Ravi Maths Tuition

d- and f- Block Elements

12th Standard

Chemistry

Multiple Choice Question 183 x 1 = 183

1) General electronic configuration of d - block elements is

(a) $(n-1)\,d^{1-10}ns^{1-2}$ (b) ns^2np^{1-6} (c) $(n-2)\,f^{0-14}(n-1)^{1-2}ns^2$ (d) $(n-1)\,d^{1-5}ns^{1-2}$

2) Which of the following is not a transition element ?

(a) Zn (b) Ru (c) Ag (d) Pb

3) In first transition series which of the following has lowest enthalpy of atomisation ?

(a) Sc (b) Cu (c) Yi (d) Zn

4) Irregular trend in the standard reduction potential value of the first row transition elements is due to

(a) regular variation of first and second row enthalpies (b) irregular variation of sublimation ethalpies

(c) regular variation of sublimation ethalpies (d) increase in number of unpaired electrons

5) Which element does not show variable oxidation state ?

(a) Sc (b) V (c) Fe (d) Hg

6) The maximum oxidation state of osmium is

(a) +6 (b) +7 (c) +8 (d) +5

7) Which of the following ixidation states is the most common among the lanthanoids ?

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

8) Which of the following ion is colourless in aqueous solution ?

(a) Fe^{2+} (b) Mn^{2+} (c) Ti^{3+} (d) Sc^{3+}

9) Which metal has highest density ?

(a) Pt (b) Os (c) W (d) Hg

10) Formation of interstitial compounds makes the transition metal

(a) more soft (b) more ductile (c) more metalic (d) more hard and brittle

11) Which of the following statement about transition elements is incorrect ?

(a) They show variable oxidation states (b) All the ions are coloured

(c) They exhibit diamagnetic and paramagnetic properties (d) They exhibit catalytic property

12) Permanent magnets are generally made of alloys of

(a) Fe (b) Co (c) Ni (d) Any one of these

13) Which of the following oxides of chromium is amphoteric in nature ?

(a) CrO (b) Ct_2O_3 (c) CrO_3 (d) CrO_5

14) In the reaction :

$NaCI + K_2Cr_2O_7 + conc.\,H_2SO_4 \xrightarrow{heat} X + Na_2SO_4 + K_2SO_4 + H_2, X$ is a

raddish brown gas which gives a yellow solution on passing through water and a yellow precipitate on treating the solution with lead acetate solution X could be

(a) Cl_2 (b) CrO_3 (c) H_2CrO_4 (d) CrO_2Cl_2

15) $KMnO_4$, oxidation number of Mn is

(a) + 2 (b) + 4 (c) + 6 (d) + 7

16) $KMnO_4$ on heating to red hot gives

(a) $K_2MnO_4 + MnO_2 + O_2$ (b) $K_2MnO_3 + MnO_2 + O_2$ (c) $K_2O + MnO_2 + O_2$ (d) None of these

17) Which is the strongest base among the following ?

(a) $La(OH)_3$ (b) $Lu(OH)_3$ (c) $Ce(OH)_3$ (d) $Yb(OH)_3$

18) The electronic configuration of gadolinium (At. No 64) is

(a) $[Xe]4f^8 5d^0 6s^2$ (b) $[Xe]4f^7 5d^1 6s^2$ (c) $[Xe]4f^3 5d^5 6s^2$ (d) $[Xe]4f^6 5d^2 6s^2$

19) Name a member of lanthanide series which is well known to exhibit + 4 oxidation state :

(a) Ce (b) La (c) Lu (d) Pr

20) Large number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being

(a) more energy difference between 5f and 6d than between 4f and 5d orbitals

(b) more reactive nature of the actinoids than the lanthanoids (c) 4f orbitals more diffused than the 5 f orbitals

(d) lesser energy difference between 5f and 6d than between 4f and 5d orbitals

21) Which of the following factor may be regarded as the main cause of lanthanide contraction ?

(a) Poor shielding of one of the 4f - electrons by another in the subshell

(b) Effective shielding of one of the 4f - electrons by another in the subshell

(c) Poorer shielding of 5d electrons by 4f electrons (d) Greater shielding of 5d electrons by 4f electrons.

22) Which of the following pairs has the same size ?

(a) Zi^{4+}, Hf^{4+} (b) Zn^{2+},Hf^{4+} (c) Fe^{2+},Ni^{2+} (d) Zr^{4+},Ti^{4+}

23) The maximum oxidation state exhibited by actinide ions is

(a) +5 (b) +4 (c) +7 (d) +8

24) Electronic configuration of a transition element X in +3 oxidation state is [Ar] $3d^5$. What is its atomic number ?

(a) 25 (b) 26 (c) 27 (d) 24

25) The electronic configuration of Cu (II) is $3d^9$ whereas that of Cu (I) is $3d^{10}$. Which of the following is correct ?

(a) Cu (II) is more stable (b) Cu (II) is less stable (c) Cu (I) and Cu (II) are equally stable

(d) Stability of Cu (I) and Cu (II) depends on nature of copper salts

26) Metallic radii of some transition elements are given below. Which of these elements will have hig

Element	Fe	Co	Ni	Cu
Metallic	126	125	125	128

(a) Fe (b) Ni (c) Co (d) Cu

27) Generally transition elements form coloured salts due to the presence of unpaired electrons. Which of the following compounds will be coloured in solid state ?

(a) Ag_2SO_4 (b) CuF_2 (c) ZnF_2 (d) Cu_2Cl_2

28) On addition of small amount of $KMnO_4$ to concentrated H_2SO_4, a green oily compound is obtained which is highly explosive in nature, Identify the compound from the following.

(a) Mn_2O_7 (b) MnO_2 (c) $MnSO_4$ (d) Mn_2O_3

29) The magnetic nature of elements depends on the presence of unpaired electrons, Identify the configuration of transition element, which shows highest magnetic moment.

(a) $3d^7$ (b) $3d^5$ (c) $3d^8$ (d) $3d^2$

30) Which of the following oxidation state is common for all lanthanoids ?

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

31) Which of the following reactions are disproportionation reactions?

$(i)\ Cu^{+} \longrightarrow Cu^{2+} + Cu$

$(ii)\ 3MnO_4^{-} + 4H^{+} \longrightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$

$(iii)\ 2KMnO_4 \longrightarrow K_2MnO_4 + MnO_2 + O_2$

$(iv)\ 2MnO_4^{-} + 3Mn^{2+} + 2H_2O \longrightarrow 5MnO_2 + 4H^{+}$

(a) (i),(ii) (b) (i),(ii),(iii) (c) (ii),(iii),(iv) (d) (i),(iv)

32) When $KMnO_4$ solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time because

(a) CO_2 is formed as the product (b) Reaction is exothermic (c) MnO_4^{-} catalyses the reaction

(d) Mn^{2+} acts as autocatalyst

33) There are 14 elements in actinoid series. Which of the following elements does belong to this series ?

(a) U (b) Np (c) Tm (d) Fm

34) $KMnO_4$ acts as an oxidising agent in acidic medium. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphide ions in acidic solution is

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) $\frac{1}{5}$

35) Which of the following are amphoteric oxides ?

$Mn_2O_7, CrO_3, Cr_2O_3, CrO, V_2O_5, V_2O_4$

(a) V_2O_5, Cr_2O_3 (b) Mn_2O_7, CrO_3 (c) CrO, V_2O_5 (d) V_2O_5, V_2O_5

36) Gadolinium belongs to 4f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium ?

(a) $[Xe]4f^7 5d^1 6s^2$ (b) $[Xe]4f^6 5d^2 6s^2$ (c) $[Xe]4f^8 6s^2$ (d) $[Xe]4f^9 5s^1$

37) Interstitial compounds are formed when small atoms are trapped inside the crystal lattice of metals. Which of the following is not the characteristic property of interstitial compounds ?

(a) They have high melting points in comparison to pure metals (b) They are very hard

(c) They retain metallic conductivity (d) They are chemically very reactive

38) The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion is ..... .

(a) 2.87 B.M. (b) 3.87 B.M. (c) 3.47 B.M. (d) 3.57 B.M.

39) $KMnO_4$ acts as an oxidising agent in alkaline medium. When alkaline $KMnO_4$ is treated with KI, iodide ion is oxidised to ..... .

(a) I_2 (b) IO^{-} (c) IO_3^{-} (d) IO_4^{-}

40) Which of the following statements is not correct ?

(a) Copper liberates hydrogen from acids

(b) In its higher oxidation states, manganese forms stable compounds with oxygen and fluorine

(c) Mn^{3+} and Co^{3+} are oxidising agents in aqueous solution

(d) Ti^{2+} and Cr^{2+} are reducing agents in aqueous solution

41) When acidified $K_2Cr_2O_7$ solution is added to Sn^{2+} salts, then Sn^{2+} changes to

(a) Sn (b) Sn^{3+} (c) Sn^{4+} (d) Sn^{+}

42) Highest oxidation state of manganese in fluoride is +4 (MnF_4) but highest oxidation state in oxides is +7 (Mn_2O_7) because ..... .

(a) fluorine is more electronegative than oxygen (b) fluorine does not possess d - orbitals

(c) fluorine stabilise lower oxidation state

(d) in covalent compounds, fluorine can form single bond only while oxygen forms double bond

43) Although Zirconium belongs to 4d transition series and Hafnium to 5d transition series even then they show similar physical and chemical properties because ..... .

(a) both belong to d - block (b) both have same number of electrons (c) both have similar atomic radius

(d) both belong to the same group of the periodic table

44) Why is HCl not used to make the medium acidic in oxidations of $KMnO_4$ in acidic medium ?

(a) Both HCl and $KMnO_4$ acts as oxidising agents

(b) $KMnO_4$ oxidises HCl into Cl_2 which is also an oxidising agent

(c) $KMnO_4$ is a weaker oxidising agent than HCl (d) $KMnO_4$ acts as a reducing agent in the presence of HCl.

45) Generally transition elements and their salts are coloured due to the presence of unpaired electrons in metal ions. Which of the following compounds are coloured ?

(a) $KMnO_4$ (b) $Ce(SO_4)_2$ (c) $TiCl_4$ (d) Cu_2Cl_2

46) Transition elements show magnetic moment due to spin and orbital motion of electrons. Which of the following metallic ions have almost same spin only magnetic moment ?

(a) Co^{2+} (b) Cr^{2+} (c) Mn^{2+} (d) Cr^{3+}

47) In the form of dichromate, Cr (VI) is a strong oxidising agent in acidic medium but Mo (VI) in MoO_3 and W (VI) in WO_3 are not because _____.

(a) Cr (VI) is more stable than Mo (VI) and W (VI). (b) Mo (VI) are more stable than Cr (VI).

(c) Higher oxidation states of heavier members of group - 6 of transition series are more stable

(d) Lower oxidation states of heavier members of group - 6 of transition series are more stable

48) Which of the following actinoids show oxidation states upto +7 ?

(a) Am (b) Pu (c) U (d) Np

49) General electronic configuration of actinoids is (n - 2) f^{1-14} (n - 1) d^{0-2} ns^2. Which of the following actinoids have one electron in 6d orbital?

(a) U (Atomic no. 92) (b) Np (Atomic no. 93 (c) Pu (Atomic no. 94) (d) Am (Atomic no. 95)

50) Which of the following lanthanoids show +2 oxidation state besides the characteristic oxidation state +3 of lanthanoids?

(a) Ce (b) Eu (c) Yb (d) Ho

51) Which of the following ions show higher spin only magnetic moment value ?

(a) Ti^{3+} (b) Mn^{2+} (c) Fe^{2+} (d) Co^{3+}

52) Transition elements form binary compounds with halogens. Which of the following elements will form MF_3 type compounds ?

(a) Cr (b) Co (c) Cu (d) Ni

53) Which of the following will not act as oxidising agents ?

(a) CrO_3 (b) MoO_3 (c) WO_3 (d) CrO_4^{2-}

54) Although +3 is the characteristic oxidation state for lanthanoids but cerium also shows +4 oxidation state because ..... .

(a) it has variable ionisation enthalpy (b) it has a tendency to attain noble gas coniguration

(c) it has a tendency to attain f^o configuration (d) it resembles Pb^{4+}

55) Which of the following transition metals of 3d series has the lowest melting point ?

(a) Ti (Z = 22) (b) V (Z = 23) (c) Cr (Z = 24) (d) Mn (Z = 25) (e) Fe (Z = 26)

56) The correct order of decreasing second ionization enthalpy of Ti (22), V(23), Cr(24) and Mn(25) is

(a) V > Mn > Cr > Ti (b) Mn > Cr > Ti > V (c) Ti > V > Cr > Mn (d) Cr > Mn > V > Ti

57) The number of unpaired electrons in gaseous species of Mn^{3+}. Cr^{3+} and V^{3+} respectively are ..... and most stable species is ..... .

(a) 4,3 and 2 and V^{3+} is most stable (b) 3,3 and 2 and Cr^{3+} is most stable (c) 4,3 and 2 and Cr^{3+} is most stable

(d) 3,3 and 3 and Mn^{3+} is most stable.

58) The correct order of $E^o_{M^{2+}/M}$ values with negative for the four successive elements Cr, Mn, Fe and Co is

(a) Fe > Mn > Cr > Co (b) Cr > Mn > Fe > Co (c) Mn > Cr > Fe > Co (d) Cr > Fe > Mn > Co

59) Which one of the following ions is the most stable in aqueous solution ?

(a) Mn^{2+} (b) Cr^{3+} (c) V^{3+} (d) Ti^{3+}

60) The stability of ferric ion is due to

(a) half - filled d - orbitals (b) half - filled f - orbitals (c) completely filled d - orbitals

(d) completely filled f - orbitals

61) Four successive members of the first row transition elements are listed below with atomic numbers. Which one of them is expected to have the highest $E^o_{M^{2+}/M}$ value ?

(a) Co (Z = 27) (b) Cr (Z = 24) (c) Mn (Z = 25) (d) Fe (Z = 26)

62) Four successive members of the first series of the transition metals are listed below. For which one of them, the standard potential ($E^o_{M^{2+}/M}$) value has a positive sign ?

(a) Cu (Z = 29) (b) Fe(Z = 26) (c) Co(Z = 27) (d) Ni (Z = 28)

63) Among the following pairs of ions, the lower oxidation state in aqueous solution is more stable than the other, in

(a) Ti^+,Ti^{3+} (b) Cu^+,Cu^{2+} (c) Cr^{2+},Cr^{3+} (d) V^{2+},VO^{2+}

64) A transition metal exists in its highest oxidation state. It is expected to behave as

(a) a chelating agent (b) a central metal in a coordination compound (c) an oxidizing agent

(d) a reducing agent

65) In context with the transition elements, which of the following statements is incorrect ?

(a) In the highest oxidation states, the transition metals show basic character and form cationic complexes.

(b) In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding.

(c) Once the d^5 configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases.

(d) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.

66) For the four successive transition elements (Cr,Mn, Fe and Co), the stability of +2 oxidation state will be there in which of the following order ?

(a) Cr > Mn > Co > Fe (b) Mn > Fe > Cr > Co (c) Fe > Mn > Co > Cr (d) Co > Mn > Fe > Cr

67) The titanium (atomic number 22) compound that does not exist is

(a) TiO (b) TiO_2 (c) K_2TiF_6 (d) $TiCl_3$ (e) K_2TiO_4

68) Out of $TiF_6^{2-}, CoF_6^{3-}, Cu_2CI_2 \quad and \quad NiCI_4^{2-}$ (Z of Ti = 22, Co = 27, Cu = 29, Ni = 28), the colourless species are

(a) $Cu_2Cl_2 and NiCI_4^{2-}$ (b) $TiF_6^{2-} and Cu_2CI_2$ (c) $CoF_6^{3-} and NiCI_4^{2-}$

(d) $TiF_6^{2-} and CoF_6^{3-}$

69) The colour of the light absorbed by an aqueous solution of $CuSO_4$ is

(a) orange - red (b) blue - green (c) yellow (d) violet

70) The catalytic activity of transition metals and their compounds is ascribed mainly to

(a) their ability to adopt variable oxidation states (b) their chemical reactivity (c) their magnetic behaviour

(d) their unfilled d - orbitals

71) Among the following compounds that is both paramagnetic and coloured is

(a) $K_2Cr_2O_7$ (b) $(NH_4)_2[TiCl_6]$ (c) $VOSO_4$ (d) $K_3[Cu(CN)_4]$

72) The value of 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is

(a) d^4 (in strong ligand field) (b) d^4 (in weak ligand field) (c) d^3 (in weak as well as strong fields)

(d) d^5 (in strong ligand field)

73) Which of the following statement(s) is/are correctly applicable to all the transition elements with atomic numbers 21 - 29 ? 1. The lowest oxidation state +1 2. The 4s orbital is completely filled in the ground state. 3. The 3d orbital is incompletely filled in the ground state. 4. The ion in the +2 oxidation state is paramagnetic.

(a) 1,2 and 3 (b) 3 and 4 only (c) 4 only (d) 3 only

74) Which one of the following does not correctly represent the correct order of the property indicated against it ?

(a) Ti< V< Cr< Mn : increasing melting points (b) Ti< V< Mn< Cr : increasing 2nd ionization enthalpy

(c) Ti< V< Cr< Mn : increasing number of oxidation states

(d) $Ti^{3+}< V^{3+}< Cr^{3+}< Mn^{3+}$: increasing magnetic moment

75) Which of the following arrangements does not represent the correct order of the property stated against it ?

(a) Sc< Ti< Cr< Mn : number of oxidation states (b) $V^{2+}< Cr^{2+}< Mn^{2+}< Fe^{2+}$: paramagnetic behaviour.

(c) $Ni^{2+}< Co^{2+}< Fe^{2+}< Mn^{2+}$: ionic size (d) $Co^{3+}< Fe^{3+}< Cr^{3+}< Sc^{3+}$: stability in aqueous solution

76) Which of the following statements about the interstitial compounds is incorrect ?

(a) They retain metallic conductivity (b) They are chemically reactive

(c) They are much harder than the pure metal (d) They have higher melting points than the pure metal

77) Magnetic moment of 2.84 B.M is given by which of the following ion?

(a) Ti^{3+} (b) Ni^{2+} (c) Cr^{3+} (d) Mn^{2+}

78) Basic properties of TiO_2, ZrO_2 and HfO_2 are in the order :

(a) $TiO_2< ZrO_2< HfO_2$ (b) $ZrO_2< HfO_2< TiO_2$ (c) $HfO_2< TiO_2< ZrO_2$ (d) $TiO_2< HfO_2< ZrO_2$

79) Among the oxides, Mn_2O_7 (I), V_2O_3(II),V_2O_5 (III),CrO (IV) and Cr_2O_3 (V), the basic oxides are

(a) I and II (b) II and III (c) III and IV (d) II and IV (e) III and V

80) The acidic, basic or amphoteric nature of Mn_2O_7 , V_2O_5 and CrO are respectively

(a) acidic, acidic and basic (b) basic, amphoteric and acidic (c) acidic, amphoteric and basic

(d) acidic, basic and amphoteric (e) acidic, basic and basic

81) In chromite ore, the oxidation number of iron and chromium are respectively

(a) +3, +2 (b) +3, +6 (c) +2, +6 (d) +2, +3

82) $K_2Cr_2O_7$ reacts with NH_4Cl in presence of H_2SO_4. The product formed is

(a) chromyl chlorate with green vapour (b) chromous chloride with white vapour

(c) chromous chloride with blue vapour (d) chromyl chloride with deep red colour

83) When hydrogen peroxide is added to acidified potassium dichromate, a blue colour is produced due to formation of

(a) CrO_3 (b) Cr_2O_3 (c) CrO_5 (d) CrO_4^{2-} (e) CrO_7^{2-}

84) When sulphur dioxide is passed through an acdified $K_2Cr_2O_7$ solution, the oxidation state of sulphur is changed from.

