25. d- and f- Block Elements – Multiple Choice Questions

1. General Characteristics

1. Which of the following set has all the coloured ions

(a) Cu^{+}, Cu^{2+}, Ni^{2+} (b) $Cu^{2+}, Co^{2+}, Sc^{3+}$

(c) $Cu^{2+}, Fe^{2+}, Co^{2+}$ (d) Na^{+}, Mg^{2+}, Al^{3+}

2. Which of the following ions has the smallest radius

(a) Ti^{2+} (b) Ni^{2+}

(c) Pt^{2+} (d) Zr^{2+}

3. For which element of first transition series the oxidation potential value $(M \rightarrow M^{2+} + 2e^{-})$ is lowest

(a) *Mn* (b) *Fe*

(c) *Ni* (d) *Cu*

4. Which one of the following sets correctly represents the increase in the paramagnetic property of the ions

(a) $Cu^{2+} > V^{2+} > Cr^{2+} > Mn^{2+}$

(b) $Cu^{2+} < Cr^{2+} < V^{2+} < Mn^{2+}$

(c) $Cu^{2+} < V^{2+} < Cr^{2+} < Mn^{2+}$

(d) $V^{2+} < Cu^{2+} < Cr^{2+} < Mn^{2+}$

5. The tendency of 3*d*-metal ions to form stable complexes is due to their

(a) Variable oxidation state

(b) Strong electronegative nature

(c) High charge/size ratio and vacant *d*-orbitals

(d) Very low ionization energies

6. The colour imparted by Co(II) compounds to glass is

(a) Green (b) Deep-blue

(c) Yellow (d) Red

7. The metal ion which does not form coloured compound is

(a) Chromium (b) Manganese

(c) Zinc (d) Iron

8. Which one of the following has a magnetic moment of 1.75 B.M

(a) Ti^{3+} (b) V^{3+}

(c) Cr^{3+} (d) Fe^{3+}

9. Which of the following may be colourless

(a) Cr^{+3} (b) Cu^{+}

(c) Fe^{+3} (d) Cu^{2+}

10. In which of the following ions, *d-d* transition is not possible

(a) Ti^{4+} (b) Cr^{3+}

(c) Mn^{2+} (d) Cu^{2+}

11. $Sc(Z = 21)$ is a transition element but $Zn(Z = 30)$ is not because

(a) Both Sc^{3+} and Zn^{2+} ions are colourless and form white compounds

(b) In case of *Sc*, 3*d* orbitals are partially filled but in *Zn* these are filled

(c) Last electron is assumed to be added to 4*s* level in case of *Zn*

(d) Both *Sc* and *Zn* do not exhibit variable oxidation states

12. $[Sc(H_2O)_6]^{3+}$ ion is

(a) Colourless and diamagnetic

(b) Coloured and octahedral

(c) Colourless and paramagnetic

(d) Coloured and paramagnetic

13. The highest oxidation state shown by any transition elements is

(a) +8 (b) +5

(c) +6 (d) +7

14. Identify the metal that forms colourless compounds

(a) Iron (Z = 26) (b) Chromium (Z = 24)

(c) Vanadium (Z = 23) (d) Scandium (Z = 21)

15. Transition metal with low oxidation number will act as

(a) A base (b) An acid

(c) An oxidising agent (d) None of these

16. Which of the following pair of transitional elements exhibit highest and lowest density

(a) *Os* and *Sc* (b) *Os* and *Pt*

(c) *Hg* and *Sc* (d) *Os* and *Ir*

17. The atomic radii from Cr to Cu is almost identical because of

(a) Increasing nuclear charge from Cr to Cu

(b) Repulsion among increased electrons

(c) Increased screening effect to nullify increased nuclear charge

(d) All the above

18. 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

19. 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

20. Coinage metals are present in

(a) s-block (b) d-block

(c) p-block (d) f-block

21. Consider the following salts: $NaCl, HgCl_2, Hg_2Cl_2, CuCl_2$, and $AgCl$. Identify the correct set of insoluble salts in water

(a) $Hg_2Cl_2, CuCl, AgCl$ (b) $HgCl_2, CuCl, AgCl$

(c) $Hg_2Cl_2, CuCl_2, AgCl$ (d) $Hg_2Cl_2, CuCl, NaCl$

22. In the first transition series, the highest b.p. and m.p. is of

(a) Cr (b) V

(c) Ni (d) Fe

23. Which of the following has second ionisation potential less than expected

(a) Cr (b) Zn

(c) V (d) Mo

24. In which of the following, metallic bond is strongest

(a) Fe (b) Sc

(c) V (d) Cr

25. The correct order of density is

(a) $Cu > Ni > Zn > Sc$ (b) $Ni > Cu > Zn > Sc$

(c) $Zn > Cu > Ni > Sc$ (d) $Sc > Zn > Ni > Cu$

26. Which of the following is not a ferromagnetic substance

(a) Cobalt (b) Nickel

(c) Manganese (d) Iron

27. Which among following transition metals does not show variable oxidation states

(a) Cu (b) Fe

(c) Ni (d) Sc

28. Super conductors are derived from compounds of

(a) p-block elements (b) Lanthanides

(c) Actinides (d) Transition elements

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

(a) Regular variation of first and second ionisation enthalpies

(b) Irregular variation of sublimation enthalpies

(c) Regular variation of sublimation enthalpies

(d) Increase in no. of unpaired electrons

30. Metallic radii of some transition elements are given below. Which of these elements will have highest density

Element	Fe	Co	Ni	Cu
Metallic radii/pm	126	125	125	128

(a) Fe (b) Ni

(c) Co (d) Cu

31. Which of the following reactions are disproportionation reactions

A. $Cu^+ \longrightarrow Cu^{2+} + Cu$

B. $3MnO_4^- + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$

C. $2KMnO_4 \longrightarrow K_2MnO_4 + MnO_2 + O_2$

D. $2MnO_4^- + 3Mn^{2+} + 2H_2O \longrightarrow 5MnO_2 + 4H^+$

(a) (i) (b) (i), (ii) and (iii)

(c) (ii), (iii) and (iv) (d) (i) and (iv)

