

# Chemistry



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# IIT-JEE

**Chapterwise Solved Paper**

**Transition Elements**

**Objective Questions – I [Only one correct option]**

- Which of the following dissolves in concentrated NaOH solution?  
(a) Fe (b) Zn  
(c) Cu (d) Ag
- One of the constituent of German silver is  
(a) Ag (b) Cu  
(c) Mg (d) Al
- How many unpaired electrons are present in  $\text{Ni}^{2+}$  ?  
(a) 0 (b) 2  
(c) 4 (d) 8
- Zinc-copper couple that can be used as a reducing agent is obtained by  
(a) mixing of zinc dust and copper gauge  
(b) zinc coated with copper  
(c) copper coated with zinc  
(d) zinc and copper wires welded together
- The reaction which proceed in the forward direction is  
(a)  $\text{Fe}_2\text{O}_3 + 6\text{HCl} \longrightarrow 2\text{FeCl}_3 + 3\text{H}_2\text{O}$   
(b)  $\text{NH}_3 + \text{H}_2\text{O} + \text{NaCl} \longrightarrow \text{NH}_4\text{Cl} + \text{NaOH}$   
(c)  $\text{SnCl}_4 + \text{Hg}_2\text{Cl}_2 \longrightarrow \text{SnCl}_2 + 2\text{HgCl}_2$   
(d)  $2\text{CuI} + \text{I}_2 + 4\text{H}^+ \longrightarrow 2\text{Cu}^{2+} + 4\text{KI}$
- Ammonium dichromate is used in some fireworks. The green coloured powder blown in the air is  
(a)  $\text{CrO}_3$  (b)  $\text{Cr}_2\text{O}_3$   
(c) Cr (d) CO
- Which of the following compounds is expected to be coloured?  
(a)  $\text{Ag}_2\text{SO}_4$  (b)  $\text{CuF}_2$   
(c)  $\text{MgF}_2$  (d)  $\text{CuCl}$
- In the dichromate dianion  
(a) 4 Cr – O bonds are equivalent  
(b) 6 Cr – O bonds are equivalent  
(c) All Cr – O bonds are equivalent  
(d) all Cr – O bonds are nonequivalent.
- On heating ammonium dichromate, the gas evolved is  
(a) oxygen (b) ammonia  
(c) nitrous oxide (d) nitrogen
- Amongst the following, identify the species with an atom in + 6 oxidation state

- (a)  $\text{MnO}_4^-$  (b)  $\text{Cr}(\text{CN})_6^{3-}$   
(c)  $\text{NiF}_6^{2-}$  (d)  $\text{CrO}_2\text{Cl}_2$
11. When  $\text{MnO}_2$  is fused with  $\text{KOH}$ , a coloured compound is formed, the product and its colour is  
(a)  $\text{K}_2\text{MnO}_4$ , purple green  
(b)  $\text{KMnO}_4$ , purple  
(c)  $\text{Mn}_2\text{O}_3$ , brown  
(d)  $\text{Mn}_3\text{O}_4$ , black
12.  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  on heating gives a gas which is also given by  
(a) heating  $\text{NH}_4\text{NO}_2$  (b) heating  $\text{NH}_4\text{NO}_3$   
(c)  $\text{Mg}_3\text{N}_2 + \text{H}_2\text{O}$  (d)  $\text{Na}(\text{comp.}) + \text{H}_2\text{O}_2$
13. The pair of compounds having metals in their highest oxidation state is  
(a)  $\text{MnO}_2$ ,  $\text{FeCl}_2$  (b)  $[\text{MnO}_4]^-$ ,  $\text{CrO}_2\text{Cl}_2$   
(c)  $[\text{Fe}(\text{CN})_6]^{3-}$ ,  $[\text{Co}(\text{CN})_3]$  (d)  $[\text{NiCl}_4]^{2-}$ ,  $[\text{CoCl}_4]^-$
14. When  $\text{I}^-$  is oxidised by  $\text{MnO}_4^-$  in alkaline medium,  $\text{I}^-$  converts into  
(a)  $\text{IO}_3^-$  (b)  $\text{I}_2$   
(c)  $\text{IO}_4^-$  (d)  $\text{IO}^-$
15. Which of the following pair is expected to exhibit same colour in solution?  
(a)  $\text{VOCl}_2$ ;  $\text{FeCl}_2$  (b)  $\text{CuCl}_2$ ;  $\text{VOCl}_2$   
(c)  $\text{MnCl}_2$ ;  $\text{FeCl}_2$  (d)  $\text{FeCl}_2$ ;  $\text{CuCl}_2$
16. Which of the following will not be oxidised by  $\text{O}_3$ ?  
(a)  $\text{KI}$  (b)  $\text{FeSO}_4$   
(c)  $\text{KMnO}_4$  (d)  $\text{K}_2\text{MnO}_4$