(a) +4 to +6 (b) +6 to +4 (c) +4 to 0 (d) +4 to +2

85) A mixture of salts (Na_2SO_3+$K_2Cr_2O_7$) in a test tube is treated with dil. H_2SO_4 and resulting gas is passed through lime water. Which of the following observations is correct about this test ?

(a) Solution in test tube becomes green and lime water turns milky

(b) Solution in test tube is colourless and lime water turns milky

(c) Solution in test tube becomes green and lime water remains clear

(d) Solution in test tube remains clear and lime water also remains clear.

86) How many moles of iodine are liberated when 1 mole of potassium dichromate reacts with potassium iodide ?

(a) 1 (b) 2 (c) 3 (d) 4

87) Which of the following compounds will not give positive chromyl test ?

(a) $CuCl_2$ (b) $HgCl_2$ (c) $ZnCl_2$ (d) $C_6H_5{}^+NH_3Cl^-$

88) In which of the following ions, the colour is not due to d - d transition ?

(a) $Ti(H_2O)_6^{3+}$ (b) CoF_6^{3-} (c) CrO_4^{2-} (d) $[Cu(NH_3)_4]^{2+}$

89) The bonds present in the structure of dichromate ion are

(a) four equivalent Cr - O bonds only (b) six equivalent Cr - O bonds and one O - O bond

(c) six equivalent Cr - O bonds and one Cr - Cr bond (d) eight equivalent Cr - O bonds

(e) six equivalent Cr - O bonds and one Cr - O - Cr bond.

90) Which of the following does not give oxygen on heating ?

(a) $KClO_3$ (b) $Zn(ClO_3)_2$ (c) $K_2Cr_2O_7$ (d) $(NH_4)_2Cr_2O_7$

91) Identify the product and its colour when MnO_2 is fused with solid KOH in the presence of O_2

(a) $KMnO_4$, purple (b) K_2MnO_4, dark green (c) MnO, colourless (d) Mn_2O_3, brown (e) MnO_2, black

92) $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction :

$3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$

The reaction can go to completion by removing OH^- ions by adding

(a) HCl (b) KOH (c) CO_2 (d) SO_2

93) When manganous salt is fused with a mixture of KNO_3 and solid NaOH, the oxidation number of Mn changes from +2 to

(a) +4 (b) +3 (c) +6 (d) +7

94) In acidic medium, MnO_4^{2-}

(a) disproportionates to MnO_2 and MnO_4^- (b) is oxidized to MnO_4^- (c) is reduced to MnO_2

(d) is reduced to Mn^{2+}

95) The coloured spot of $KMnO_4$ on any article can be bleached by

(a) $SO_2 + H^+$ (b) $C_2O_4^{2-} + H^+$ (c) $H_2O_2 + H^+$ (d) all of these

96) MnO_4^- reacts with Br^- in alkaline pH to give.

(a) BrO_3^-, MnO_2 (b) Br_2, MnO_4^{2-} (c) Br_2, MnO_2 (d) BrO^-, MnO_4^{2-}

97) Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out the presence of HCl because HCl

(a) reduces permanganate to Mn^{2+} (b) oxides oxalic acid to carbon dioxide and water

(c) gets oxidized by oxalic acid to chlorine (d) furnishes H^+ ions in addition to those from oxalic acid.

98) A student accidently added conc . H_2SO_4 to potassium permanganate and it exploded due to the formation of an explosive which is

(a) MnO (b) Mn_2O_3 (c) Mn_2O_5 (d) Mn_2O_7

99) $KMnO_4$ gets reduced to

(a) K_2MnO_4 in neutral medium (b) MnO_2 in acidic medium (c) Mn^{2+} in alkaline medium

(d) MnO_2 in neutral medium

100) The colour of $KMnO_4$ is due to

(a) $L \rightarrow M$ charge transfer transition (b) $\sigma \rightarrow \sigma^*$ transition (c) $M \rightarrow L$ charge transfer transition

(d) $d \rightarrow d$ transition.

101) In acidic medium, H_2O_2 changes $Cr_2O_7^{2-}$ to CrO_5 which has two (-O-O-) bonds. Oxidation state of Cr in CrO_5 is

(a) + 5 (b) + 3 (c) + 6 (d) - 10

102) The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives

(a) Mn^{4+} and O_2 (b) Mn^{2+} and O_2 (c) Mn^{2+} and O_3 (d) Mn^{4+} and MnO_2

103) Gadolinium belongs to 4 f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium ?

(a) [Xe]4 f^9 5 s^1 (b) [Xe] 4 f^7 5 d^1 6 s^2 (c) [Xe] 4 f^6 5 d^2 6 s^2 (d) [Xe] 4 $f^8$6 d^2

104) Cerium (Z = 58) is an important member of the lanthanoids. Which of the following statements about cerium is incorrect ?

(a) The common oxidation states of cerium are +3 and +4

(b) The +3 oxidation state cerium is more stable than +4 oxidation state.

(c) The +4 oxidation state of cerium is not known in solutions. (d) Cerium (IV) acts as an oxidizing agent.

105) The atomic number of cerium (Ce) is 58. The correct electronic configuration of Ce^{3+} ion is

(a) $[Xe]4f^1$ (b) $[Xe]4f^1$ (c) $[Xe]4f^{13}$ (d) $[Xe]4d^1$

106) The electronic configuration of Gd^{2+} is (atomic no. of Gd is 64)

(a) $[Xe]4f^7$ (b) $[Xe]4f^75d^1$ (c) $[Xe]4f^8$ (d) $[Xe]4f^75d^16s^2$

107) Which of the following exhibits only +3 oxidation state ?

(a) Ac (b) Pa (c) U (d) Th

108) Lanthanide contraction is observed in

(a) Gd (b) At (c) Xe (d) Th

109) Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii ? (Numbers in parenthesis are atomic numbers)

(a) Zr (40) and Hf (72) (b) Zr (40) and Ta (73) (c) Ti (22) and Zr (40) (d) Zr (40) and Nb (41)

110) The correct order of ionic radii of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is

(a) $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$ (b) $Lu^{3+} < Y^{3+} < Eu^{3+} < La^{3+}$

(c) $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$ (d) $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$

111) Which one of the following is the correct increasing order of the magnitude of ionic radii of Ce^{3+}, La^{3+}, Pm^{3+} and Yb^{3+}?

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

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

112) Identify the incorrect statement among the following :

(a) Shielding power of 4f electrons is quit weak

(b) There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu

(c) Lanthanoid contraction is the accumulation of successive shrinkages.

(d) As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of the elements.

113) Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of the following statements is incorrect ?

(a) The ionic sizes of Ln (III) decrease in general with increasing atomic number.

(b) Ln (III) compounds are generally colourless. (c) Ln (III) hydroxides are mainly basic in character

(d) Because of the large size of the Ln (III) ions, the bonding in its compounds is predominantly ionic in character.

114) Which of the following lanthanoid ion is paramagnetic ?

(a) Ce^{4+} (b) Yb^{2+} (c) Lu^{3+} (d) Eu^{2+}

115) Consider the following statements in respect of lanthanides :
1. The basic strength of hydroxides of lanthanides increases from La $(OH)_3$ to Lu$(OH)_3$.
2. The lanthanide ions Lu^{3+},Yb^{2+} and Ce^{4+} are diamagnetic.
Which of the statement(s) given above is/ are correct ?

(a) 1 only (b) 2 only (c) both 1 and 2 (d) Neither 1 nor 2

116) In context of the lanthanoids, which of the following statements is not correct ?

(a) All the members exhibit +3 oxidation state

(b) Because of similar properties, the separation of lanthanoids is not easy.

(c) Availability of 4f electrons results in the formation of compounds in +4 state for all the members of series.

(d) There is a gradual decrease in the radii of the members with increasing atomic number in the series.

117) Consider the following statements (I) La$(OH)_3$ is least basic among hydroxides of lanthanides (II) Zi^{4+} and Hf^{4+} possess almost the same ionic radii (III) Ce^{4+} can act as an oxidizing agent Which of the above is/are true ?

(a) (I) and (III) (b) (II) and (III) (c) (II) only (d) (I) and (II) (e) (I) only

118) Which is not correct statement about the chemistry of 3d and 4f series elements ?

(a) 3d - elements show more oxidation states than 4f - series elements

(b) The energy difference between 3d and 4s orbitals is very little (c) Europium (II) is more stable than Ce (II)

(d) The paramagnetic character in 3d - series elements increases from scandium to copper.

119) Which one of the following elements shows maximum number of different oxidation states in its compounds ?

(a) Eu (b) La (c) Gd (d) Am

120) Which of the following is not an actinoid ?

(a) Curium (Z = 96) (b) Californium (Z = 98) (c) Uranium (Z = 92) (d) Terbium (Z = 65)

121) Among the following actinide pairs, the maximum oxidation states is shown by

(a) U and Np (b) Np and Pu (c) Pu and An (d) U and Pa (e) Th and Pu

122) The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because

(a) the 5f orbitals extend farther from the nucleus than the 4f orbitals

(b) the 5f orbitals are more buried than the 4f orbitals

(c) there is a similarity between 4f and 5f orbitals in their angular part of the wave function

(d) the actinoids are more reactive than the lanthanoids

123) Reason of lanthanoid contraction is

(a) negligible screening effect of 'f' - orbitals (b) increasing nuclear charge (c) decreasing nuclear charge

(d) decreasing screening effect

124) All Cu (II) halides are known except iodide. The reason for this is that

(a) iodide ion is a bulky ion (b) Cu^{2+} oxidizes iodide to iodine

(c) Cu^{2+} (aq) has much more negative hydration enthalpy (d) Cu^{2+} ion has smaller size.

125) In nitroprusside ion, the iron and NO exist as Fe^{II} and NO^{+} rather than Fe^{III} and NO. These forms can be differentiated by

(a) estimating the concentration of iron (b) measuring the concentration of CN^{-}

(c) measuring the solid state magnetic moment (d) thermally decomposing the compound.

126) A red solid is insoluble in water. However, it becomes soluble if some KI is added to water. Heating the red solid in a test tube results in liberation of some violet coloured fumes and droplets of a metal appear on the cooler parts of the test tube. The red solid is

(a) HgI_2 (b) HgO (c) Pb_3O_4 (d) $(NH_4)_2\,Cr_2O_7$

127) $[Fe(H_2O)_5NO]^{2+}$ is a complex formed in the brown ring test for NO_3^- ion. In this complex

(a) NO transfers its electron to Fe^{2+} so that we have iron as Fe(I) and NO as NO^{+}

(b) There are three unpaired electrons so that its magnetic moment is 3.87 B.M

(c) The colour is due to charge transfer (d) All the above statements are correct.

128) Prussian blue is

(a) $K_3[Fe(CN)_6]$ (b) $K_4[Fe(CN)_6]$ (c) $K \quad Fe[Fe(CN)_6]$ (d) $Fe_4[Fe(CN)_6]$

129) Which one of the following reactions involves disproportionation ?

(a) $2H_2SO_4 + Cu \longrightarrow CuSO_4 + 2H_2O + SO_2$

(b) $As_2O_3 + 3H_2S \longrightarrow As_2S_3 + 3H_2O$

(c) $2KOH + CI_2 \longrightarrow KCI + KOCI + H_2O$

(d) $Ca_3P_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2PH_3$ (e) $4NH_3 + O_2 \longrightarrow 2N_2 + 6H_2O$

130) Pick out the correct statements from the following

1. Cobalt (III) is more stable in octahedral complexes.
2. Zinc forms coloured ions or complexes.
3. Most of the d - block elements and their compounds are ferromagnetic.
4. Osmium shows (VIII) oxidation state.
5. Cobalt (II) is more stable in octahedral complexes.

(a) 1 and 2 (b) 1 and 3 (c) 2 and 4 (d) 1 and 4 (e) 2 and 5

131) Which out of the following belong to 3d series ?

(a) copper (b) cobalt (c) gold (d) silver

132) Transition elements have greater tendency to form complexes because

(a) They have vacant d orbitals (b) They have large size (c) They have large charge/ size ratio

(d) They have two electrons in their outermost shells

133) The colour of the transition metal ions is due to

(a) d - d transition (b) charge transfer (c) change in the geometry (d) none

134) Which of the following show oxidation state of +4 ?

(a) Ce (b) Ac (c) Th (d) U

135) Potassium manganate (K_2MnO_4) is formed when

(a) Chlorine is passed through aqueous $KMnO_4$ solution.

(b) Manganese dioxide is fused with potassium hydroxide in air

(c) Formaldehyde reacts with potassium permanganate in presence of strong alkali.

(d) Potassium permanganate reacts with H_2SO_4.

136) Which of the following statements are correct with reference to the ferrous and ferric ions ?

(a) Fe^{3+} gives brown colour with potassium ferricyanide.

(b) Fe^{2+} gives blue precipitate with potassium ferricyanide

(c) Fe^{3+} gives red colour with potassium thiocyanate (d) Fe^{2+} gives brown colour with ammonium thiocyanate.

137) Which of the following statements are correct when a 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 yellow solution of Na_2CrO_4 (c) chlorine gas is evolved

(d) chromyl chloride is formed

138) Reduction of the metal centre in aqueous permanganate ion involves.

(a) 3 electrons in neutral medium (b) 5 electrons in neutral medium (c) 3 electrons in alkaline medium

(d) 5 electron in acidic medium

139) The correct statement(s) about Cr^{2+} and Mn^{3+} is (are) [Atomic numbers of Cr = 24 and Mn = 25]

(a) Cr^{2+} is a reducing agent (b) Mn^{3+} is an oxidizing agent

(c) Both Cr^{2+} and Mn^{3+} exhibit d^4 electronic configuration

(d) When Cr^{2+} is used as a reducing agent, the chromium ion attains d^5 configuration

140) Which element do you expect to have the smallest atomic radius ?

(a) Sc (b) Zn (c) La (d) Hg

141) Which element do you expect to have the highest melting point ?

(a) La (b) W (c) Os (d) Pt

142) Which element out of the following do you expect to have the lowest melting point ?

(a) Cr (b) Mn (c) Fe (d) Co

143) Which of the following is the correct order of second ionization energy ?

(a) V > Cr > Mn (b) V< Cr< Mn (c) V< Cr > Mn (d) V > Cr< Mn

144) In the second transition series, the largest number of oxidation states are shown by

(a) Tc (b) Ru (c) Rh (d) Pd

145) Which of the following pair of compounds is expected to exhibit same colour in aqueous solution ?

(a) $FeCl_2$, $CuCl_2$ (b) $VOCl_2$,$CuCl_2$ (c) $VOCl_2$,$FeCl_2$ (d) $FeCl_2$, $MnCl_2$

146) When pyrolusite id fused with KOH and $KClO_3$, we get

(a) $KMnO_4$ (b) K_2MnO_4 (c) Both $KMnO_4$ and K_2MnO_4 (d) None of these

147) The purple colour of $KMnO_4$ is due to

(a) incomplete d - subshell (b) ionic nature of $KMnO_4$ (c) charge transfer (d) resonance in MnO_4^- ion

148) Mohr salt, $FeSO_4$, $(NH_4)_2SO_4$. 6 H_2O, is preferred over $FeSO_4$. 7 H_2O for standardization of $KMnO_4$ solution because.

(a) Mohr salt is a double salt while ferrous sulphate is a single salt.

(b) Mohr salt is not hygroscopic but $FeSO_4$. 7 H_2O is hygroscopic

(c) Mohr salt contains only ferrous ions whereas ferrous sulphate contains some ferric ions.

(d) Mohr salt solution can be titrated even in the absence of H_2SO_4

149) The variability of oxidation state

(a) is a characteristic of transition elements

(b) arises out of incomplete filling of d-orbitals in such a way that their oxidation states differ from each other by unity

(c) differs from the variability of oxidation states of non-transition elements, where the oxidation states normally differ by two unit.

(d) All of the above are true

150) Which of the following compounds is used as the starting material for the preparation of potassium dichromate?

(a) K_2SO_4 . $Cr_2(SO_4)_3.24H_2O$(chrome alum) (b) $PbCrO_4$(chromite yellow) (c) $FeCr_2O_4$ (chromite)

(d) $PbCrO_4$. PbO(chrome red)

151) When acidified $K_2Cr_2O_7$solution is added to Sn^{2+} salt then Sn^{2+}changes to

(a) Sn (b) Sn^{3+} (c) Sn^{4+} (d) Sn^+

152) The equilibrium, $Cr_2O^{2-}_7 \rightleftharpoons 2CrO_4^{2-}$ is shifted to right in

(a) an acidic medium (b) a basic medium (c) a neutral medium (d) it does not exist

153) Catalyst used in the oxidsation of SO_2 in the manufacture of H_2SO_4 is

(a) $CuCl_2$ (b) V_2O_5 (c) MnO_2 (d) None of these

154) Which of the following has abnormally low value of third ionisation enthalpy.

(a) Lanthanum (b) Gadolinium (c) Lutetium (d) All of the above

155) Aman made white silvery metal radioactive in nature has strong tendency to form oxocations and complexes. It is used as a nuclear fuel in atomic reactor. This metal is a

(a) actinide (b) lanthanide (c) representative element (d) transition metal

156) Outermost electronic configuration of lanthanide is

(a) $4f^{1-14}$, $5d^0$, $6s^2$ (b) $4f^{1-14}$, $5d^{0-1}$, $6s^2$ (c) $4f^{0-14}$, $5d^{0-2}$, $6s^2$ (d) $4f^{0-14}$,$5d^1$,$6s^2$

157) As the atomic number of lanthanides increases, there atomic radius decreases, but exception is

(a) Ga and Eu (b) Eu and Yb (c) Nd and Ho (d) Dy and Ho

158) Choose the appropriate option about the misch metal.

(a) It is an alloy which consists of a lanthanoid metal (-95%) and iron (-5%) and traces of S, C, Ca and Al

(b) Used in Mg based alloy to produce bullets, shell and lighter flint.

(c) It fmds application in making aeroplane body (d) Both (a) and (b)

159) Which of the following element show catalytic property?

(a) Ca (b) Fe (c) Pb (d) None of these

160) Transition elements have unique property that

(a) they show variable oxidation state (b) these elements acts as catalyst

(c) they form coloured compounds (d) All of the above

161) Across the lanthanide series, the basicity of the lanthanide hydroxides

(a) increases (b) decreases (c) first increases and then decreases (d) first decreases and then increases

162) The incorrect statement about cerium is

(a) its common oxidation states are +3 and +4 (b) +3 state is more stable than +4

(c) +4 state is not seen in solution (d) Ce (IV) is an oxidant

163) In which of the following pairs, both the ions are coloured in aqueous solutions?

