2	white precipitate
(ii) Bottle 1 + Bottle 3	white precipitate
(iii) Bottle 1 + Bottle 4	white precipitate
(iv) Bottle 2 + Bottle 3	colourless gas evolved
(v) Bottle 2 + Bottle 4	no visible reaction
(vi) Bottle 3 + Bottle 4	blue precipitate

1. Chemical formula of white precipitate in observation (i) is :

(A) $CuCl_2$ **(B)** $PbCl_2$

(C) $PbCO_3$ **(D)** $CuSO_3$

2. Colourless solution present in Bottle-1 is -

(A) $CuSO_4$ **(B)** HCl

(C) $Pb(NO_3)_2$ **(D)** Na_2CO_3

3. Nature of gas evolved in observation (iv) is -

(A) Acidic **(B)** Neutral

(C) Basic **(D)** Amphoteric

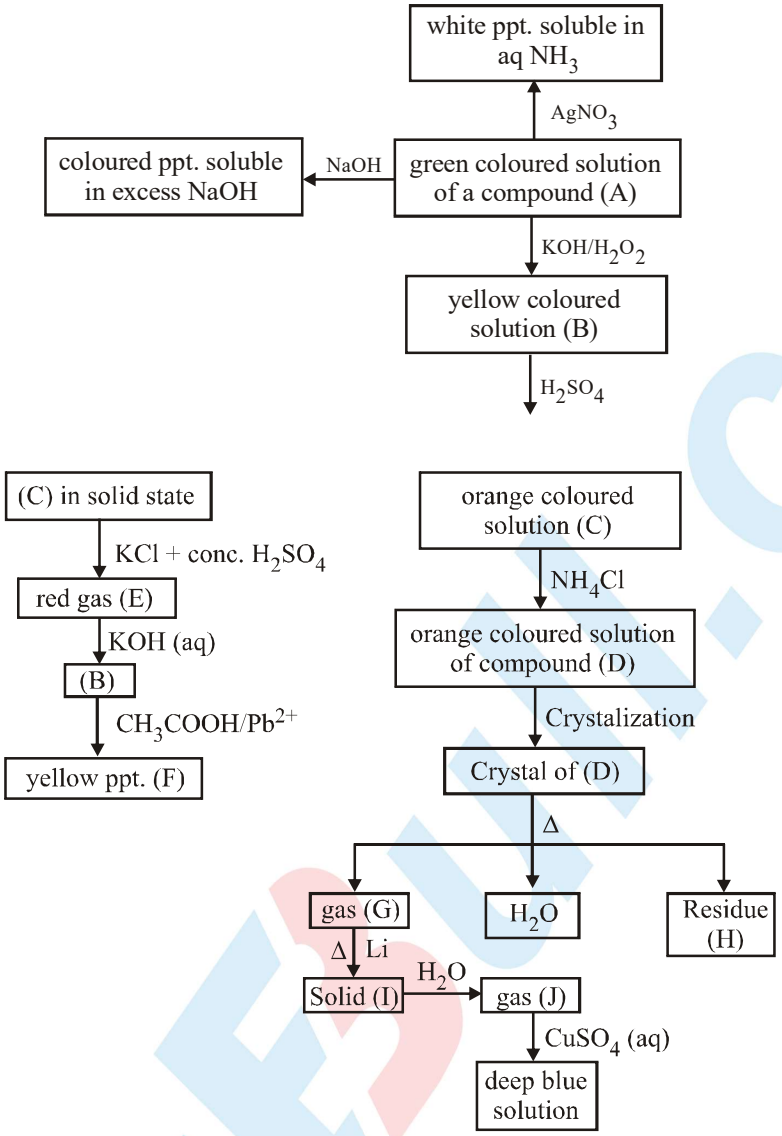
4. Chemical formula of white ppt. formed in observation (iii) is :

(A) $PbCl_2$ **(B)** $PbCO_3$

(C) $CuCO_3$ **(D)** $PbSO_4$

Comprehension # 5

Read the following short write up and answer subsequent questions based on observations **(A)** to **(J)**.



1. Compound A and B are respectively :

(A) $FeCl_2$; $FeCl_3$ **(B)** $CuCl_2$; $2H_2O$; $[CuCl_4]^{-2}$

(C) $CrCl_3$; K_2CrO_4 **(D)** $NiCl_2$; $NiCl_3$

2. Gas (J) is also produced by :

(i) heating NH_4NO_3 **(ii)** heating NH_4NO_2

(iii) heating NH_4Cl **(iv)** Reaction of NH_4Cl and $Ca(OH)_2$

(A) (i) and (iii) **(B)** (i) and (ii) **(C)** (i) and (iv) **(D)** (iii) and (iv)

3. Select the incorrect reaction :

(A) **(C)** in solid state + KBr + conc. H_2SO_4 $\longrightarrow$ Red gas

(B) **(C)** in solid state + KCl + conc. H_2SO_4 $\longrightarrow$ Red gas

(C) **(C)** in solid state + $FeCl_3$ + conc. H_2SO_4 $\longrightarrow$ Red gas

(D) **(C)** in solid state + $HgCl_2$ + conc. H_2SO_4 $\longrightarrow$ Red gas

Comprehension # 6

Three metal ions x^{+2}, y^{+2}, z^{+2} are identify in qualitative analysis. Nitrates of x^{+2}, y^{+2}, z^{+2} dissolve in three seprate test tubes and gives following observation.

