

The d-Block Elements and Some of Their Compounds

EXERCISE # I

❑ Only one correct answer :

- Which of the following chromate is brick red colour precipitate ?
 (a) BaCrO_4 (b) SrCrO_4
 (c) Ag_2CrO_4 (d) Hg_2CrO_4
- Which of the following chromate is scarlet red colour precipitate ?
 (a) BaCrO_4 (b) SrCrO_4
 (c) Ag_2CrO_4 (d) Hg_2CrO_4
- When potassium permanganate in small portion is added to well cooled concentrated sulphuric acid, a dark green solution is formed which is used as explosive. The oxidation state of manganese in product is :-
 (a) +2 (b) +4
 (c) +6 (d) +7
- The highest oxidation state of Mn is not observed in which of the following compound of Mn :-
 (a) KMnO_4 (b) K_2MnO_4
 (c) Mn_2O_7 (d) MnO_3F
- Oxalic acid in presence of sulphuric acid produces CO_2 gas when it is allowed to react with KMnO_4 solution. The reagent which is used as autocatalyst in this reaction is :-
 (a) $(\text{CO}_2\text{H})_2$ (b) KMnO_4
 (c) $\text{dil. H}_2\text{SO}_4$ (d) MnSO_4
- Which element is not affected by $1(\text{M}) \text{H}^+$, among transitional element :-
 (a) Cu (b) Fe
 (c) Co (d) Ni
- Which reaction is most spontaneous?
 (a) $\text{Mn} + 2\text{H}^+ \rightarrow \text{Mn}^{2+} + \text{H}_2$
 (b) $\text{Fe} + 2\text{H}^+ \rightarrow \text{Fe}^{2+} + \text{H}_2$
 (c) $\text{Zn} + 2\text{H}^+ \rightarrow \text{Zn}^{2+} + \text{H}_2$
 (d) $\text{Co} + 2\text{H}^+ \rightarrow \text{Co}^{2+} + \text{H}_2$
- The actual $E^\circ_{\text{Zn}^{2+}/\text{Zn}}$ is more negative than expected from the general trend. It is because of :-
 (a) very low enthalpy of hydration of Zn^{2+}
 (b) stability of Zn^{2+} due to d^5 configuration
 (c) stability of Zn^{2+} due to completely filled d subshell
 (d) None
- Lunar caustic is :-
 (a) NaOH (b) KOH
 (c) $\text{Ba}(\text{OH})_2$ (d) AgNO_3
- Bordaeux mixture is :-
 (a) $\text{CuCl}_2 + \text{Cu}(\text{OH})_2$
 (b) $\text{CuSO}_4 + \text{Ca}(\text{OH})_2$
 (c) $\text{Cu}(\text{NO}_3)_2 + \text{KOH}$
 (d) $\text{Cu}_2\text{Cl}_2 + \text{K}_2\text{CO}_3$
- The correct order of ionic radii of Y^{3+} , La^{3+} , Eu^{3+} and Lu^{3+} is
 (a) $\text{Y}^{3+} < \text{La}^{3+} < \text{Eu}^{3+} < \text{Lu}^{3+}$
 (b) $\text{La}^{3+} < \text{Eu}^{3+} < \text{Lu}^{3+} < \text{Y}^{3+}$
 (c) $\text{Y}^{3+} < \text{Lu}^{3+} < \text{Eu}^{3+} < \text{La}^{3+}$
 (d) $\text{Lu}^{3+} < \text{La}^{3+} < \text{Eu}^{3+} < \text{Y}^{3+}$
- Which of the element in first series of transition elements has highest heat of atomisation ?
 (a) Cr (b) V
 (c) Co (d) Ni

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13. E° value is highest +ve for which of the following reaction :-
(a) $\text{MnO}_4^- + e \longrightarrow \text{MnO}_4^{2-}$
(b) $\text{MnO}_4^- + 4\text{H}^+ + 3e \longrightarrow \text{MnO}_2 + 2\text{H}_2\text{O}$
(c) $\text{MnO}_4^- + 8\text{H}^+ + 5e \longrightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$
(d) $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6e \longrightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$
15. Metal (M) + dilute HCl \rightarrow H_2 gas
Metal (M) (red hot) + steam \rightarrow H_2 gas + Mixed oxide
Metal M can be :-
(a) Copper (b) Zinc
(c) Iron (d) Cadmium
16. In mild acidic medium manganate ion disproportionate in :-
(a) Mn^{2+} , MnO_4^-
(b) MnO_2 , MnO_4^-
(c) Mn^{2+} , Mn_2O_7
(d) MnO_2 , $\text{Mn}(\text{OH})_2$
17. Arrange the following species in the increasing order of their magnetic properties :-
(a) $\text{VCl}_3 > \text{VOSO}_4 > \text{Na}_3\text{VO}_4 > [\text{V}(\text{H}_2\text{O})_6]\text{SO}_4 \cdot \text{H}_2\text{O}$
(b) $[\text{V}(\text{H}_2\text{O})_6]\text{SO}_4 > \text{VCl}_3 > \text{VOSO}_4 > \text{Na}_3\text{VO}_4$
(c) $\text{VCl}_3 > \text{VOSO}_4 > [\text{V}(\text{H}_2\text{O})_6]\text{SO}_4 \cdot \text{H}_2\text{O} > \text{Na}_3\text{VO}_4$
(d) All
18. Oxide of which d^{10} ion is amphoteric :-
(a) ZnO (b) CdO
(c) HgO (d) OH
19. The aqueous solution of CuCrO_4 is green because it consists of :-
(a) Green Cu^{2+} ion
(b) Blue Cu^{2+} & Green CrO_4^{2-} ion
(c) Blue CrO_4^{2-} & Green Cu^{2+} ion
(d) Blue Cu^{2+} & Yellow CrO_4^{2-} ion
20. The highest oxidation state is exhibited by the transition metals with configuration -
(a) $(n-1)d^3ns^2$ (b) $(n-1)d^5ns^1$
(c) $(n-1)d^5ns^2$ (d) $(n-1)d^8ns^2$
21. $\text{RCH}=\text{O} + \text{Fehling solution} \rightarrow \text{RCO}_2\text{H} + \text{Reddish brown precipitate}$
Reddish brown precipitate is
(a) CuO (b) Pb_3O_4
(c) Hg_2O (d) Cu_2O
22. The stability order :-
(a) $\text{CrO}_4^{2-} > \text{MnO}_4^{2-} > \text{FeO}_4^{2-}$
(b) $\text{CrO}_4^{2-} > \text{FeO}_4^{2-} > \text{MnO}_4^{2-}$
(c) $\text{MnO}_4^{2-} > \text{CrO}_4^{2-} > \text{FeO}_4^{2-}$
(d) $\text{FeO}_4^{2-} > \text{CrO}_4^{2-} > \text{MnO}_4^{2-}$
23. +4 oxidation state of Pt is observed in :-
(a) $\text{O}_2[\text{PtF}_6]$ (b) $\text{H}_2[\text{PtCl}_4]$
(c) $\text{H}_2[\text{PtCl}_6]$ (d) $\text{K}_2[\text{Pt}(\text{CN})_4]$
24. The colour of mercurous iodide precipitate is :-
(a) Green (b) Black
(c) Yellow (d) Scarlet red
25. The colour of mercuric iodide precipitate is :-
(a) Green (b) Black
(c) Yellow (d) Scarlet red
26. The colour of mercurous oxide precipitate is :-
(a) Green (b) Black
(c) Yellow (d) Scarlet red
27. The colour of mercuric oxide precipitate is :-
(a) Green (b) Black
(c) Yellow (d) Scarlet red
28. The aqueous solution of CuCrO_4 is green because it contains :-
(a) green Cu^{2+} ions
(b) green CrO_4^{2-} ions
(c) blue Cu^{2+} ions & green CrO_4^{2-} ions
(d) blue Cu^{2+} ions & yellow CrO_4^{2-} ions
29. The compound of pentavalent gold is ?
(a) AuF_5 (b) AuCl_5
(c) AuBr_5 (d) AuI_5
30. Which cuprous halide is white in colour ?
(a) CuF (b) CuCl
(c) CuCl_2 (d) CuBr