32. 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

33. 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

34. Which does not form amalgam

(a) Fe (b) Co

(c) Ag (d) Zn

35. 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

36. The electronic configuration of $Cu(II)$ is $3d^9$ where as 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

37. Which of the following is amphoteric oxide

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

(a) V_2O_5, Cr_2O_3 (b) Mn_2O_7, CrO_3

(c) CrO, V_2O_5 (d) V_2O_5, V_2O_4

38. The electronic configuration of Ag atom is

(a) $[Kr]3d^{10}4s^1$ (b) $[Xe]4f^{14}d^{10}6s^1$

(c) $[Kr]4d^{10}5s^1$ (d) $[Kr]4d^9 5s^2$

39. Chloride of which of the following elements will be coloured

(a) Silver (b) Mercury

(c) Zinc (d) Cobalt

40. Which is an amphoteric oxide

(a) ZnO (b) CaO

(c) BaO (d) SrO

41. Zn and Hg belong to the same group, they differ in many of their properties. The property that is shared by both is

(a) They form oxide readily

(b) They react with steam readily

(c) They react with hot concentrated sulphuric acid

(d) They react with hot sodium hydroxide

42. In human body if necessary, the plate, screw or wire used for surgery are made up of

(a) Ni (b) Au

(c) Pt (d) Ta

43. A hard and resistant metal (alloy) generally used in tip of nib of fountain pen is

(a) $Os.Ir$ (b) $Pt.Cr$

(c) $V.Fe$ (d) $Fe.Cr$

44. Which of the following is a transition element as per the ground state electronic configuration

(a) Au (b) Hg

(c) Cd (d) Zn

45. Bullet-proof steel alloy is prepared by using

(a) Sc (b) Ni

(c) Zr (d) Zn

46. The test of ozone O_3 can be done by

(a) Ag (b) Hg

(c) Au (d) Cu

47. Which of the following pairs of elements cannot form an alloy

(a) Zn, Cu (b) Fe, Hg

(c) Fe, C (d) Hg, Na

48. Identify a 'Chemical twin' among the followings

(a) Zr-Ta (b) Nb-Tc

(c) Hf-Re (d) Nb-Ta

49. The electroplating of chromium is undertaken because

(a) Electrolysis of chromium is easier

(b) Chromium can form alloys with other metals

(c) Chromium gives protective and decorative coating to the base metal

(d) Of the high reactivity of metallic chromium

50. In first transition series, the melting point of Mn is low because

(a) Due to d^{10} configuration, metallic bonds are strong

(b) Due to d^7 configuration, metallic bonds are weak

(c) Due to d^5 configuration, metallic bonds are weak

(d) None of these

51. In solution of $AgNO_3$, the solution of Cu become blue due to

(a) Oxidation of Ag (b) Oxidation of Cu

(c) Reduction of Ag (d) Reduction of Cu

52. Essential constituent of an amalgam is

(a) Iron (b) An alkali metal

(c) Silver (d) Mercury

53. Mercury is transported in metal containers made of

(a) Silver (b) Lead

(c) Iron (d) Aluminium

54. Which of the following transition metal is present in misch metal

(a) La (b) Sc

(c) Ni (d) Cr

55. Which one of the following statements concerning lanthanides elements is false

(a) Lanthanides are separated from one another by ion exchange methods

(b) The ionic radii of trivalent lanthanides steadily increase with increase in atomic number

