

- Which of the following statements is wrong regarding copper sulphate.
 - It reacts with KI to give I_2 .
 - It reacts with KCl to give Cl_2 .
 - Its tartarate complex reacts with NaOH and glucose followed by heating to give Cu_2O .
 - It gives CuO on strong heating in air.
- ZnO shows yellow colour on heating due to
 - $d-d$ transition.
 - charge transfer spectra.
 - higher polarization caused by Zn^{2+} ion.
 - presence of F-center.
- Malachite and azurite are used respectively as
 - blue and green pigment.
 - red and green pigment.
 - green and blue pigment.
 - green and red pigment.
- Choose the correct options (**true** or **false**) for the following statements.
 - FeO is stable enough at room temperature.
 - FeCl₂ on heating in air and in steam produces the same iron oxide.
 - The colour of FeCl₂ depends upon the number of water of crystallization.
 - TTF
 - FTF
 - FFT
 - TFT
- The elements with maximum and minimum melting points in the second transition series respectively are
 - Cr and Zn.
 - Cr and Cd.
 - Cr and Hg.
 - Mo and Cd.
- $BaCO_3 + Na_2CrO_4 + AcOH \rightarrow M$
aq. suspension ppt.
 - $BaCO_3 + Na_2CrO_4 + HCN \rightarrow N$
aq. suspension ppt.
 Which is the correct option regarding the above reactions?
 - M and N are the same and characterized as $BaCrO_4$.
 - M is $BaCrO_4$ and N stands for no precipitate.
 - M is $BaCrO_4$ and N is $BaCO_3$.
 - M stands for no precipitate and N is $BaCrO_4$.
- Which of the following statements is incorrect regarding the similarities between hexavalent Cr and S compounds?
 - SO_3 and CrO_3 both are acidic.
 - SO_2Cl_2 and CrO_2Cl_2 on alkaline hydrolysis produce similar type of products.
 - CrO_3 and $\gamma-SO_3$ have the same structure.
 - Both can form $X_2O_7^{2-}$ type of compounds.
- $E_{MnO_4^{2-}/MnO_2}^0 = 2.26 \text{ V}$ and $E_{MnO_4^-/MnO_4^{2-}}^0 = 0.56 \text{ V}$
 Which of the following reactions will be spontaneous?
 - $MnO_4^{2-} \rightarrow MnO_4^-$
 - $MnO_4^- \rightarrow MnO_2 + MnO_4^{2-}$
 - $MnO_4^{2-} \rightarrow MnO_2 + MnO_4^-$
 - None of these.
- For the preparation of $KMnO_4$ from K_2MnO_4 which of the following reagents is the best?
 - Dil. H_2SO_4
 - $SnCl_2$ (acidified)
 - CO_2 is passed
 - Cl_2 is passed
- When $KMnO_4$ reacts with H_2O_2 in a slightly alkaline and acidic medium, the respective products obtained are
 - K_2MnO_4 and Mn^{2+}
 - MnO_2 and MnO_2
 - MnO_2 and Mn^{2+}
 - Mn^{2+} and MnO_2
- AgO actually exists as $Ag [AgO_2]$, which is diamagnetic in nature. Then which of the following statements is true regarding AgO ?
 - The arrangement of O^{2-} ions around Ag^+ ion is square planar.
 - The arrangement of O^{2-} ions around Ag^{3+} ion is tetrahedral.
 - The arrangement of O^{2-} ions around Ag^{3+} ion is square planar.
 - Both (B) and (C) are correct.
- Total number of d -orbitals involved in the hybridization of central metal ion in complex ion $[MnO_4]^-$ is
 - 6
 - 4
 - 2
 - 3
- Which of the following metal ions is expected to be coloured?
 - Zn^{2+}
 - Ti^{3+}
 - Sc^{3+}
 - Ti^{4+}
- When Cu^{2+} solution reacts with excess KI, which of the following statements is correct?
 - White ppt. of Cu_2I_2 is obtained.
 - A clear brown solution is obtained.
 - A dark brown solution is obtained in which ppt. of Cu_2I_2 is invisible.
 - A blue solution is obtained.
- When $KMnO_4$ is heated with fused KOH, then the product formed is
 - $KMnO_4$, purple
 - K_2MnO_4 , green
 - MnO_2 , black
 - Mn_2O_3 , brown