31. $[\text{Co}(\text{H}_2\text{O})_6]^{2+} + 4\text{Cl}^- \rightarrow \text{CoCl}_4^{2-}$
 Colour of the complex in reactant and product side are respectively
 (a) Blue ; Pink
 (b) Pink ; Blue
 (c) Pink ; Yellow
 (d) Dark green ; Pink
32. When acetylene is passed through cuprous chloride:-
 (a) Red colour precipitate of Cu_2C_2 is formed
 (b) White colour precipitate of Cu_2C_2 is formed
 (c) Blue colour precipitate of CuC_2 is formed
 (d) Blue colour precipitate of Cu_2C_2 is formed
33. Microcosmic salt when heated , a transparent bead is fomed. The transparent bead is :-
 (a) NaBO_2 (b) B_2O_3
 (c) P_2O_5 (d) NaPO_3
34. Which of the following black colour precipitate ?
 (a) Cr_2O_3 (b) SnS_2
 (c) HgS (d) AgI
35. Which one of the following ions do not give borax bead test ?
 (a) Cr^{3+} (b) Cu^{2+}
 (c) Mn^{2+} (d) Zn^{2+}
36. A white powder (A) when strogly heated , it gives off colourless odourless gas (B) which turns lime water milky (C). Also it gives solid residue D which is yellow when hot but turns white on cooling.
 (a) PbCO_3 , PbO (b) ZnCO_3 , ZnO
 (c) PbCO_3 , PbO_2 (d) Pb_2CO_3 , PH_3O_4
37. Coagulation of blood is caused by :-
 (a) Alum
 (b) Microcosmic salt
 (c) Sodium hydrogen phosphate
 (d) Borax
38. Black coloured
 (A) + $\text{H}_2\text{SO}_4 \longrightarrow \text{B(g)} + \text{C}$
 B (gas) + $\text{Pb}(\text{CH}_3\text{CO}_2)_2 \longrightarrow \text{Black ppt. (D)}$
 C $\xrightarrow{\text{K}_3[\text{Fe}(\text{CN})_6]}$ Blue colour(E)
- Here :-
 (a) A is CuS and B is H_2S
 (b) A is FeS ; C is FeSO_4 ; D is PbS ; E is $\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$
 (c) C is $\text{Zn}_2[\text{Fe}(\text{CN})_6]$ and D is PbS
 (d) D is PbS and E is $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$
39. The aqueous solution of P yields a white precipitate when treated with dilute HNO_3 and AgNO_3 . Another sample of the solution of P when treated with NaOH gives a white precipitate which is dissolved in excess of NaOH . When H_2S gas is passed through solution, a white precipitate is obtained. P is :-
 (a) CoCl_2 (b) ZnCl_2
 (c) NiCl_2 (d) SnCl_2
40. The highly water soluble red violet crystalline compound $\text{K}_3[\text{Mn}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ is octahedral complex. The magnetic moment is :-
 (a) $\sqrt{15}$ B.M. (b) $\sqrt{24}$ B.M.
 (c) $\sqrt{35}$ B.M. (d) $\sqrt{8}$ B.M.
41. Which of the following form an alloy ?
 (a) $\text{Zn} + \text{Pb}$
 (b) $\text{Fe} + \text{Hg}$
 (c) $\text{Pt} + \text{Hg}$
 (d) $\text{Fe} + \text{C}$
42. $\text{KI}_{(\text{excess})} + \text{Mercuric chloride} \rightarrow \text{Product}$.
 Product along with KOH is very important laboratory reagent. The reagent and its formula -
 (a) Nessler's reagent ; $\text{K}_2[\text{HgI}_4]$
 (b) Nessler's reagent ; $\text{K}_4[\text{HgI}_6]$
 (c) Nessler's reagent ; $\text{K}_2[\text{Hg}_2\text{I}_4]$
 (d) Nessler's reagent ; $\text{K}_2[\text{Hg}(\text{SCN})_4]$
43. H_2S gas is passed through an acidified solution of a mixture containing Cu^{2+} and Zn^{2+} ions. What will happen ?
 (a) no precipitate is formed
 (b) both will get precipitated
 (c) CuS gets precipitated only
 (d) ZnS gets precipitated only

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44. A few Cu (I) salts are coloured. The colour arises from

- (a) d-d transition
- (b) Charge transfer spectra
- (c) The large wavelengths of the rays absorbed by the solutions
- (d) The smaller wavelengths of rays is absorbed by the solution

45. Which of the following does not disproportionate?

- (a) Cu^+ (b) Au^{3+}
- (c) Ga^+ (d) Au^+

46. Acidic KMnO_4 is decolourised by

- (a) The ferric ammonium alum
- (b) Mohr's salt
- (c) A neutral ferric chloride solution
- (d) All of these

47. A colourless salt

A $\xrightarrow{\text{MnO}_4^-/\text{H}^+}$ decolourises

A $\xrightarrow{\text{Heat}}$ X + Y + Z ; X and Y are gases

Z + water \longrightarrow B

Y + B \longrightarrow milkiness

Gas X burns with blue flame. Mark the correct choices.

A	X	Y	Z	B
(a) CaCO_3	CaO	CO	CO_2	H_2CO_3
(b) CaC_2O_4	CO	CO_2	CaO	$\text{Ca}(\text{OH})_2$
(c) CaC_2O_4	CO_2	CO	CaO	$\text{Ca}(\text{OH})_2$
(d) CaSO_3	SO_2	O_2	CaO	$\text{Ca}(\text{OH})_2$

48. Statement -1: $\text{Mn}_2\text{Cl}_{10}$ will be diamagnetic.

Statement -2 : TiCl_4 is used for the test of H_2O_2 .

Statement -3 : In $\text{Cr}_3\text{O}(\text{CH}_3\text{COO})_6\text{H}_2\text{O}$, CH_3COO^- act as bridging ligand.

- (a) FTT (b) FFT
- (c) TTT (d) FFF

49. Statement -1: Actinoids show higher oxidation state than lanthanoids.

Statement -2 : All lanthanoids in M^{+3} state are coloured.

Statement -3 : Promethium is a radioactive lanthanoid.

- (a) TTF (b) TFT
- (c) FFT (d) FTF

50. Purple of cassius is :-

- (a) Colloidal sol of graphite in water
- (b) Colloidal sol of silver
- (c) Colloidal sol of gold
- (d) Colloidal sol of cellulose nitrate in ethanol

51. Which of the following has three unpaired electrons:-

- (a) Zn^{2+} (b) Cr^{3+}
- (c) Co^{2+} (d) Cu^{2+}

52. Which of the following is diamagnetic :-

- (a) La^{3+} (b) Ce^{4+}
- (c) Yb^{2+} (d) All

53. Among the following which has highest oxidising power :-

- (a) VO_2^+ (b) $\text{Cr}_2\text{O}_7^{2-}$
- (c) MnO_4^- (d) MnO_2

54. The common oxidation state of lanthanoid :-

- (a) +2 (b) +3
- (c) +4 (d) +5

55. Which of the following is negatively charged sol ?

- (a) $\text{CrO}_3 \cdot x\text{H}_2\text{O}$ (hydrated metallic oxide)
- (b) Haemoglobin (blood)
- (c) Oxides TiO_2 sol
- (d) CdS sol

56. Correct order for the wavelength of absorption in the visible region for the following :-

- (a) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4+}$
- (b) $[\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4+}$
- (c) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4+} < [\text{Ni}(\text{NH}_3)_6]^{2+}$
- (d) $[\text{Ni}(\text{NO}_2)_6]^{4+} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+}$

57. CuS precipitate is dissolved in :-

- (a) NH_4OH solution
- (b) NaOH solution
- (c) Potassium cyanide solution
- (d) Water