(c) All lanthanides are highly dense metals

(d) Most typical oxidation of lanthanides is +3

56. Which of the following trivalent ion has the largest atomic radii in the lanthanide series

(a) La (b) Ce

(c) Pm (d) Lu

57. What is the general molecular formula of the products obtained on heating lanthanoids (Ln) with sulphur

(a) LnS (b) LnS_3

(c) Ln_3S_2 (d) Ln_2S_3

58. Lanthanum is grouped with f-block elements because

(a) It has partially filled f -orbitals

(b) It is just before Ce in the periodic table

(c) It has both partially filled f and d-orbitals

(d) The properties of Lanthanum are very similar to the elements of $4f$ block

59. Which is not the 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

60. Which of the following oxide has the maximum basicity

(a) La_2O_3 (b) Pr_2O_3

(c) Sm_2O_3 (d) Gd_2O_3

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

(a) $[Xe]4f^1$ (b) $[Kr]4f^1$

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

62. The only radioactive element among the lanthanoids is

(a) Gadolinium (b) Holmium

(c) Promethium (d) Neodynium

63. Which of the following oxidation state is common for all lanthanoids

(a) +2 (b) +3

(c) +4 (d) +5

64. Cigarette or gas lighter is made up of

(a) Misch metal (b) Alkali metal

(c) Noble metal (d) None

65. Which of the following is not an actinide

(a) Curium (b) Californium

(c) Uranium (d) Terbium/Erbium

66. Which of the following lanthanoid ion is paramagnetic

(a) Ce^{4+} (b) Yb^{2+}

(c) Lu^{3+} (d) Eu^{2+}

67. There are 14 elements in actinoid series. Which of the following elements does not belong to this series

(a) U (b) Np

(c) Tm (d) Fm

68. The isoelectronic pair of ions is

(a) Sc^{2+} and V^{3+} (b) Mn^{2+} and Fe^{3+}

(c) Mn^{3+} and Fe^{2+} (d) Ni^{3+} and Fe^{2+}

69. The metal with the highest oxidation state present in K_2CrO_4, $NbCl_5$ and MnO_2 is

(a) Nb (b) Mn

(c) K (d) Cr

2. Compounds of Transitional Elements

1. Which one of the following is reduced by hydrogen peroxide in acid medium

(a) Potassium permanganate

(b) Potassium iodide

(c) Ferrous sulphate

(d) Potassium ferrocyanide

2. Bronze is a mixture of

(a) $Pb + Sn$ (b) $Cu + Sn$

(c) $Cu + Zn$ (d) $Pb + Zn$

3. Which of the following imparts green colour to the glass

(a) Cu_2O (b) CdS

(c) MnO_2 (d) Cr_2O_3

4. Silvering of mirror is done by

(a) $AgNO_3$ (b) Ag_2O_3

(c) Fe_2O_3 (d) Al_2O_3

5. Which of the following compounds volatilises on heating

(a) $MgCl_2$ (b) $HgCl_2$

(c) $CaCl_2$ (d) $FeCl_3$

6. Which can be reduced to the metal by heating it in a stream of hydrogen

(a) Copper (II) oxide (b) Magnesium oxide

(c) Aluminium oxide (d) Calcium oxide

7. Which of the following is also known as "Fools gold"

(a) Wurtzite (b) Iron pyrites

(c) Chalcosite (d) Silver glance

8. Mond's process is used for

(a) Ni (b) Al

(c) Fe (d) Cu

9. Guignet's green is known as

(a) $Cr_2O_3 . 2H_2O$ (b) $FeO_3 . 2H_2O$

(c) Cu_2O_3 (d) $FeCO_3 . Cr_2O_3$

10. Green vitriol is

(a) $CuSO_4 . 5H_2O$ (b) $FeSO_4 . 7H_2O$

(c) $CaSO_4 . 2H_2O$ (d) $ZnSO_4 . 7H_2O$

11. In electroplating, the metal that is not used for plating is

(a) Fe (b) Zn

(c) Ni (d) Au

12. The metal which is the best conductor of electricity is

(a) Iron (b) Copper

(c) Silver (d) Aluminium

13. A metal when left exposed to the atmosphere for some time becomes coated with green basic carbonate. The metal in question is

(a) Copper (b) Nickel

(c) Silver (d) Zinc

14. Mohr's salt is dissolved in dil. H_2SO_4 instead of distilled water to

(a) Enhance the rate of dissolution

(b) Prevent cationic hydrolysis

(c) Increase the rate of ionisation

(d) Increase its reducing strength

15. How many ions per molecule are produced in the solution when mohr salt is dissolved in excess of water

(a) 6 (b) 4

(c) 10 (d) 5

16. Verdigris is

(a) Basic copper acetate (b) Basic lead acetate

(c) Basic lead (d) None of these

17. Molybdenum compounds are used in

(a) Dye industry (b) For colouring leather

(c) For colouring rubber (d) All of these

18. Duralumin is an alloy of

(a) $Al + Mn$ (b) $Al + Mg + Ni + Mn$

(c) $Al + Mg + Ni$ (d) $Al + Mg + Mn + Cu$

19. Which of the following is used as indelible ink

(a) Aq. $CuSO_4$ solution (b) Aq. $AgNO_3$ solution

(c) Aq. $NaCl$ solution (d) Aq. $NaOH$ solution

20. The least stable oxide at room temperature is

(a) ZnO (b) CuO

(c) Sb_2O_3 (d) Ag_2O

21. Vanadium (III) oxide is a strong

(a) Drying agent (b) Oxidising agent

(c) Reducing agent (d) Wetting agent

(e) Precipitating agent

22. In the equation

$4M + 8CN^- + 2H_2O + O_2 \longrightarrow 4[M(CN_2)]^- + 4OH^-$ The metal M is

(a) Copper (b) Iron

(c) Gold (d) Zinc

23. The nitrate of which metal left globule on heating strongly

(a) $Pb(NO_3)_2$ (b) $NaNO_3$

(c) $AgNO_3$ (d) $Cu(NO_3)_2$

24. Out of following which compound is used for preservation of wood

(a) $NaCl$ (b) $HgCl_2$

(c) $ZnCl_2$ (d) $CaCl_2$

25. Hydroxide soluble in ammonia is

(a) $Al(OH)_3$ (b) $Fe(OH)_3$

(c) $Cr(OH)_3$ (d) $Cu(OH)_2$

26. Ammonia is a Lewis base. It forms complexes with cations. Which one of the following cations does not form complex with ammonia

(a) Ag^+ (b) Cu^{++}

(c) Cd^{++} (d) Pb^{++}

27. $MSO_4 \xrightarrow{NH_4OH} \underset{white}{\downarrow X} \xrightarrow[excess]{NH_4OH} Y \xrightarrow{H_2S} \downarrow Z$

Here M and Z are

(a) Fe, FeS (b) Cu, ZnS

(c) Al, Al_2S_3 (d) Zn, ZnS

28. The trace metal present in insulin is

(a) Iron (b) Cobalt

(c) Zinc (d) Manganese

29. Bulletproof helmets are made from

(a) Lexan (b) Saran

(c) Glyptal (d) Thiokol

30. When sulphur dioxide is passed in an acidified $K_2Cr_2O_7$ 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

31. In which of the following ionic radii of chromium would be smallest

(a) Al, Al_2S_3 (b) CrO_2

(c) $CrCl_3$ (d) CrF_2

32. The colour of $K_2Cr_2O_7$ changes from red orange to lemon yellow on treatment with aqueous KOH because of

(a) The reduction of Cr^{VI} to Cr^{III}

(b) The formation of chromium hydroxide

(c) The conversion of dichromate to chromate

(d) The oxidation of potassium hydroxide to potassium peroxide

33. Chrome green is

(a) Chromium sulphate (b) Chromium chloride

(c) Chromium nitrate (d) Chromium oxide

34. Which of the following is the green coloured powder produced when ammonium dichromate is used in fire works

(a) Cr (b) CrO_3

(c) Cr_2O_3 (d) $CrO(O_2)$

35. 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^+

36. In the reduction of dichromate by $Fe(II)$ the number of electrons involved per chromium atom is

(a) 2 (b) 3

(c) 4 (d) 1

37. The orange solid on heating gives a colourless gas and a green solid which can be reduced to metal by aluminium powder. The orange and the green solids are respectively

(a) $(NH_4)_2Cr_2O_7$ and Cr_2O_3 (b) $Na_2Cr_2O_7$ and Cr_2O_3

(c) $K_2Cr_2O_7$ and CrO_3 (d) $(NH_4)_2Cr_2O_4$ and CrO_3

38. The reddish brown gas produced by heating KCl with $K_2Cr_2O_7$ (solid) and conc. H_2SO_4 is

(a) Cl_2 (b) CrO_2Cl_2

(c) CrO_3 (d) H_2CrO_4

39. When H_2O_2 is shaken with an acidified solution of $K_2Cr_2O_7$ in presence of ether, the ethereal layer turns blue due to the formation of

