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CHEMISTRY

TARGET : JEE Advanced - 2023

CAPS – 15

Qualitative analysis

SINGLE CHOICE QUESTIONS

1. A solution containing As^{3+},Cd^{2+},$Ni^{2+}$and Zn^{2+} is treated with NH_4OH and H_2S gas is passed into it. The precipitate obtained will be a mixture of the sulphides of

(A) As,Cd (B) As,Cd,Ni (C) Zn,Ni (D) As,Cd,Ni,Zn

2. A metal M and its compounds can give the following observable changes in sequence of reactions.

$$M \xrightarrow{\text{dil. } HNO_3} \begin{bmatrix}\text{colourless}\\ \text{solution}\end{bmatrix} \xrightarrow{\text{dil. NaOH}} \begin{bmatrix}\text{white}\\ \text{ppt.}\end{bmatrix} \xrightarrow{\text{excess NaOH}} \begin{bmatrix}\text{colourless}\\ \text{solution}\end{bmatrix} \xrightarrow{H_2S} \begin{bmatrix}\text{white}\\ \text{ppt.}\end{bmatrix}$$

The metal M is

(A) Mg (B) Pb (C) Zn (D) Sn

3. Identify the correct statements

(I) NH_4Cl is added along with NH_4OH so that only IIIrd group cations can be precipitated as their hydroxides.

(II) In place of NH_4Cl, $(NH_4)_2SO_4$ cannot be used as barium (Vth Group radical) will also be precipitated as $BaSO_4$ along with Al^{+3}, Fe^{+3} & Cr^{+3}.

(III) Aqueous solution of ammonium sulphate also produces white ppt. With $BaCl_2$ solution which is insoluble in conc. HCl.

(A) I & II only (B) II & III only (C) I & III only (D) I, II & III

4. A pale yellow precipitate and a gas with pungent odour are formed on warming dilute hydrochloric acid with an aqueous solution containing :

(A) sulphate ion (B) sulphide ion (C) thiosulphate ion (D) sulphite ion

MULTIPLE CHOICE QUESTIONS

5. Which of the following statement(s) is/are correct when a solid mixture of NaCl and $K_2Cr_2O_7$ is gently warmed with conc. H_2SO_4 ?

(A) A deep red vapour is evolved

(B) The vapour when passed into NaOH solution gives a yellow solution of Na_2CrO_4

(C) Chlorine gas is evolved

(D) Chromyl chloride is formed

6. The compound/s which react/s and soluble in excess of hot conc. NaOH solution is/are

(A) $Be(OH)_2$ (B) $Al(OH)_3$ (C) $Zn(OH)_2$ (D) CrO_3

COMPREHENSION (FOR Q. 7 TO Q. 10)

(A) + NaCl $\longrightarrow$ (B) (white ppt.),

(B) + KI $\longrightarrow$ (C) (green ppt.)

(C) + KI $\longrightarrow$ (D) + (E) (colourless solution)

(excess)

(E) + NH_3 + KOH $\longrightarrow$ (F)

7. Compounds (A) and (B) are respectively:

(A) $AgNO_3$ and AgCl (B) $Pb(NO_3)_2$ and $PbCl_2$

(C) $Hg_2(NO_3)_2$ and Hg_2Cl_2 (D) $Cu_2(NO_3)_2$ and Cu_2Cl_2

8. When compound (A) react with Na_2CrO_4 solution, the colour of the compound formed is:

(A) Black (B) Red (C) Yellow (D) White

9. Type of hybridization in compound (E) is:

(A) d^2sp^3 (B) sp^3d^2 (C) sp^3 (D) dsp^2

10. Colour of the compound (F) is:

(A) Yellow (B) Blue (C) White (D) Brown

COMPREHENSION (FOR Q. 11 TO Q. 13)

An orange-colored compound (X) on heating decomposes to form a solid and gases mixture which contains a gas (Y) and H_2O vapour. (Y) on treatment with CaC_2 gives (Z). (Z) on hydrolysis with hot water liberates a gas (P) which when added to Hg_2Cl_2 results in the formation of black precipitate.

11. The compound 'X' is

(A) $(NH_4)_2CO_3$ (B) $K_2Cr_2O_7$ (C) $(NH_4)_2Cr_2O_7$ (D) $Na_2Cr_2O_7$

12. The compound (Y) is

(A) NO_2 (B) N_2O (C) NH_3 (D) N_2

13. What would be the colour if solution of (P) is added in excess to Ni^{+2} solution

(A) red (B) green (C) colour less (D) blue

COMPREHENSION (FOR Q. 14 TO Q. 16)

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 slightly coloured precipitate (D). The substance (D) burns in air to produce a gas (E) which reacts with (B) to yield (D) and a colourless liquid. Anhydrous copper sulphate is turned blue on addition of this colourless liquid. Addition of aqueous NH_3 or NaOH to (C) produces first a precipitate, which dissolves in the excess of the respective reagent to produce a clear solution in each case.