58. $\text{Cr}(\text{OH})_3$ precipitate is dissolved in :-
 (a) Sodium hydroxide
 (b) Sodium peroxide solution
 (c) 50% HNO_3
 (d) All
59. $\text{Zn}(\text{OH})_2$ precipitate is dissolved in :-
 (a) NH_3
 (b) Sodium hydroxide solution
 (c) 50% HNO_3
 (d) All
60. Mischmetal is an alloy which consists of :-
 (a) 50% of lanthanoid metal and 50% iron & traces of S, C, Ca and Al
 (b) 80% of lanthanoid metal and 20% iron & traces of S, C, Ca and Al
 (c) 95% of lanthanoid metal and 5% iron & traces of S, C, Ca and Al
 (d) None
61. The most stable ion in aqueous solution :-
 (a) V^{3+} (b) Tl^{3+}
 (c) Cr^{3+} (d) Mn^{3+}
62. $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$, What is the ΔH for the reaction.
 Given $(\Delta H_f)_{\text{Al}_2\text{O}_3} = -827 \text{ kJ}\cdot\text{mol}^{-1}$,
 $(\Delta H_f)_{\text{Cr}_2\text{O}_3} = -540 \text{ kJ}\cdot\text{mol}^{-1}$
 (a) $+287 \text{ kJ}\cdot\text{mol}^{-1}$
 (b) $-287 \text{ kJ}\cdot\text{mol}^{-1}$
 (c) $1367 \text{ kJ}\cdot\text{mol}^{-1}$
 (d) $-1367 \text{ kJ}\cdot\text{mol}^{-1}$
63. Ag^+ does not give white precipitate with :-
 (a) potassium thiocyanate solution
 (b) potassium chloride solution
 (c) potassium ferrocyanide solution
 (d) potassium iodide solution
64. Which of the following statement is correct :-
 (a) the +1 oxidation state of Ni is not stable
 (b) NiO is an amphoteric oxide
 (c) the most important ore is melachite
 (d) silver is poor conductor of heat and electricity
65. Lanthanoid contraction is caused due to :-
 (a) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
 (b) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge
 (c) the same effective nuclear charge from Ce to Lu
 (d) the imperfect shielding on outer electron by 4f electrons from the nuclear charge
66. Identify the incorrect statement among the following:-
 (a) d-block elements show irregular and erratic chemical properties among themselves
 (b) La and Lu have partially filled d orbitals and no other partially filled orbitals
 (c) The chemistry of various lanthanoids is very similar
 (d) 4f and 5f orbitals are equally shielded
67. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because :-
 (a) the 5f orbitals are more buried than the 4f orbitals
 (b) there is similarity between 4f and 5f orbitals in their angular part of the wave function
 (c) the actinoids are more reactive than the lanthanoids
 (d) the 5f orbitals extend further from the nucleus than the 4f orbitals
68. The lanthanoids contraction is responsible for the fact that :-
 (a) Zr and Zn have the same oxidation state
 (b) Zr and Hf have about the same radius
 (c) Zr and Nb have similar oxidation state
 (d) Zr and Y have about the same radius
69. More positive the value of $E_{\text{M}^{n+}/\text{M}}^\circ$:-
 (a) greater is the stability of M^{n+} ion in aqueous medium
 (b) less is the stability of M^{n+} ion in aqueous medium
 (c) greater is the stability of M ion in aqueous medium
 (d) None of these

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70. Three separate test tubes contains aq. solution of dichloride of a metal :

(I) test tube -1 $\xrightarrow{\text{KOH}(\text{excess})}$ No change

(II) test tube -2 $\xrightarrow{\text{dil. H}_2\text{SO}_4}$ No change

(III) test tube -3 $\xrightarrow{\text{NH}_4\text{OH}(\text{excess})}$ No change

dichloride of metal is -



(a) SnCl_2 (b) FeCl_2

(c) CuCl_2 (d) ZnCl_2

EXERCISE # II

❑ One or More Than One Correct Answer :

- When chromite ore is fused with excess of Na_2O_2 , then:-
 - brown precipitate is formed
 - Orange solution is observed
 - Green colour precipitate is observed
 - Yellow solution is observed
- CrO_5 is stabilised in ether solution as the coordination complex by :-
 - Pyridine
 - Trimethyl amine
 - Aniline
 - Amyl alcohol
- Ammonium-dichromate decompose violently on heating giving -
 - N_2
 - N_2O_3
 - H_2O
 - Cr_2O_3
- Which carboxylic acid can be oxidised by KMnO_4 solution ?
 - HCO_2H
 - $\text{CH}_3\text{CO}_2\text{H}$
 - $(\text{CO}_2\text{H})_2$
 - H_2CO_3
- Manganous sulphate is oxidised to permanganic acid by treatment with :-
 - PbO_2 is HNO_3
 - Sodium bismuthate (NaBiO_3) in HNO_3
 - KIO_4 is HNO_3
 - Ammonium perdisulphate
- What are the correct statement regarding potassium manganate solution ?
 - Potassium manganate solution is quite stable in acidic medium
 - Potassium manganate solution is quite stable in basic medium
 - Potassium manganate disproportionates in basic medium depositing MnO_2 and giving a purple solution of permanganate.
 - Potassium manganate disproportionates in acidic medium
- At least one gaseous product is formed for which compound when reacts with MnO_2 :-
 - Concentrated HCl
 - Concentrated H_2SO_4
 - Solid NH_4Cl
 - Oxalic acid in presence of H_2SO_4
- In 3d series, which element has positive electron gain enthalpy ?
 - Cr
 - Fe
 - Mn
 - Zn
- Among all d block element :-
 - Hg has lowest melting point
 - W has highest melting point
 - Fe has highest melting point
 - Zn has lowest melting point
- Which of the following statements are correct regarding use of d block element ?
 - Mo is used in X-ray tube
 - Co is used for radiotherapy of cancerous tumour
 - Pt is used as catalyst for hydrogenation of alkene
 - Ni is used in nickel plating
- Cr^{2+} is reducing and Mn^{3+} is oxidising but both are d^4 configuration. It is because :-
 - Cr^{2+} is itself oxidised to Cr^{3+} which has half filled t_{2g} orbital
 - Mn^{3+} is itself reduced to Mn^{2+} which has half filled d^5 configuration
 - Cr^{2+} is itself oxidised to Cr^{3+} which has half filled eg orbital
 - Mn^{3+} is itself reduced to Mn^{4+} which has half filled eg orbital
- Example of mixed oxide of transition elements are :-
 - Pb_3O_4
 - Mn_3O_4
 - Fe_3O_4
 - Co_3O_4

13. Among the following pair of ions, the lower oxidation state in aqueous solution is more stable than the other in :-
 (a) $\text{Cu}^+(\text{aq.})$; $\text{Cu}^{2+}(\text{aq.})$
 (b) Mn^{2+} , Mn^{3+}
 (c) Cr^{2+} ; Cr^{3+}
 (d) Tl^{+1} ; Tl^{3+}
14. The aqueous solution of the salt will be coloured. The salt can be :-
 (a) NaNO_3
 (b) ZnCl_2
 (c) $\text{Cr}_2(\text{SO}_4)_3$
 (d) $\text{Cu}(\text{NO}_3)_2$
15. Which of the following options are correct regarding ionisation potential of Ni and Pt :-
 (a) $(\text{IP}_1 + \text{IP}_2)_{\text{Ni}} < (\text{IP}_1 + \text{IP}_2)_{\text{Pt}}$
 (b) $(\text{IP}_1 + \text{IP}_2)_{\text{Ni}} > (\text{IP}_1 + \text{IP}_2)_{\text{Pt}}$
 (c) $(\text{IP}_3 + \text{IP}_4)_{\text{Ni}} < (\text{IP}_3 + \text{IP}_4)_{\text{Pt}}$
 (d) $(\text{IP}_3 + \text{IP}_4)_{\text{Ni}} > (\text{IP}_3 + \text{IP}_4)_{\text{Pt}}$
16. Ammoniacal Cu_2Cl_2 absorbs :-
 (a) CO_2 (b) CO
 (c) C_2H_4 (d) C_2H_2
17. Mn-an element which forms oxide in +2 to +7 oxidation state. Correct options is -
 (a) Oxide in +2 oxidation state is ionic
 (b) Oxide in +7 oxidation state is covalent
 (c) Oxide in +2 oxidation state is covalent
 (d) Oxide in +7 oxidation state is ionic
18. Addition of nonmetals like B and C to the interstitial sites of a transition metal results the metal :-
 (a) of more ductability
 (b) of less ductability
 (c) less malleable
 (d) more hardness
19. Which of the following options are correct ?
 (a) Hydrated Co^{2+} salt is pink.
 (b) Anhydrous Co^{2+} salt is blue.
 (c) Hybridisation of $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ is sp^3d^2
 (d) Co^{2+} has coordination number + 8
20. Which of the following options are correct ?
 (a) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is blue
 (b) Anhydrous CuSO_4 is white.
 (c) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is blue
 (d) CuO is black
21. Which reactions are spontaneous ?
 (a) $2\text{AgNO}_3 + \text{Cu} \rightarrow 2\text{Ag} + \text{Cu}(\text{NO}_3)_2$
 (b) $\text{CuSO}_4 + \text{Zn} \rightarrow \text{Cu} + \text{ZnSO}_4$
 (c) $\text{Fe}_2(\text{SO}_4)_3 + \text{Cu} \rightarrow \text{Fe} + \text{CuSO}_4$
 (d) $\text{Fe}_2(\text{SO}_4)_3 + \text{Cu} \rightarrow 2\text{FeSO}_4 + \text{CuSO}_4$
22. Which of the following options are correct ?
 (a) CuO is black colour compound
 (b) CuO is formed by heating copper nitrate $\text{Cu}(\text{NO}_3)_2$
 (c) CuO is insoluble in NH_3 solution
 (d) CuO is soluble in concentrated NH_3 solution forming deep blue Schwitzer's reagent.
23. What can be possible complex formed by combination between iron and carbon monoxide?
 (a) $\text{Fe}(\text{CO})_5$ (b) $\text{Fe}_2(\text{CO})_{10}$
 (c) $\text{Fe}_3(\text{CO})_{12}$ (d) $\text{Fe}_2(\text{CO})_9$
24. KI solution can be used to identify ?
 (a) Hg^{2+} (b) Pb^{2+}
 (c) Ag^+ (d) Cu^{2+}
25. Which of the following reactions give correct product ?
 (a) $\text{Zn} + \text{KOH} \rightarrow \text{K}_2\text{ZnO}_2 + \text{H}_2$
 (b)  + $\text{FeSO}_4 + \text{H}_2\text{O}_2 \rightarrow$ 
 (c) $\text{Cu}^{2+} + \text{KI} \rightarrow \text{CuI}_2 + \text{K}^+$
 (d) $\text{Cr}(\text{OH})_3 + \text{NaOH} + \text{H}_2\text{O}_2 \rightarrow \text{Na}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{O}$
26. Which of the following pair has/have similar chemical properties?
 (a) Zirconium and hafnium
 (b) Niobium and tantalum
 (c) Cu and Zn
 (d) Fe and Cd