(a) Sc^{3+}, Ti (b) Sc^{3+}, Co^{2+} (c) Ni^{2+}, Cu^{+} (d) Ni^{2+}, Ti^{3+}

164) Which of the following is most stable in aqueous solution?

(a) Mn^{2+} (b) Cr^{3+} (c) V^{3+} (d) Ti^{3+}

165) The number of moles of $KMnO_4$ that will be needed to react with one mole of SO_3^{2-} in acidic solution.

(a) 1 (b) 3/5 (c) 4/5 (d) 2/5

166) Acidified $K_2Cr_2O_7$ solution turns green when SO_2 gas is passed through it due to formation of

(a) $Cr_2(SO_4)_3$ (b) CrO_4^{-2} (c) $Cr_2(SO_3)_3$ (d) $CrSO_4$

167) The stability of Mn^{2+}, Fe^{2+},Cr^{2+}, Co^{2+} is in order of (At o. of Mn = 25, Fe = 26, Cr = 24, Co = 27)

(a) $Mn^{2+} > Fe^{2+} > Cr^{2+} > CO^{2+}$ (b) $Fe^{2+} > Mn^{2+} > Co^{2+} > Cr^{2+}$ (c) $Co^{2+} > Mn^{2+} > Fe^{2+} > Cr^{2+}$

(d) $Cr^{2+} > Mn^{2+} > Co^{2+} > Fe^{2+}$

168) Which ofthe following lanthanoid ion is diamagnetic? (At No. of Ce = 58, Sm = 62, Eu = 63 Yb = 70)

(a) Eu^{2+} (b) Yb^{2+} (c) Ce^{2+} (d) Sm^{2+}

169) $KMnO_4$ is not acidified by 8CI instead of H_2SO_4 because

(a) H_2SO_4 is stronger acid than 8CI (b) HCI is oxidised to Cl_2 by $KMnO_4$ (c) H_2SO_4 is dibasic acid

(d) rate is faster in presence of H_2SO_4

170) Out of Mn_2O_7, V_2O_3, V_2OS, CrO, Cr_2O_3, the basic oxides are

(a) Mn_2O_7, $V2O_3$ (b) V_2O_3, V_2O_5 (c) V_2O_5,CrO (d) V_2O_3 and CrO

171) The oxidation state of Cr in final product formed by reaction of KI and acidified dichromate solution is

(a) +4 (b) +6 (c) +2 (d) +3

172) The electronic configuration of Gd (64) is

(a) [Xe] $4f^6$ $5d^1$$6s^2$ (b) [Xe] $4f^6$ $5d^2$$6s^2$ (c) [Xe] $4f^8$$6s^2$ (d) [Xe] $4f^9$ $5s^1$

173) Which of the following statements related to lanthanoids is incorrect?

(a) Eu shows + 2 oxidation state (b) $Pr(OH)_3$ to $Lu(OH)_3$, basicity decreases

(c) All lanthanoids more reactive than Al (d) Ce^{4+} is used as oxidising agent

174) Name the gas that can readily decolourised by acidified $KMnO_4$ solution.

(a) SO_2 (b) NO_2 (c) P_2O_5 (d) CO_2

175) The reason for greater range of oxidation state of actinoids is due to

(a) actinoid contraction (b) Sf, 6d, 7s levels have comparable energies

(c) 4f and 5d levels are close in energies (d) the radioactive nature of actinoids

176) In the following reactions, ZnO is respectively acting as a/an
$(i)\mathrm{ZnO} + \mathrm{Na_2O} \longrightarrow \mathrm{Na_2ZnO_2}$
$(ii)\mathrm{ZnO} + \mathrm{CO_2} \longrightarrow \mathrm{ZnCO_3}$
(a) acid and acid (b) acid and base (c) base and acid (d) base and base

177) Transition metals are known to make interstitial compounds. Formation of interstitial compounds makes the transition metal
(a) more hard (b) more soft (c) more ductile (d) more metallic

178) The ions of metals of Group 12 (Zn, Cd and Hg] have completely filled d-orbitals and so they
(a) behave like semiconductors (b) are very high melting points (c) do not behave like transition metals
(d) behave like superconductors

179) Which of the following transition metals does not show variable oxidation state?
(a) Ti (b) Cr (c) Cu (d) Sc

180) Which of the following characteristics of transition metals is associated with their catalytic activity?
(a) Paramagnetic nature (b) Colour of hydrated ions (c) High enthalpy of atomisation
(d) Variable oxidation states

181) Which property of transition metals enables them to behave as catalysts?
(a) High melting point (b) High ionisation enthalpy (c) Alloy formation (d) Variable oxidation states

182) Which of the following is a diamagnetic ion (atomic numbers of Sc, V, Mn and Cu are 21, 23, 25 and 29 respectively)
(a) $V^{2}+$ (b) Sc^{3+} (c) Cu^{2+} (d) Mn^{3+}

183) Which set of ions exhibit specific colours? (Atomic number of Sc = 202121, Ti = 22, V = 23, Mn 25, Fe 26, Ni=28, Cu=29 and Zn = 30)
(a) Sc^{3+}, Ti^{4+}, Mn^{3+} (b) Sc^{3+}, Zn^{2+}, Ni^{2+} (c) V^{3+}, V^{2+}, Fe^{3+} (d) Ti^{3+}, Ti^{4+}, Ni^{2+}

Fill up / 1 Marks 39 x 1 = 39

184) Complete and balance the following chemical equation $Cr_2O_7^{2-}+I^-+H^+ \longrightarrow$ _____.

185) The general outer shell electronic configuration of transition elements is _____ .

186) Third transition series starts with the element _____ and ends at the element _____.

187) In the d-block, the elements which do not generally show the characteristics of transition elements include _____, _____ and _____ .

188) Silver and gold atoms have nearly the same atomic radii due to _____.

189) Among the d-block elements, the highest melting point is shown by _____ .

190) Among the transition metals of the first series (leaving zinc which is not considered as a transition metal), the lowest melting point is shown by _____.

191) In the first transition series, the maximum number of oxidation states is shown by _____.

192) The reaction in which the same substance undergoes oxidation, as well as reduction, is called _____ reaction.

193) $[Ti(H_2O)_6]^{3+}$ complex ion has purple colour due to absorption of _____ coloured light and causing transition from _____to _____orbitals

194) Transition metals in which vacant spaces are occupied by small atoms such as hydrogen, carbon etc. are called _____.

195) Iron, cobalt and nickel are collectively called as _____ metals.

196) Copper, silver and gold are collectively called as ..... metals.

197) The first synthetic element, i.e., element made artificially was ..... .

198) Chromite ore has the formula ..... .

199) When $K_2Cr_2O_7$ is heated to white heat, the products formed are ....., ... and ..... .

200) When KOH is added to $K_2Cr_2O_7$ solution, the colour changes from ..... to ..... due to the formation of ..... .

201) $\overset{V}{Cr}O_4^{3-}$ in acidic medium undergoes disproportionation to form ..... and ..... .

202) Reddish brown vapours formed when a chloride is heated with $K_2Cr_2O_7$ and conc. H_2SO_4 are due to the formation of ..... .

203) Acidified $K_2Cr_2O_7$ reacts with H_2O_2 to give ..... colour due to the formation of ..... .

204) Yellow colour of CrO_4^{2-} or orange colour of $Cr_2O_7^{2-}$ is not due to d-d transition but due to _____ .

205) The powdered pyrolusite ore when fused with KOH in presence of air forms ..... .

206) MnO_4^{2-} in acidic solution undergoes disportionation to give ..... and ..... .

207) When heated strongly, $KMnO_4$ decomposes to form ..... and ..... .

208) Prussian blue is a complex with the formula ..... .

209) When excess of KCN is added to a solution of copper sulphate, the final product formed is ..... .

210) The green coloured salt formed on heating $(NH_4)_2Cr_2O_7$ is ..... .

211) f - block elements are known as ..... .

212) The general electronic configuration of inner transition elements is ..... .

213) The basic strength ..... as we proceed from $La(OH)_3$ to $Lu(OH)_3$ (decreases or increases or remains constant).

214) Mischmetal contains about ..... percent of lanthanoids and is used in making Mg - based alloy called ..... .

215) The most common mineral containing lanthanoids is ..... .

216) Philospher's wool is the name given to the compound ..... .

217) Complete the following equations
(i) $2MnO_4^- + 5SO_3^{2-} + 6H^+ \longrightarrow$ _____.
(ii) $2CrO_4^{2-} + 2H^+ \longrightarrow$ _____.

218) $2MnO_4^- + 16H^+ + 5\underset{\underset{COO^-}{|}}{COO^-} \longrightarrow 2Mn^{2+}$ + _____ + $8H_2O$

219) $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+}$ + _____ + $7H_2O$

220) $Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \longrightarrow 2Cr^{3+}$ + _____ + $7H_2O$

221) Cr^{3+} is _____ stable than Mn^{2+}.

222) The general molecular formula of compounds formed by heating lanthanoids with sulphur is _____

True or False 5 x 1 = 5

223) Cu2+ is reduced by C complex $[Cu(CN)4]^{3-}$. [True/False]

(a) True (b) False

224) The number of moles of Mohr's salt required per mole of dichromate ion are 6. [True/False)]

(a) True (b) False

225) The colour of light absorbed by an aqueous solution of CuSC > 4 is orange-red. [True/False]

(a) True (b) False

226) Cr in CrO_4^{2-} is sp^3 hybridised and tetrahedral shape.

(a) True (b) False

227) MnO_4^- and MnO_4^{2-} have tetrahedral structure.

(a) True (b) False

Assertion and reason 33 x 1 = 33

228) In the following questions an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Codes:

Assertion (A) First ionisation enthalpy of Cr is lower than that of Zn.

Reason (R) Ionisation enthalpy of Cr is lower than Zn due to the stability of d^5 -electron configuration.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

229) In the following questions an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Codes:

Assertion (A) Cr^{2+} is reducing, while $Mn^{3+}$is oxidising even both have d^4-configuration.

Reason (R) Configuration of Cu changes from d^3 to d^4.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

230) In the following questions. an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Codes:

Assertion (A) $KMnO_4$ oxidises oxalic acid to CO_2 and itself changes to Mn^{2+} ion.

Reason (R) $KMnO_4$ acts as an oxidising agent.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

231) In the following questions an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Codes:

Assertion (A) Many trivalent lanthanoid ions are coloured both in solid state and in aqueous solution.

Reason (R) Colour of these ions is due to the presence of f- electrons.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

232) In the following questions. an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Codes:

Assertion (A) The highest oxidation state of osmium is +8 .

Reason (R) Osmium is a 5d-series element.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

233) In the following questions an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Assertion (A) Transition metals are good catalysts.

Reason (R) V_2O_5 or Pt is used in the preparation of H_2SO_4 by contact process.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

234) In the following questions an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Assertion (A) Transition metals form substitutional alloys.

Reason (R) Alloys are made to develop some useful properties which are absent in the constitutent elements.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

235) In the following questions an Assertion (A) is followed by a corresponding Reason (R) Use the following keys to choose the appropriate answer.

Assertion (A) $La(OH)_2$ is more basic than $La(OH)_3$.

Reason (R) The basic character of oxides and hydroxides decrease from $La(OH)_2$ to $La(OH)_3$.

Codes:

(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).

(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).

(c) (A) is correct; (R) is incorrect.

(d) (A) is incorrect; (R) is correct.

236) **Assertion:** Mn^{2+} is more stable than Mn^{3+}.

Reason: Mn^{2+} has half-filled configuration.

Codes:

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

237) **Assertion:** Members of 4d and 5d series of transition elements have nearly same atomic radii.

Reason : Atomic and ionic radii for transition elements are smaller than their corresponding s-block elements.

Codes:

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement

238) **Assertion:** Fe^{2+} is paramagnetic.
Reason: Fe^{2+} contains four unpaired electrons
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

239) **Assertion:** Transition metals are good catalysts.
Reason: V_2O_5 or Pt is used in the preparation of H_2SO_4 by Contact process
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

240) **Assertion:** Zinc becomes dull in moist air.
Reason: Zinc is coated by a thin film of its basic carbonate in moist air.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

241) **Assertion:** Fe^{3+} is more stable than Fe^{2+}.
Reason: Fe^{2+} ions are easily oxidised to Fe^{3+} ions
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

242) **Assertion:** $[Ti\ (H_2O)_6]^{3+}$ is a coloured ion.
Reason: Ti shows +2, +3, +4 oxidation states.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

243) **Assertion:** Transition metals form a large number of interstitial compounds.
Reason: They have high melting point and boiling point
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

244) **Assertion:** Chromium is hard but mercury is soft.
Reason: Chromium is a 3d transition element.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

245) **Assertion:** Most of the trivalent lanthanide ions are coloured both in the solid state and in aqueous solution.
Reason: The elements with xf electrons have a similar colour to those of (14 - x) f electrons
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement

246) **Assertion:** Cu^{2+} is paramagnetic.
Reason: Cu^{+} is less stable than Cu^{2+}.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

247) **Assertion:** In transition elements, ns orbital is filled up first and (n - 1)d afterwards, during ionization ns electrons are lost prior to (n -1)d electrons.
Reason: The effective nuclear charge felt by (n - 1)d electrons is higher as compared to that by ns electrons.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

248) **Assertion:** Europium (II) is more stable than cerium (II).
Reason: Cerium salts are used as a catalyst in petroleum cracking.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

249) **Assertion:** Zinc is used in the galvanisation of iron.
Reason: Its coating on iron articles increases their life by protecting them from rusting.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

250) **Assertion:** When Zn is placed in a magnetic field, it is feebly magnetised in a direction opposite to that of the magnetising field.
Reason: Zn has completely filled atomic orbitals.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

251) **Assertion:** The correct order of oxidising power is: $VO_2^{+} < VO < VO_2^{+}$.
Reason: The oxidation state of Mn is +7.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

252) **Assertion:** Transition metals form substitutional alloys.
Reason: Alloys are made to develop some useful properties which are absent in the constituent elements.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

253) **Assertion:** Promethium is a manmade element.
Reason: It is radioactive and has been prepared by artificial means.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

254) **Assertion:** Reduction potential of Mn (+3 to +2) is more positive than Fe (+3 to +2).
Reason: Ionisation potential of Mn is more than that of Fe.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

255) **Assertion:** Co (IV) is known but Ni (IV) is not.
Reason: Ni (IV) has d^6 electronic configuration.
Codes:
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

256) In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices
Assertion: Cu^{2+} iodide is not known.
Reason: Cu^{2+} oxidises 1- to iodine.
Codes:
(a) Both assertion and reason are true, and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is not true but reason is true.
(d) Both assertion and reason are false.

257) In the following question a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.
Assertion: Actinoids form relatively less stable complexes as compared to lanthanoids.
Reason: Actinoids can utilise their Sf orbitals along with 6d orbitals in bonding but lanthanoids do not use their 4f orbital for bonding.
Codes:
(a) Both assertion and reason are true, and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is not true but reason is true.
(d) Both assertion and reason are false.

258) **Assertion(A)** Zr and HF are of almost similar atomic radii.
Reason (R) This is due to lanthanoid contraction.
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Asserton (A) is false, but Reason (R) is true.

259) Assertion (A) : Zinc is not regarded as a transition element.
Reason (R) : In zinc, 3d orbitals are completely filled in its ground state as well as in its oxidised state.
(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).
(c) (A) is correct; (R) is incorrect.
(d) (A) is incorrect; (R) is correct.

260) Assertion (A) : Copper is a non-transition element.
Reason (R) : Copper has completely filled d-otrbitals in its ground state.
(a) Both (A) and (R) are correct, (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A).
(c) (A) is correct; (R) is incorrect.
(d) (A) is incorrect; (R) is correct

Passage Based Questions 10 x 1 = 10

261) Transition metals show a great variety of oxidation states in its compounds (variable valency) except the first and the last element. This is because of the fact that, the difference in the energy of (n - 1) d-electrons and ns-electrons is low which implies that electrons from both energy levels can take part in bonding. In 3d-series, all elements show +2 oxidation state except Sc (Sc = +3). Oxidation states first increases from Sc to Mn due to increase in number of unpaired electrons and then decreases because pairing takes place. Fe and Ni show zero oxidation state in metal carbonyls. The oxidation state of a metal in a solvent depends on the nature of the solvent, e.g. Cu^+ is unstable in aqueous solution and undergo disproportionation reaction. Low oxidation states are found if a complex compound has ligands capable of π-acceptor character and c-bonding, e.g. $Ni(CO)_4$ and $Fe(CO)_5$ the oxidation state of nickel and iron is zero in the pregence of CO as ligand.
Why do transition elements show variable oxidation states?

262) Transition metals show a great variety of oxidation states in its compounds (variable valency) except the first and the last element. This is because of the fact that, the difference in the energy of (n - 1) d-electrons and ns-electrons is low which implies that electrons from both energy levels can take part in bonding. In 3d-series, all elements show +2 oxidation state except Sc (Sc = +3). Oxidation states first increases from Sc to Mn due to increase in number of unpaired electrons and then decreases because pairing takes place. Fe and Ni show zero oxidation state in metal carbonyls. The oxidation state of a metal in a solvent depends on the nature of the solvent, e.g. Cu^+ is unstable in aqueous solution and undergo disproportionation reaction. Low oxidation states are found if a complex compound has ligands capable of π-acceptor character and c-bonding, e.g. $Ni(CO)_4$ and $Fe(CO)_5$ the oxidation state of nickel and iron is zero in the pregence of CO as ligand.
Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only ?

263) Transition metals show a great variety of oxidation states in its compounds (variable valency) except the first and the last element. This is because of the fact that, the difference in the energy of (n - 1) d-electrons and ns-electrons is low which implies that electrons from both energy levels can take part in bonding. In 3d-series, all elements show +2 oxidation state except Sc (Sc = +3). Oxidation states first increases from Sc to Mn due to increase in number of unpaired electrons and then decreases because pairing takes place. Fe and Ni show zero oxidation state in metal carbonyls. The oxidation state of a metal in a solvent depends on the nature of the solvent, e.g. Cu^+ is unstable in aqueous solution and undergo disproportionation reaction. Low oxidation states are found if a complex compound has ligands capable of π-acceptor character and c-bonding, e.g. $Ni(CO)_4$ and $Fe(CO)_5$ the oxidation state of nickel and iron is zero in the pregence of CO as ligand.
Name the oxometal anion of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number.

264) Transition metals show a great variety of oxidation states in its compounds (variable valency) except the first and the last element. This is because of the fact that, the difference in the energy of (n - 1) d-electrons and ns-electrons is low which implies that electrons from both energy levels can take part in bonding. In 3d-series, all elements show +2 oxidation state except Sc (Sc = +3). Oxidation states first increases from Sc to Mn due to increase in number of unpaired electrons and then decreases because pairing takes place. Fe and Ni show zero oxidation state in metal carbonyls. The oxidation state of a metal in a solvent depends on the nature of the solvent, e.g. Cu^+ is unstable in aqueous solution and undergo disproportionation reaction. Low oxidation states are found if a complex compound has ligands capable of π-acceptor character and c-bonding, e.g. $Ni(CO)_4$ and $Fe(CO)_5$ the oxidation state of nickel and iron is zero in the pregence of CO as ligand.
Name the element showing maximum number of oxidation states among the first series of transition metals from Sc to Zn.