(i) All solution produce carbonate precipitate with $(NH_4)_2CO_3$

(ii) Only one produce white ppt on addition of NaCl.

(iii) Out of 3 cations two produce sulphide ppt.

(iv) Sulphide of y^{+2} is not produce by H_2S/H^+ but produce when H_2S is passed in basic medium.

(v) Only y^{+2} produce soluble sulphate

(vi) x^{+2} gives no ppt with dil NH_4OH.

1. Select in correct statement :

(A) y^{+2} not produce precipitate with I^{st} group reagent in salt analysis

(B) y^{+2} not produce ppt with 2^{nd} group reagent in salt analysis

(C) z^{+2} produce ppt with II^{nd} group reagent in salt analysis

(D) z^{+2} is not produce ppt with I^{st} group reagent in salt analysis

2. Select order of K_{sp} of sulphide of x^{+2}, y^{+2}, z^{+2} -

(A) xs > ys > zs **(B)** xs > zs > ys

(C) ys > zs > xs **(D)** zs > ys > xs

3. Select correct about xCO_3, y CO_3, z CO_3 -

(A) All are soluble in dil. H_2SO_4 **(B)** All are soluble in dil HCl

(C) None is soluble in dil. H_2SO_4 **(D)** Except ZCO_3 all are soluble in dil. HCl

4. **(i)** $x^{+2} + H_2S \xrightarrow{NH_4OH}$ **(ii)** $x^{+2} + NaOH$ (dil) $\longrightarrow$

(iii) $x^{+2} + Na_2CO_3 \longrightarrow$

Precipitate is obtain in

(A) Reaction (i), (ii), (iii) **(B)** Only in reaction (iii)

(C) Only in reaction (i) and (ii) **(D)** Only in reaction (ii)

Exercise # 4 [Subjective Type Questions]

1. Which radical of group IVth gives bluish white / white precipitate with excess $K_4[Fe(CN)_6]$?

2. What products are formed ? When :

(i) Disodium hydrogen phosphate is added to magnesium sulphate in presence of ammonium chloride and aqueous ammonia.

(ii) A solution containing Zn^{2+} ions is poured in an aqueous ammonia.

(iii) $Bi(NO_3)_3$ solution is mixed with KI and then resulting precipitate is heated with water.

(iv) Disodium hydrogen phosphate is boiled with concentrated HNO_3 and ammonium molybdate reagent.

3. Complete and balance the following chemical reactions.

(i) $Cu(BO_2)_2 + C \xrightarrow{\text{fused}}$ **(ii)** $AgBr + \text{concentrated } NH_3 \longrightarrow$

(iii) $Cr(OH)_3 + Na_2CO_3 + KNO_3 \xrightarrow{\text{fused}}$ **(iv)** $Cu(NO_3)_2 \xrightarrow{\Delta}$

4. Salt + H_2SO_4 (dilute) $\longrightarrow$ Coloured vapours which turns starch iodide paper blue. Identify the acid radical and the coloured vapours giving the relevant chemical equations.

5. Which chloride of Ist group basic radicals turns black on treatment with NH_3 ?

6. Which basic radicals form oxo-cations in aqueous solutions ?

7. Complete and balance the following reaction.

(i) $Na_2S + CdCO_3 \longrightarrow$ ..... + ... **(ii)** $CoCl_2 + NH_4SCN \xrightarrow{\text{Ether}}$ ..... + ...

8. A black coloured compound (A) on reaction with dilute 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 precipitate (F) soluble in dilute HNO_3. After boiling this solution when an excess of NH_4OH is added, a intense blue coloured compound (G) is formed. To this solution on addition of acetic acid and aqueous $K_4[Fe(CN)_6]$ a chocolate brown precipitate (H) is obtained. On addition of an aqueous solution of $BaCl_2$ to an aqueous solution of (E) a white precipitate insoluble in dilute HCl is obtained. Identify the compounds from (A) to (H).

9. A compound (A) is greenish crystalline salt, which gave the following reactions.

(i) Addition of $BaCl_2$ solution to the solution of (A) results in the formation of white precipitate (B) which is insoluble in dilute HCl.