7.10 THE d-BLOCK ELEMENTS AND SOME OF THEIR COMPOUNDS

27. The complex of La where it shows a coordination number of more than 8 :-
(a) $[\text{La}.\text{EDTA}.\text{(H}_2\text{O)}_4]\text{3H}_2\text{O}$
(b) $\text{La}_2(\text{SO}_4)_3.9\text{H}_2\text{O}$
(c) LaX_2
(d) $\text{Cu}_2[\text{LaF}_8]$
27. Which of the following atomic number are the atomic numbers of the inner transition elements : 29, 59, 74, 95, 102, 104?
(a) 59 (b) 95
(c) 102 (d) 104
28. The true statements about Re–Re bonding in $[\text{Re}_2\text{X}_8]^{2-}$ are,
(a) Re–Re bond length is abnormally short
(b) Re–Re bond is comprised of one σ , two π and one δ -bond.
(c) If Re–Re bond points along z-axis, then square planar ReX_4 unit will use s, p_x , p_y and $d_{x^2-y^2}$ orbitals for the formation of four Re–X σ bonds.
(d) d_{xy} orbitals will overlap to form δ -bond.
29. Which of the following is/are correct?
(a) Of the d^4 series, Cr^{+2} is strongly reducing while Mn^{3+} is strongly oxidising.
(b) Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents it easily oxidised.
(c) The d^1 configuration is very unstable in ions.
(d) $\text{Na}_2\text{Cr}_2\text{O}_7$ is preferred over $\text{K}_2\text{Cr}_2\text{O}_7$ in volumetric analysis.
30. Choose the correct statements :-
(a) First ionisation energy of Cu(29) is higher than that of K (19)
(b) Second ionisation of Cu is lower than that of K (19)
(c) The third ionisation energy of Cu is higher than that of K
(d) Third ionisation energy of Cu is lower than that of K
31. The correct statement about oxide of transition metal
(a) Oxide of a metal may be acidic and basic
(b) Ionic radius of M^{+2} in MO of 3d series decrease from SC to V and then increase from V to Mn
(c) FeO is a non stoichiometric compound
(d) Mn_2O_7 is a coloured oxide due to d-d transition
32. Cu^{2+} gives black precipitate with :-
(a) saturated solution of H_2S
(b) potassium iodide solution
(c) potassium ferrocyanide solution
(d) potassium thiocyanate solution
33. Green precipitate is formed when :-
(a) FeSO_4 reacts with H_2S
(b) $\text{Ni}(\text{NO}_3)_2$ reacts with H_2S
(c) FeSO_4 reacts with NaOH
(d) $\text{Ni}(\text{NO}_3)_2$ reacts with NaOH
34. Black precipitate is formed when :-
(a) FeSO_4 reacts with H_2S
(b) $\text{Ni}(\text{NO}_3)_2$ reacts with H_2S
(c) FeSO_4 reacts with NaOH
(d) $\text{Ni}(\text{NO}_3)_2$ reacts with NaOH
35. The oxo metal anions of the first series of the transitional metal exhibits the oxidation state equal to its group number :-
(a) VO_3^{3-} (b) VO_4^{3-}
(c) CrO_4^{2-} (d) MnO_4^-
36. Which of the following statements are correct :-
(a) Thomas slag is used as fertiliser
(b) CuO is amphoteric in nature
(c) Cu_2O is amphoteric in nature
(d) Thomas slag is used as fuel
37. Most common oxidation state of Ce (Cerium) are :-
(a) +3 (b) +4
(c) +2 (d) +5

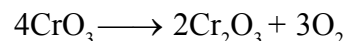
38. Which of the following statements are correct :-
- (a) the compounds of lanthanoids are less basic than those of actinoids
 - (b) the highest oxidation state by lanthanoids is +7
 - (c) lanthanoids dissolve in warm water to liberate hydrogen
 - (d) the outer electronic configuration of tungsten is of the type $(n-1)d^4ns^2$
39. Correct statements are :-
- (a) the transition metals form a number of interstitial compounds with hydrogen, carbon, nitrogen, boron etc.
 - (b) the fluorides of transition metals are ionic nature
 - (c) ferric chloride exists as a dimer (Fe_2Cl_6) at 1023 K and as a monomer at 717 K
 - (d) the chemical composition of rust is $Fe_3O_4 \cdot 6H_2O$
40. Dental amalgam used for filling teeth consists of :-
- (a) Ag
 - (b) Sn
 - (c) Au
 - (d) Hg
41. Which of the following reagents are used to convert MnO_2 to green melt of manganate salt :-
- (a) $KOH + KNO_3$
 - (b) $KOH + KClO_3$
 - (c) $KOH + O_2$
 - (d) $KOH + H_2$
42. Which ion can undergo disproportionation :-
- (a) Hg_2^{2+}
 - (b) Zn^{2+}
 - (c) Cu^{+1}
 - (d) Mn^{2+}
43. Which can produce Riemann's green with cobalt nitrate solution :-
- (a) ZnO
 - (b) $ZnSO_4$
 - (c) $3Zn(OH)_2 \cdot ZnCO_3$
 - (d) $Pb(OH)_2 \cdot PbCO_3$
44. Identify correct statement with copper sulphate :-
- (a) $CuSO_4 + KI \longrightarrow I_2$
 - (b) $CuSO_4 + KCl \longrightarrow Cl_2$
 - (c) $CuSO_4 \xrightarrow{\Delta} CuO$
 - (d) Its tartarate complex reacts with NaOH and glucose to give Cu_2O
45. The aqueous solution of the salt will be coloured in the case of :-
- (a) $Zn(NO_3)_2$
 - (b) $LiNO_3$
 - (c) $Co(NO_3)_2$
 - (d) $CrCl_3$

EXERCISE # III

□ Linked Comprehension Type :

Passage for Q.1 to Q.3

CrO_3 melts at $197^\circ C$ to a dark red liquid and begins to decompose at $200^\circ C$ giving off oxygen :



The decomposition is complete at 420° . A solution of CrO_3 in glacial acetic acid is often used as an oxidising reagent.

- CrO_3 reacts with F_2 at normal pressure at $150^\circ C$ and $220^\circ C$ respectively gives :-
 - (a) $CrOF_4$, CrO_2F_2
 - (b) CrO_2F_2 , $CrOF_4$
 - (c) $CrOF_4$, CrF_6
 - (d) CrO_2F_2 , CrF_6
- CrO_3/H_2SO_4 usually taken in acetone is called Jones reagent. Jones reagents oxidises :-
 - (a) 1° alcohol to aldehyde $RCH=O$
 - (b) 2° alcohol (R_2CHOH) to ketone $R_2C=O$
 - (c) 3° alcohol (R_3C-OH) to alkene
 - (d) can not oxidise alcohol
- CrO_3 is similar as SO_3 like :-
 - (a) CrO_3 is acidic oxide like SO_3
 - (b) CrO_3 when reacts with KOH , it gives K_2CrO_4 like SO_3 give K_2SO_4
 - (c) Crystal structure of CrO_3 consists of infinite chains of linked CrO_4 tetrahedra, $\beta-SO_3$ has also similar infinite chains of linked SO_4 tetrahedral.
 - (d) All

Passage for Q.4 to Q.6

When potassium permanganate is heated in test tube, gas (G_1) is evolved and a black residue remains behind. Upon extracting with a little water and filtering, a green solution is obtained.