(a) Cr_2O_3 (b) CrO_4^{2-}

(c) $Cr_2(SO_4)_3$ (d) CrO_5

40. How is sodium chromate converted into sodium dichromate in the manufacture of potassium dichromate from chromite ore

(a) By the action of concentrated sulphuric acid

(b) By roasting with soda ash

(c) By the action of sodium hydroxide

(d) By the action of lime stone

41. Which of the following gases turns the acidified potassium dichromate paper green

(a) HCl (b) H_2S

(c) CO_2 (d) SO_2

42. Which of the following is formed when CO_2 gas is passed through aqueous solution of sodium chromate

(a) $Cr(OH)_3$ is precipitated

(b) Yellow solution of $Cr_2(CO_3)_3$ is formed

(c) Orange solution of $Na_2Cr_2O_7$ is formed

(d) No reaction

43. Acidified solution of chromic acid on treatment with hydrogen peroxide yields

(a) $CrO_3 + H_2O + O_2$ (b) $Cr_2O_3 + H_2O + O_2$

(c) $CrO_5 + H_2O$ (d) $H_2Cr_2O_7 + H_2O + O_2$

44. In aqueous solution, Cr^{2+} is stronger reducing agent than Fe^{2+}. This is because

(a) Cr^{2+} ion is more stable than Fe^{2+}

(b) Cr^{3+} ion with d^3 configuration has favourable crystal field stabilisation energy

(c) Cr^{3+} has half-filled configuration and hence more stable

(d) Fe^{3+} in aqueous solution is more stable than Cr^{3+}

(e) Fe^{2+} ion with d^6 configuration has favourable crystal field stabilization energy

45. The correct order of increasing oxidizing power in the series is

(a) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$ (b) $Cr_2O_7^{2-} < VO_2^+ < MnO_4^-$

(c) $Cr_2O_7^{2-} < MnO_4^- < VO_2^+$ (d) $MnO_4^- < Cr_2O_7^{2-} < VO_2^+$

46. Mn^{2+} compounds are more stable than Fe^{2+} compounds towards oxidation to their +3 state, because

(a) Mn^{2+} is more stable with high 3rd ionisation energy

(b) Mn^{2+} is bigger in size

(c) Mn^{2+} has completely filled *d*-orbitals

(d) Mn^{2+} does not exist

47. Potassium permanganate acts as an oxidant in neutral, alkaline as well as acidic media. The final products obtained from it in the three conditions are, respectively

(a) MnO_2, MnO_2, Mn^{2+} (b) $MnO_4^{2-}, Mn^{3+}, Mn^{2+}$

(c) $MnO_2, MnO_4^{2-}, Mn^{3+}$ (d) MnO, MnO_4, Mn^{2+}

48. Which oxide of manganese is amphoteric

(a) MnO_2 (b) Mn_2O_3

(c) Mn_2O_7 (d) MnO

49. 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-}

50. Which of the following statement is incorrect for $KMnO_4$

(a) It is an oxidizing agent

(b) It is used as antiseptic

(c) It is used as bleaching agent in textile industries

(d) It is dark purple coloured amorphous substance

51. Mn^{++} can be converted into Mn^{7+} by reacting with

(a) SO_2 (b) Cl_2

(c) PbO_2 (d) $SnCl_2$

52. Formula of thiosulphate, manganate and arsenate respectively are

(a) $S_4O_6^{2-}, MnO_4^{2-}, AsO_3^{3-}$ (b) $S_2O_3^{2-}, MnO_4^{2-}, AsO_4^{3-}$

(c) $S_2O_3^{2-}, MnO_4^{2-}, AsO_3^{3-}$ (d) $S_4O_6^{2-}, MnO_4^{2-}, AsO_4^{3-}$

53. When a brown compound of $Mn(A)$ is treated with HCl, it gives a gas (B). The gas (B) taken in excess reacts with NH_3 to give an explosive compound (C).

The compounds *A*, *B* and *C* are

(a) $A = MnO_2, B = Cl_2, C = NCl_3$

(b) $A = MnO, B = Cl_2, C = NH_3Cl$

(c) $A = Mn_3O_4, B = Cl_2, C = NCl_3$

(d) $A = MnO_3, B = Cl_2, C = NCl_2$

54. 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

55. 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

56. $KMnO_4$ 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) $\frac{1}{5}$

57. $KMnO_4$ 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^-

58. Why is HCl not used to make the medium acidic, in oxidation reactions of $KMnO_4$ in acidic medium

(a) Both HCl and $KMnO_4$ act 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

59. Reaction of solid $KMnO_4$ with conc. H_2SO_4 produces manganese heptoxide (Mn_2O_7) in

(a) Solution state (b) Solid state

(c) Fine powder (d) None of these

60. 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 stabilises lower oxidation state

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

61. Invar, an alloy of *Fe* and *Ni* is used in watches and meter scale, its characteristic property is

(a) Small coefficient of expansion

(b) Resistance to corrosion

(c) Hardness and elasticity

(d) Magnetic nature

62. The percentage of carbon in cast iron is

(a) 5 – 10 (b) 0.250 – 2.5

(c) 2.5 – 5.0 (d) 0.12 – 0.2

63. Purest form of iron is

(a) Cast iron (b) Wrought iron

(c) Hot steel (d) Stainless steel

64. Aqueous solution of ferric chloride is

(a) Acidic (b) Basic

(c) Neutral (d) Amphoteric

65. The process of zinc-plating on iron sheet is known as

(a) Aneling (b) Roasting

(c) Galvanization (d) Smelting

66. When ferric oxide reacts with $NaOH$, the product formed is

(a) NaF (b) $FeCl_3$

(c) $Fe(OH)_3$ (d) $NaFeO_2$

67. Stainless steel does not rust because

(a) Chromium and nickel combine with iron

(b) Chromium forms an oxide layer and protects iron from rusting

(c) Nickel present in it, does not rust

(d) Iron forms a hard chemical compound with chromium present in it

68. Rust is

(a) $FeO + Fe(OH)_2$ (b) Fe_2O_3

(c) $Fe_2O_3 + Fe(OH)_2$ (d) Fe_2O_3 and $Fe(OH)_3$

69. Stainless steel is an alloy steel of the following metals

(a) *Fe* Only (b) *Cr* and *Ni*

(c) *W* and *Cr* (d) *Ni* and *Be*

70. Most stable oxidation state of iron is

(a) +2 (b) +3

(c) –2 (d) –3

71. Iron loses magnetic property at

(a) Melting point (b) 1000*K*

(c) Curie point (d) Boiling point

72. Heat treatment alters the properties of steel due to

(a) Chemical reaction on heating

(b) Partial rusting

(c) Change in the residual energy

(d) Change in the lattice structure due to differential rate of cooling

73. Which metal is used to make alloy steel for armour plates, safes and helmets

(a) *Al* (b) *Mn*

(c) *Cr* (d) *Pb*

74. Annealing is

(a) Heating steel in nitrogen and cooling

(b) Heating steel to bright redness and then cooling slowly

(c) Heating wrought iron with carbon to redness

(d) Heating steel to high temperature and cooling suddenly by plunging in water

75. Iron pipes lying under acidic soil are often attached to blocks of magnesium for protection from rusting. Magnesium offers protection to iron against corrosion because it