265) Transition metals show a great variety of oxidation states in its compounds (variable valency) except the first and the last element. This is because of the fact that, the difference in the energy of (n - 1) d-electrons and ns-electrons is low which implies that electrons from both energy levels can take part in bonding. In 3d-series, all elements show +2 oxidation state except Sc (Sc = +3). Oxidation states first increases from Sc to Mn due to increase in number of unpaired electrons and then decreases because pairing takes place. Fe and Ni show zero oxidation state in metal carbonyls. The oxidation state of a metal in a solvent depends on the nature of the solvent, e.g. Cu^+ is unstable in aqueous solution and undergo disproportionation reaction. Low oxidation states are found if a complex compound has ligands capable of π-acceptor character and c-bonding, e.g. $Ni(CO)_4$ and $Fe(CO)_5$ the oxidation state of nickel and iron is zero in the pregence of CO as ligand.
Name the element which shows only +3 oxidation state.

266) Potassium dichromate ($K_2Cr_2O_7$) is used in leather industry and acts as an oxidant for the preparation of many azo compounds. It is a crystalline ionic solid having bright, reddish orange colour. It is odourless with density around 2.67 g cm^{-3}. It is soluble in water and insoluble in alcohol, acetone, etc. Being highly water soluble, it is extensively used as an oxidising agent in organic chemistry.
Give the name and chemical formula of the ore from which potassium dichromate is prepared.

267) Potassium dichromate ($K_2Cr_2O_7$) is used in leather industry and acts as an oxidant for the preparation of many azo compounds. It is a crystalline ionic solid having bright, reddish orange colour. It is odourless with density around 2.67 g cm^{-3}. It is soluble in water and insoluble in alcohol, acetone, etc. Being highly water soluble, it is extensively used as an oxidising agent in organic chemistry.
Draw the structure of dichromate and chromate ions.

268) Potassium dichromate ($K_2Cr_2O_7$) is used in leather industry and acts as an oxidant for the preparation of many azo compounds. It is a crystalline ionic solid having bright, reddish orange colour. It is odourless with density around 2.67 g cm^{-3}. It is soluble in water and insoluble in alcohol, acetone, etc. Being highly water soluble, it is extensively used as an oxidising agent in organic chemistry.
What are the oxidation states of Cr in chromate and dichromate ion?

269) Potassium dichromate ($K_2Cr_2O_7$) is used in leather industry and acts as an oxidant for the preparation of many azo compounds. It is a crystalline ionic solid having bright, reddish orange colour. It is odourless with density around 2.67 g cm^{-3}. It is soluble in water and insoluble in alcohol, acetone, etc. Being highly water soluble, it is extensively used as an oxidising agent in organic chemistry.
Complete the following reaction:
$\mathrm{Na_2Cr_2O_7 + 2KCl \longrightarrow}$

270) Potassium dichromate ($K_2Cr_2O_7$) is used in leather industry and acts as an oxidant for the preparation of many azo compounds. It is a crystalline ionic solid having bright, reddish orange colour. It is odourless with density around 2.67 g cm^{-3}. It is soluble in water and insoluble in alcohol, acetone, etc. Being highly water soluble, it is extensively used as an oxidising agent in organic chemistry.
Give the uses of potassium dichromate ?

2 Marks 363 x 2 = 726

271) Why are Cr^{2+} reducing and Mn^{3+} oxidising when both have d^4 configuration?

272) Actinoid contraction is greater from element to element than lanthanoid contraction. Why?

273) Silver atom has completely filled d orbitals ($4d^{10}$) in its ground state. How can you say that it is a trasition element?

274) Name a transition element which does not exhibit variable oxidation states.

275) Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only?

276) Which of the 3d series of the transition metals exhibits the largest number of oxidation states and why?

277) Predict which of the following will be coloured in aqueous solution. Ti^{3+}, V^{3+}, Cu^{+}, Sc^{3+}, Mn^{2+}, Fe^{3+} and Co^{2+}. Give reason for each.

278) Which metal in the first series of transition metals exhibits +1 oxidation state most frequently and why?

279) The $E^{\ominus}\left(\mathrm{M}^{2+}/\mathrm{M}\right)$ value for copper is positive (+0.34 V). What is possibly the reason for this? (Hint: consider it's high $\Delta_a H^o$ and low $\Delta_{hyd} H^o$)

280) Name the oxometal anions of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number.

281) What may be the stable oxidation stateof the transition element with the following d electron configurations in the ground state of their atoms: $3d^3$, $3d^5$, $3d^8$ and $3d^4$?

282) Use Hund's rule to derive the electronic configuration of Ce^{3+} ion, and calculate its magnetic moment on the basis of 'spin-only' formula.

283) Write down the electronic configuration of :
(a) Cr^{3+}
(b) Cu^{+}
(c) Co^{2+}
(d) Mn^{2+}
(e) Pm^{3+}
(f) Ce^{4+}
(g) Lu^{2+}
(h) Th^{4+}

284) Explain briefly how +2 state becomes more and more stable in the first half of the first-row transition elements with increasing atomic number?

285) To what extent do the electronic configurations decide the stability of oxidation states in the first series of the transition elements? Illustrate your answer with examples.

286) In what way is the electronic configuration of the transition elements different from that of the non transition elements?

287) For M^{2+}/M and M^{3+}/M^{2+} system the $E^{\ominus}$ values for some metals are as follows:
Cr^{2+}/Cr -0.9 V Cr^{3+}/Cr^{2+} -0.4 V
Mn^{2+}/Mn-1.2 V Mn^{3+}/Mn^{2+}+1.5 V
Fe^{2+}/Fe -0.4 V Fe^{3+}/FE^{2+} +0.8 V
Use this data to comment upon:
(a) The stability of Fe^{3+} in acid solution as compared to that of Cr^{3+} or Mn^{3+} and
(b) The ease with which iron can be oxidised as compared to the similar process for either chromium or manganese metal.

288) How would you account for the irregular variation of ionisation enthalpies (first and second) in the first series of the transition elements?

289) Compare the stability of +2 oxidation state for the elements of the first transition series.

290) What are inner transition elements? Decide which of the following atomic numbers are the atomic numbers of the inner transition elements:
29, 59, 95, 102, 104.?

291) Calculate the number of unpaired electrons in following gaseous ions: Mn^{3+}, Cr^{3+}, V^{3+} and Ti^{3+}. Which one of these is the most stable in aqueous solution?

292) The chemistry of the actinoid elements is not so smooth as that of the lanthanoids. Justify this statement by giving some examples from the oxidation state of these elements.

293) Name the members of the lanthanoid series which exhibit +4 oxidation states and those which exhibit +2 oxidation states. Try to correlate this type of behaviour with the electronic configuration of these elements.

294) On what ground can you say that scandium (Z = 21) is a transition element but zinc (Z = 30) is not ?

295) For the first row transition metals, the E^o values are

E^o	V	Cr	Mn	Fe	Co	Ni	Cu
(M^{2+}/M)	-1.18	-0.91	-1.08	-0.44	-0.28	-0.25	+0.34

Explain the irregularity in the above values.

296) Why is the $E^{\ominus}$ values for Mn^{3+}/Mn^{2+} couple much more positive than for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+} ? Explain?

297) Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

298) What is meant by 'disproportionation' of an oxidation state? Give an example.

299) What are interstitial compounds? Why are such compounds well known for transition metals?

300) Why are Mn^{2+} compounds more stable than Fe^{2+} compounds towards oxidation to their +3 state ?

301) Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why ?

302) What is meant by 'disproportionation'? Give two examples of disproportionation reactions in aqueous solution.

303) What is lanthanoid contraction? What are the consequences of lanthanoid contraction?

304) Explain why Cu^+ ion is not stable in aqueous solution?

305) How would you account for the increasing oxidising power in the series $\mathrm{VO_2^+ < Cr_2O_7^{2-} < MnO_4^-}$?

306) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.

307) What are the different oxidation states exhibited by the lanthanoids?

308) Lanthanoids form primarily +3 ions, while the actinoids usually have higher oxidation states in their compounds, +4 or even +6 being typical. Give reason.

309) Most of the transition metal ions exhibit characterisitic in colours in aqueous solutions. Give reason.

310) Among landthanoids, Ln(III) compounds are predominant. however, occasionally in solutions or in solid compounds, +2 and +4 ions are also obtained. Give reason.

311) There is hardly any increase in atomic size with increasing atomic numbers in a series of transition metals. Give reason.

312) What is meant by 'lanthanoid contraction'?

313) Write the outer electronic configuration of Cr atom (Z=24).

314) Out of Cr^{2+} and $Cr^{3+,}$ which one is stable in aqueous solution?

315) Write the highest oxidation state shown by element with atomic number 23.

316) What is the highest oxidation state shown by Cr (Z=24)?

317) The d-electron configuration of Mn^{2+} and Ti^{2+} is d^5 and d^2 respectively. Which one of these ions will be more paramagnetic?

318) The electronic configuration of Co^{2+} and Cu^{2+} is d^7 and d^9 respectively, which of these ions is expected to be more paramagnetic?

319) What is the most stable oxidation state of Mn (Z=25)?

320) Which of the following ions is paramagnetic Sc^{3+} (Z = 21), Cu^+ (Z = 29)

321) Which trivalent cation is largest in the lanthanoid series?

322) In permanganate ion, all the bonds formed between Mn and O are covalent. Give reasons.

323) Why is Pt(IV) more stable than nickel (IV) stage?

324) Arrange the given in increasing order acidic character - Cro_3, Cro, Cr_2O_3.

325) Which is more stable Fe^{2+} or Fe^{3+} and why?

326) Arrange the following in increasing order of basic character: MnO, MnO_2, Mn_2O_7.

327) Why is $KMnO_4$ kept in dark bottles?

328) What happens when $KMnO_4$ is heated? Give chemical equation.

329) Explain why does colour of $KMnO_4$ disappear when oxalic acid is added to its solution in acidic medium?

330) Why does copper not replace hydrogen from acids?

331) Why first ionisation enthalpy of Cr is lower than that of Zn?

332) Transition elements show high melting points. Why?

333) When Cu^{2+} ion is treated with KI, a white precipitate is formed. Explain the reaction with the help of chemical equation.

334) Out of Cu_2Cl_2 and $CuCl_2$, which is more stable and why?

335) Altough fluorine is more electronegative than oxygen, but the ability of oxygen to stabilise higher oxidation states exceeds that of fluorine. Why?

336) Although Zr belongs to 4d and Hf belongs to 5d transition series but it is quite difficult to separate them. Why?

337) Although +3 oxidation states is the characteristic oxidation state of lanthanoids but cerium shows +4 oxidation state also. Why?

338) E^o of Cu is +0.34 V while that of Zn is -0.76 V. Explain.

339) Reactivity of transition elements decreases almost regularly from Sc to Cu. Explain.

340) What is lanthanoid contraction? What are the consequences of lanthananoid contraction?

341) How would you account for the following?
(i) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidising agent.
(ii) In a transition series of metals, the metal which exhibits the greatest number of oxidation states occurs in the middle of the series.

342) Explain the following observations giving an appropriate reason for each.
(i) There occurs much more frequent metal-metal bonding in compounds of heavy transition metals (i.e. 3rd series).
(ii) Mn^{2+} is much more resistant than Fe^{2+} towards oxidation.

343) Assign reasons for the following:
(i) Copper (I) ion is not known in aqueous solution.
(ii) Actinoids exhibit greater range of oxidation states than lanthanoids.

344) Explain giving a suitable reason for each of the following:
(i) Transition metals and their compounds are generally found to be good catalysts.
(ii) Metal-metal bonding is more frequent for the 4d and the 5d series transition metals than that for the 3d series.

345) State reasons for the following:
(i) Cu (I) ion is not stable in an aqueous solution.
(ii) Unlike Cr^{3+}, Mn^{2+}, Fe^{3+} and the subsequent other M^{2+} ions of the 3d series of elements, the 4d and the 5d series metals generally do not form stable cationic species.

346) Explain giving reasons:
(i) transition metals and their compounds generally exhibit a paramagnetic behaviour.
(ii) The chemistry of actinoidsis not so smooth as that of lanthanoids.

347) Assign reasons for each of the following :
(i) Transition metals generally form coloured compounds.
(ii) Manganese exhibits the highest oxidation state of +7 among the 3d series of transition elements.

348) Complete the following chemical equations:
(i) $MnO_4^-(aq)+C_2O_4^{2-}(aq)+H^+(aq) \rightarrow$
(ii) $Cr_2O_7^{2-}(aq) + Fe^{2+}(aq) +H^+(aq) \rightarrow$

349) Explain the following observations:
(i) Generally there is an increase in density of elements from titanium (Z = 22) to copper (Z = 29) in the first series of transition elements.
(ii) Transition elements and their compounds are generally found to be good catalysts in chemical reactions.

350) Explain the following observations:
(i) Transition elements generally form colored compounds.
(ii) Zinc is not regarded as a transition element.

351) Describe the preparation of
(i) Potassium dichromate from sodium chromate and
(ii) $KMnO_4$ from K_2MnO_4.

352) Give reasons for the following observations:
(i) Mn(II) ion shows maximum paramagnetic character amongst the bivalent ions of first transition series.
(ii) Scandium (At. no. 21) salts are white.

353) State reasons for the following observations:
(i) The enthalpies of atomisation of transition elements are quite high.
(ii) There is a greater horizontal similarity in the properties of the transition elements than of the main group elements.

354) Write complete chemical equations for:
(i) Oxidation of Fe^{2+} by $Cr_2O_7^{2-}$ in acid medium.
(ii) Oxidation of $S_2O_3^{2-}$ by MnO_4^- in neutral aqueous medium.

355) Compare the relative stability of +2 oxidation states in aqueous solutions for the metals having in their atoms the outer electron configurations, $3d^3$, $4s^2$, $3d^6$ $4s^2$ and $3d^5$ $4s^2$.

356) Explain any one of the following statements:
(i) The transition metals are well-known for the formation of interstitial compounds.
(ii) The largest number of oxidation states are exhibited by manganese in the first series of transition elements.

357) Answer the following questions:
(i) Which element in the first series of transition elements does not exhibit variable oxidation states and why?
(ii) Why do actinoids, in general, exhibit a greater range of oxidation states than the lanthanoids?

358) Write chemical equations for the reactions involved in the manufacture of potassium permanganate from pyrolusite ore.

359) Why is the +2 oxidation state of manganese quite stable, while the same is not true for iron? [Mn = 25, Fe = 26]

360) What is misch metal? Mention its two important uses.

361) What is meant by 'lanthanoids contraction'? State one use each of lanthanoid metals and their oxides.

362) Describe the steps involved in the preparation of either potassium dichromate from sodium chromate or potassium permanganate from manganese dioxide.

363) What are interstitial compounds ? Why are such compounds well known for transition metals?Small atoms like C, H, N, B get fit into voids resulting in formation of interstitial compounds. Transition metals have voids, therefore, they form interstitial compounds.

364) Why E^o values for Mn, Ni and Zn are more negative than expected?

365) Although Cr^{3+} and Co^{2+} ions have same number of unpaired electrons but the magnetic moment of Cr^{3+} is 3.87 B.M. and that of $Co^{2+}$is 4.87 B.M. Why?

366) Ionisation enthalpies of Ce, Pr and Nd are higher than Th, Pa and U. Why?

367) Which filling up of electrons in the atomic orbitals, the 4s orbital is filled before the 3d orbitals, but reverse happens during the ionisation of the atom. Explain why?

368) Mention the type of compounds formed when small atoms like H, C and N get trapped inside the crystal lattice of transition metals. Also give physical and chemical characteristics of these compounds.

369) The only metal which has a positive standard reduction potential in the first transition series is ..... .

370) Though copper, silver and gold have completely filled sets of d-orbitals yet they are considerde as transition metals. Why ?

371) Name the elements which are not really transition elements but are discussed with them. Why is it so ?

372) Explain why transition elements have many irregularities in their electronic configuration.

373) Explain why Fe is a transition metal but Na is not ?

374) Why is there striking similarities (horizontal and vertical) in successive members of the transition series ?

375) Why do the transition metal ions have high enthalpy of hydration ?

376) Why the properties of third transition series are very similar to second transition series? Or Why the second and third members in each group of the transition elements have very similar atomic radii ?

377) Chromium is a typical hard metal while mercury is a liquid. Explain why ?

378) The melting and boiling points of Zn,Cd and Hg are low . Why Zn,Cd and Hg are soft and have low m.pt. ?

379) The second ionisation enthalpies of both Cr and Cu are higher than those of the next element . Explain.

380) K_2PtCl_6 is a well known compound whereas corresponding Ni Compound is not known. State a reason for it.

381) Most of the transition metals do not displaced hydrogen from dilute acids. Why ?

382) The E^o values in respect of the electrodes of chromium (Z = 24) manganese (Z = 25) and iron (Z = 26) are : $Cr^{3+}/Cr^{2+} = -0.4V, Mn^{3+}/Mn^{2+} = +1.5V, Fe^{3+}/Fe^{2+} = +0.8V.$ On the basis of the above information compare the feasibilities of furthur oxidation of their +2 oxidation states.

383) Why do transition elements show variable oxidation states ?

384) How would you account for the following ?
Among lanthanoids, Ln (III) compounds are predominant. However, occasionally in solutions or in the solid compounds, +2 and +4 ions are also obtained.

385) How would you account for the fact that the transition metals and their compounds are found to be good catalyst in many process ?

386) Why generally there is an increase in density of elements from titanium (Z = 22) to copper (Z = 29) in the first series of transition elements.

387) Giving reasons indicate which one of the following would be coloured ?
Cu^+, VO^{2+}, Sc^{3+} , Ni^{2+} (At. Nos. Cu = 29, V = 23, Sc = 21, Ni = 28]

388) Scandium forms no coloured ions, yet it is regarded as a transition element. Explain why ?

389) A substance is found to have a magnetic moment of 3.9 B.M. How many unpaired electrons does it contain ?

390) The paramagnetic character in 3d transition series elements increases upto Mn and then decreases. Explain why.

391) (a) Of the ions Ag^+,Co^{2+} and Ti^{4+} , which one will be coloured in aqueous solutions? (Atomic nos : Ag = 47, Co = 27, Ti = 22).
(b) If each one of the above ionic species is in turn placed in a magnetic field, how will it respond and why?

392) Why are the ionization energies of 5d elements greater then 3d elements?

393) Describe giving reason which one of the following pairs has the property indicated ?
(i) Fe or Cu has higher melting point.
(ii) Co^{2+} or Ni^{2+} has lower magnetic moment.

394) Give reasons for the following features of transition metal chemistry :
(i) The lowest oxide of a transition metal (say, chromium, atomic number 24) is basic wheares the highest oxide is usually acidic.
(ii) Transition metals sometimes exhibit very low oxidation states such as +1 and 0.