14. Addition of excess of KCN to the aqueous solution of C gives a complex. The co-ordination number of the central atom in the complex is

(A) 2 (B) 4 (C) 6 (D) 8

15. Compound C

(A) crystallizes from water as an anhydrous salt.

(B) crystallizes from water as a pentahydrate.

(C) crystallizes from water as a heptahydrate.

(D) cannot be crystallized from water.

16. Compound E is

(A) NO (B) SO_3 (C) NO_2 (D) SO_2

17. Match the Following:

Column-I	**Column-II**
(A) $HgCl_2 + NH_4OH$	(p) $Hg(NH_2)Cl$
(B) $HgCl_2 + NH_3$	(q) Hg
(C) $Hg_2Cl_2 + NH_4OH$	(r) $[Hg(NH_3)_2]Cl_2$
(D) $Hg_2Cl_2 + SnCl_2$	(s) $SnCl_4$

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

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

18. **Column-I** and **Column-II** contains four entries each. Entries of **Column-I** are to be matched with some entries of **Column-II**. One or more than one entries of **Column-I** may have the matching with the same entries of **Column-II**.

Column-I	**Column-II**
(A) Gas evolved by the action of dilute H_2SO_4 on a sulphite	(p) Colour of acidifed $KMnO_4$ is discharged
(B) Gas evolved by the action of dilute H_2SO_4 on a carbonate	(q) Acidified dichromate solution is turned green
(C) Gas evolved by heating an ammonium salt with NaOH	(r) Nessler`s reagent gives a brown precipitate
(D) Gas evolved by the action of dilute H_2SO_4 on a sulphide	(s) Baryta water turns milky
	(t) Alkaline nitroprusside truns violet

SUBJECTIVE ANSWER TYPE

19. An unknown inorganic compound (X) loses its water of crystallisation. On heating and its aqueous solution gives the following reactions:

(i) It gives a white turbidity with dilute HCl solution.

(ii) It decolourises a solution of iodine in KI.

(iii) It gives a white precipitate with $AgNO_3$ solution which turns black on standing.

Identify compound (X) and give chemical equations for the reactions at step (i), (ii) & (iii).

20. Identify (A), (B), (C) & (D) and give their chemical formulae:

(i) $(A) + NaOH \xrightarrow{heat} NaCl + NH_3 + H_2O$ (ii) $NH_3 + CO_2 + H_2O \rightarrow (B)$

(iii) $(B) + NaCl \rightarrow (C) + NH_4Cl$ (iv) $(C) \xrightarrow{heat} Na_2CO_3 + H_2O + (D)$

21. An aqueous solution of a gas (X) gives the following reactions:

(i) It decolourises an acidified $K_2Cr_2O_7$ solution.

(ii) On boiling it with H_2O_2, cooling it & then adding an aqueous solution of $BaCl_2$ a precipitate insoluble in dilute HCl is obtained.

(iii) On passing H_2S in the solution a white turbidity is obtained.

Identify (X) and give equations for the reactions at step (i), (ii) & (iii).

22. An organic compound (A) on heating produces two gases (B) and (C) and neutral oxide (D) which turns cobalt chloride paper pink. Gas (B) turns lime water milky and produces an acidic solution with water Gas (C) produces a poisonous gas (E) with chlorine gas, this gas with ammonia gives an organic compound (F) which on further reaction with (D) gives NH3 gas. Identify (A) to (F).

23. An inorganic Lewis acid (X) shows the following reactions.

(i) It fumes in moist air.

(ii) The intensity of fumes increases when a rod dipped in NH_4OH is brought near it.

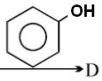
(iii) An acidic solution of (X) on addition of NH_4Cl & NH_4OH gives a precipitate which dissolves in NaOH solution.

(iv) An acidic solution of (X) does not give precipitate with H_2S. Identify (X) and give chemical equations.

24. How many anions will give colourless acid vapour/gas with conc. H_2SO_4 on reaction with following given anions?

$CH_3COO^-, Cl^-, Br^-, S^{2-} SO_3^{2-}, BO_3^{3-}, NO_2^-, I^-$

25. An orange solid (A) on heating gives a green residue (B), a colourless gas (C) and water vapour. The dry gas (C) on passing over heated Mg gave a white solid (D). (D) on reaction with water gave a gas (E) which formed dense white fumes with HCl. Identify (A) to (E) giving reactions.

26. $\left(\begin{matrix}\text{Brown fumes and} \\ \text{pungent smell}\end{matrix}\right) B \xrightarrow{NaBr + MnO_2} A \xrightarrow{conc.HNO_3} C(\text{intermediate}) \xrightarrow{} D$  Acid

Find A, B, C and D. Also write equations A to B and A to C.