(a) Is more readily converted into positive ions

(b) Is lighter than iron

(c) Forms a corrosion-resistant alloy with iron

(d) Prevents air from reaching the surface of iron

76. Haemoglobin is a complex of

(a) Fe^{3+} (b) Fe^{2+}

(c) Fe^{4+} (d) Cu^{2+}

77. Light green crystals of ferrous sulphate lose water molecule and turn brown on exposure to air. This is due to its oxidation to

(a) Fe_2O_3 (b) $Fe_2O_3.H_2O$

(c) $Fe(OH)SO_4$ (d) $Fe_2O_3 + FeO$

78. Dipping iron article into a strongly alkaline solution of sodium phosphate

(a) Does not affect the article

(b) Forms $Fe_2O_3.xH_2O$ on the surface

(c) Forms iron phosphate film

(d) Forms ferric hydroxide

79. On heating $K_4[Fe(CN)_6]$ with conc. H_2SO_4 gives the gas

(a) SO_2 (b) CO_2

(c) CO (d) NO_2

80. How H_2S is liberated in laboratory

(a) $FeSO_4 + H_2SO_4$

(b) $FeS + dil.\ H_2SO_4$

(c) $FeS +$ conc. H_2SO_4

(d) Elementary H_2 + elementary S

81. Iron is dropped in dil. HNO_3, it gives

(a) Ferric nitrate

(b) Ferric nitrate and NO_2

(c) Ferrous nitrate and ammonium nitrate

(d) Ferrous nitrate and nitric oxide

82. Steel becomes soft and pliable by

(a) Annealing (b) Nitriding

(c) Tempering (d) Case hardening

83. Pure conc. HNO_3 makes iron passive as the surface is covered with protective layer of

(a) Fe_2O_3 (b) FeO

(c) Fe_3O_4 (d) $Fe(NO_3)_3$

84. Red hot iron absorbs SO_2 giving the product

(a) $FeS + O_2$ (b) $Fe_2O_3 + FeS$

(c) $FeO + FeS$ (d) $FeO + S$

85. If steel is heated to a temperature well below red hot and is then cooled slowly, the process is called

(a) Tempering (b) Hardening

(c) Softening (d) Annealing

86. Railway wagon axles are made by heating rods of iron embedded in charcoal powder. The process is known as

(a) Case hardening (b) Sheradizing

(c) Annealing (d) Tempering

87. The presence of Si in steel gives it

(a) Fibrous structure (b) Silicate type structure

(c) Sheet type structure (d) None of these

88. When SCN^- is added to an aqueous solution containing $Fe(NO_3)_3$, the complex ion produced is

(a) $[Fe(OH_2)_2(SCN)]^{2+}$ (b) $[Fe(OH_2)_5(SCN)]^{2+}$

(c) $[Fe(OH_2)_8(SCN)]^{2+}$ (d) $[Fe(OH_2)(SCN)]^{6+}$

89. The protection of steel by chrome plating is due to

(a) Cathodic protection

(b) Anodic protection

(c) Covering of steel surface

(d) Formation of alloy with iron

90. KI and $CuSO_4$ solution when mixed, give

(a) $CuI_2 + K_2SO_4$ (b) $Cu_2I_2 + K_2SO_4$

(c) $K_2SO_4 + Cu_2I_2 + I_2$ (d) $K_2SO_4 + CuI_2 + I_2$

91. Copper displaces which of the metal from their salt solutions

(a) $AgNO_3$ (b) $ZnSO_4$

(c) $FeSO_4$ (d) All of these

92. From a solution of $CuSO_4$, the metal used to recover copper is

(a) Sodium (b) Iron

(c) Silver (d) Hg

93. If excess of NH_4OH is added to $CuSO_4$ solution, it forms blue coloured complex which is

(a) $Cu(NH_3)_4SO_4$ (b) $Cu(NH_3)_2SO_4$

(c) $Cu(NH_4)_4SO_4$ (d) $Cu(NH_4)_2SO_4$

94. When $CuSO_4$ solution is added to $K_4[Fe(CN)_6]$, the formula of the product formed is

(a) $Cu_2Fe(CN)_6$ (b) KCN

(c) $Cu(CN)_3$ (d) $Cu(CN)_2$

95. When metallic copper comes in contact with moisture, a green powdery/ pasty coating can be seen over it. This is chemically known as

(a) Copper sulphide - Copper carbonate

(b) Copper carbonate - Copper sulphate

(c) Copper carbonate - Copper hydroxide

(d) Copper Sulphate - Copper sulphide

96. Colourless solutions of the following four salts are placed separately in four different test tubes and a strip of copper is dipped in each one of these. Which solution will turn Blue