- The gas evolved is :-
 - (a) O_2
 - (b) O_3
 - (c) H_2O
 - (d) CO_2
- Black residue is :-
 - (a) Mn_2O_3
 - (b) MnO
 - (c) MnO_2
 - (d) Mn_2O_7

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6. Green solution is :-

- (a) $K_2Mn_2O_3$ (b) K_2MnO_4
(c) MnO (d) $MnSO_4$

Passage for Q.7 to Q.9

$KMnO_4$ when reacts with KI in acidic medium give different products w.r.t. products formed when it reacts with KI in basic medium.

7. In acidic medium $KMnO_4$ oxidises KI to give P_1 and it is itself converted into P_2 . P_1 and P_2 are respectively :-

- (a) I_2 , Mn^{2+} (b) IO_3^- , Mn^{2+}
(c) I_2 , MnO_2 (d) IO_3^- , MnO_2

8. In basic medium $KMnO_4$ oxidises KI to give P'_1 and it is itself converted into P'_2 . P'_1 and P'_2 are respectively :-

- (a) I_2 , Mn^{2+} (b) IO_3^- , Mn^{2+}
(c) I_2 , MnO_2 (d) IO_3^- , MnO_2

9. When $KMnO_4$ reacts with sodium sulphite or sodium thiosulphate :-

- (a) MnO_2 is precipitated
(b) Mn^{2+} is formed
(c) Green MnO_4^{2-} ion formed
(d) None

Passage for Q.10 to Q.12

One of the notable features of a transition element is the great variety of oxidation state it may show in its compounds. The element which give the greatest number of oxidation state occur in or near the middle of the series. The maximum oxidation state of reasonable stability correspond in value to the sum of the s and d electrons upto manganese.

10. Lowest oxidation state +1 is exhibited by which of the transition elements :-

- (a) Mn (b) Fe
(c) Co (d) Cu

11. +6 oxidation states are exhibited by which of the transition elements :-

- (a) Cr (b) Mn
(c) Fe (d) All

12. Which element can show +2, +3, +4 oxidation state :-

- (a) Fe (b) Co
(c) Ni (d) All

Passage for Q.13 to Q.15

The d-block occupies the large middle section flanked by s & p-block in the periodic table. The very name transition given to the elements of d-block is only because of their position between s & p-block elements. The d orbitals of the penultimate energy level in their atoms receive electrons giving rise to the three rooms of the transitional metals i.e., 3d, 4d and 5d.

13. Which of the following elements are occupied in d-block but not considered as transition elements.

- (a) Zn (b) Cd
(c) Hg (d) All

14. Re ; Os ; Ir ; Pt belongs to -

- (a) 3d series (b) 4d series
(c) 5d series (d) 6d series

15. Mo ; Ru ; Rh ; Pd belongs to -

- (a) 3d series (b) 4d series
(c) 5d series (d) 6d series

Passage for Q.16 to Q.18

Nearly all the transition elements display typical metallic properties such as high tensile strength, ductility, malleability, high thermal and electrical conductivity and metallic lustre.

The transition elements are very much hard and have low volatility. Their melting and boiling point are high.

16. Correct melting point order of 1st series of transition elements -

- (a) $Mn > Cr > V > Ti > Cu$
(b) $Cr > Mn > V > Ti > Cu$
(c) $Cr > V > Ti > Mn > Cu$
(d) $Mn > Fe > Co > Pd > Cu$

17. The lowest melting point of 2nd series of transition elements is observed for -

- (a) Ru (b) Rh
(c) Nb (d) Ag

18. The structure of Hg :-

- (a) Body centered cubic structure
- (b) Hexagonal close packed structure
- (c) Cubic close packed structure
- (d) A typical metal structure

Passage for Q.19 to Q.20

X (Green colour carbonate salt) $\xrightarrow{\Delta}$ Y (Black residue) + CO₂ + H₂O :

Y (Black residue) $\xrightarrow{\Delta}$ Z (Reddish brown residue) + W gas

19. X can be :-

- (a) CuCO₃.Cu(OH)₂ (b) CuCO₃.2Cu(OH)₂
- (c) both (a) and (b) (d) FeCO₃

20. Y can be :-

- (a) Cu₂O (b) FeO
- (c) CuO (d) Fe₂O₃

21. Z can be :-

- (a) Cu₂O (b) FeO
- (c) CuO (d) Fe₂O₃

Passage for Q.22 to Q.24

An orange solid X is a very important chemical used in leather industry and an oxidant for preparation of many azo compound. When X is heated, it gives yellow coloured B and green coloured C. Also during heating a colourless, odourless gas D is evolved :-

22. Compound A is

- (a) KMnO₄ (b) K₂Cr₂O₇
- (c) K₂CrO₄ (d) Cr₂O₃

23. Compound C is obtained on heating of

- (a) (NH₄)₂Cr₂O₇ (b) NH₄ClO₄
- (c) NH₄NO₃ (d) None of these

24. Gas D is :-

- (a) O₂ (b) NO₂
- (c) N₂ (d) H₂

Passage for Q.25 to Q.27

A certain metal A is boiled in dilute HNO₃ to give salt(B) and an oxide of nitrogen(C). Aqueous solution B with brine solution gives a precipitate D which is soluble in NH₄OH.

25. A is :-

- (a) Pb (b) Hg
- (c) Ag (d) Zn

26. When B reacts with hypo solution, what will be observation :-

- (a) white precipitate is formed which on boiling turns reddish brown
- (b) white precipitate is formed which on boiling turns yellow
- (c) white precipitate is formed which on boiling turns black
- (d) none

27. Cu²⁺ ion can be reduced to Cu⁺¹ by addition of an aqueous solution of :-

- (a) KF (b) KCl
- (c) KI (d) KOH

Passage for Q.28 to Q.29

A brown black solid (A) on fusion with KNO₃ is KOH gives a green compound B and a colourless compound C. Green compound B in aqueous solution on electrolytic oxidation gives a violet compound D. KOH and H₂ gas. An aqueous solution (D) in cold reacts with ethylene to give glycol and its pink solution is discharged due to precipitation of A:-

28. A and B are :-

- (a) MnO₂, K₂MnO₄ (b) Cr₂O₃, K₂CrO₄
- (c) MnO₂, KMnO₄ (d) Cr₂O₃, K₂Cr₂O₇

29. C and D are :-

- (a) NO, K₂MnO₄ (b) KNO₂, K₂MnO₄
- (c) NO, KMnO₄ (d) NO, K₂Cr₂O₇

Passage for Q.30 to Q.32

An aqueous solution of a salt upon analysis gives the following results :

- (i) It gives a white precipitate with BaCl₂ solution insoluble in water.
- (ii) Addition of excess KI gives a brown precipitate which turns starch-iodide complex blue black.
- (iii) It gives a chocolate brown coloured precipitate with potassium ferrocyanide solution.

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30. What inference can be drawn from (i) above ?

- (a) Presence of SO_4^{2-} ion
- (b) Presence of Pb^{2+} ion
- (c) Presence of Zn^{2+} ion
- (d) Presence of SO_3^{2-}

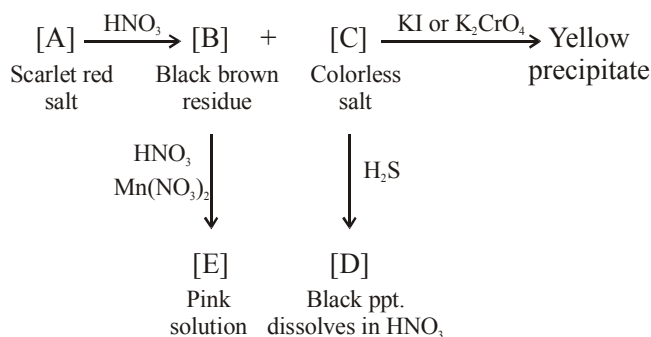
31. What is the formula of chocolate brown precipitate:-

- (a) $\text{Cu}[\text{Fe}(\text{CN})_4]$ (b) $\text{Cu}_2[\text{Fe}(\text{CN})_6]$
- (c) $\text{Cu}_3[\text{Fe}(\text{CN})_6]_2$ (d) Cu_2I_2

32. From the above inference, the formula of salt is :-

- (a) CuSO_4 (b) CuSO_3
- (c) CuCl_2 (d) $\text{Cu}(\text{OH})_2$

Passage for Q.33 to Q.35



33. The compound [A] is

- (a) An oxide (b) A chromate
- (c) A manganate (d) Chloride

34. The correct formula of compound (E) is

- (a) KMnO_4 (b) H_2MnO_4
- (c) HMnO_4 (d) K_2MnO_4

35. The yellow ppt. formed by reaction of [C] with K_2CrO_4 is also given by (other than that in C)

- (a) Pb^{2+} (b) Ca^{2+}
- (c) Ba^{2+} (d) Na^+

Passage for Q.36 to Q.38

The halides of silver are sensitive to light. This concept is utilised in photography.