(ii) On heating (A), water vapours and two oxides of sulphur (C) and (D) are liberated leaving a red brown residue (E).

(iii) (E) dissolves in warm concentrated HCl to give a yellow solution (F).

(iv) Solution (F) on treatment with thiocyanate ions gives blood red coloured compound (G).

Identify the compounds from (A) to (G).

10. **(i)** A blue coloured compound (A) on heating gives two product (B) & (C).

(ii) A metal (D) is deposited on passing hydrogen through heated (B).

(iii) The solution of (B) in HCl on treatment with the $[Fe(CN)_6]^{4-}$ 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 step (i) to (iv).

11. Why in cobalt nitrate test for aluminium salts, excess of cobalt nitrate should not be added ?

12. In the reaction sequence : $CrO_2Cl_2 \xrightarrow{NaOH} A \xrightarrow{dil\ H_2SO_4} B \xrightarrow{NaOH} C \xrightarrow{AgNO_3} D$

Identify [A] to [D].

13. 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 $K_2Cr_2O_7$ 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 white 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).

14. A mixture of two salts was treated as follows.

(i) The mixture was heated with precipitated MnO_2 and concentrated H_2SO_4 when a yellowish green gas was liberated.

(ii) The mixture on heating with NaOH solution gave a gas which turned red litmus blue.

(iii) Its solution in water gave red colouration with dimethylglyoxime in alkaline solution and white precipitate with $K_4[Fe(CN)_6]$ in absence of air.

(iv) The mixture was boiled with KOH and the liberated gas was bubbled through an alkaline solution of K_2HgI_4 to give a brown precipitate. Identify the ions present in the mixture.

15. **(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 $K_4Fe(CN)_6$ gives a blue coloured compound (C).

(iii) (A) on heating with excess of solid $K_2Cr_2O_7$ in presence of concentrated H_2SO_4 gives deep red vapour of (D).

(iv) On passing vapour of (D) into a solution of NaOH and then adding the solution of acetic 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).

16. What happens when ?

(a) To a Zn^{2+} ions solution faintly acidified with 2M acetic acid, 0.1 mL of 0.25 M $CuSO_4$ solution and 2 mL of ammonium tetrathiocyanatomercurate(II) reagent is added.

(b) The above test is performed in absence of $CuSO_4$ solution.

17. Amongst the following, the total number of compounds soluble in concentrated NH_3 solution is :

(A) Ag_2CrO_4, **(B)** $Cu(OH)_2 . CuSO_4$, **(C)** $PbSO_3$, **(D)** $Al(OH)_3$, **(E)** $Ni(OH)_2$,
(F) $Zn_3(PO_4)_2$ **(G)** $BaSO_4$, **(H)** $Bi(OH)_2NO_3$, **(I)** $Mn(OH)_2$

18. An alcoholic solution of dimethylglyoxime is added to an aqueous solution of nickel(II) chloride. Slow addition of ammonium hydroxide led to the precipitation of a bright-red coloured metal complex.

Find out the number of hydrogen bonds present in the structure of the complex.

19. $Fe^{2+}(aq) + NO_3^-(aq) + H_2SO_4(conc.) \longrightarrow$ Brown ring

The brown ring is due to the formation of complex, $[Fe(H_2O)_5NO]SO_4$. What is the oxidation state of iron in the complex ?

20. How many of the following salts impart characteristic colours to the Bunsen flame?

$NaCl$, KCl, $CuCl_2$, $BaCl_2$, $CaCl_2$, $SrCl_2$, $ZnCl_2$, $MgCl_2$, $AlCl_3$

21. How many of the following liberate coloured vapour/gas with concentrated H_2SO_4?

$KCl\,(s) + K_2Cr_2O_7\,(s), KNO_2\,(s), KI(s), KBr(s), KCl(s)$

$KBr\,(s) + MnO_2\,(s), KNO_3, KCI(s) + MnO_2, K_2SO_3$

22. How many of the following pairs of ions can be separated by H_2S in dilute HCl?

Bi^{3+} and Sn^{4+}, Al^{3+} and Hg^{2+}, Cd^{2+} and Zn^{2+}, Fe^{3+} and Cu^{2+}, As^{3+} and Sb^{3+}

23. An aqueous solution contains Hg^{2+}, Hg_2^{2+}, Pb^{2+}, Ag^{+}, Bi^{3+} and Cd^{2+}. Out of these, how many ions will produce white precipitate with dilute HCl ?

24. What happens when 4–nitrobenzene diazonium chloride reagent reacts with an ammonium salt in the presence of sodium hydroxide solution ?

25. **(i)** A black coloured compound (B) is formed on passing H_2S through the solution of a compound (A) in NH_4OH.

(ii) (B) on treatment with HCl and potassium chlorate or aquaregia gives (A).