(a) KNO_3 (b) $AgNO_3$

(c) $Zn(NO_3)_2$ (d) $ZnSO_4$

97. The metal which can be used to obtain metallic Cu from aqueous $CuSO_4$ solution is

(a) Na (b) Ag

(c) Hg (d) Fe

98. Identify the statement which is not correct regarding copper sulphate

(a) It reacts with KI to give iodine

(b) It reacts with KCl to give Cu_2Cl_2

(c) It reacts with $NaOH$ and glucose to give Cu_2O

(d) It give CuO on strong heating in air

99. What is the effect of shaking dil. H_2SO_4 with small quantity of anhydrous $CuSO_4$

(a) The white solid dissolves to form a colourless solution

(b) The white solid dissolves to form a green solution

(c) The white solid turns blue but does not dissolve

(d) The white solid dissolves to form a blue solution

100. Which among the following alloys is used in making instruments for electrical measurements

(a) Stainless steel (b) Manganin

(c) Spiegeleisen (d) Duralumin

101. When $CuSO_4$ is hydrated, then it becomes

(a) Acidic (b) Basic

(c) Neutral (d) Amphoteric

102. Silver nitrate produces a black stain on skin due to

(a) Being a strong reducing agent

(b) Its corrosive action

(c) Formation of complex compound

(d) Its reduction to metallic silver

103. Which of the following compounds does not dissolve in ammonium hydroxide solution

(a) AgF (b) $AgBr$

(c) $AgCl$ (d) AgI

104. Silver nitrate is mainly used

(a) In photography (b) In model formation

(c) As reducing agent (d) As dehydrating agent

105. Which of the following is more soluble in ammonia

(a) $AgCl$ (b) $AgBr$

(c) AgI (d) None of these

106. The solubility of silver bromide in hypo solution due to the formation of

(a) $[Ag(S_2O_3)_2]^{-3}$ (b) Ag_2SO_3

(c) $[Ag(S_2O_3)]^-$ (d) $Ag_2S_2O_3$

107. $AgNO_3$ gives a red ppt. with

(a) KI (b) $NaBr$

(c) $NaNO_3$ (d) K_2CrO_4

108. Which one of the following is known as lunar caustic when in fused state

(a) Silver nitrate (b) Silver sulphate

(c) Silver chloride (d) Sodium sulphate

109. Which silver halide is used in medicine

(a) $AgNO_3$ (b) $AgCl$

(c) $AgBr$ (d) AgF

110. During extraction of silver, which of the following is formed

(a) $Na[Ag(CN)_2]$ (b) $Na_2[Ag(CN)_2]$

(c) $Na_4[Ag(CN)_2]$ (d) None of these

111. Which of the nitrates on strong heating leaves the metal as the residue

(a) $AgNO_3$ (b) $Pb(NO_3)_2$

(c) $Cu(NO_3)_2$ (d) $Al(NO_3)_3$

112. $AgCl$ dissolves in a solution of NH_3 but not in water because

(a) NH_3 is a better solvent than H_2O

(b) Ag^+ forms a complex ion with NH_3

(c) NH_3 is a stronger base than H_2O

(d) The dipole moment of water is higher than NH_3

113. Parke's process of desilverization of lead depends upon

(a) Partition coefficient of silver between molten zinc/molten lead having a high value

(b) Partition coefficient of silver between molten zinc/molten lead having a low value

(c) Crystallizing out of pure lead while the silver–lead eutectic which has a lower melting point is left behind in liquid form

(d) Chemical combination of zinc and silver which precipitates out easily

114. $AgCl$ when heated with Na_2CO_3 gives

(a) Ag_2O (b) Ag

(c) Ag_2CO_3 (d) $NaAgCO_3$

115. $AgCl$ is dissolved in excess of each of NH_3, KCN and $Na_2S_2O_3$. The complex ions produced in each case are

(a) $[Ag(NH_3)_2]^+, [Ag(CN)_2]^+$ and $[Ag(S_2O_3)_2]^{3-}$

(b) $[Ag(NH_3)_2]^{2+}, [Ag(CN)_2]^{3-}$ and $[Ag(S_2O_3)_2]^{2-}$

(c) $[Ag(NH_3)_4]^{2+}, [Ag(CN)_2]^{3-}$ and $[Ag_2(S_2O_3)_2]^{2-}$

(d) $[Ag(NH_3)_2]^+, [Ag(CN)_2]^-$ and $[Ag(S_2O_3)_2]^{3-}$

116. A copper coin is completely covered with a gold film and is placed in dilute HNO_3. This will result in formation of

(a) Gold nitrate (b) Copper nitrate

(c) None of these (d) Purple of cassius

117. Name the reagent that is used in leaching of gold

(a) Carbon (b) Sodium cyanide

(c) Carbon monoxide (d) Iodine

118. Which of the following is called white vitriol

(a) $ZnCl_2$ (b) $MgSO_4.7H_2O$

(c) $ZnSO_4.7H_2O$ (d) $Al_2(SO_4)_3$

119. In the metallurgy of zinc, the zinc dust obtained from roasting and reduction of zinc sulphide contains some ZnO. How is this removed

(a) Absorbance of ultraviolet light and re-emission of white light is employed

(b) Shock cooling by contact with a shower of molten lead is done

(c) X–ray method is used

(d) Smelting is employed

120. Zinc when reacted with excess of $NaOH$ gives

(a) Zinc hydroxide (b) Zinc oxide

(c) Di sodium zincate (d) Sodium zincate

121. Zinc reacts with hot and concentrated H_2SO_4 to give

(a) H_2 (b) SO_2

(c) SO_3 (d) H_2S

122. Reaction of zinc with cold and very dilute nitric acid yields

(a) $Zn(NO_3)_2 + N_2O$ (b) $Zn(NO_3)_2 + NO$

(c) $Zn(NO_3)_2 + NH_4NO_3$ (d) $Zn(NO_3)_2 + NO_2$

123. What happens when aluminium and zinc salts react with an excess of $NaOH$

(a) White precipitate is formed

(b) White precipitate of both Zn and Al first formed re-dissolve in excess of $NaOH$

(c) White precipitate of Al redissolves but that of Zn does not

(d) White precipitate of Zn redissolves and that of Al does not

124. The formula of corrosive sublimate is

(a) $HgCl_2$ (b) Hg_2Cl_2

(c) Hg_2O (d) Hg

125. The main product obtained when a solution of sodium carbonate reacts with mercuric chloride is

(a) $Hg(OH)_2$ (b) $HgCO_3.HgO$

(c) $HgCO_3$ (d) $HgCO_3.Hg(OH)_2$

126. The gas produced on heating MnO_2 with conc. HCl is

(a) Cl_2 (b) H_2

(c) O_2 (d) O_3

127. The number of moles of $KMnO_4$ required to oxidize one equivalent of KI in the presence of sulphuric acid is

(a) 5 (b) 2

(c) 1/2 (d) 1/5

128. The number of electrons required to reduce chromium completely in $Cr_2O_7^{2-}$ to Cr^{3+} in acidic medium, is

(a) 5 (b) 3

(c) 6 (d) 2

129. In alkaline medium, the reaction of hydrogen peroxide with potassium permanganate produces a compound in which the oxidation state of *Mn* is