### Objective Questions II [One or more than one correct option]

1. Potassium manganate ( $\text{K}_2\text{MnO}_4$ ) is formed when  
(a) chlorine is passed into aqueous  $\text{KMnO}_4$  solution  
(b) manganese dioxide is fused with  $\text{KOH}$  in air  
(c) formaldehyde reacts with potassium permanganate in presence of strong alkali  
(d) potassium permanganate reacts with conc.  $\text{H}_2\text{SO}_4$
2. The aqueous solution of the following salts will be coloured in case of  
(a)  $\text{Zn}(\text{NO}_3)_2$  (b)  $\text{LiNO}_3$   
(c)  $\text{Co}(\text{NO}_3)_2$  (d)  $\text{CrCl}_3$
3. Which of the following alloys contains  $\text{Cu}$  and  $\text{Zn}$ ?  
(a) Bronze (b) Brass  
(c) Gun metal (d) Type metal



4. Which of the following statement (s) is/are correct when a mixture of NaCl and  $K_2Cr_2O_7$  is gently warmed with conc.  $H_2SO_4$ ?
- (a) A deep red vapours in formed  
(b) Vapours when passed into NaOH solution gives a yellow solution of  $Na_2CrO_4$   
(c) Chlorine gas is evolved  
(d) Chromyl chloride is formed
5. Which of the following statement (s) is/are correct?
- (a) The electronic configuration of Cr is  $[Ar] 3d^5 4s^1$  (Atomic number of Cr = 24)  
(b) The magnetic quantum number may have a negative value  
(c) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type (Atomic number of Ag = 47)  
(d) The oxidation state of nitrogen in  $HN_3$  is - 3
6. Reduction of the metal centre in aqueous permanganate ion involves
- (a) three electrons in neutral medium  
(b) five electrons in neutral medium  
(c) three electrons in alkaline medium  
(d) five electrons in acidic medium

### Assertion and Reason

Read the following questions and answer as per the direction given below :

- (a) Statement I is true; Statement II is true; Statement II is the correct explanation of Statement I.  
(b) Statement I is true; Statement II is true; Statement II is not the correct explanation of Statement I.  
(c) Statement I is true; Statement II is false.  
(d) Statement I is false; Statement II is true.
1. Statement I : To a solution of potassium chromate if a strong acid is added, it changes its colour from yellow to orange.  
Statement II : The colour change is due to the change in oxidation state of potassium chromate.
2. Statement I :  $Zn^{2+}$  is diamagnetic.  
Statement II : The electrons are lost from 4s orbital to form  $Zn^{2+}$ .

### Fill in the Blanks

1.  $Mn^{2+}$  can be oxidized to  $MnO_4^-$  by .....( $SnO_2$ ,  $PbO_2$ ,  $BaO$ )  
2. The salts ..... and ..... are isostructural. ( $FeSO_4 \cdot 7H_2O$ ,  $CuSO_4 \cdot 5H_2O$ ,  $MnSO_4 \cdot 4H_2O$ ,  $ZnSO_4 \cdot 7H_2O$ )  
3. Fehling's solution A consists of an aqueous solution of copper sulphate while Fehling's solution B consists of an alkaline solution of .....