36. A photographic plate consist of -

- (a) Sensitive emulsion of fine particles of AgF
- (b) Sensitive emulsion of fine particles of AgCl
- (c) Sensitive emulsion of fine particles of AgBr
- (d) Sensitive emulsion of fine particles of AgI

37. Hypo solution is used in photography to dissolve

- (a) Undissociated silver halide to give complex $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$
- (b) Undissociated silver halide to give complex $[\text{Ag}(\text{S}_2\text{O}_3)]^{-1}$
- (c) Metallic silver to give complex $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$
- (d) Metallic silver to give complex $[\text{Ag}(\text{S}_2\text{O}_3)]^{-1}$

38. The developer used in photography is

- (a) $\text{K}_2[\text{Fe}^{\text{II}}(\text{CO}_3)_2]$ (b) $\text{K}_2[\text{Fe}^{\text{II}}(\text{C}_2\text{O}_4)_2]$
- (c) $\text{K}[\text{Fe}^{\text{III}}(\text{C}_2\text{O}_4)_2]$ (d) $\text{K}[\text{Fe}^{\text{III}}(\text{CO}_3)_2]$

Matrix Match Type :

39. Match the column :-

Column - I

Ion

- (A) CrO_4^{2-}
- (B) $\text{Cr}_2\text{O}_7^{2-}$
- (C) MnO_4^{2-}
- (D) MnO_4^-

Column - II

Colour

- (P) Purple/Pink solution
- (Q) Green solution
- (R) Yellow
- (S) Orange

40. Match the column :-

Column - I

Compound

- (A) Cr_2O_3
- (B) CrO_3
- (C) CrO_5
- (D) CrO_2

Column - II

Colour

- (P) Green colour
- (Q) Red colour
- (R) Intense blue colour
- (S) Black colour

41. Match the column :-

Column - I

Compound

- (A) Mn_2O_7
- (B) MnO_2
- (C) MnO
- (D) Mn_3O_4

Column - II

Feature

- (P) Black colour ; most important ore of Mn
- (Q) Dark green liquid as explosive
- (R) Red oxide of manganese
- (S) Olive green powder, formed by decomposition by MnCO_3
- (T) Anhydride of HMnO_4

42. Match the column :-

Column - I

Elements

- (A) W
(B) Co
(C) Zn
(D) Cd

Column - II

Structure type

- (P) Transition elements
(Q) Hexagonal close packed
(R) Body centered cubic
(S) Cubic close packed
(T) Typical metal structure

43. Match the column :-

Column - I

Conversion

- (A) $\text{MnO}_4^{2-} \longrightarrow \text{MnO}_4^-$
(B) $\text{CrO}_4^{2-} \longrightarrow \text{Cr}_2\text{O}_7^{2-}$
(C) $\text{CrO}_7^{2-} \longrightarrow \text{CrO}_4^{2-}$
(D) $\text{MnO}_4^- \longrightarrow \text{MnO}_4^{2-}$

Column - II

Feature

- (P) Oxidation state remain unchanged during conversion
(Q) $\text{pH} < 7$, conversion is carried out
(R) $\text{pH} > 7$, conversion is carried out
(S) Oxidation state changes during conversion
(T) Electrolytic oxidation in alkaline medium

44. Match the column :-

Column - I

Property

- (A) Least 1st ionisation enthalpy
(B) Highest 1st ionisation enthalpy
(C) Highest 2nd ionisation enthalpy
(D) Least ionic radii in M^{2+} ion

Column - II

Transitional element

- (P) Sc
(Q) Zn
(R) Cu
(S) Ni

45. Match the Coloumn

Column - I

Complex

- (A) $[\text{M}(\text{CN})_2]^{-x}$
(B) $[\text{M}(\text{CN})_4]^{-x}$
(C) $[\text{M}(\text{CN})_4]^{-x}$
(D) $[\text{M}(\text{CN})_6]^{-x}$

Column - II

Transitional elements

- (P) $x = 1$; Ag, Au
(Q) $x = 3$; Mn, Fe, Co
(R) $x = 2$; Zn, Cd, Hg
(S) $x = 3$; Cu only

46. **Column - I**

Reaction

- (A) $\text{Fe} + 2\text{HCl} \rightarrow$
(B) $\text{Fe} + \text{Conc. H}_2\text{SO}_4 \rightarrow$
(C) $\text{Fe} + \text{HNO}_3$ (warm & concentrated) \rightarrow
(D) $\text{Fe} + \text{HNO}_3$ (cold & dilute) \rightarrow

Column - II

Product nature

- (P) ferrous salt
(Q) ferric salt
(R) colourless, odourless gas
(S) colourless, paramagnetic gas
(T) Pungent odour gas

47. Match the column :-

Column - I

Reaction

- (A) $\text{N}_2\text{H}_4 + \text{CuO} \rightarrow$
(B) $\text{Quinol} + \text{AgBr(s)} \rightarrow$
(C) $\text{FeSO}_4(\text{s}) \xrightarrow{\Delta}$
(D) $\text{CaCl}_2(\text{s}) + \text{K}_2\text{Cr}_2\text{O}_7(\text{s}) + \text{H}_2\text{SO}_4(\text{conc.}) \rightarrow$

Column - II

Feature

- (P) Reddish brown vapour is formed
(Q) One of the product is +6 oxidation state
(R) Redox reaction
(S) One of the product is acidic oxide
(T) Photograpy

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48. Match the column :-

Column - I**Reaction**

- (A) Turnbull's Blue pigment
 (B) Prussian Blue pigment
 (C) Brown ring
 (D) $\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$

Column - II**Feature**

- (P) Oxidation state of iron in coordination sphere $\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$ is +1
 (Q) Oxidation state of iron in coordination sphere $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ is +2
 (R) Oxidation state of iron in coordination sphere $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$ is +3
 (S) Iron in anionic part of complex
 (T) Iron in cationic part of complex

49. Match the column :-

Column - I**Column - II**

- (A) $\text{Cr} < \text{W}$ (P) stability of the complex in +2 oxidation state
 (B) $\text{Mn} < \text{Fe}$ (Q) melting point
 (C) $\text{Zn} < \text{Cu}$ (R) magnetic moment
 (D) $\text{Cd} < \text{Hg}$ (S) tendency to form metal-metal bond
 (T) ionisation energy

50. Match the column :-

Column - I**Column - II**

- (A) $\text{Fe}^{2+} > \text{Fe}^{3+}$ (P) Crystal field splitting energy with strong ligand
 (B) $\text{Pt}^{2+} > \text{Ni}^{2+}$ (Q) Complexing tendency with dipyrindyl
 (C) $\text{Mn}^{2+} > \text{Cr}^{2+}$ (R) Tendency to form complex with CO
 (D) $\text{Cu}^{2+} > \text{Cu}^+$ (S) Magnetic moment
 (T) ionic radius

51. Match the column :-

Column - I**Column - II**

- (A) FeCl_3 (P) Oxidising agent and as mordant in dyeing
 (B) FeF_3 (Q) Exists as Fe^{3+}
 (C) FeBr_3 (R) d^5 ion
 (D) FeO_4^{2-} (S) Stable in strongly alkaline aqueous medium
 (T) Gives prusian blue colour with $\text{K}_4[\text{Fe}(\text{CN})_6]$

52. Match the column :-

Column - I**Column - II**

- (A) Fe^{3+} (P) Precipitate with NH_4OH
 (B) Fe^{2+} (Q) Precipitate with NaOH
 (C) Cu^{2+} (R) Complex with KCN (excess)
 (D) Ag^+ (S) Complex with hypo solution
 (T) Hydrometallurgical extraction