(a) 2 (b) +2

(c) +3 (d) +4

130. The major product formed in the oxidation of acetylene by alkaline $KMnO_4$ is

(a) Ethanol (b) Acetic acid

(c) Formic acid (d) Oxalic acid

131. Upon heating with acidic $KMnO_4$ an organic compound produces hexan – 1, 6 – dioic acid as the major product the starting compound is

(a) Benzene (b) Cyclohexene

(c) 1– methylcyclohexene (d) 2–methylcyclohexene

3. IIT-JEE/ AIEEE

1. Of the following outer electronic configuration of atoms, the highest oxidation state is achieved by which one of them **[2004]**

(a) $(n-1)d^5ns^2$ (b) $(n-1)d^8ns^2$

(c) $(n-1)d^5ns^1$ (d) $(n-1)d^3ns^2$

2. Which of the following ions has the highest magnetic moment **[2002]**

(a) Ti^{3+} (b) Sc^{3+}

(c) Mn^{2+} (d) Zn^{2+}

3. The atomic number of vanadium (*V*), chromium (*Cr*), manganese (*Mn*) and iron (*Fe*) are respectively 23, 24, 25 and 26 which one of these may be expected to have the highest second ionization enthalpy **[2003]**

(a) *V* (b) *Cr*

(c) *Mn* (d) *Fe*

4. In context with the transition elements, which of the following statements is incorrect **[2009]**

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

(b) In the highest oxidation states, the transition metal show basic character and form cationic complexes

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

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

5. A reduction in atomic size with increase in atomic number is a characteristic of elements of **[2003]**

(a) High atomic masses (b) *d*-block

(c) *f* –block (d) Radioactive series

6. Which of the following arrangements does not represent the correct order of the property stated against it **[2013]**

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

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

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

(d) $Sc < Ti < Cr < Mn$: number of oxidation states

7. 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 $E^0_{M^{3+}/M^{2+}}$ value **[2013]**

(a) $Cr(Z = 24)$ (b) $Mn(Z = 25)$

(c) $Fe(Z = 26)$ (d) $Co(Z = 27)$

8. Which pair of compound is expected to show similar colour in aqueous medium **[2005]**

(a) $FeCl_2$ and $CuCl_2$ (b) $VOCl_2$ and $CuCl_2$

(c) $VOCl_2$ and $FeCl_2$ (d) $FeCl_2$ and $MnCl_2$

9. The colour of light absorbed by an aqueous solution of $CuSO_4$ is **[2012]**

(a) Orange-red (b) Blue-green

(c) Yellow (d) Violet

10. Cerium ($Z = 58$) is an important member of the lanthanoids. Which of the following statements about cerium is incorrect **[2004]**

(a) The +4 oxidation state of cerium is not known in solutions

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

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

(d) Cerium (IV) acts as an oxidizing agent

11. Knowing that the chemistry of lanthanoids (*Ln*) is dominated by its +3 oxidation state, which of the following statements is incorrect **[2009]**

(a) Because of the large size of the *Ln* (III) ions the bonding in its compounds is predominantly ionic in character

(b) The ionic sizes of *Ln* (III) decrease in general with increasing atomic number

(c) *Ln*(III) compounds are generally colourless

(d) *Ln* (III) hydroxides are mainly basic in character

12. The actinoids exhibits more number of oxidation states is greater than the lanthanoids. This is because **[2007]**

(a) The $5f$ orbitals are more buried than the $4f$ orbitals

(b) There is a similarity between $4f$ and $5f$ orbitals in their angular part of the wave function

(c) The actinoids are more reactive than the lanthanoids

(d) The $5f$ orbitals extend further from the nucleus than the $4f$ orbitals

13. Identify the incorrect statement among the following **[2007]**

(a) d-block elements show irregular and erratic chemical properties among themselves

(b) La and Lu have partially filled d orbitals and no other partially filled orbitals

(c) The chemistry of various lanthanoids is very similar

(d) $4f$ and $5f$ orbitals are equally shielded

14. Most common oxidation states of Ce (cerium) are **[2002]**

(a) + 2, + 3 (b) + 2, + 4

(c) + 3, + 4 (d) + 3, + 5

15. The main reason for larger number of oxidation states exhibited by the actinoids than the corresponding lanthanoids is **[2008]**

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

(b) Larger atomic size of actinoids than the lanthanoids

(c) More energy difference between $5f$ and $6d$ orbitals than between $4f$ and $5d$ orbitals

(d) Greater reactive nature of the actinoids than the lanthanoids

16. The lanthanide contraction is responsible for the fact that **[2005]**

(a) Zr and Y have about the same radius

(b) Zr and Nb have similar oxidation state

(c) Zr and Hf have about the same radius

(d) Zr and Zn have the same oxidation sate

17. Which of the following factors may be regarded as the main cause of lanthanide contraction **[2005]**

(a) Poor shielding of one of $4f$ electron by another in the subshell

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

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

(d) Greater shielding of $5d$ electron by $4f$ electrons

18. In context of the lanthanoids, which of the following statement is not correct **[2011]**

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

(b) All the member exhibit +3 oxidation state

(c) Because of similar properties the separation of lanthanoids is not easy

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

19. Arrange $Ce^{+3}, La^{+3}, Pm^{+3}$ and Yb^{+3} in increasing order of their ionic radii **[2002]**

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

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

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

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

20. Which of the following is not oxidized by O_3 **[2005]**

(a) KI (b) $FeSO_4$

(c) $KMnO_4$ (d) K_2MnO_4

21. Which one of the following dissolve ; in hot concentrated $NaOH$ solution **[1980]**

(a) Fe (b) Zn

(c) Cu (d) Ag

22. Which one of the following oxides is ionic **[1995]**

(a) MnO (b) Mn_2O_7

(c) CrO_3 (d) P_2O_5

23. Which one of the following statements is correct **[2003]**

(a) Manganese salts give violet borax bead test in the reducing flame

(b) From a mixed precipitate of $AgCl$ and AgI ammonia solution dissolves only $AgCl$

(c) Ferric ions give a deep green precipitate on adding potassium ferrocyanide solution

(d) On boiling a solution having K^+, Ca^{2+} and HCO_3^- ions we get a precipitate of $K_2Ca(CO_3)_2$