(iii) (A) on treatment with KCN gives a buff / reddish-brown 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 in air.

(v) The solution of (A) was treated with excess of $NaHCO_3$ & then with bromine water. On cooling & 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.

Exercise # 5 Part # I [Previous Year Questions] [AIEEE/JEE-MAIN]

1. An alkali is titrated against an acid with Methyl organe as indicator, which of the following is a correct combination? **[JEE (Main) 2018]**

Base	Acid	End point
(1) Strong	Strong	Pinkish red to yellow
(2) Weak	Strong	Yellow to Pinkish red
(3) Strong	Strong	Pink to colourless
(4) Weak	Strong	Colourless to Pink

Part # II [Previous Year Questions][IIT-JEE ADVANCED]

1. A sodium salt on treatment with $MgCl_2$ gives white precipitate only on heating. The anion of the sodium salt is: **[JEE 2004]**

(A) HCO_3^- **(B)** CO_3^{2-} **(C)** NO_3^- **(D)** SO_4^{2-}

2. 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 : **[JEE - 2005]**

(A) Hg^{2+} **(B)** Bi^{3+} **(C)** Pb^{2+} **(D)** Cu^+

3. A white precipitate is obtained when a solution is diluted with H_2O and boiled. On addition of excess NH_4Cl/NH_4OH, the volume of precipitate decreases leaving behind a white gelatinous precipitate. Identify the precipitate which dissolves in ammonia solution or NH_4Cl. **[JEE 2006]**

(A) $Al(OH)_3$ **(B)** $Zn(OH)_2$ **(C)** $Mg(OH)_2$ **(D)** $Ca(OH)_2$

4. In blue solution of copper sulphate excess of KCN is added then solution becomes colourless due to the formation of **[JEE 2006]**

(A) $[Cu(CN)_4]^{2-}$ **(B)** Cu^{2+} get reduced to form $[Cu(CN)_4]^{3-}$
(C) $Cu(CN)_2$ **(D)** CuCN

5. $MgSO_4 + NH_4OH + Na_2HPO_4 \longrightarrow$ white crystalline precipitate. The formula of crystalline precipitate is : **[JEE 2006]**

(A) $MgCl_2.MgSO_4$ **(B)** $MgSO_4$ **(C)** $Mg(NH_4)PO_4$ **(D)** $Mg(PO_4)_2$

6. A solution of a metal ion when treated with KI gives a red precipitate which dissolves in excess KI to give a colourless solution. Moreover, the solution of metal ion on treatment with a solution of cobalt(II) thiocyanate gives rise to a deep blue crystalline precipitate. The metal ion is : **[JEE 2007]**

(A) Pb^{2+} **(B)** Hg^{2+} **(C)** Cu^{2+} **(D)** Co^{2+}

7. A solution of colourless salt H on boiling with excess NaOH produces a nonflammable gas. The gas evolution ceases after some time. Upon addition of Zn dust to the same solution, the gas evolution restarts. The colourless salt(s) H is (are) : **[JEE 2008]**

(A) NH_4NO_3 **(B)** NH_4NO_2 **(C)** NH_4Cl **(D)** $(NH_4)_2SO_4$

Paragraph for Question Nos. 8 to 10

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.

8. The compound X is : **[JEE 2009]**

(A) $NaNO_3$ **(B)** NaCl **(C)** Na_2SO_4 **(D)** Na_2S

9. The compound Y is : **[JEE 2009]**

(A) $MgCl_2$ **(B)** $FeCl_2$ **(C)** $FeCl_3$ **(D)** $ZnCl_2$

10. The compound Z is : **[JEE 2009]**

(A) $Mg_2[Fe(CN)_6]$ **(B)** $Fe[Fe(CN)_6]$

(C) $Fe_4[Fe(CN)_6]_3$ **(D)** $K_2Zn_3[Fe(CN)_6]_2$

Paragraph for Question Nos. 11 to 13

When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N the solution turns light blue. Addition of aqueous NaCl to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

11. The metal rod M is : **[JEE 2011]**

(A) Fe **(B)** Cu **(C)** Ni **(D)** Co

12. The compound N is : **[JEE 2011]**

(A) $AgNO_3$ **(B)** $Zn(NO_3)_2$ **(C)** $Al(NO_3)_3$ **(D)** $Pb(NO_3)_2$

13. The final solution contains **[JEE 2011]**

(A) $[Pb(NH_3)_4]^{2+}$ and $[CoCl_4]^{2-}$ **(B)** $[Al(NH_3)_4]^{3+}$ and $[Cu(NH_3)_4]^{2+}$

(C) $[Ag(NH_3)_2]^{+}$ and $[Cu(NH_3)_4]^{2+}$ **(D)** $[Ag(NH_3)_2]^{+}$ and $[Ni(NH_3)_6]^{2+}$