53. Match the column :-

Column - I

- (A) Pb^{2+} gives yellow precipitate with
 (B) Bi^{3+} gives black precipitate with
 (C) Hg_2Cl_2 gives black precipitate with
 (D) CuSO_4 gives deep blue colour with

Column - II

- (P) KI
 (Q) K_2CrO_4
 (R) NH_4OH
 (S) Na_2SnO_2 in alkaline medium

54. Match the column :-

Column - I**Column - II**

- (A) Cu^{2+} (P) Form amphoteric oxide
 (B) Zn^{2+} (Q) Diamagnetic and colourless compounds
 (C) Cr^{3+} (R) Form complex with NH_3
 (D) Sc^{3+} (S) Form colourless tetrahedral complex with KCN
 (T) Form inner orbital octahedral complex with NH_3

55. Match the column

Column - I

- (A) $\text{Hg}_2\text{Cl}_2 \xrightarrow{\text{NH}_3\text{OH}}$ Product/is
 (B) $\text{Hg}_2\text{Cl}_2 + \text{SnCl}_2 \longrightarrow$ Product/ is
 (C) $\text{Hg}^{+2} + \text{SnCl}_2 \longrightarrow$ Product/ is
 (D) $\text{HgCl}_2 + \text{Cu} \longrightarrow$ Product/ is

Column - II

- (P) Hg
 (Q) $\text{Hg}(\text{NH}_2)\text{Cl}$
 (R) Oxidation
 (S) Metal-metal bond in product
 (T) Reduction

EXERCISE # IV

Integer Type :

- At what pH chromate-dichromate changes :-
- Find out the n factor of $\text{Cr}_2\text{O}_7^{2-}$ in acidic medium?
- MnO_4^- when oxidises other compounds in acidic medium, it is itself converted into Mn^{2+} . The molecular weight of MnO_4^- is x times of its equivalent weight. The value of x :-
- Find out number of electrons present in 4f orbital in Gadolinium. (At. no. 64) ?
- Find out number of electrons present in 5d orbital in Ytterbium (At. no. 70) ?
- Find out number of electrons present in 6s orbital in leutetium (At. no. 71) ?
- How many statements are correct ?
 - Permanganate titration in presence of hydrochloric acid is unsatisfactory
 - Mn^{2+} compounds are more stable than Fe^{2+} toward oxidation to their +3 state
 - Ammoniacal AgNO_3 converts glucose to gluconic acid and metallic silver is precipitated
 - Titanium and copper both in the first series of transition metals exhibits +1 oxidation stae most frequently.
 - Anhydrous ferric chloride is formed by heating metallic iron in a stream of dry chlorine gas.
- Find out the number of ions in solution which are colourless :-
 Ti^{4+} ; Ti^{3+} ; Cu^{+} ; Zn^{2+}
- The oxidation state of Mn in the product of oxidative fusion of pyrolusite ore in basic medium :-
- The oxidation state of Cr in the product of oxidative fusion of chromite ore in basic medium :-
- TiCl_4 is example of colourless liquid at room temperature.If it reacts with Zn followed by addition of water molecule give purple colour compound X. What is the number of unpaired electron present in X.
- A metal A which is strongly attracted by a magnet is attacked slowly by HCl liberating a gas and producing a blue solution. The addition of water of this solution causes it to burn pink. What is the atomic number of A. A belong to 3d series element:-
- Some transitional metals are used as traditional coinage metals in ancient world. Find out number of coinage metals.
- When 0.25 mole of hydrated ferric chloride ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$) is made anhydrous by reacting with 1.5 mole of 2,2-dimethoxy propane :-
- What is the number of moles of SnCl_2 required for reduction of 1 mole of $\text{K}_2\text{Cr}_2\text{O}_7$ into Cr^{3+} :-
- Peacock ore is Cu_xFeS_4 . The value of x ?
- The highest oxidation state exhibited among all transitional element :-
- How many statements are correct :-
 - Metre scales are made up of invar alloy
 - Rusting iron is due to formation of $\text{Fe}_2\text{O}_3 + \text{Fe}(\text{OH})_3$
 - Transitional elements in positive oxidation state can act as Lewis acid.
 - Bordaux mixture is used as fungicide. It is a mixture of $\text{CuSO}_4 + \text{Ca}(\text{OH})_2$
 - Ce^{4+} (ceric ion) is used as an oxidising reagent in volumetric analysis

7.18 THE d-BLOCK ELEMENTS AND SOME OF THEIR COMPOUNDS

19. How many statements are incorrect :-
 (a) Acidified KMnO_4 can be decolorised by $\text{Fe}_2(\text{SO}_4)_3$
 (b) KMnO_4 does not act as oxidising reagents in alkaline medium
 (c) Among ZnCl_2 , CdCl_2 , HgCl_2 maximum covalent character is shown by ZnCl_2
 (d) Promethium is naturally found element
20. Number of moles of CrO_3 required to oxidise 9 moles of 2 butanol ?
21. An ornamental gold has 75% gold. It is x carat. The value of x :-
22. What is the basicity of Perhenic acid :-
23. A metal ion M^{2+} gives cherry blood red colour with DMG and complex formed is diamagnetic in nature. Which group of qualitative analysis metal will belong -
24. $\text{CuSO}_4 + \text{KCN} \xrightarrow{\text{(excess)}}$ Complex of Cu. The spin only magnetic moment of the complex.
25. How many reagents can be used to distinguish ferrous salt and ferric salt. :-
 NH_4OH ; NaOH ; $\text{K}_4[\text{Fe}(\text{CN})_6]$; $\text{K}_3[\text{Fe}(\text{CN})_6]$
26. A metal ion M^{3+} gives brown red colour with $\text{K}_3[\text{Fe}(\text{CN})_6]$. With which group it may belong?
27. $\text{S}_2\text{O}_3^{2-} + \text{CN}^- \rightarrow \text{X} + \text{SO}_3^{2-} \xrightarrow{\text{Fe}^{3+}}$ Blood red colour $\xrightarrow[\text{excess}]{\text{NaF}}$ colourless complex
 The coordination number of Fe^{3+} in colourless complex -
28. The general electronic configuration of transition element is $(n-1)d^{x-y}n s^{z-w}$
 x = minimum number of electron present in d-orbital
 y = maximum number of electron present in d-orbital
 z = minimum number of electron present in s-orbital
 w = maximum number of electron present in s-orbital
 Find out the value of $y - z$:-

29. Rust consist of hydrated iron oxide. What is the oxidation state of iron in rust.

30. P_1 (imparts violet colour in flame test) $\xrightarrow[\text{conc. H}_2\text{SO}_4]{\text{comp. P}_2}$ P_3 (reddish brown gas)

$\xrightarrow{\text{NaOH} + \text{AgNO}_3}$ P_4 (red ppt.)

P_4 (red ppt.) $\xrightarrow[\text{excess}]{\text{NH}_3 \text{ solution}}$ P_5 (soluble)

P_4 (red ppt.) $\xrightarrow{\text{HCl solution}}$ P_6 (white precipitate)

$\text{P}_2 \xrightarrow{\text{NaOH solution}}$ P_7 (gives white fumes with HCl)

How many products are correctly mentioned -

$\text{P}_1 = \text{K}_2\text{Cr}_2\text{O}_7$ $\text{P}_4 = \text{Ag}_2\text{CrO}_4$ $\text{P}_7 = \text{NH}_3$

$\text{P}_2 = \text{NH}_4\text{Cl}$ $\text{P}_5 = [\text{Ag}(\text{NH}_3)_2]^+$

$\text{P}_3 = \text{CrO}_2\text{Cl}_2$ $\text{P}_6 = \text{AgCl}$

EXERCISE # V(A) JEE-MAIN

1. Which of the following arrangements does not represent the correct order of the property stated against it? [AIEEE 13]

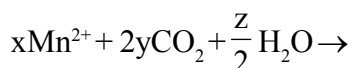
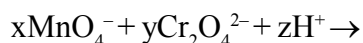
(1) $\text{V}^{2+} < \text{Cr}^{2+} < \text{Mn}^{2+} < \text{Fe}^{2+}$: paramagnetic behaviour

(2) $\text{Ni}^{2+} < \text{Co}^{2+} < \text{Fe}^{2+} < \text{Mn}^{2+}$: ionic size

(3) $\text{Co}^{3+} < \text{Fe}^{3+} < \text{Cr}^{3+} < \text{Sc}^{3+}$: stability in aqueous solution