MULTIPLE CORRECT CHOICE TYPE QUESTIONS

1. Measurement of magnetic moment helps to predict
 - (A) whether the compound is paramagnetic or diamagnetic.
 - (B) whether the compound is coloured or not.
 - (C) the number of unpaired electrons in the system.
 - (D) whether the compound is low spin or high spin, wherever it is applicable.
2. Which of the following properties of a substance disappear in solution?
 - (A) Paramagnetism.
 - (B) Diamagnetism.
 - (C) Ferromagnetism.
 - (D) Antiferromagnetism.
3. The colour of a compound may be due to
 - (A) polarization.
 - (B) $d-d$ transition.
 - (C) $f-f$ transition.
 - (D) charge transfer spectra.
4. The colour of a metal ion depends upon
 - (A) the nature of the ligand.
 - (B) the number of ligands.
 - (C) the shape of the complex.
 - (D) None of these.
5. Which of the following statements are correct regarding Mohr's salt?
 - (A) It does not dissolve in water completely.
 - (B) It is one of the primary standard substances used in the laboratory.
 - (C) The oxidation state of Fe in it is +III.
 - (D) It produces NH_3 when NaOH is added into it.
6. K_2MnO_4 is unstable in solution and the green solution obtained is changed into purple colouration. Correct statements regarding the above change are:
 - (A) It is a disproportionation reaction.
 - (B) It produces KMnO_4 .
 - (C) Overall solution becomes alkaline.
 - (D) It produces black precipitate of hydrated MnO_2 .
7. When chromite ore is heated with Na_2CO_3 powder in the presence of air
 - (A) one gaseous product is formed.
 - (B) one product is water insoluble which is dark brown in colour.
 - (C) one product is water soluble which is red in colour.
 - (D) one product is water soluble which is yellow in colour.
8. Choose incorrect options from the following statements.
 - (A) O_2 is evolved during the hydrolysis of XeF_2 , XeF_4 , XeF_6 .
 - (B) $\text{K}_2\text{Cr}_2\text{O}_7$ is not a deliquescent substance.
 - (C) All C-C bonds are ruptured in glucose when it is treated with alkaline solution of AgNO_3 .
 - (D) $\text{K}_2\text{Cr}_2\text{O}_7$ reacts with cold conc. H_2SO_4 to produce a green compound.
9. For the standardization of hypo solution
 - (A) standard KMnO_4 can be used which is prepared fresh.
 - (B) standard $\text{K}_2\text{Cr}_2\text{O}_7$ can be used which is prepared one month before.
 - (C) Both can be used.
 - (D) None is suitable.
10. Consider the following reaction:

$$\text{Metal M} + \text{aq. KCN} + \text{air} \rightarrow ? \xrightarrow{\text{Zn}} [\text{Zn}(\text{CN})_4]^{2-} + \text{M} \downarrow$$

(Impure) (Pure)

Then M is:

 - (A) Au
 - (B) Ag
 - (C) Both
 - (D) None

COMPREHENSION TYPE QUESTIONS

Passage 1: For Questions 1–3

A mixture is treated with KI as follows:

1 mole of each (CuSO_4 , CdSO_4 and FeCl_3) $\xrightarrow{\text{KI in excess}}$
 product mixture $\xrightarrow{\text{Na}_2\text{S}_2\text{O}_3 \text{ solution}}$ ppt. obtained

1. How many moles of $\text{Na}_2\text{S}_2\text{O}_3$ are required in the above process?
 - (A) $\frac{1}{2}$ mole
 - (B) 2 moles
 - (C) 1 mole
 - (D) $1\frac{1}{2}$ moles
2. How many moles of KI are consumed to obtain the product mixture?
 - (A) 4 moles
 - (B) $6\frac{1}{2}$ moles
 - (C) 7 moles
 - (D) $5\frac{1}{2}$ moles
3. The precipitate obtained is:
 - (A) $\text{CdI}_2 + \text{Cu}_2\text{I}_2$
 - (B) Cu_2I_2
 - (C) $\text{Cu}_2\text{I}_2 + \text{FeI}_2$
 - (D) None of these.

Passage 2: For Questions 4–6

Light green compound (A) $\xrightarrow{\Delta}$ White residue (B)
 $\xrightarrow[\text{temp.}]{\text{High temp.}}$ C + D + E

- D and E are acidic gases.
 - D is passed through HgCl_2 solution to give yellow precipitate.
 - When E is passed through water first and then H_2S is passed, white turbidity is obtained.
 - A is water soluble and on addition of HgCl_2 in it, a white precipitate is obtained which does not turn grey on addition of excess solution of A.
- D and E are respectively
 - SO_2 and SO_3 .
 - SO_3 and SO_2 .
 - SO_2 and CO_2 .
 - CO_2 and CO .
 - The yellow precipitate in the above reaction is
 - mercuric oxide.
 - basic mercury (II) sulphite.
 - basic mercury (II) sulphate.
 - mercuric iodide.
 - C is soluble in
 - dil. HCl .
 - dil. H_2SO_4 .
 - conc. H_2SO_4 under hot conditions.
 - boiled conc. HCl .