14. Passing H_2S gas into a mixture of Mn^{2+}, Ni^{2+}, Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates: **[JEE 2011]**

(A) CuS and HgS **(B)** MnS and CuS **(C)** MnS and NiS **(D)** NiS and HgS

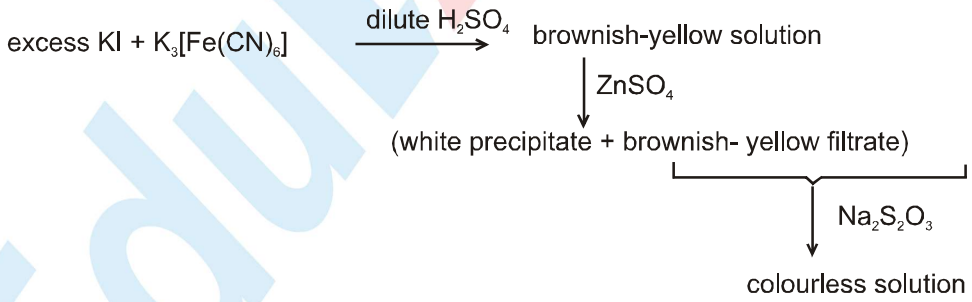
15. The equilibrium

$$2Cu^{I} \rightleftharpoons Cu^{0} + Cu^{II}$$

in aqueous medium at 25° C shifts towards the left in the presence of : **[JEE 2011]**

(A) NO_3^- **(B)** Cl^- **(C)** SCN^- **(D)** CN^-

16. For the given aqueous reaction which of the statement(s) is (are) true ? **[JEE 2012]**



(A) The first reaction is a redox reaction

(B) White precipitate is $Zn_3[Fe(CN)_6]_2$

(C) Addition of filtrate to starch solution gives blue colour.

(D) White precipitate is soluble in NaOH solution

17. Concentrated nitric acid, upon long standing, turns yellow-brown due to the formation of : **[JEE(Advanced) 2013]**

(A) NO **(B)** NO_2 **(C)** N_2O **(D)** N_2O_4

18. Upon treatment with ammoniacal H_2S, the metal ion that precipitates as a sulfide is : **[JEE(Advanced) 2013]**

(A) Fe(III) **(B)** Al (III) **(C)** Mg(II) **(D)** Zn(II)

Paragraph for Question 19 and 20

An aqueous solution of a mixture of two inorganic salts, when treated with dilute HCl, gave a precipitate (P) and a filtrate (Q). The precipitate P was found to dissolve in hot water. The filtrate (Q) remained unchanged, when treated with H_2S in a dilute mineral acid medium. However, it gave a precipitate (R) with H_2S in an ammoniacal medium. The precipitate R gave a coloured solution (S), when treated with H_2O_2 in an aqueous NaOH medium.

19. The precipitate P contains **[JEE(Advanced) 2013]**

(A) Pb^{2+} **(B)** Hg_2^{2+}

(C) Ag^{+} **(D)** Hg^{2+}

20. The coloured solution **S** contains **[JEE(Advanced) 2013]**

(A) $Fe_2(SO_4)_3$ **(B)** $CuSO_4$

(C) $ZnSO_4$ **(D)** Na_2CrO_4

21. In neutral or faintly alkaline solution, 8 moles of permanganate anion quantitatively oxidize thiosulphate anions to produce X moles of a sulphur containing product. The magnitude of X is **[JEE(Advanced) 2016]**

22. The correct option(s) to distinguish nitrate salts of Mn^{2+} and Cu^{2+} taken separately is (are) **[JEE(Advanced) 2018]**

(A) Mn^{2+} show the characteristic green colour in the flame test.

(B) Only Cu^{2+} show the formation of precipitate by passing H_2S in acidic medium

(C) Only Mn^{2+} show the formation of precipitate by passing H_2S in faintly basic medium

(D) Cu^{2+}/Cu has higher reduction potential than Mn^{2+} / Mn (measured under similar conditions)

MOCK TEST

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. Zinc pieces are added to acidified solution of SO_3^{-2}. AGs liberated can :

(A) turn lead acetate paper black **(B)** turns lime water milky

(C) gives both of the above tests **(C)** gives none of the above tests

2. A sodium salt on treatment with $MgCl_2$ gives white precipitate only on heating. The anion of the sodium salt is :

(A) HCO_3^- **(B)** CO_3^{-2} **(C)** NO_3^- **(D)** SO_4^{-2}

3. An aqueous blue coloured solution of a transition metal sulphate reacts with H_2S to give a black precipitate. The black precipitate dissolves in 50% nitric acid forming a blue coloured solution. The blue solution on treatment with KI in weakly acidic medium turns yellow/brown and produces a white precipitate. Identify the transition metal ion from the following ions ?