395) The 4d and 5d series of transition metals frequent metal - metal bonding in their compounds than do the 3 d metals. Explain.

396) Assign reason for each of the following statements :
(i) The largest number of oxidation states are exhibited by the elements in the middle of the first row transition elements.
(ii) The atomic radii decrease in size with the increasing atomic number in the lanthanoid series.

397) (i) Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why?
(ii) Explain why Cu^{+} ion is not stable in aqueous solution?
(iii) Explain why Ce^{4+} is a stronger oxidizing agent.

398) Explain why Zn shows only +2 oxidation state.

399) Give the relationship between the equivalent weight and molecular weight of $KMnO_4$ in
(a) acidic
(b) alkaline and
(c) neutral media.

400) Why is it not advisable to dissolve $KMnO_4$ in conc. H_2SO_4?

401) Why in permaganate ion, there is a covalency between Mn and oxygen?

402) The +3 oxidation states of lanthanum (Z = 57), gandolinium (Z = 64) and lutetium (Z = 71) are especially stable. Why ?

403) Why Zr and Hf or Nb and Ta exhibit similar properties ? Or Zirconium (atomic number 40) and hafnium (atomic number 72) occur together in minerals and they exhibit similar properties. Give reasons.

404) Why Sm^{2+}, Eu^{2+}, and Yb^{2+} ions in solutions are good reducing agents but an aqueous solution of Ce^{4+} is a good oxidizing agent ?

405) One among the lanthanides, Ce (III), can be easily oxidized to Ce (IV) (At.No of Ce = 58). Explain why?

406) Account for the following :
(i) Oxidizing power in the series : $VO^{2+} < Cr_2O_7^{2-} < MnO_4^-$
(ii) Actinoid contraction is greater from element to element than lanthanoid contraction.
(iii) Oxoanions of a metal show higher oxidation states.

407) Account for the following :
(a) Europium (II) is more stable than cerium (II).
(b) Transition metals have high enthalpies of atomisation.
(c) Actioid ions are generally coloured.

408) Why are transition elements so named ?

409) Why are transition elements known as d - block elements?

410) How many elements are present in the d - block of the periodic table ?

411) How many transition series of elements are there in the periodic table ? Name them

412) Write the general electronic configuration of transition elements or d - block elements.

413) Why does a transition series contain 10 elements ?

414) Zinc, cadmium and mercury are generally not considered as transition metals, Give reasons .

415) Which out of the following is/are transition elements and why? Zn, Ag, Cd, Au.

416) Name the element in the 3d series that
(i) shows maximum oxidation state
(ii) is diamagnetic.

417) What is the common oxidation state of Cu, Ag and Au ?

418) Why does vanadium pentoxide act as a catalyst ?

419) Which divalent metal ion has maximum paramagnetic character among the first transition metals ? Why?

420) What do you mean by 18 carat gold?

421) Which elements are called ferrous metals ?

422) Which elements are called platinum metals ?

423) What are coinage metals ? Why are they so called?

424) Complete the following reaction : $(NH_4)_2Cr_2O_7 \xrightarrow{Heat}$ _____.

425) Name one ore each of manganese and chromium.

426) Why $KMnO_4$ is used in cleaning surgical instruments in hospitals ?

427) Write the electronic configuration of Gadolinium (Z = 64) and its most stable oxidation state.

428) Which is the most common oxidation contraction ?

429) What is meant by lanthanoid contraction ?

430) Why is the separation of lanthanoide elements difficult ?

431) Explain why lanthanoids are paramagnetic in nature ?

432) Give the general electronic configuration of Actinides.

433) Write the electronic configuration of the element with atomic number 102.

434) What is the maximum oxidation state shown by actinides?

435) What are transition elements ? Write two characteristics of the transition elements.

436) Why do transition elements exhibit the tendency for complex formation ? Explain with suitable examples.

437) Explain:
(a) transition metals act as catalysts
(b) Chromium group elements have the highest melting points in their respective series
(c) transition metals form coloured complexes.

438) What happens when
(i) $KMnO_4$ is heated
(ii) $K_2Cr_2O_7$ is heated.

439) What is lanthanide contraction ? What is its cause and what is its cause and what are its consequences ?

440) Write a note on lanthanoid contraction.

441) What is Misch metal ? Give its one use.

442) How would you account for the following ?
(i) Many of the transition elements and their compounds can act as good catalysts.
(ii) The metallic radii of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second series.

443) Zr (Z = 40) and Hf (Z = 72) have almost identical radii.
There is a greater range of oxidation states among the actinoids than among the lanthanoids

444) Why in any transition series, melting points first increase and then decrease and also they show a dip in the middle ?

445) Why hydrated copper sulphate is blue while anhydrous copper sulphate is white ?

446) Atomic radius of Cu is greater than that of Cr but ionic radius of Cr^{2+} is greater than that of Cu^{2+} . Give suitable explanation.

447) Give reasons for the following : Variations in the radii of transition elements are not as pronounced as those of representative elements.

448) Explain why mercury (I) ion exists as Hg_2^{2+} ion while copper (I) ion exists as Cu^+ ion.

449) A mixed oxide of iron and chromium, FeO. Cr_2O_3 , is fused with sodium carbonate in presence of air to form a yellow coloured compound (A). On acidification, the compound (A) forms an orange coloured compound (B) which is a strong oxidizing agent. Identify
(i) the compounds (A) and (B)
(ii) Write balanced chemical equations for each step.

450) (a) A blackish brown coloured solid 'A' when fused with alkali metal hydroxides in presence of air, produces a dark green coloured compound 'B', which on electrolytic oxidation in alkaline medium gives a dark purple coloured compound C. Identify A,B and C and write the reactions involved.
(b) What happens when an acidic solution of the green compound (B) is allowed to stand for some time ? Give the equation involved. What is this type of reaction called ?

451) In what way do the d - block metals differ from alkali and alkaline earth metals ?

452) Explain why transition elements have irregularities in their electronic configuration.

453) Why is +2 oxidation state of manganese quite stable while the same is not true for iron ?

454) (a) Why to transition elements show variable oxidation states ?
(b) The paramagnetic character in 3d transition series elements increases upto Mn and ten decreases. Explain why.
(c) Explain why Cu^+ ion is not stable in aqueous solution ?

455) Why d^1 configuration is very unstable in ions ?

456) Explain giving reason :
(i) Transition metals and many of their compounds show paramagnetic behaviour.
(ii) The enthalpies of atomisation of the transition metals are high
(iii) The transition metals generally form coloured compounds.
(iv) Transition metals and their many compounds act as good catalyst.
(v) Transition metals form interstial compounds.

457) How would you account for the following?
Cobalt (III) is stable in aqueous solution but in the presence of complexing reagents, it is easily oxidized.

458) Out of $[Sc(H_2O)_6]^{3+}$ and $[Ti(H_2O)_6]^{3+}$ ions which is coloured and why? Give reason.

459) Copper (I) compounds are white and diamagnetic while copper (II) compounds are coloured and paramagnetic and form coloured compounds. Explain.

460) Which of the two : V (IV) or V(V) is paramagnetic ? Give reasons.

461) (a) Give the relationship between the equivalent weight and molecular weight of $KMnO_4$ in
(i) acidic
(ii) alkaline and
(iii) neutral media.(b) In the titration of Fe^{2+} ions with $KMnO_4$ in acidic medium, why dilute H_2SO_4 is used and not dilute HCl ?
(c) Why is it not advisable to dissolve $KMnO_4$ in conc. H_2SO_4 ?

462) (a) Briefly explain why electronic configurations of lanthanoids are not known with certainty.
(b) The +3 oxidation states of lanthanum (Z = 57), gadolinium (Z = 64) and lutetium (Z = 71) are especially stable. Why ?

463) Why Sm^{2+}, Eu^{2+} and Yb^{2+} ions in solutions are good reducing agents but an aqueous solution of Ce^{4+} is a good oxidizing agent ?
(b) Which out of the two, La $(OH)_3$ and $Lu(OH)_3$ is more basic and why ?
(c) Why is the separation of lanthanide elements difficult ?

464) What are alloys ? Name an important alloy which contains some of the lanthanoid metals. Mention its uses.

465) How would you account for the following?
(a) Actinoids exhibit a larger number of oxidation states than the corresponding lanthanoids?
(b) Actinoids form a larger number of complexes than lanthanoids
(c) Actinoids contraction is greater from element to element than lanthanoid contraction. Why ?

466) (a) How would you account for the irregular variation of ionization enthalpies (first and second) in first series of the transition elements?
(b) Unlike Cr^{3+}, Mn^{2+}, Fe^{3+} and the subsequent M^{3+} ions 3d series of elements, the 4d and 5d series metals generally do not form stable cationic species. Why ?
(c) The outer electronic configurations of to members of the lanthanoid series are as follows:
$4f^15d^16s^2 \ and \ 4f^75d^06s^2$

467) What are their atomic numbers? Predict the oxidation states exhibited by these elements in their compounds.

468) The second and third rows of transition elements resemble each other much more than they resemble the first row. Explain why?

469) Write a balanced equation for the reaction of chromite ore with sodium carbonate in the presence of air.

470) What is the action of heat on potassium dichromate?

471) Which of the following do you expect to be coloured and why: Cr^+ or Cu^+ ?

472) Why is copper sulphate pentahydrate coloured?

473) Cooper (I) compounds are white and diamagnetic while copper (II) compounds are coloured and paramagnetic. Why?

474) Which divalent metal ion has maximum paramagnetic character among the first transition metals? Why?

475) How many water molecules are involved in coordination in $CuSO_45H_2O$?

476) What are different oxidation states exhibited by lanthanoids?

477) Which trivalent ion has maximum size in lanthanoid series?

478) Why are Zn^{2+} salts colourless while Ni^{2+} salts are coloured ?

479) K_2PtCI_6 is known but Ni compound is not known. State a reason for it.

480) The standard reduction potentials of Co^{2+} and Co^{3+} are $-0.28V$ and $1.8V$ respectively. Which should be a better oxidising agent in water: Co^{2+} or ?Co^{3+}

481) What is the most common form of chromium in basic solution? What ion forms when a basic solution? What ion forms when a basic solution of chromium is acidified?

482) What is meant by lanthanoid contraction?

483) Explain the behaviour of dichromate and chromate ions in acidic and alkaline solutions.

484) Give two examples showing oxidising character of acidified $KMnO_4$.

485) What is the paramagnetism? Which of the two: V (IV) or V (V) is paramagnetic? Give reasons (At. No. of V=23).

486) Transition metals form alloys with other transition metals. Explain.

487) Explain: Transition metals have high melting and boiling points.

488) Name of the following:
(i) Divalent ion of first transition series having maximum magnetic moment.
(ii) Coloured ion out of Cu^{+} or Cu^{2+} .
(iii) Two ions of first transition series having zero dipole moment.

489) Complete the following reaction equations:
(i) $Cr_2O_7^{2-} + Sn^{2+} + H^{+} \longrightarrow$
(ii) $MnO_4^{-} + Fe^{2+} + H^{+} \longrightarrow$

490) Among the lanthanides, Ce (III) can be easily oxidized to Ce (IV). (At. No. of Ce=58)

491) Why is europium (II) more stable than cerium (II)?

492) Chemistry of all lanthanoids is so identical. Explain.

493) Give important differences between lanthanoids and actinoids.

494) Why are Ni^{2+} compounds thermodynamically more stable than Pt^{2+} compounds while Pt^{4+} compounds are relatively more stable than Ni^{4+} compounds?

495) Write the preparation (chemical equation only) of:
(i) Potassium dichromate from chromite
(ii) $KMnO_4$ from pyrolusite.

496) Why are the ionisation enthalpy of $5d$ -elements greater than $3d$ -elements?

497) Account for the following:
(i) Zirconium and Hafnium exhibit almost similar properties.
(ii) Zinc salts are white while Cu^{2+} salts are coloured.

498) How would you account for the following?
(i) Cobalt (III) is stable in aqueous solution but in the presence of complexing reagents, it is easily oxidised.
(ii) The transition elements exhibit high enthalpy of atomization.
(iii) Of the d^4 species, Cr^{2+} is strongly reducing while manganese (III) is strongly oxidizing.

499) Complete the following chemical reaction equations:
(i) $MnO_4^{-}(aq) + C_2O_4^{2-}(aq) + H_{+}(aq) \longrightarrow$
(ii) $Cr_2O_7^{2-}(aq) + Fe^{2+}(aq) + H^{+}(aq) \longrightarrow$

500) Describe the trends in the following properties of the first series of the transition elements:
(i) Oxidation states
(ii) Atomic sizes
(iii) Magnetic behaviour of dispositive gaseous ions (M^{2+}) .

501) State reasons for the following:
(i) (Cu (I) is not stable in aqueous solution.
(ii) Unlike Cr^{3+}, Mn^{2+}, Fe^{3+} and the subsequent other M^{2+} ions of the $3d$ series of the elements, the $4d$ and the $5d$ series metals generally do not form stable atomic species.

502) How would you account for the following?
(i) Many of the transition elements are known to form interstitial compounds.
(ii) The metallic radii of the third (5d) series of transition metals are virtually the same as those of the corresponding group members of the second $(4d)$ series.
(iii) Lanthanoids from primarily +3, while the actinoids usually have higher oxidation states in their compounds, +4 or even +6 being typical.

503) How would you account for the following:
(i) With the same d-orbital configuration $(d^4)Cr^{2+}$ is a reducing agent while Mn^{3+} is an oxidizing agent.
(ii) The actinoids exhibit a larger number of oxidation states than the corresponding members in the lanthanoid series.
(iii) Most of the transition metal ions exhibit characteristic in colours in aqueous solutions.

504) Explain the following observations giving an appropriate reason for each.
(i) The enthalpies of atomization of transition elements are quite high.
(ii) There occurs much more frequent metal-metal bonding in compounds of heavy transition metals (i.e., 3rd series)
(iii) Mn^{2+} is much more resistant than Fe^{2+} towards oxidation.

505) Complete the following chemical reaction equations:
(i) $Cr_2O_7^{2-} + I + H^+ \longrightarrow$
(ii) $MnO_4^- + NO_2^- + H^+ \longrightarrow$

506) How would you account for the following?
(i) The $E^\circ_{M^{2+}/M}$ for copper is positive (0.34 V). Copper is the only metal in the first series of transition elements showing this behaviour.
(ii) The metallic radii of the third (5d) series of transition metals are nearly the same as those of the corresponding members of the second series.

507) Explain the following observations:
(i) Many of the transition elements are known to form interstitial compounds.
(ii) There is a general increase in density from titanium (Z = 22) to copper (Z = 29).
(iii) The members of the actioned series exhibit a larger number of oxidation states than the corresponding members of the lanthanoid series.

508) Explain the following observations:
(i) With the same d-orbital configuration (d^4), Cr^{2+} is a reducing agent while Mn^{3+} is an oxidising agent.
(ii) Actinoids exhibit a much larger number of oxidation states than the lanthanoids.
(iii) There is hardly any increase in atomic size with increasing atomic numbers in a series of transition metals.

509) (a) Which metal in the first transition series (3d series) exhibits +1 oxidation state most frequently and why?
(b) Which of the following cations are coloured in aqueous solutions and why?

510) How would you account for the following:
(i) Transition metals exhibit variable oxidation states.
(ii) Zr (Z = 40) and Hf (Z = 72) have almost identical radii.
(iii) Transition metals and their compounds act as catalyst.

511) Complete the following chemical equations:
(i) $Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \longrightarrow$
(ii) $2CrO_4^{2-} + 2H^+ \longrightarrow$
(iii) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow$

512) (a) How would you account for the following:
(i) Actinoid contraction is greater than lanthanoid contraction.
(ii) Transition metals form coloured compounds.
(b) Complete the following equations:
$2MnO_4^- + 6H^+ + 5NO_2^- \longrightarrow$

513) What are the transition elements? Write two characteristics of the transition elements.

514) Why do the transition elements have higher enthalpies of atomisation? In 3d series (Sc to Zn), which element has the lowest enthalpy of atomisation and why?

515) (a) How would you account for the following.
(i) The chemistry of actinoids is more complicated as compared to lanthanoids.
(ii) Transition metals form complex compounds.
(b) Complete the following equation:
$2MnO_4^- + 6H^+ + 5SO_2^{2-} \longrightarrow$

516) When chromite ore $FeCr_2O_4$ is fused with $NaOH$ in presence of air, a yellow-colored compound (A) is obtained, which on acidification with dilute sulphuric acid gives a compound (B). compound (B) on the reaction with KCl forms an orange coloured crystalline compound (C).
(i) Write the formulae of the compounds (A), (B) and (C).
(ii) Write one use of compound (C).

517) Complete the following chemical equations:
(i) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow$
(ii) $Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ \longrightarrow$

518) Give reasons:
(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine, it shows the highest oxidation state of +4.
(ii) Transition metals show variable oxidation states.
(iii) Actinoids show irregularities in their electronic configurations.

519) Complete the following reaction equations:
(i) $Cr_2O_7^{2-} + Sn^{2+} + H^+ \longrightarrow$
(ii) $MnO_4^- + Fe^{2+} + H^+ \longrightarrow$

520) Which out of $Lu(OH_3)$ and $La(OH)_3$ is more basic and why?

521) Explain as to why the E^Θ value for the $Mn^{3+}|Mn^{2+}$ couple is much more positive than that for $Cr^{3+}|Cr^{2+}$ or $Fe^{3+}|Fe^{2+}$.

522) Account for the following:
(i) Zirconium and hafnium exhibit almost similar properties.
(ii) Zinc salts are white while Cu^{2+} salts are coloured.

523) Explain the following observation:
Most of the transition metal ions exhibit characteristic colour in aqueous solution.

524) Name the following:
(i) A transition metal which does not exhibit variation in oxidation state in its compounds.
(ii) A compound where the transition metal is in the +7 oxidation state.
(iii) A member of the lanthanoid series which is well known to exhibit +4 oxidation state.
(iv) Ore used in the preparation of Potassium dichromate.

525) Give reasons:
(i)Zn is not regarded as a transition element.
(ii) Cr^{2+} is a strong reducing agent.

526) Explain the following observation the members of the actinoid series exhibit a large number of oxidation state than the corresponding members of the lanthanoid series.

527) Write one similarity and one difference , between the chemistry of lanthanoids and actinoides?

528) Write the formula of an oxo-anion of manganese (Mn) in which it shows the oxidation state equal to its group number.

529) Write IUPAC name of the following compound: $(CH_3)_2N - CH_2CH_3$.

530) Transition metals are much harder than the alkali metals. Why?

531) SC(21), is a transition element but Ca(20) is not. Why?

532) Compounds of transition elements are often coloured.Why?

533) Cr^{2+} is a strong reducing agent whereas Mn^{3+} with the same (d^4) configuration is an oxidising agent. Give reason.

534) Though a transition element, scandium (Z = 21) does not exhibit variable oxidation states. Give reason.

535) Why do transition elements show variable oxidation states? In 3d series (Sc to Zn), which element shows the maximum number of oxidation states and why?