Passage 3: For Questions 7–9

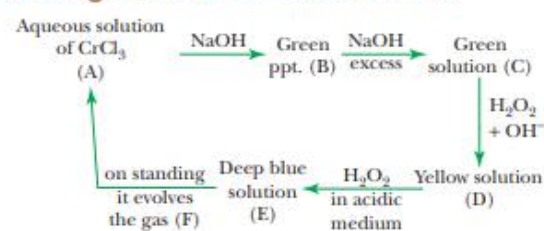
Aqueous solution of A + $\text{AgNO}_3 \rightarrow$ Black ppt. (B)

Aqueous solution of A + $[\text{Cr}(\text{H}_2\text{O})_6]^{3+} \xrightarrow{\text{H}^+}$ yellow to orange solution (C)

Aqueous solution of A + MnSO_4 solution $\xrightarrow{\text{H}^+}$ pink solution (D) $\xrightarrow{\text{BaCl}_2}$ pink ppt. (E)

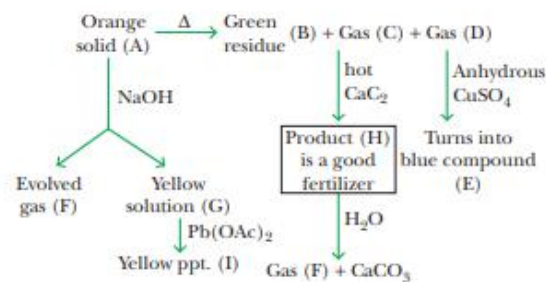
- The black precipitate is
 - AgO
 - Ag_2O
 - Ag_2S
 - Ag
- The true oxidation state of Ag in the black precipitate is/are
 - +2
 - +1 and +3
 - +1
 - None of these.
- The formula of pink precipitate (E) is
 - BaSO_4
 - $\text{Ba}(\text{MnO}_4)_2$
 - MnO_2
 - MnSO_4

Passage 4: For Questions 10–12



- The evolved gas F is
 - O_2
 - O_3
 - H_2
 - N_2
- In which of the following compounds will chromium have the same oxidation state (VI)?
 - A, B, C
 - B, D, E
 - D, E
 - B, C, D
- For the conversion of C \rightarrow D, which other reagent can be used?
 - $\text{NaBO}_3 + \text{NaOH}$
 - $\text{Br}_2 + \text{NaOH}$
 - $\text{Na}_2\text{S}_2\text{O}_8 + \text{H}^+$
 - All of these.

Passage 5: For Questions 13–16



- The evolved gas F is
 - N_2
 - H_2
 - NH_3
 - O_2
- The product H is
 - $\text{Ca}(\text{CN})_2$
 - CaCN_2
 - CaH_2
 - $\text{CaCN}_2 + \text{C}$

15. The number of water of crystallization present in compound E is
(A) 4
(B) 5
(C) 2
(D) 6
16. The oxidation state of the metal present in A is the same as that of the metal present in
(A) G and I
(B) G and E
(C) B and E
(D) B and G

ASSERTION-REASONING TYPE QUESTIONS

In the following set of questions, a Statement I is given and a corresponding Statement II is given below it. Mark the correct answer as:

- (A) If both Statement I and Statement II are true and Statement II is the correct explanation of Statement I.
(B) If both Statement I and Statement II are true but Statement II is not the correct explanation for Statement I.
(C) If Statement I is true but Statement II is false.
(D) If Statement I is false but Statement II is true.

1. **Statement I:** Cu^{2+} is more stable than Cu^+ .

Statement II: Ligand field effects in the complexes are more important than electron configuration in determining stable oxidation state.

2. **Statement I:** Concentrated solution of CuCl_2 in water is yellow in colour.

Statement II: The concentrated solution contains $[\text{CuCl}_4]^{2-}$ ion and $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ ion.

3. **Statement I:** Anhydrous ZnCl_2 cannot be made by heating $\text{ZnCl}_2 \cdot 2\text{H}_2\text{O}$.

Statement II: It undergoes hydrolysis to produce $\text{Zn}(\text{OH})_2$ and HCl .

4. **Statement I:** FeCl_2 is a secondary standard substance.

Statement II: The weight of FeCl_2 changes with time by any means.

5. **Statement I:** CuI_2 does not exist.

Statement II: I^- ions are very susceptible towards oxidation by Cu^{2+} ions.

6. **Statement I:** $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ is isomorphous with $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$.

Statement II: Both molecules have the same number of water molecules of crystallization.

7. **Statement I:** Lithophone is preferred over white lead as white pigment.

Statement II: In the presence of H_2S in air, white lead turns black.

8. **Statement I:** CO_3^{2-} and HCO_3^- ions are distinguished by using AgNO_3 .

Statement II: CO_3^{2-} gives white (yellowish) ppt. with AgNO_3 and no ppt. with HCO_3^- .

9. **Statement I:** Ag does not liberate H_2 with dil. HCl .