(A) Co^{+2} **(B)** Cu^{+2} **(C)** Hg^{+2} **(D)** Pb^{+2}

4. A 0.1 M solution of a certain cation will form a precipitate with 0.1 M solution of all these anions ;

OH^-, CO_3^{-2}, Cl^-, SO_4^{-2}. Which cation fits in the description ?

(A) Ba^{+2} **(B)** Fe^{+2} **(C)** Mg^{+2} **(D)** Pb^{+2}

5. The ion that cannot be precipitated by both HCl and H_2S is

(A) Pb^{+2} **(B)** Cu^+ **(C)** Ag^+ **(D)** Sn^{+2}

6. 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^+

7. Fe^{+2} does not give prussian blue colour with $K_4[Fe(CN)_6]$, but on its reaction with (X), prussian blue colour appears. (X) can be :

(A) MnO_4^-/H^+ **(B)** H_2SO_4 **(C)** NH_3 **(D)** All true

8. To increase significantly the concentration of free Zn^{+2} ion in a solution of complex ion $[Zn(NH_3)_4]^{+2}$

$$Zn^{2+}(aq) + 4NH_3(aq) \; f \; [Zn(NH_3)_4]^{2+}(aq)$$

add to the solution some :

(A) H_2O **(B)** HCl(aq) **(C)** NH_3 **(D)** NH_4Cl(aq)

9. A black coloured sulphide is insoluble in conc. HCl but dissolves when $KClO_3$ is added. The solution on treatment with potassium cyanide gives a buff or light pink coloured precipitate which dissolves in excess of this reagent forming a yellowish brown solution. The sulphide is :

(A) CoS **(B)** ZnS **(C)** NiS **(D)** MnS

10. A coloured precipitate is obtained when H_2S gas is passed through an aqueous solution of salt in presence of ammonium hydroxide. The precipitate dissolves in dilute HCl and reacts with NaOH to give a white precipitate which on standing turns into brown/black precipitate. The brown/black precipitate on fusion with KNO_3 and Na_2CO_3 gives green coloured compound. The cation of the salt is :

(A) Co^{+2} **(B)** Mg^{+2} **(C)** Ni^{+2} **(D)** Mn^{+2}

11. Intense blue precipitate of $Fe_4[Fe(CN)_6]_3$ and sodium hydroxide solution when mixed gives :

(A) Soluble prussian blue **(B)** reddish-brown precipitate

(C) deep-red colouration **(D)** turnbull's blue

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

12. Which of the following statement(s) is/are true ?

(A) Soluble bicarbonates gives white precipitate with $MgCl_2$ in cold.

(B) Soluble calcium bicarbonate gives white precipitate with dil. ammonium solution.

(C) All bicarbonates are generally soluble in water.

(D) Hg(II) chloride forms a reddish brown precipitate in a solution of soluble carbonate.

13. Each of these solution is added to a mixture of aqueous solution of iodide and chloroform, separately. Which will give a positive test for iodine when the solutions are vigorously mixed ?

(A) NaCl solution **(B)** NaBr solution **(C)** chlorine water **(D)** bromine water

14. Identify the incorrect reaction (s):

(A) $K_2Cr_2O_7 + 4NaCl + 3H_2SO_4\,(conc.) \longrightarrow 2CrO_2Cl_2 + 2Na_2SO_4 + K_2SO_4 + 3H_2O$

(B) $K_2Cr_2O_7 + 6\,KI + 7H_2SO_4\,(conc.) \longrightarrow 3I_2 + Cr_2(SO_4)_3 + 4K_2SO_4 + 7H_2O$

(C) $K_2Cr_2O_7 + 4AgCl + 3H_2SO_4\,(conc.) \longrightarrow 2CrO_2Cl + 2Ag_2SO_4 + K_2SO_4 + 3H_2O$

(D) $MnO_2 + NaCl + 2H_2SO_4\,(conc.) \longrightarrow NaHSO_4 + MnSO_4 + HCl + H_2O + 1/2O_2$

15. Which of the following compound on treatment with a solution of $HgCl_2$ first gives a white precipitate and then a grey precipitate ?

(A) H_3PO_2 **(B)** $SnCl_2$ **(C)** KI **(D)** NH_3

16. An organic lewis acid [X] gives gelatinous white precipitate with NH_4OH in presence of NH_4Cl. [X] will respond to which of the following characteristics ?

(A) X fumes in moist air.

(B) X on heating with solid $K_2Cr_2O_7$ and conc. H_2SO_4 gives deep red fumes.

(C) Xo on addition of excess NaOH gives white precipitate.

(D) X on heating with Na_2CO_3 and then cobalt nitrate gives a blue bead in oxidising flame.