536) Assign a reason for each of the following observations:
(i) The transition metals (with the exception of Zn, Cd and Hg) are hard and have high melting and boiling points.
(ii) The ionisation enthalpies (first and second) in the first series of the transition elements are found to vary irregularly.

537) The enthalpy of atomisation is lowest for Zn in first series (3d) of the transition elements.

538) Describe the general trends in the following properties of the first series (3d) of the transition elements:
(i) Number of oxidation states exhibited.
(ii) Formation of oxo metal ions

539) Assign reasons for the following:
(i) Copper (I) ion is not known to exist in aqueous solutions.
(ii) Both O_2 and F_2 stabilise high.oxidation states of transition metals but the ability of oxygen to do so exceeds that of fluorine

540) Assign reasons for the following:
(i) Transition metals and many of their compounds act as good catalysts.
(ii) Transition metals generally form coloured compounds.

541) How would you account for the following?
(i) The highest oxidation state of a transition metal is usually exhibited in its oxide.
(ii) The oxidising power of the following three oxo-ions in the series follows the order:

542) Complete the following reactions in the aqueous medium:
$(i) MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow$
$(ii) Cr_2O_7^{2-} + H_2S + H^+ \longrightarrow$

543) Complete the following chemical equations:
$(i) Fe^{3+} + I^- \longrightarrow$
$(ii) CrO_4^{2-} + H^+ \longrightarrow$

544) Write balance chemical equations of two reactions in which KMn04 acts as an oxidising agent in the acidic medium.

545) Explain the following observations:
(i) Among the divalent cations in the first series of transition elements, manganese exhibits the maximum paramagnetism.
(ii) Cu^+ ion is not known in aqueous solutions.

546) Account for the following:
(i) In the series Sc to Zn, the enthalpy of atomisation of zinc is the lowest.
(ii) EO value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+}.

547) Complete the following chemical equations:
$(i) Cr_2O_7^-(aq) + C_2O_4^{2-}(aq) + H^+(aq) \longrightarrow$
$(ii) MnO_4^-(aq) + Fe^{2+}(aq) + H^+(aq) \longrightarrow$

548) The chemistry of actinoids is not so smooth as that of lanthanoids. Give reason.

549) Unlike Cr^{3+}, Mn^{2+}, Fe^{3+} and the subsequent other V^{2+} ions of 3d series of elements, the 4d and 5d series do not form cationic species. Give reason.

550) La^{3+} (Z = 57) and Lu^{3+} (Z = 71) do not show any colour in solutions. Give reason.

551) There is a close similarity in physical and chemical properties of the 4d and 5d-series of the transition elements, much more than expected on the basis of usual family relationship.

552) The gradual decrease in size (actinoid contraction) from element to element is greater among the actinoids than that among the lanthanoids (lanthanoid contraction).

553) Account for the following:
There are irregularities in the electronic configuration of actinoids.

554) Account for the following:
The second and third series members in each group of the transition elements have very similar atomic radii.

555) What is lanthanoid contraction? What are its two consequences?

556) What is lanthanoid contraction? List any two consequences of lanthanoid contraction.

557) What is lanthanoid contraction? What is its effect on the chemistry of the elements which follow the lanthanoids?

558) Transition elements exhibit their highest oxidation state in their oxides not in Flourides. Why?

559) Explain why, Zn (II) salts are white while Mn (VII) are deep purple in colour?

560) $KMnO_4$ is used in acidic medium quite frequently than in its aqueous or alkali for oxidizing purpose. Why?

561) Give reasons:
i) Zr and Hf have identical sizes
ii) In the titration of $FeSO_4$ with $KMnO_4$ in the acidic medium dil. H2SO4 is used instead of dil HCl.

562) Calculate the spin only magnetic moment of Iron present in the following compound.
$[Fe(H_2O)5NO]^{2+}$

563) $K_2[PtCl_6]$ is a well known compound whereas the corresponding Ni compound is not known. State the reason for it.

564) Among the ionic species Sc^{3+}, Ce^{4+} and Eu^{2+} Which one is a good oxidizing agent?

565) Why are Fe^{3+} and Cu^{2+} prominent in their aqueous solutions?

566) There is a dip in the melting point curve at Mn, though the preceding element also has similar electronic configuration. Why?

567) CrO_3 is an acid anhydride. Explain.

568) Though both Cr^{2+} and Mn^{3+} have d4 configuration, yet Cr^{2+} is reducing and Mn^{3+} is oxidizing. Explain Why?

569) Write down the general electronic configuration of transition elements.

570) Name the element which shows outer electronic configuration $3d^24s^2$.

571) What are interstitial compounds?

572) The $E^0_{M^{2+}/M}$ value of copper is positive (+ 0.34 V). What is the possible reason for this?

573) Which transition metal of the 3d-series has positive $E^0_{M^{2+}/M}$ value and why?

574) Name the two transition elements which have abnormal electronic configuration and why?

575) Explain the following observations:
(i) Copper atom has completely filled d orbitals ($3d^{10}$)in its ground state, yet it is regarded as a transition element .
(ii) $Cr^{2+}$is a stronger reducing agent than Fe^{2+}in aqueous solutions.

576) Explain, why density of transition elements increases from left to right in a period?

577) Explain, why oxidation states of transition elements first increases from Sc to Mn and then decreases?

578) What happens when dichromate ion is dissolved in alkali?

579) Write the formula of compound in which transition metal is in +7 oxidation state.

580) Complete the following equations.
$(i)2CrO_4^{2-} + 2H^+ \longrightarrow (ii)KMnO_4 \qquad \xrightarrow{Heat}$

581) $Cr_2O_7^{2-} \xrightarrow{H^+} Cr^{3+}; \quad E^\circ RP = +1.33\ V$
$MnO_4^- \xrightarrow{H^+} Mn^{2+}; E^\circ RP = +1.51\ V$
What can you assert about the nature of $KMnO_4$ and $K_2Cr_2O_7$?

582) Complete and balance the following chemical equations:
$(a)Fe^{2+} + MnO_4^- + H^+ \rightarrow$
$(b)MnO_4^- + H_2O + I^- \rightarrow$

583) Write down the electronic configuration of gadolinium (Gd). Its atomic number is 64.

584) Name the elements which are used for the synthesis of transuranic elements.

585) What are the uses of mischmetal?

586) Explain the large difference in melting point of Cr (1920°C)and Zn(420° C)

587) Why does copper metal not replace hydrogen from acid?

588) Why are the E^0 values of Mn, Zn more negative than expected?

589) The atomic size of Fe, Co and Ni are nearly same. Explain with reason.

590) Why Zn^{2+}salts are white while Ni^{2+}salts are blue?

591) Out of $[Sc(H_2O)_6]^{3+}$and $[Ti(H_2O)_6]^{3+}$ions, which is coloured and why? Give reason.

592) What factors led to the appearance of colour in the transition elements?

593) In chromic acid, (CrO_3), Cr has d^O configuration but it is bright orange coloured solid, why?

594) Draw the structures of manganate ion and permanganate ion.

595) Write the formula of compound in which transition metal is in +6 oxidation state.

596) Why there is striking similarities (horizontal and vertical) among successive members of the transition series?

597) Why fluorine is stabilises in low oxidation states of transition metals?

598) (i) In the titration of Fe^{2+}ions with KMn04 in acidic medium, dil. H_2SO_4 is used but not the dil. HCl Why?
(ii) Arrange the following oxides of Mn in the order of their decreasing acidic nature.
MnO, Mn_2O_3' Mn_3O_4, MnO_2,Mn_2O_7.

599) (i) Why Cu^{2+}salts are colourless, while Cu^{2+}salts are coloured?
(ii) The elements of d-series exhibit a larger number of oxidation states than the elements of f-series. Explain.

600) What happens when
(i) H_2S reacts with acidified $K_2Cr_2O_7$ solution?
(ii) ethanol is oxidised with acidified $K_2Cr_2O_7$ solution?

601) Which oxidation state is common for all lanthanoids?

602) Name one amphoteric oxide.

603) Name the transition metal which does not exhibit variation in the oxidation of in its compounds.

604) Given the number of unpaired electrons present CO^{2+}.

605) Name the element that forms MF_3 type compounds.

606) Name the major product form when potassium permanganate heated strongly.

607) Which element of the first transition series has highest second ionisation enthalpy?

608) What is the highest oxidation state shown by the element with atomic number 23?

609) write the formula of a compound where transition metal is in +7 oxidation state.

610) On what ground can you say that scandium (Z = 21) is a transition element but zinc (Z = 30) is not?

611) What is the lattice structure of Tc?

612) Density of d-block elements is quite high. Why?

613) Ni(II) compounds are thermodynamically more stable than Pt(II) compounds. Why?

614) Why do transition metals show variable oxidation states?

615) Why the value of standard electrode potentials (E^o) for Ni is more negative?

616) Which type of magnetic behaviour is generally shown by transition elements?

617) What is the colour of Mn^{2+} ions in aqueous solution?

618) Name two complex compounds formed by transition metals.

619) Name a catalyst used in contact process.

620) Write any two interstitial compounds.

621) Give two physical properties of aUoy formed by transition metals.

622) What is the geometry of chromate ion?

623) How will you convert Fe^{3+} ion (yellow) from Fe^{2+} ion (green)? Write chemical reaction equation.

624) Complete the following equations:
(i) $2MnO_4^- + 5NO_2^- + 6H^+ \longrightarrow$
(ii) $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow$

625) State reasons for the following:
(i) Actinoids exhibit greater range of oxidation states than lanthanoids.
(ii) Unlike Cr^{3+}, Mn^{2+}, Fe^{3+} and the subsequent other M^{2+} ions of the 3d series of elements, the 4d and the 5d series metals generally do not form stable cationic species.

626) Why do the transition metals have higher enthalpy of atomisation? In 3d series (Sc to Zn), which element has lowest enthalpy of atomisation and why?

627) How would you account for the following?
(i) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4), Mn^{3+} is an oxidising agent.
(ii) Name the element showing maximum number of oxidation states among the first series of transition metal Sc (21) to Zn (30)

628) Complete the following equations
(i) $2MnO_4^- + 5SO_3^{2-} + 6H^+ \longrightarrow$
(ii) $2CrO_4^{2-} + 2H^+ \longrightarrow$

629) State reasons for the following observations:
(i) Ti^{4+} is colourless whereas V^{4+} is coloured in an aqueous solution.
(ii) There is a greater horizontal similarity in the properties of the transition elements than of the main group elements.

630) Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

631) Name a lightest and heaviest transition metal.

632) What is the magnetic nature of Hg^+?

633) Name an element of lanthanoid series which is well known to shown +4 oxidation state. Is it a strong oxidising agent or reducing agent?

3 Marks 76 x 3 = 228

634) Describe the preparation of potassium dichromate from iron chromite ore. What is the effect of increasing pH on a solution of potassium dichromate?

635) Which is the last element in the series of the actinoids? Write the electronic configuration of this element. Comment on the possible oxidation state of this element.

636) What are the characteristics of the transition elements and why are they called transition elements ? Which of the d-block elements may not be regarded as the transition elements?

637) How would you account for the following?
(a) Of the d^4 species, Cr^{2+} is strongly reducing while manganese (III) is strongly oxidising.
(b) Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents, it is easily oxidised.
(c) The d^1 configuration is very unstable in ions.

638) Compare the chemistry of actinoids with that of the lanthanoids with special reference to:
(a) electronic configuration,
(b) Oxidation state,
(c) atomic and ionic sizes, and
(d) chemical reactivity.

639) Indicate the steps in the preparation of :
(a) $K_2Cr_2O_7$ from chromite ore.
(b) $KMnO_4$ from pyrolusite ore.

640) Give examples and suggest reasons for the following features of the transition metal chemistry:
(i) The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.
(ii) A transition metal exhibits highest oxidation state in oxides and fluorides.
(iii) The highest oxidation state is exhibited in oxoanions of a metal.

641) What are alloys? Name an important alloy which contains some of the lanthanoid metals. Mention its uses.

642) Describe the oxidising action of potassium dichromate and write the ionic equations for its reaction with
(i) iodide
(ii) iron(II) solution and
(iii) H_2S

643) Why do the transition elements exhibit higher enthalpies of atomisation?

644) In the series (Z = 21) to Zn (Z = 30), the enthalpy of zinc is the lowest 126 kJ mol^{-1} Why?

645) How is the variability in oxidation states of transition metals different from that of the non transition metals? Illustrate with examples.

646) Compare the chemistry of the actinoids with that of lanthanoids with reference to the following :
(i) Electronic configuration
(ii) Oxidation states
(iii) Chemical reactivity

647) Calculate the 'spin only' magnetic moment of $M^{2+}(aq)$ ion (Z = 27).

648) The halides of transition elements become more covalent with increasing oxidation state of the metal. Why?

649) How would you account for the following?
(I) The E^o value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for the Cr^{3+}/Cr^{2+} couple or Fe^{3+}/Fe^{2+} couple.
(ii) The highest oxidation state of a metal is exhibited in its oxide or fluoride.
(iii) The atomic radii ofthe metals ofthe third (Sd) series of transition elements are virtually the same as those of the corresponding members of the second (4d) series.

650) Explain the following:
(i) The transition elements have great tendency for complex formation.
(ii) There is a gradual decrease in the atomic sizes of transition elements in a series with increasing atomic numbers.
(iii) Lanthanum and Lutetium do not show colouration in solutions.
(At. No : La = 57, Lu = 71)

651) (a) Comlete the following chemical equations for reactions in aqueous media:
(i) $Cr_2O_7^{2-}+H^++Fe2+ \longrightarrow$
(ii) $MnO_4^-+I^-+H^+ \longrightarrow$
(b) How many unpaired electrons are present in Mn^{2+} ion (At. no. of Mn =25)? How does it influence magnetic behaviour of Mn^{2+} ions?

652) Give reasons for each of the following:
(i) Transition metal fluorides are ionic in nature, whereas bromides and chlorides are usually covalent in nature.
(ii) Size of trivalent lanthanoid cations decreases with increase in the atomic number.
(iii) Chemistry of all the lanthanoids is quite similar.

653) Identify the first row transition metal ions which have outer electronic configurations of $3d^4$ and $3d^6$ and describe their oxidation states.

654) Complete the following reactions:
(a) $Cr_2O_7^{2-}+14H^++6e^- \longrightarrow$ ..... $+7H_2O$
(b) $CrO_4^{2-}+$.....$\rightleftharpoons$ .....$\rightleftharpoons$ .....$+H_2O$
(c) $MnO_4^-+2H_2O+3e^- \xrightarrow{medium}$ ..... $+4OH^-$

655) When a brown compound of manganese (A) is treated with HCl it gives a gas (B). The gas taken in excess, reacts with NH_3 to give an explosive compound (C). Identify compounds A, B and C.

656) A solution of $KMnO_4$ on reduction yields either a colourless solution or a brown precipitate or a green solution depending on pH of the solution. What difference stages of the reducing do these represent and how are they carried out?

657) When an oxide of manganese (A) is fused with KOH in the presence of an oxidising agent and dissolved in water, it gives a Compound (B) disproportionates in neutral or acidic solution to give purple compound (C). An alkaline solution of compound (C) oxidises potassium iodide solution to a compound (D) and compound (A) is also formed. Identify compound A to D and also explain the reactions involved.

658) A violet compound of manganese (A) decomposes on heating to liberate oxygen and compounds (B) and (C) of manganese are formed. Compound (C) reacts with KOH in the presence of potassium nitrate to give compound (B). On heating compound (C) with conc. H_2SO_4 and NaCl, chlorine gas is liberated and a compound (D) of manganese along with other products is formed. Identify compound A to D and also explain the reactions involved.

659) Complete the following chemical equations :
$(i)Cr_2O_7^{2-}+6Fe^{2+}+14H^+ \longrightarrow$
$(ii)2CrO_4^{2-}+2H^+ \longrightarrow$
$(iii)2MnO_4^-+5C_2O_4^{2-}+16H^+ \longrightarrow$

660) What is lanthanoid contraction ? Give two examples of lanthanoid elements. What are oxidation states exhibited by lanthanoid elements ?

661) Compare the chemistry of actinoids with that of lanthanoids with special reference to
(i) electronic configuration
(ii) oxidation state
(iii) chemical reactivity.

662) Explain as to why the $E^{\ominus}$ value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+} .

663) Which is stronger reducing agent Cr^{2+} or Fe^{2+} and why?

664) Calculate the spin only magnetic moment of $M^{2+}(aq)(Z=27)$.

665) Although fluorine is more electronegative than oxygen, but the ability of oxygen to stabilise higher oxidation states exceeds that of fluorine. Why?

666) When orange solution containing $Cr_2O_7^{2-}$ ion is treated with an alkali, a yellow solution is formed and when H^+ ions are added to yellow solution, an orange solution is obtained. Explain why does this happen?

667) Which of the two Na^+ or Ag^+ is stronger Lewis acid and why?

668) Which of two : cuprous chloride or cupric chloride is coloured and why?

669) First ionisation energy of copper is higher than those of alkali metals, while second and third ionisation energies are lower. Explain.

670) Zinc is a transition element and has many useful applications. The presence of zinc in trace amounts is essential in humans and many animals.
Answer the following questions:
(i) What is the role of zinc in the body of humans and animals?
(ii) A compound of zinc is used as a rodent poison. Name the compound.
(iii) Name the compound of zinc used in paints.
(iv) Is $ZnSO_4(aq)$ coloured or colourless?

671) The decomposition of potassium chlorate $(KCIO_3)$ is a slow process. But the decomposition becomes fast in the presence of a black powder.
Answer the following:
(i) Why does the use of black powder make the decomposition fast?
(ii) What is black powder?
(iii) Can the black powder be used for all decomposition reactions?
(iv) Can you name the substance which can slow down the decomposition of H_2O_2 ?

672) Write the complete chemical equation for each the following:
(i) An alkaline solution of $KMnO_4$ reacts with an iodide.
(ii) An excess of $SnCI_2$ solution is added to a solution of mercury (II) chloride.
(iii) Potassium chromate is acidified with sulphuric acid.

673) Explain why a green solution of potassium manganate turns purple and a brown solid is precipitated when CO_2 gas is bubbled into the solution ?

674) Explain why a green solution of potassium manganate turns purple and a brown solid is precipitated when CO_2 gas is bubbled into the solution?

675) (i) Account for the following:
(a) Cu^+ is unstable in an aqueous solution.
(b) Transition metals form complex compounds.
(ii) Complete the following equation:
$Cr_2O_7^{2-} + 8H^+ + 3NO_2^- \rightarrow$

676) (a) How would you account for the following?
(i) Highest fluoride of Mn is MnF_4 whereas the highest oxide is Mn_2O_7.
(ii) Transition metals and their compounds show catalytic properties.
(b) Complete the following equation:
$3MnO_4^{2-} + 4H^+ \rightarrow$

677) From the given data of E^0 values, answer the following questions:

$E^0_{(M^{2+}/Mn)}$	Cr	Mn	Fe	Co	Ni	Cu
	-0.91	**-1.18**	**-0.44**	**-0.28**	**-0.25**	**+0.34**

(i) Why is $E^0_{(Cu^{2+}/Cu)}$ value exceptionally positive?
(ii) Why is $E^0_{(M^{2+}/Mn)}$ value highly negative as compared to other elements?
(iii) Which is a stronger reducing agent Cr^{2+} or Fe^{2+}? Give reason.