Statement II: $E_{\text{Ag}^+/\text{Ag}}^0 > E_{\frac{1}{2}\text{H}_2/\text{H}^+}^0$

10. **Statement I:** On addition of alkali to the yellow solution of chromate, it turns orange.

Statement II: CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$ are present in equilibrium and their relative concentrations depend upon the pH of the medium.

INTEGER ANSWER TYPE QUESTIONS

The answer to each of the following questions is a non-negative integer.

1. How many non-axial d -orbitals are involved in the hybridization of CrO_2Cl_2 ?
2. The sum of the oxidation states of Mn in KMnO_4 , K_2MnO_4 and K_3MnO_4 is _____.
3. The number of equivalent Cr–O bonds in CrO_4^{2-} is _____.

4. The number of the following reagents that produce ppt. with ZnSO_4 solution is _____.
 NaOH , Na_2CO_3 , NaCl , Na_2HPO_4 , Na_2S , $\text{CH}_3\text{CO}_3\text{Na}$.

5. The change in the magnetic moment value when $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ is converted to $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is _____.
6. The change in the number of unpaired electrons when $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ is changed into $[\text{Fe}(\text{CN})_6]^{4-}$ is _____.

MATRIX-MATCH TYPE QUESTIONS

In each of the following questions, statements are given in two columns, which have to be matched. The statements in Column I are labelled as (A), (B), (C) and (D), while those in Column II are labelled as (P), (Q), (R), (S) and (T). Any given statement in Column I can have correct matching with *one or more* statements in Column II.

1. Match the names with their chemical formulae.

Column I	Column II
(A) Kipp's apparatus waste	(P) HgCl_2
(B) Corrosive sublimate	(Q) $\text{Cu}(\text{OH})_2 \cdot 2\text{CuCO}_3$
(C) Azurite	(R) FeSO_4 solution
(D) Bordeaux mixture	(S) $\text{Ca}(\text{OH})_2 + \text{CuSO}_4$

2. Match the compounds with their chemical properties.

Column I	Column II
(A) KMnO_4	(P) Acts as oxidizing agent.
(B) $\text{K}_2\text{Cr}_2\text{O}_7$	(Q) All X–O bonds are equivalent.
(C) Na_2SO_4	(R) d^2s hybridization for the central atom (s)

3. Match the reaction with the nature of the product obtained.

Column I	Column II
(A) $\text{C}_2\text{O}_4^{2-} + \text{H}_2\text{O}_2 + \text{H}^+ \rightarrow$	(P) Redox reaction
(B) $\text{CrO}_5 + \text{H}^+ \rightarrow$	(Q) Evolution of O_2 takes place.
(C) $\text{Cr}^{3+} + \text{K}_2\text{S}_2\text{O}_8 + \text{H}^+ \rightarrow$	(R) A green solution is obtained.
(D) $\text{KMnO}_4 + \text{conc. KOH} \rightarrow$	(S) A blue solution is obtained.

4. Match the isolated gaseous ions with the number of unpaired electrons.

Column I	Column II
(A) Cr^{3+}	(P) 2
(B) Fe^{3+}	(Q) 3
(C) Ni^{2+}	(R) 4
(D) Mn^{3+}	(S) 5

5. Match the ore with its formula and the use to which it is put.

Column I	Column II	Column III
(A) Chromite ore	(M) $\text{Ca}_2\text{B}_6\text{O}_{11} \cdot 5\text{H}_2\text{O}$	(P) For preparing KMnO_4
(B) Colemanite ore	(N) MnO_2	(Q) For preparing borax
(C) Pyrolusite ore	(O) FeCr_2O_4	(R) For preparing $\text{K}_2\text{Cr}_2\text{O}_7$.

ANSWERS

Single Correct Choice Type Questions

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

Multiple Correct Choice Type Questions

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

Comprehension Type Questions

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

Assertion–Reasoning Type Questions

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

Integer Answer Type Questions

- | | | | | | |
|------|-------|------|------|------|------|
| 1. 3 | 2. 18 | 3. 4 | 4. 4 | 5. 0 | 6. 4 |
|------|-------|------|------|------|------|

Matrix–Match Type Questions

- | | | |
|---|---|---|
| 1. (A) \rightarrow (R)
(B) \rightarrow (P)
(C) \rightarrow (Q)
(D) \rightarrow (S) | 3. (A) \rightarrow (P)
(B) \rightarrow (P), (Q), (R)
(C) \rightarrow (P)
(D) \rightarrow (P), (Q), (R) | 5. (A) \rightarrow (O), (R)
(B) \rightarrow (M), (Q)
(C) \rightarrow (N), (P) |
| 2. (A) \rightarrow (P), (Q), (R)
(B) \rightarrow (P), (R)
(C) \rightarrow (Q) | 4. (A) \rightarrow (Q)
(B) \rightarrow (S)
(C) \rightarrow (P)
(D) \rightarrow (R) | |