- The outermost electronic configuration of Cr is .....
- The compound  $\text{YBa}_2\text{Cu}_3\text{O}_7$  which show super conductivity has copper in oxidation state ..... assuming that the rare earth element Yttrium in its usual +3 oxidation state.

**True/False**

- Copper metal reduces  $\text{Fe}^{2+}$ , in an acid medium.
- Dipositive zinc exhibit paramagnetism due to loss of two electrons from 3d orbitals of neutral atom.

**Subjective Questions**

- Complete and balance the following reactions
  - $\text{Zn} + \text{NO}_3^- \longrightarrow \text{Zn}^{2+} + \text{NH}_4^+$
  - $\text{Cr}_2\text{O}_7^{2-} + \text{C}_2\text{H}_2\text{O} \longrightarrow \text{C}_2\text{H}_4\text{O}_2 + \text{Cr}^{3+}$
- State the conditions under which the following preparations are carried out. Give necessary equations which need not be balanced.

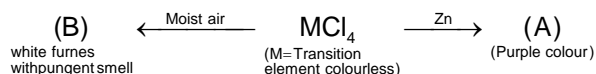
"Potassium permanganate from manganese dioxide"
- Show with balanced equations for the reactions when
  - Potassium permanganate interacts with manganese dioxide in presence of potassium hydroxide.
  - Potassium ferricyanide is heated with concentrated sulphuric acid.
- Give reason in one or two sentences  
"Most transition metal compounds are coloured."
- Complete and balance the following reactions
  - $\text{Mn}^{2+} + \text{PbO}_2 \longrightarrow \text{MnO}_4 + \text{H}_2\text{O}$
  - $\text{Ag}^+ + \text{AsH}_3 \longrightarrow \text{H}_3\text{AsO}_3 + \text{H}^+$
- Write the balanced chemical equations for the following reactions
  - A mixture of potassium dichromate and sodium chloride is heated with concentrated  $\text{H}_2\text{SO}_4$ .
  - Potassium permanganate is added to a hot solution of manganous sulphate.
- Complete and balance the following reaction  
 $(\text{NH}_4)_2\text{S}_2\text{O}_8 + \text{H}_2\text{O} + \text{MnSO}_4 \longrightarrow \dots + \dots + \dots$
- Complete and balance the following reactions
  - $[\text{Ni}(\text{NO}_4)]^{2-} + \text{H}^+ \longrightarrow \dots + [\text{MnO}_4]^- + \text{H}_2\text{O}$
  - $\text{SO}_2(\text{aq}) + \text{Cr}_2\text{O}_7^{2-} + 2\text{H}^+ \longrightarrow \dots + \dots +$
- Write balanced equations for the following :
  - Oxidation of hydrogen peroxide with potassium permanganate in acidic medium.

(ii) Reaction of zinc with dilute nitric acid.

10. A compound of vanadium has a magnetic moment of  $1.73 \sqrt{3} \text{ BM}$ . Work out the electronic configuration of the vanadium ion of the compound.

11. Give reasons :  $\text{CrO}_3$  is an acid anhydride.

12.



Identify the metal M and hence  $\text{MCl}_4$ . Explain the difference in colours of  $\text{MCl}_4$  and A.

### Answers

1. (b) 2.(b) 3. (b) 4. (b) 5. (a) 6. (b) 7. (b)  
 8. (b) 9.(d) 10. (d) 11. (a) 12. (a) 13. (b)  
 14. (a) 15.(b) 16.(c)

### Objective Questions 11

1. (b,c) 2. (c,d)  
 3. (a,b,c) 4. (a,b,c,d)  
 5. (a,b,c) 6. (a,c,d)

### Assertion and Reason

1. (c) 2. (b)

### Fill in the Blanks

1.  $\text{PbO}$   
 2.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$   
 3. Rochelle salt  
 4.  $3d^5 4s^1$   
 5.  $x = +\frac{7}{3}$

### True / False

1. F 2. F