678) Assign suitable reasons for the following:
(a) In the 3d series from Sc (Z = 21) to Zn (Z = 30), the enthalpy of atomization of Zn is the lowest.
(b) The Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to their +3 state.
(c) Sc^{3+} is colourless in aqueous solution, whereas Ti^{3+} is coloured.

679) Complete the following chemical equations:
$(i) MnO_4^- + C_2O_4^{2-} + H^+ \xrightarrow[Heat]{} $
$(ii) KMnO_4 \longrightarrow$
$(iii) Cr_2O_7^{2-} + H_2S + H^+ \longrightarrow$

680) How would you account for the following?
(i) Metal-metal bonding is more extensive in the 4d and 5d -series of transition elements than 3d -series.
(ii) Mn (III) undergoes disproportionation reaction easily.
(iii) Co (II) is easily oxidised in the presence of strong ligands

681) Describe the preparation of potassium permanganate from pyrolusite ore. Write the ionic equation for the reaction that takes place between acidified $KMnO_4$ solution and iron (II) ions

682) Explain the following observations:
(i) With the same d-orbital configuration (d^4), Cr^{2+} ion is a reducing agent while Mn^{3+} ion is an oxidising agent.
(ii) Cu^+ ion is not stable in aqueous solutions.
(iii) Among the 3d series of transition elements, the largest number of oxidation states are exhibited by manganese.

683) Why do transition elements show variable oxidation states?
(i) Name the element showing maximum number of oxidation states among the first series of transition metals from Sc (Z = 21) to Zn (Z = 30)
(ii) Name the element which shows only +3 oxidation state.

684) $Ni^{2+}$is more stable than Pt^{2+} but the trend is reverse where $Pt^{4+}$is more stable than Ni^{4+}. Explain.

685) (a) Give reasons for the following:
(i) Mn^{3+} is a good oxidising agent.
(ii) $E^{\circ}_{M^{2+}/M}$ values are not regular for first row transition metals (3d series).
(iii) Although F is more electronegative than O, the highest fluoride of Mn is MnF_4 whereas the highest oxide is Mn_2O_7.

686) Give reasons:
(a) E^0 value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+}.
(b) Iron has higher enthalpy of atomisation than that of copper.
(c) Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is colured.

687) (i) Give reasons for the following:
(a) Compounds of transition elements are generally coloured.
(b) MnO is basic while Mn_2O_7 is acidic.
(ii) Calculate the magnetic moment of a divalent ion in aqueous medium if its atomic number is 26.

688) A mixed oxide of iron and chromium is fused with sodium carbonate in free access of air to form a yellow coloured compound (A). On acidification, the compound (A) forms an orange coloured compound (B), which is a strong oxidizing agent. Identify compound (A) and (B). Write chemical reactions involved.

689) The outer electronic configurations of two members of the lanthanoid series are as follows: $4f^1\ Sd^1$ and $4f^7\ 5d^o\ 6s^2$. What are their atomic numbers? Predict the oxidation states exhibited by these elements in their compounds.

690) How would you account for the following?
(i) Copper (I) is diamagnetic, whereas copper (II) is paramagnetic.
(ii) What is the common oxidation state of Cu, Ag, Au?
(iii) The d^1-configuration is very unstable in ions.

691) Explain the following:
(i) The paramagnetic character in 3d transition series increases upto Cr and then decreases.
(ii) Transition metals are very good catalyst.
(iii) Transition metals form a large number of interstitial compounds.

692) Chromium is used extensively in steel alloys. It is extracted from its ore chromite ($FeCr_2O_4$), which contains chromium in +3 oxidation state.
(i) Give the electronic configuration of the elements iron and chromium.
(ii) What is the oxidation state of iron in chromite?

693) The E^O value in respect of electrodes of chromium (Z = 24), manganese (Z = 25) and iron (Z = 26) are Cr^{3+}/Cr^{2+} = - 0.4 V ; Mn^{3+} / Mn^{2+}= : 1.5 V Fe^{3+} / Fe^{2+}= + 0.8 V. On the basis of the above information, compare the feasibilities of further oxidation of their +2 oxidation state.

694) Which oxoanion (among VO^{3-}_4 CrO_4^{2-}, MnO^{2-}_4 or FeO_4^{2-}) is strongest oxidant and which is weak oxidant?

695) (i) How $KMnO_4$ can be obtained from MnO_2, KOH and KNO_3?
(ii) K_2PtCl_6 is a well known compound whereas corresponding Ni compound is not known. State the reason for it.

696) Describe the factors on which the stability of an oxidation state of lanthanoid elements depends.

697) (i) Nb_4 is paramagnetic while NbX_4 (X = : Cl, Br, I) are diamagnetic, why?
(ii) Out of $La(OH)_3$ and $Lu(OH)_3$, which is more basic and why?

698) (a) How would you account for the following?
(i) Transition metals and their compounds show catalytic properties.
(ii) Mn shows highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state +4.
(b) Complete the following equation:
$3MnO_4^{2-} + 4H^+ \rightarrow$

699) Give reasons for the following:
(i) Transition metals form alloys.
(ii) Mn_2O_3 is basic whereas Mn_2O_7 is acidic.
(iii) Eu^{2+} is a strong reducing agent.

700) (a) What are the different oxidation states exhibited by the lanthanoids?
(b) Write two characteristics of the transition elements.
(c) Which of the 3d-block elements may not be regarded as the transition elements and why?

701) Zn, Cd and Hg are soft and have low melting points. Why?

702) (i) Why are fluorides of transition metals more stable in their higher oxidation state as compared to the lower oxidation state?
(ii) Which one of the following would feel attraction when placed in magnetic field Co^{2+}, Ag^+, Ti^{4+} and Zn^{2+}?
(iii) It has been observed that first ionisation energy of 5 d-series of transition elements are higher than that of 3d and 4d series, explain why?

703) Transition metals and their compounds show catalytic activities.

704) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.

705) Explain why Cu(I) ion is not stable in aqueous solution ?

706) Separation of a mixture of lanthanoid elements is difficult, Give reason.

707) When MnO_2 is fused with KOH in the presence of KNO_3 as an oxidising agent, it gives a dark green compound (A). Compound (A) disproportionates in acidic solution to give purple compound (B). An alkaline solution of compound (B) oxidises KI to compound (C) whereas an acidified solution of compound (B) oxidised KI to (D). Identify (A), (B), (C) and (D).

708) Observed and calculated values for the standard electrode potentials of elements from Ti to Zn in the first reactivity series are depicted in figure
Explain the following observations.
(i) The general trend towards less negative E° values across the series,
(ii) The unique behaviour of copper.
(iii) More negative E^o values of Mn and Zn.

709) Account for the following.
(i) Ti(IV) is more stable than the Ti (II) or Ti(III).
(ii) In case of transition elements, ions of the same charge in a given series show progressive decrease in radius with increasing atomic number.
(iii) Zinc is comparatively a soft metal, iron and chromium are typically hard.

Case Study Questions 9 x 4 = 36

710) **Read the passage given below and answer the following questions:**

The f-block elements are those in which the differentiating electron enters the (n -2) forbital. There are two series of f-block elements corresponding to filling of 4f and 5f-orbitals. The series of 4f- orbitals is called lanthanides. Lanthanides show different oxidation states depending upon stability of f^0, f^7 and f^{14} configurations, though the most common oxidation states is +3. There is a regular decrease in size of lanthanides ions with increase in atomic number which is known as lanthanide contraction.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) The atomic numbers of three lanthanide elements X, Y and 2 are 65, 68 and 70 respectively, their Ln^{3+} electronic configuration is

(a) $4f^8$, $4f^{11}$, $4f^{13}$ (b) $4f^{11}$, $4f^8$, $4f^{13}$ (c) $4f^o$, $4f^2$, $4f^{11}$ (d) $4f^3$, $4f^7$, $4f^9$

(ii) Lanthanide contraction is observed in

(a) Gd (b) At (c) Xe (d) Te

(iii) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.

(a) Cerium (Z = 58) (b) Europium (Z = 63) (c) Lanthanum (Z = 57) (d) Gadolinium (Z = 64)

(iv) Identify the incorrect statement among the following.

(a) Lanthanojd contraction is the accumulation of successive shrinkages.

(b) The different radii of Zr and Hf due to consequence of the lanthanoid contraction.

(c) Shielding power of 4f electrons is quite weak.

(d) There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu.

711) **Read the passage given below and answer the following questions:**

The transition elements have incompletely filled d-subshells in their ground state or in any of their oxidation states. The transition elements occupy position in between s- and p-blocks in groups 3-12 of the Periodic table. Starting from fourth period, transition elements consists of four complete series : Sc to Zn, Y to Cd and La, Hf to Hg and Ac, Rf to Cn. In general, the electronic configuration of outer orbitals of these elements is (n - 1) d^{1-10} ns^{1-2}. The electronic configurations of outer orbitals of Zn, Cd, Hg and Cn are represented by the general formula (n - 1)d^{10} n^2. All the transition elements have typical metallic properties such as high tensile strength, ductility, malleability. Except mercury, which is liquid at room temperature, other transition elements have typical metallic structures. The transition metals and their compounds also exhibit catalytic property and paramagnetic behaviour. Transition metal also forms alloys. An alloy is a blend of metals prepared by mixing the components. Alloys may be homogeneous solid solutions in which the atoms of one metal are distributed randomly among the atoms of the other.

The following questions are multiple choice questions. Choose the most appropriate answer :

(i) Which of the following characteristics of transition metals is associated with higher catalytic activity?

(a) High enthalpy of atomisation **(b) Variable oxidation states**

(c) Paramagnetic behaviour **(d) Colour of hydrated ions**

(ii) Transition elements form alloys easily because they have

(a) same atomic number **(b) same electronic configuration**

(c) nearly same atomic size **(d) same oxidation states.**

(iii) The electronic configuration of tantalum (Ta) is

(a) $[\mathrm{Xe}]4f^0 5d^1 6s^2$ **(b)** $[\mathrm{Xe})4f^{14} 5d^2 6s^2$

(c) $[\mathrm{Xe}]4f^{14} 5d^3 6s^2$ **(d)** $\left[\mathrm{Xe}\right]4f^{14} 5d^4 6s^2$

(iv) Which one of the following outer orbital configurations may exhibit the largest number of oxidation states?

(a) $3d^5 4s^1$ (b) $3d^5 4s^2$ (c) $3d^2 4s^2$ (d) $3d^3 4s^2$

712) **Read the passage given below and answer the following questions:**

The unique behaviour of Cu, having a positive E^o accounts for its inability to liberate H_2 from acids. Only oxidising acids (nitric and hot concentrated sulphuric acid) react with Cu, the acids being reduced. The stability of the half-filled (d^5) subshell in Mn^{2+} and the completely filled (d^{10}) configuration in Zn^{2+} are related to their E^o (M^{3+} /M^{2+}) values. The low value for Sc reflects the stability of Sc^{3+} which has a noble gas configuration. The comparatively high value for Mn shows that Mn^{2+}(d^5) is particularly stable, whereas a comparatively low value for Fe shows the extra stability of Fe^{3+} (d^5). The comparatively low value for V is related to the stability of V^{2+} (half-filled t_{2g} level).

The following questions are multiple choice questions.Choose the most appropriate answer :

(i) Standard reduction electrode potential of Zn^{2+} /Zn is - 0.76 V. This means

(a) ZnO cannot be reduced to Zn by H_2 under standard conditions

(b) Zn cannot liberate H_2 with concentrated acids

(c) Zn is generally the anode in an electrochemical cell

(d) Zn is generally the cathode in an electrochemical cell.

(ii) E^o values for the couples Cr^{3+}/Cr^{2+} and Mn^{3+} /Mn^{2+} are -0.41 and +1.51 volts respectively. These values suggest that

(a) Cr^{2+} acts as a reducing agent whereas Mn3+ acts as an oxidizing agent

(b) Cr^{2+} is more stable than Cr^{3+} state

(c) Mn^{3+} is more stable than Mn^{2+}

(d) Cr^{2+} acts as an oxidizing agent whereas Mn^{3+} acts as a reducing agent

(iii) The reduction potential values of M, Nand O are +2.46, -1.13 and -3.13 Y respectively. Which of the following order is correct regarding their reducing property?

(a) O > N > M (b) O > M > N (c) M > N > O (d) M > O > N

(iv) Which of the following statements are true?

(i) Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to +3 state.

(ii) Titanium and copper both in the first series of transition metals exhibits +1 oxidation state most frequently.

(iii) Cu^+ ion is stable in aqueous solutions.

(iv) The E^0 value for the Mn^{3+} /Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+}.

(a) (ii) and (iii)(b) (i) and (iv)(c) (i) and (iii)(d) (ii) and (iv)

713) **Read the passage given below and answer the following questions:**

Transition metal oxides are compounds formed by the reaction of metals with oxygen at high temperature. The highest oxidation number in the oxides coincides with the group number. In vanadium, there is a gradual change from the basic V_2O_3 to less basic V_2O_4 and to amphoteric V_2O_5 **.** V_2O_4 dissolves in acids to give VO^{2+} salts. Transition metal oxides are commonly utilized for their catalytic activity and semiconductive properties. Transition metal oxides are also frequently used as pigments in paints and plastic. Most notably titatnium dioxide. One of the earliest application of transition metal oxides to chemical industry involved the use of vanadium oxide for catalytic oxidation of sulfur dioxide to sulphuric acid. Since then, many other applications have emerged, which include benzene oxidation to maleic anhydride on vandium oxides; cyclohexane oxidation to adipic acid on cobalt oxides. An important property of the catalyst material used in these processes is the ability of transition metals to change their oxidation state under a given chemical potential of reductants and oxidants.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) Which oxide of vanadium is most likely to be basic and ionic ?

(a) VO (b) V_2O_3 (c) VO_2 (d) V_2O_5

(ii) Vanadyl ion is

(a) VO^{2+} (b) VO_2^+ (c) V_2O^+ (d) VO_4^{3-}

(iii) The oxidation state of vanadium in V_2O_5 is

(a) +5/2 (b) +7 (c) +5 (d) +6

(iv) Identify the oxidising agent in the following reaction.

(a) V_2O_5 (b)Ca (c) V (d) None of these

714) **Read the passage given below and answer the following questions:**

Transition elements are elements that have partially filled d-orbitals. The configuration of these elements corresponds to (n - 1)d^{1-10} ns^{1-2}. It is important to note that the elements mercury, cadmium and zinc (Ire not considered transition elements because of their electronic configurations, which corresponds to (n - 1)d^{1-10} ns^2.

Some general properties of transition elements are :

These elements can form coloured compounds and ions due to d-d transition;

These elements exhibit many oxidation states;

A large variety of ligands can bind themselves to these elements, due to this, a wide variety of stable complexes formed by these ions. The boiling and melting point of these elements are high. These elements have a large ratio of charge to the radius.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

(i) **Assertion:** Tungsten has very high melting point.

Reason: Tungsten is a covalent compound.

(ii) **Assertion:** Zn, Cd and Hg are normally not considered transition metals.

Reason: d-Orbitals in Zn, Cd and Hg elements are completely filled, hence these metals do not show the general characteristics properties of the transition elements.

(iii) **Assertion:** Copper metal gets readily corroded in acidic aqueous solution such as HCI and dil. H_2SO_4

Reason: Free energy change for this process is positive.

(iv) **Assertion:** Tailing of mercury occurs on passing ozone through it.

Reason: Due to oxidation of mercury.

715) $KMnO_4$ and $K_2Cr_2O_7$ are most important chemicals which are used as oxidising agents and disinfectants. K2MnO4 is prepared by fusing MnO_2 with KOH in presence of O_2.K_2MnO_4 is electrolysed to get purple coloured $KMnO_4$. Na_2CO_4 is prepared by heating chromite ore with Na_2CO_3 in presence of O_2. Na_2CrO_4 is converted into $Na_2Cr_2O_7$ by reacting with concentrated H_2SO_4 , $Na_2Cr_2O_7$ is reacted with KCI to get $K_2Cr_2O_7$ orange coloured solid, soluble in water, changes to yellow coloured CrO_4^{2-} in basic medium, $KMnO_4$ acts as oxidising agent in acidic, neutral as well tasic medium. In acidic medium, it converts Fe^{2+} to Fe^{3+}, Sn^{2+} to Sn^{4+}, $\begin{matrix}COO^-\\|\\COO^-\end{matrix}$ to CO_2. In asic medium it converts I^- to $IO_3^- \cdot K_2Cr_2O_7$ acts as oxidising agent only in acidic medium, converts H_2S to S, SO_2 to SO_4^{2-}, I^- to I_2. Lanthanoids and actinoids belong to f-block elements with general electronic configuration $(n-2)f^{1\text{ to }14}(n-1)d^{0-2}ns^2$. All actinoids are radio active. Both show contraction in atomic and ionic radii but actinoid contraction is more than lanthanoid contraction. Lanthanoid show +3 oxidation state, few elements show +2 and +4 oxidation states also. Actinoids show +3, +4, +5, +6, +7 oxidation states.

(a) Which lanthanoid shows +4 oxidation state and why?

(b) Give two similarity between lanthanoids and actinoids.

(c) Complete the equation and balance:

$Cr_2O_7^{2-} + Fe^{2+} + H^+ \longrightarrow$

(d) Convert sodium chromate to sodium dichromate. Give chemical equation.

(e) Complete the following:

$3MnO_4^{2-} + 4H^+ \longrightarrow$

716) The d-block of the periodic table contains the elements of the groups 3 to 12 and are known as transition elements. In general, the electronic configuration of these elements is $(n-1)d^{1-10}ns^{1-2}$. The d-orbitals of the penultimate energy level in their atoms receive electrons giving rise to the three rows of the transition metals i.e. 3d, 4d and 5d series. However Zn, Cd and Hg are not regarded as transition elements. Transition elements exhibit certain characteristic properties like variable oxidation stables, complex formation, formation of coloured ions, alloys, catalytic activity etc. Transition metals are hard (except Zn, Cd and Hg) and have a high melting point.

(a) Why are Zn, Cd and Hg non-transition elements?

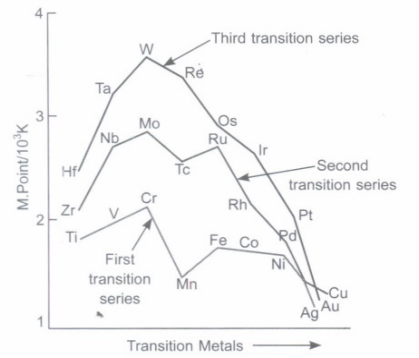
(b) Which transition metal of 3d series does not show variable oxidation state?

(c) Why do transition metals and their compounds show catalytic activity?

(d) Why are melting points of transition metals high?

(e) Why is Cu^{2+} ion coloured while Zn^{2+} ion is colourless in aqueous solution?

717) Observe the graph of transition metal and their melting points and answer the questions based on the graph and related concepts.