17. The reagents, ammonium chloride and aqueous ammonia will precipitate :

(A) Bi^{+3} **(B)** Pb^{+2} **(C)** Mg^{+2} **(D)** Fe^{+3}

18. Which of the following statement(s) is/are true?

(A) In a mixture of Sr^{+2} and Ca^{+2}, ammonium sulphate precipitates only Sr^{+2} as $SrSO_4$ but $CaSO_4$ dissolves in ammonium sulphate forming a soluble complex.

(B) Barium chromate is insoluble in dilute acetic acid.

(C) $Cr(OH)_3$ is soluble in NaOH and Br_2 water while $Fe(OH)_3$ is insoluble.

(D) Cu and Cd separation is based upon the fact that in presence of excess KCN, only Cd is precipitated as sulphide on passing H_2S.

SECTION - III : ASSERTION AND REASON TYPE

19. **Statement - 1**: A very dilute acidic solution of Cd^{+2} and Ni^{+2} gives a yellow precipitate of CdS on passing hydrogen sulphide gas.

Statement - 2 : Solubility products (K_{sp}) of CdS is less than that of NiS.

(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.

20. **Statement - 1** : No yellow precipitate is formed when an excess of more concentrated (6M) solution of KI is added to a solution containing Pb^{+2} ions.

Statement - 2 : Yellow precipitate of $PbCl_2$ does not dissolve in excess of dilute solution of KI.

(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.

21. **Statement - 1** : In very dilute solution of strontium ions, yellow precipitate of $SrCrO_4$ is formed with CrO_4^{-2} ions.

Statement - 2 : The $SrCrO_4$ precipitate is appreciably soluble in water, therefore, no precipitation occurs when water is taken in large quantity.

(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.

22. **Statement - 1** : Addition of ammonium chloride to a solution containing ferric and magnesium ions is essential for selective precipitation of ferric hydroxide by aqueous ammonia.

Statement - 2 : The function of NH_4Cl is to suppress the ionization of NH_4OH by common ion effect and thus prevents the precipitation of $Mg(OH)_2$ because Ksp of $Mg(OH)_2$ is high.

(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.

SECTION - IV : COMPREHENSION TYPE

Read the following comprehensions carefully and answer the questions.

Comprehension # 1

A black coloured compound (A) on reaction with dil. H_2SO4 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 black precipitate (F) which is soluble in hot concentrated (C). After boiling this solution when excess of ammonia solution is added, a blue coloured compound (G) is formed. To the solution of (E), on addition of acetic acid and aq.

potassium ferrocyanide, a chocolate brown precipitate (H) is formed. On addition of an aqueous solution of $BaCl_2$ to an aqueous solution of (E) white precipitate insoluble in HNO_3 is obtained.

23. Black coloured compound (A) is :

(A) PbS **(B)** CuS **(C)** AgS **(D)** All of these

24. To which of the following property, the compound (E) will respond ?

(A) It gives white precipitate with $(CH_3COO)_2Pb$ solution soluble in ammonium acetate.

(B) It gives dirty white precipitate with KI.

(C) Its hydrated salts effloresces

(D) All of these.

25. The gas (B) on passing through an acid (C) gives a white turbidity (D) because

(A) gas (B) acts as an oxidising agent

(B) gas (B) acts as an reducing agent

(C) acid (C) acts as an oxidising agent

(D) (B) and (C) both.

26. When a piece of iron or zinc is added to the solution of a compound (F) in hot concentrated (C) acid:

(A) a reddish brown precipitate is formed

(B) a white precipitate is formed

(C) a black precipitate is formed

(D) none of these

Comprehension # 2

$[Ag(NH_3)_2]^+ + NH_2 - NH_2 . H_2SO_4$ (Saturated solution) $\longrightarrow$ Products

27. Which of the following the products obtained in the above chemical reaction ?

(A) A gas is obtained which produces white dense fumes with a glass rod dipped in dilute HCl.

(B) A salt is obtained which also gives the same gas (option A) with sodium hydroxide.

(C) A gas is liberated which is also obtained by heating ammonium dichromate.

(D) All of these.

28. The above reaction describes about _____.

(A) Gutzeit's test **(B)** Marsh's test **(C)** Silver mirror test **(D)** Lake test

29. Which of the following statement is true ?

(A) Silver sulphate is produced as one of the products.

(B) Silver nitride is obtained as one of the products

SECTION - V : SUBJECTIVE TYPE

30. A mixture of two inorganic salts gives following reactivity :

(i) Mixture on reaction with dil. H_2SO_4 produces suffocating gas which turns acidified potassium dichromate solution green.

(ii) Mixture on reaction with conc. H_2SO_4 gives reddish brown gas and on adding paper pellets the evolution of reddish brown vapours becomes brisk.