(4) $\text{Sc} < \text{Ti} < \text{Cr} < \text{Mn}$: number of oxidation states

2. Consider the following reaction : [AIEEE 13]



The values of x, f and z in the reaction are respectively :-

(a) 5, 2 and 16

(b) 2, 5 and 8

(c) 2, 5 and 16

(d) 5, 2 and 8

3. Arrange Ce^{3+} , La^{3+} , Pm^{3+} and Yb^{3+} in increasing order of their ionic radius :- [AIEEE 02]

(a) $\text{Yb}^{3+} < \text{Pm}^{3+} < \text{Ce}^{3+} < \text{La}^{3+}$

(b) $\text{Ce}^{3+} < \text{Yb}^{3+} < \text{Pm}^{3+} < \text{La}^{3+}$

(c) $\text{Yb}^{3+} < \text{Pm}^{3+} < \text{La}^{3+} < \text{Ce}^{3+}$

(d) $\text{Pm}^{3+} < \text{La}^{3+} < \text{Ce}^{3+} < \text{Yb}^{3+}$

4. The radius of La^{3+} is 1.06 \AA , which of the following given values will be closest to the radius of Lu^{3+} (At. no. of Lu = 71, La = 57) [AIEEE 03]
 - (a) 1.6 \AA (b) 1.4 \AA
 - (c) 1.06 \AA (d) 0.85 \AA
5. The atomic number of vanadium (V), chromium (Cr), manganese (Mn) and iron (Fe) are 23, 24, 25 and 26 respectively. Which one of these may be expected to have the highest second ionisation enthalpy - [AIEEE 03]
 - (a) V (b) Cr
 - (c) Mn (d) Fe
6. What would happen a solution of potassium chromate is treated with an excess of dilute nitric acid :- [AIEEE 03]
 - (a) Cr^{3+} and $\text{Cr}_2\text{O}_7^{2-}$ are formed
 - (b) $\text{Cr}_2\text{O}_7^{2-}$ and H_2O are formed
 - (c) $\text{Cr}_2\text{O}_7^{2-}$ is reduced to +3 state of Cr
 - (d) $\text{Cr}_2\text{O}_7^{2-}$ is oxidised to +7 state of Cr
7. Among the following series of transition metal ions are one where all metal ions have $3d^2$ electronic configuration is :- [AIEEE - 04]
 - (a) Ti^{+3} , V^{2+} , Cr^{3+} , Mn^{4+}
 - (b) Ti^{+} , V^{4+} , Cr^{6+} , Mn^{7+}
 - (c) Ti^{4+} , V^{4+} , Cr^{2+} , Mn^{3+}
 - (d) Ti^{2+} , V^{3+} , Cr^{4+} , Mn^{5+}
8. Cerium ($Z = 58$) is an important member of the lanthanoids. Which of the following statements about cerium is incorrect :- [AIEEE 04]
 - (a) Cerium (IV) acts as an oxidising agent
 - (b) The +3 oxidation state of cerium is more stable than the +4 oxidation state
 - (c) The +4 oxidation state of cerium is not known in solutions
 - (d) The common oxidation states of cerium are +3 and +4
9. The aqueous solution containing which one of the following ions will be colourless? [AIEEE 05] (Atomic number : Sc = 21, Fe = 26, Ti = 22, Mn = 25)
 - (a) Sc^{3+} (b) Fe^{2+}
 - (c) Ti^{3+} (d) Mn^{2+}
10. The lanthanoid contraction is responsible for the fact that :- [AIEEE 05]
 - (a) Zr and Y have about the same radius
 - (b) Zr and Nb have similar oxidation state
 - (c) Zr and Hf have about the same radius
 - (d) Zr and Zn have similar oxidation state
11. Lanthanoid contraction is caused due to :- [AIEEE 06]
 - (a) the same effective nuclear charge from Ce to Lu
 - (b) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge
 - (c) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
 - (d) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge
12. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This because :- [AIEEE 07]
 - (a) the 5f-orbitals are more buried than the 4f-orbitals
 - (b) there is a similarity between 4f and 5f in their angular part of the wave function
 - (c) the actinoids are more reactive than the lanthanoids
 - (d) the 5f-orbitals extend further from the nucleus than the 4f-orbitals
13. Identify the incorrect statement among the following :- [AIEEE 07]
 - (a) d-block elements show irregular and erratic chemical properties among themselves
 - (b) La and Lu have partially filled d-orbitals and no other partially filled orbitals
 - (c) the chemistry of various lanthanoids is very similar
 - (d) 4f and 5f-orbitals are equally shielded
14. In context with the transition elements, which of the following statements is incorrect :- [AIEEE 09]
 - (a) In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding
 - (b) Once the d^5 configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases.

7.20 THE d-BLOCK ELEMENTS AND SOME OF THEIR COMPOUNDS

- (c) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.
- (d) In the highest oxidation state, the transition metal show basic character and form cationic complexes.
15. Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of the following statements is incorrect? [AIEEE 09]
- (a) Ln(III) compounds are generally colourless
- (b) Ln(III) hydroxides are mainly basic in character
- (c) Because of the large size of the Ln(III) ions the bonding in its compounds is predominantly ionic in character
- (d) The ionic sizes of Ln(III) decrease in general with increasing atomic number
16. The correct order of $E_{M^{2+}/M}^\circ$ values with negative sign for the four successive elements Cr, Mn, Fe and Co is :- [AIEEE 2010]
- (a) Cr > Mn > Fe > Co
- (b) Mn > Cr > Fe > Co
- (c) Cr > Fe > Mn > Co
- (d) Fe > Mn > Cr > Co
17. In content of the lanthanoids, which of the following statements is not correct :- [AIEEE 2011]
- (a) because of similar properties the separation of lanthanoids is not easy
- (b) availability of 4f electrons results in the formation of compounds in +4 state for all the members of the series
- (c) there is a gradual decrease in the radii of the members with increasing atomic number in the series
- (d) all the members exhibit +3 oxidation state
18. Which series of reactions correctly represents chemical relations related to iron and its compound? [Jee-Mains 2014]

- (a) $\text{Fe} \xrightarrow{\text{Cl}_2, \text{heat}} \text{FeCl}_3 \xrightarrow{\text{heat, air}} \text{FeO}$
- (b) $\text{Fe} \xrightarrow{\text{O}_2, \text{heat}} \text{Fe}_3\text{O}_4 \xrightarrow{\text{CO}, 600^\circ\text{C}} \text{FeO} \xrightarrow{\text{CO}, 700^\circ\text{C}} \text{Fe}$
- (c) $\text{Fe} \xrightarrow{\text{dil. H}_2\text{SO}_4} \text{FeSO}_4 \xrightarrow{\text{H}_2\text{SO}_4, \text{O}_2} \text{Fe}_2(\text{SO}_4)_3 \xrightarrow{\text{Heat}} \text{Fe}$
- (d) $\text{Fe} \xrightarrow{\text{O}_2, \text{heat}} \text{FeO} \xrightarrow{\text{dil. H}_2\text{SO}_4} \text{FeSO}_4 \xrightarrow{\text{Heat}} \text{Fe}$
19. The equation which is balanced and represents the correct product(s) is :- [Jee-Mains 2014]
- (a) $[\text{Mg}(\text{H}_2\text{O})_6]^{2+} + (\text{EDTA})^{4-} \xrightarrow{\text{excess NaOH}} [\text{Mg}(\text{EDTA})]^{2-} + 6\text{H}_2\text{O}$
- (b) $\text{CuSO}_4 + 4\text{KCN} \longrightarrow \text{K}_2[\text{Cu}(\text{CN})_4] + \text{K}_2\text{SO}_4$
- (c) $\text{Li}_2\text{O} + 2\text{KCl} \longrightarrow 2\text{LiCl} + \text{K}_2\text{O}$
- (d) $[\text{CoCl}(\text{NH}_3)_5]^+ + 5\text{H}^+ \longrightarrow \text{Co}^{2+} + 5\text{NH}_4^+ + \text{Cl}^-$

EXERCISE # V(B) JEE-ADVANCED

1. Anhydrous ferric chloride is prepared by : [JEE-2002]
- (a) heating hydrated ferric chloride at a high temperature in a stream of air
- (b) heating metallic iron in a stream of dry chlorine gas
- (c) reaction of ferric oxide with HCl
- (d) reaction of metallic iron with HCl
2. When MnO_2 is fused with KOH, a coloured compound is formed, the product and its colour is : [JEE-2003]
- (a) K_2MnO_4 , green
- (b) KMnO_4 , purple
- (c) Mn_2O_3 , brown
- (d) Mn_3O_4 , black