(a) Why does W (tungsten) has highest melting point?
(b) Which element in 3d series has lowest enthalpy of atomisation and why?
(c) Why is mercury liquid?
(d) Why are transition metals less electropositive than 's'-block elements?
(e) How does density vary from left to right in 3d series and why?

718) Observe the table given below belonging to 3d series, their first, second, third ionisation enthalpy and $\mathbf{E}^{\circ}_{\mathbf{M^{2+}/M}}$ and $\mathbf{E}^{\circ}_{\mathbf{M^{3+}/M^{2+}}}$ and answer the questions that follow based on table and related concepts.

Element	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
1 st ionisation enthalpy	631	656	650	652	717	762	758	736	745	905 kJ ml $^{-1}$
IInd ionisation enthalpy	1245	1320	1376	1635	1513	1564	1648	1757	1962	1736
IIIrd ionisation enthalpy	2451	2721	2874	2995	3258	2964	3238	3401	3561	3839
$\mathbf{E}^{\circ}_{\mathbf{M^{2+}/M}}$ in volts	-	-1.63V	-1.18V	-0.91V	-1.18V	-0.44V	-0.28V	-0.25V	+0.34V	-0.76V
$\mathbf{E}^{\circ}_{\mathbf{M^{3+}/M^{2+}}}$ in volts	-	-0.37V	-0.26V	-0.41V	+1.57V	+0.77V	+1.97V	-	-	-

(a) Why does zinc have highest first ionisation enthalpy?
(b) Why is 3 rd ionisation enthalpy of Mn high?
(c) Why is Cr^{3+} more stable than Cr^{2+}?
(d) Why is $\mathbf{E}^{\circ}_{\mathbf{Mn^{2+}/Mn}} \mathbf{-1.18V}$?
(e) Why is $\mathbf{E}^{\circ}_{\mathbf{Cn^{2+}/Cn}} \mathbf{+0.34V}$?
(f) Why is Fe^{3+} more stable than Fe^{2+}?
(g) Why is Mn $^{3+}$ good oxidising agent and $\mathbf{E}^{\circ}_{\mathbf{Mn^{3+}/Mn^{2+}}} \mathbf{= 1.57V}$?

5 Marks 51 x 5 = 255

719) Explain giving reason:
(a) The enthalpies of atomisation of the transition metals are high.
(b) Transition metals and many of their compounds show paramagnetic behaviour.
(c) The transition metals generally form coloured compounds.
(d) transition metals and their many compounds act as good catalyst.

720) Comment on the statement that elements of the first transition series possess many properties different from those of heavier transition elements.

721) What can be inferred from the magnetic moment values of the following complex species

Example	Magnetic Moment (BM)
$K_4[Mn(CN)_6]$	2.2
$[Fe(H_2O)6]^{2+}$	5.3
$K_2[MnCl_4]$	5.9

722) Write the electronic configurations of the elements with the atomic numbers 61, 91, 101, and 109.

723) Compare the general characteristics of the first series of the transition metals with those of the second and third columns. Give special emphasis on the following points:
(i) electronic configurations,
(ii) oxidation states,
(iii) ionisation enthalpies and
(iv) atomic sizes.

724) Write down the number of 3d electrons in each of the following ions: Ti^{2+}, V^{2+}, Cr^{3+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+} and Cu^{2+}. Indicate how would you expect the five 3d orbitals to be occupied for these hydrated ions (octahedral).

725) Describe the preparation of potassium permanganate. How does the acidified permanganate solution react with
(i) iron(II) ions
(ii) SO2 and
(iii) oxalic acid?
Write the ionic equations for the reactions.

726) When a chromite ore(A) is fused with sodium carbonate in free excess of air and the product is dissolved in water, a yellow solution of compound (B) is obtained. After treatment of this yellow solution with sulphuric acid, compound (C) can be crystallised from the solution. When compound (C) is treated with KCl, orange crystals of compound (D) crystallise out. Identify (A) (B) (C) and write the reactions.

727) (a) Given below the following characteristics of the first series of the transition metals and their trends in the series (Sc to Zn):
(i) Atomic radii
(ii) Oxidation status
(iii) Ionisation enthalpies
(b) Name an important alloy which contains some of the lanthanoid metals. Mention its two uses.

728) (a) Write the electronic configuration of Ce^{3+} ion, and calculate the magnetic moment on the basis of 'spin-only' formula. [Atomic No. of Ce = 58]
(b) Account for the following
(i) The enthalpies of atomisation of the transition metals are high.
(ii) The lowest oxide of a transition metal is basic, the highest is amphoteric/ acidic.
(iii) Cobalt (II) is stable in aqueous solution but in the presence of complexing agents, it is easily oxidised.

729) (a) Given below are the electrode potential values, E^o for the some of the first row of transition elements:

Element	$E^o_{M^{2+}/M}$ (V)
V(23)	-1.18
Cr(24)	-0.91
Mn(25)	-1.18
Fe(26)	-0.44
Co(27)	-0.28
Ni(28)	-0.25
Cu(29)	+0.34

Explain the irregularities in these values on the basis of electronic structures of atoms.
(b) Complete the following reaction equations:
(i) $Cr_2O_7^{2-} + Sn^{2+} + H^+ \longrightarrow$
(ii) $MnO_4^- + Fe^{2+} + H^+ \longrightarrow$

730) On the basis of Lanthanoid contraction, explain the following:
(i) Nature of bonding in La_2O_3 and Lu_2O_3.
(ii) Trends in the stability of oxo salts of lanthanoids from LA to Lu.
(iii) Stability of the comlexes of lanthanoids.
(iv) Radii of 4d and 5d block elements.
(v) trends in acidic character of lanthanoid oxides.

731) (a) Answer the following questions:
(i) Which element of the first transition series has highest second ionisation enthalpy?
(ii) Which element of the first transition series has highest third ionisation enthalpy?
(iii) Which element of the first transition series has lowest enthalpy of atomisation?
(b) Identify the metal and justify your answer.
(i) Carbonyl $M(CO)_5$
(ii) MO_3F

732) (a) Transition metals can act as catalysts because these can change their oxidation state. How does Fe(III) catalyse the reaction between iodide ans persulphate ions?
(b) Mention any three processes where transition metals act as catalysts.

733) (a) Out of Ag_2SO_4, CuF_2, MgF_2 and CuCl, which compound will be coloured and why?
(b) Explain :
(i) CrO_4^{2-} is a strong oxidizing agent while MnO_4^{2-} is not.
(ii) Zr and Hf have identical sizes.
(iii) The lowest oxidation state of manganese is basic while the highest is acidic.
(iv) Mn (II) shows maximum paramagnetic character amongst the divalent ions of the first transition series.

734) (a) What is meant by the term 'lanthanoid contraction? What is it due to and what consequences does it have on the chemistry of elements following lanthanoids in the periodic table?
(b) Explain the following observations :
(i) Cu^+ ion unstable in aqueous solution
(ii) Although Co^{2+} ion appears to be stable, It is eaily to Co^{3+} on in the presence of a strong ligand.
(iii) The $E^o_{Mn^{2+}/Mn}$ value for manganese is much more than expected from the trend for other elements in the series

735) (a) Complete the following chemical equations :
$(i)\ Cr_2O_7^{2-}(aq) + H_2S(g) + H^+(aq) \longrightarrow$
$(ii)\ Cu^{2+}(aq) + I^-(aq) \longrightarrow$
(b) How would you account for the following ?
(i) The oxidizing power of oxoanions is the order : $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$
(ii) The third ionization enthalpy of manganese (Z = 25) is exceptionally high.
(iii) Cr^{2+} is stronger reducing agent than Fe^{2+}

736) (i) Name the element of 3d transition which shows maximum number of oxidation states. Why does it show so?
(ii) Which transition element of 3d series has positive $E^o_{M^{2+}/M}$ value and why?
(iii) Out of Cr^{3+} and Mn^{3+}, which is stronger oxidizing agent and why?
(iv) Name a member of the lanthanoid series which is well known to exhibit + 2 oxidation state.
(v) Complete the equation : $MnO_4^- + 8H^+ + 5e^- \longrightarrow$

737) Complete the following chemical reaction equations:
(i) $CrO_7^{2\ -}(aq) + H_2S(g) + H^+(aq) \longrightarrow$
(ii) $CrO_7^{2\ -}(aq) + H_2S(g) + H^+(aq) \longrightarrow$
(b) Explain the following observations:
(i) Transition metals form compounds which are usually coloured.
(ii) Transition metals exhibit variable oxidation states.
(iii) The actinoids exhibit a greater range of oxidation states than the lanthanoids.

738) (a) Give reasons for the following:
(i) Mn^{3+} is a good oxidising agent.
(ii) $E^{\circ}{}_{M^{2+}/M}$ values are not regular for first row transition metals (3d series).
(iii) Although 'F' is more electronegative than 'O' the highest Mn fluoride is MnF_4 ,
(b) Complete the following equations:
(i) $2CrO_4^{2-} + 2H^+ \longrightarrow$
(ii) $KMnO_4 \overset{Heat}{\longrightarrow}$

739) (i) Name the element of 3d transition series which shows maximum number of oxidation states. Why does it show so?
(ii) Which transition metal of 3d series has positive $E^{\circ}(M^{2+}/M)$ value and why?
(iii) Out of Cr^{3+} and Mn^{3+}, which is a stronger oxidizing agent and why?
(iv) Name a member of the lanthanoid series which is well known to exhibit a +2 oxidation state.
(v) Complete the following equation:
$MnO_4^- 8H^+ 5e^- \longrightarrow$

740) (a) Complete the following equations:
(i) $Cr_2O_7^{2-} + 2OH \longrightarrow$
(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow$
(b) Account for the following:
(i) Zn is not considered as a transition element.
(ii) Transition metals from a large number of complexes.
(iii) The E° value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} couple.

741) (i) With reference to structural variability and chemical reactivity, write the differences between lanthanoids and actinoids.
(ii) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.
(iii) Complete the following equation:
$MnO_4^- 8H^+ 5e^- \longrightarrow$
(iv) Out of Mn^{3+} and Cr^{3+}, which is more paramagnetic and why?
(Atomic nos.: Mn = 25, Cr = 24)

742) (a) Account for the following:
(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine, it shows the highest oxidation state of +4.
(ii) Zirconium and Hafnium exhibit similar properties.
(iii) Transition metals act as catalysts.
(b) Complete the following equations:
(i) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta}$
(ii) $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow$

743) The elements of $3d$ transition series are given as:
Sc Ti V Cr Mn Fe Co Ni Cu Zn
Answer the following:
(i) Write the element which is not regarded as a transition element. Give reason.
(ii) Which element has the highest m.p?
(iii) Write the element which can shown an oxidation state of +1.
(iv) Which element is a strong oxidizing agent in +3 oxidation state and why?

744) (a) Give the preparation of potassium dichromate from chromate ore:
(b) Explain the following:
(i) Transition metals have good tendency to form complexes.
(ii) Transition metals exhibit variable oxidation states.
(c) Write the general electronic configuration of lanthanoids.

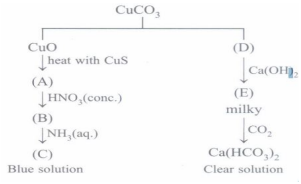
745) Gas (A) and gas (B) both turn $k_2Cr_2O_7/H^+$ green. Gas (A) also turn lead acetate paper black. When gas (A) is passed into gas (B) in an aqueous solution, yellowish-white turbidity appears.Identify gas (A) and gas (B). Explain reaction also.

746) One day a salesman was selling cutlery. He knocked at the door of Seema. Seema is a simple graduate from arts (i.e. B.A.). The salesman showed Seema some cutlery made of German silver. He told her that German silver is a special silver based alloy made in Germany and he will sell these pieces of cutlery for Rs.100 a piece only. In the mean time Seema'a next door friend Priyanka arrived. On enquiry, the salesman explained everything to Priyanka also. Priyanka is a science graduate. She stopped Seema from buying the cutlery and called police to catch the salesman as he was cheating innocent people.
Give answer of following questions:
(i) Do you think salesman was a cheat? Give reason for your answer.
(ii) What the values associated with Priyanka's initiative?

747) Lokesh is a social worker. A milkman in the village has been complaining that a factory in his nearby area dumps chemical waste in his field which has become a major cause of decreasing productivity. Lokesh visited that place and found after analysis that the major waste was potassium permanganate which is being absorbed by the soil. He advised the factory people that they should treat potassium permanganate solution before dumping it into the drain.
Comment in brief:
(i) About the environmental values displayed by Lokesh.
(ii) Write balanced chemical equations for the two reactions showing oxidizing nature of potassium permanganate.

748) Gas (A) and gas (B) both turn $K_2Cr_2O_7$ /H^+ green. Gas (A) also turn lead acetate paper black. When gas (A) is passed into gas (B)in an aqueous solution, yellowish white turbidity appears. Identify gas (A) and gas (B). Explain reactions also.

749) Identify A to E and also explain the reactions involved.



750) The elements of 3d transition series are given as:
8c Ti V Cr Mn Fe Co Ni Cu Zn
Answer the following:
(i) Write the element which shows maximum number of oxidation states. Give reason.
(ii) Which element has the highest melting point?
(iii) Which element shows only +3 oxidation state?
(iv) Which element is a strong oxidising agent in +3 oxidation state and why?

751) Explain the following observations:
(a) The transition metal ions are usually coloured in aqueous solutions.
(b) Cu(I) ion is not stable in an aqueous solution.
(c) The highest oxidation state of a transition metal is exhibited in its oxide or fluoride

752) In a party of children, Yathartha used stainless steel glasses in place of disposable glasses as kids were small and not able to handle them properly. Yathartha washed those stainless steel glasses with potassium permanganate. Answer the following questions.
(i) What is the composition of stainless steel?
(ii) Why Yathartha used $KMnO_4$?
(iii) What is the oxidation state of Mn in $KMnO_4$?
(iv) Mention the values associated with this act of Yathartha.

753) Nuclear power station consists of nuclear reactor, in which a controlled chain reaction involving nuclear fission occurs using either U or Pu as fuel in reactor. The heat produced is extracted from the reactor and this heat is used to generate steam which drives a turbine and produces electricity. U or Pu can also be used in making atom bombs. The subcritical mass of U or Pu is carried out in aeroplanes and combine them to give a critical mass when dropped over the target. It leads to uncontrolled chain reaction which produces tremendous amount of energy and lot of destruction.Plutonium bomb was dropped over Hiroshima and Nagasaki, Japan in world War II which caused lot of destruction.
Answer the following questions.
(i) Should we use U and Pu for making atom bombs?
(ii) What is the long term disadvantages of nuclear radiation?
(iii) Why is U-235 used in nuclear reactor?
(iv) Why are breeder reactors more useful?

754) Account for the following :
(a) Transition metals show variable oxidation states.
(b) Zn, Cd and Hg are soft metals
(c) E^o value for the Mn^{3+} /Mn^{2+} couple is highly positive (+ 1.57 V) as compared to Cr^{3+} /Cr^{2+}.
(ii) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

755) (i) (a) How is the variability in oxidation states of transition metals different from that of the p-block elements?
(b) Out of Cu^{+} and Cu^{2+}, which ion is unstable in aqueous solution and why?
(c) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with, an alkali. Why?
(ii) Chemistry of actinoids is complicated as compared to lanthanoids. Give two reasons.

756) Account for the following.
(i) Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.
(ii) The enthalpy of atomisation is lowest for Zn in 3d-series of the transition elements.
(iii) Identify the metal in M03F and justify your answer.
(iv) The E^0 value for the Mn^{3+} / Mn^{2+} couple is much more positive than that for Cr^{3+} /Cr^{2+} couple.
(v) Transition metals form a large number of complexes.

757) (i) Name a compound of
(a) transition metal which is used in the manufacture of sulphuric acid.
(b) transition metal that is used in Haber's process for the manufacture of ammonia.
(c) transition metal that have light sensitive properties and act as valuable source in photographic industry.
(ii) Write the equations which are involved in the oxidation of hydrogen sulphide to sulphur by potassium permanganate solution.

758) (i) Yb^{2+} acts as a reductant while Tb4+ act as an oxidant. Why?
(ii) Account for the following.
(a) Paramagnetism is shown by lanthanoid ions. Comment.
(b) Compare the basic strength of $Ln(OH)_3$, $Ca(OH)_3$ and $Al(OH)_3$.
(c) Lanthanoids do not form their carbonyl compounds.

759) (i) (a) Which transition element in 3d series has positive $E^0_{M^{2+}/M}$ value and why?
(b) Name a member of lanthanoid series which is well known to exhibit + 4 oxidation state and why?
(ii) (a) The highest oxidation state is exhibited in oxonions of transition metals.
(b) HCI is not used to acidify $KMnO_4$, solution.
(c) Transition metals have high enthalpy of atomisation.

760) (i) Write the steps involved in the preparation of
(a) $K_2Cr_2O_7$ from Na_2CrO_4(b) $KMnO_4$ from K_2MnO_4
(ii) What is the effect of lanthanoid contraction on the chemistry of the lanthanoids?

761) (i) A blackish brown coloured solid A which is an oxide of manganese, when fused with alkali metal hydroxide and an oxidising agent like KNO_3, produces a dark green coloured compound B which on disproportionation in neutral and acidic solution gives a purple coloured compound C. Identify A, B and C and write the reaction involved when compound C is heated to 513 K.
(ii) (a) $E^o_{M^{3+}/M^{2+}}$ values for the first series of transition elements are given below:

E^0(V)	Ti	V	Cr	Mn	Fe	Co
M^{3+}/M^{2+}	-0.37	-0.26	-0.41	+1.57	+0.77	+1.97

Identify the two strongest oxidising agents in the aqueous solution from the above data.
(b) Copper (I) ion is not known in aqueous solution. Explain.
(c) In this series the highest oxidation state of a metal is exhibited in its oxide. Identify the metal

762) (i) Distinguish the structure of chromate ion from that of dichromate ion.
(ii) Between the dichromates of sodium and potassium, which one is preferred for oxidising organic compound and why?
(iii) Give two equations that explains the nature of $K_2Cr_2O_7$ as reducing agent.

763) (a) Define:
(i) Interstitial compounds
(ii) Misch-metal
(b) Write one difference between transition elements and p-block elements with reference to variability of oxidation states.
(c) What are-inner transition elements? Give some applications of inner transition elements.

764) What is the cause of actinoid contraction? Describe some similarities and differences between lanthanoids and actinoids.

765) Attempt any five of the following.

(a) Ce(III) is easily oxidised to Ce(IV) Comment.

(b) $E°(Mn^{2+}/Mn)$ is -1.18 V. Why is this value highly negative in comparison to neighbouring d-block elements?

(c) Which element of 3d-series has lowest enthalpy of atomisation and why?

(d) What happens when sodium chromate is acidified?

(e) Zn, Cd and Hg are soft metals. Why?

(f) Why is permanganate titration not carried out in the presence of HCl?

(g) The lower oxides of transition metals are basic whereas the highest are amphoteric/acidic. Given reason.

766) (a) (i) Account for the following:

(1) Zn^{2+} salts are colourless while Ni^{2+} salts are coloured.

(2) Cr^{2+} is a strong reducing agent.

(3) Transition metals and their compounds show catalytic activities.