(iii) Original solution of mixture gives white ppt. with dil HCl which is soluble in ammonium hydroxide forming a soluble complex. The soluble complex gives white precipitate with HNO_3 and yellow precipitate with KI solution.

(iv) The filtrate obtained after separating the white precipitate also gives white precipitate with H_2S in presence of NH_4Cl and NH_4OH. The solution of white precipitate in dil. HCl again gives white precipitate with excess of potassium ferrocyanide solution. Identify the cations and anions present in the mixture.

31. A mixture consists (A) (yellow solid) and (B) (colourless solid).

(i) Mixture gives lilac colour in flame

(ii) Mixture gives black precipitate on passing H_2S which is soluble only in aquaregia.

(iii) Black precipitate solution in aqua-regia, on adding $SnCl_2$ gives greyish black precipitate.

(iv) The salt solution with NH_4OH gives a brown precipitate.

(v) The sodium extract of the salt with CCl_4/Cl_2 gives a violet layer.

(vi) The sodium extract gives bright yellow precipitate with $AgNO_3$, very slightly soluble in concentrated ammonia. Identify the cation and anion present in (A) and (B) ?

ANSWER KEY

EXERCISE - 1

1. A, D **2.** D **3.** C **4.** A, B, C **5..** B **6.** C **7.** B **8.** B, C **9.** A **10.** D **11.** D **12.** B
13. B **14.** D **15.** B **16.** C **17.** A, B **18.** A **19.** C **20.** A **21.** A **22.** B **23.** D **24.** B **25.** D
26. B **27.** C **28.** C **29.** C **30.** B **31.** A, B, C, D **32.** B **33.** D **34.** D **35.** C **36.** C **37.** D
38. A **39.** A **40.** C **41.** C **42.** A, B, C, D **43.** C **44.** A **45.** A, C **46.** B **47.** C **48.** C **49.** D
50. B **51.** B **52.** D **53.** D **54.** D **55.** D **56.** B **57.** B **58.** C **59.** A **60.** A, B, C, D **61.** B
62. A **63.** D **64.** D **65.** C **66.** C **67.** B, C **68.** B **69.** D **70.** D **71.** C **72.** D **73.** A **74.** B
75. A **76.** C **77.** A **78.** D **79.** C **80.** A **81.** B **82.** A **83.** A **84.** D **85.** D **86.** C **87.** D
88. A **89.** C **90.** A **91.** A **92.** A **93.** C **94.** C **95.** B **96.** D **97.** B **98.** A **99.** D **100.** B
101. C **102.** B **103.** B **104.** B **105.** B **106.** A **107.** A **108.** B **109.** C **110.** B **111.** D **112.** A **113.** B
114. D **115.** D **116.** C **117.** C **118.** B **119.** B **120.** D **121.** D **122.** C **123.** A **124.** A **125.** B **126.** A
127. C **128.** D **129.** B **130.** B **131.** B

EXERCISE - 2 : PART # I

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

PART # II

1. B **2.** B **3.** B **4.** B **5.** E **6.** B **7.** B **8.** B **9.** B **10.** A **11.** D **12.** B **13.** A

EXERCISE - 3 : PART # I

1. A → p, q, r, B → r, s, C → p, q, s, t, D → p, s

2. A → p, r, B → p, q, C → p, s, D → q, s

3. A → p, q, B → p, s, C → s, D → p, r

4. A → q, B → p, q, s, C → p, q, r, D → p, q, s

5. A → q, B → p, q, C → r, s, D → p

6. A → p, q, s, B → p, r, s, C → q, D → q

7. A → p, r, B → p, q, C → p, r, D → p, q, s

8. A → q, r, s, B → p, q, r, s, C → q, r, s, D → q, s

PART # II

Comprehension # 1 : **1.** B **2.** B **3.** D

Comprehension # 2 : **1.** C **2.** B **3.** B **4.** D

Comprehension # 3 : **1.** C **2.** A **3.** A **4.** B

Comprehension # 4 : **1.** B **2.** C **3.** A **4.** D

Comprehension # 5 : **1.** C **2.** D **3.** D

Comprehension # 6 : **1.** D **2.** A **3.** D **4.** B

EXERCISE - 5 : PART # I

1. 2

PART # II

1. A **2.** B **3.** B **4.** B **5.** C **6.** B **7.** A,B **8.** D **9.** C

10. B **11.** B **12.** A **13.** C **14.** A **15.** B,C,D **16.** A,C,D **17.** B **18.** D

19. A **20.** D **21** 6 **22** B, D

MOCK-TEST

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

13. C,D **14.** C, D **15.** A,B **16.** A, B, D **17.** A, B, D **18.** A,B,C,D **19.** A **20.** B **21.** D **22.** A

23. D **24.** D **25.** D **26.** A **27.** D **28.** C **29.** D