24. Which of the following compounds is metallic and ferromagnetic **[2016]**

(a) CrO_2 (b) VO_2

(c) MnO_2 (d) TiO_2

25. Among the following the compound that is both paramagnetic and coloured is **[1997]**

(a) $K_2Cr_2O_7$ (b) $(NH_4)_2(TiCl_6)$

(c) $VOSO_4$ (d) $K_3[Cu(CN_4)]$

26. The bonds present in the structure of dichromate ion are **[1999]**

(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

27. The purple colour of $KMnO_4$ is due to **[2015]**

(a) Charge transfer (b) d-d transition

(c) f-f transition (d) d-f transition

28. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate $Fe(C_2O_4)$ in acidic solution is **[1997]**

(a) 3/5 (b) 2/5

(c) 4/5 (d) 1

29. Iron is rendered passive by the action of **[1982]**

(a) Conc. H_2SO_4 (b) Conc. H_3PO_4

(c) Conc. HCl (d) Conc. HNO_3

30. Galvanization is applying a coating of **[2016]**

(a) Cr (b) Cu

(c) Zn (d) Pb

31. Iron exhibits +2 and +3 oxidation states. Which of the following statements about iron is incorrect **[2012]**

(a) Ferrous oxide is more basic in nature than the ferric oxide

(b) Ferrous compounds are relatively more ionic than the corresponding ferric compounds

(c) Ferrous compounds are less volatile than the corresponding ferric compounds

(d) Ferrous compounds are more easily hydrolysed than the corresponding ferric compounds

32. Which series of reactions correctly represents chemical relations related to iron and its compound **[2014]**

(a) $Fe \xrightarrow{\text{dil } H_2SO_4} FeSO_4 \xrightarrow{H_2SO_4, O_2} Fe_2(SO_4)_3 \xrightarrow{\text{heat}} Fe$

(b) $Fe \xrightarrow{O_2, \text{heat}} FeO \xrightarrow{\text{dil } H_2SO_4} FeSO_4 \xrightarrow{\text{heat}} Fe$

(c) $Fe \xrightarrow{Cl_2, \text{heat}} FeCl_3 \xrightarrow{\text{heat, air}} FeCl_2 \xrightarrow{Zn} Fe$

(d) $Fe \xrightarrow{O_2, \text{heat}} Fe_3O_4 \xrightarrow{CO, 600°C} FeO \xrightarrow{CO, 700°C} Fe$

33. 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 **[1998]**

(a) Estimating the concentration of iron

(b) Measuring the concentration of CN^-

(c) Measuring the solid state magnetic moment

(d) Thermally decomposing the compound

34. Excess of KI reacts with $CuSO_4$ solution and then $Na_2S_2O_3$ solution is added to it. Which of the statements is incorrect for this reaction **[2004]**

(a) $Na_2S_2O_3$ is oxidised (b) CuI_2 is formed

(c) Cu_2I_2 is formed (d) Evolved I_2 is reduced

35. Native silver metal forms a water soluble complex with a dilute aqueous solution of $NaCN$ in the presence of **[2008]**

(a) Nitrogen (b) Oxygen

(c) Carbon dioxide (d) Argon

36. Which one of the following nitrates will leave behind a metal on strong heating **[2003]**

(a) Ferric nitrate (b) Copper nitrate

(c) Manganese nitrate (d) Silver nitrate

37. The spin magnetic moment of cobalt in the compound $Hg[Co(SCN)_4]$ is **[2004]**

(a) $\sqrt{3}$ (b) $\sqrt{8}$

(c) $\sqrt{15}$ (d) $\sqrt{24}$

38. In the following reactions, ZnO is respectively acting as a/an

(A) $ZnO + Na_2O \rightarrow Na_2ZnO_2$

(B) $ZnO + CO_2 \rightarrow ZnCO_3$ **[2017]**

(a) Base and base (b) Acid and acid

(c) Acid and base (d) Base and acid

4. NEET/ AIPMT/ CBSE-PMT

1. The catalytic activity of the transition metals and their compounds is ascribed to their **[2012]**

(a) Chemical reactivity

(b) Magnetic behaviour

(c) Unfilled d-orbitals

(d) Ability to adopt multiple oxidation states and their complexing ability

2. Which of the following ionic species will impart colour to an aqueous solution **[1998]**

(a) Ti^{4+} (b) Cu^+

(c) Zn^{2+} (d) Cr^{3+}

3. Which of the following pairs are both the ions coloured in aqueous solution **[2006; 2010]**

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

(c) Ni^{2+}, Ti^{3+} (d) Sc^{3+}, Ti^{3+}

(At. no. : $Sc = 21, Ti = 22, Ni = 28, Cu = 29, Co = 27$)

4. Among the following series of transition metal ions, the one in which all metals ions have $3d^2$ electronic configuration is **[2004]**

(a) $Ti^{4+}, V^{3+}, Cr^{2+}, Mn^{3+}$ (b) $Ti^{2+}, V^{3+}, Cr^{4+}, Mn^{5+}$

(c) $Ti^{3+}, V^{2+}, Cr^{3+}, Mn^{4+}$ (d) $Ti^{+}, V^{4+}, Cr^{6+}, Mn^{7+}$

5. Which one of the following has maximum number of unpaired electrons **[1996; 1999]**

(a) Mg^{2+} (b) Ti^{3+}

(c) V^{3+} (d) Fe^{2+}

6. Which one of the following ions has electronic configuration $[Ar]3d^6$ **[2010]**

(a) Co^{3+} (b) Ni^{3+}

(c) Mn^{3+} (d) Fe^{3+}

(At. nos. $Mn = 25$, $Fe = 26$, $Co = 27$, $Ni = 28$)

7. Magnetic moment $2.83\ BM$ is given by which of the following ions

(At. nos. $Ti = 22$, $Cr = 24$, $Mn = 25$, $Ni = 28$) **[2014; 2015]**

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

(c) Ti^{3+} (d) Ni^{2+}

8. Which is the correct order of increasing energy of the listed orbitals in the atom of titanium **[2015]**

(a) 3s 4s 3p 3d (b) 4s 3s 3p 3d

(c) 3s 3p 3d 4s (d) 3s 3p 4s 3d

9. Which one of the following characteristics of the transition metals is associated with their catalytic activity **[2003]**

(a) Variable oxidation states

(b) High enthalpy of atomization

(c) Paramagnetic behaviour

(d) Colour of hydrated ions

10. Four successive members of the first row transition elements are listed below with their atomic numbers. Which one of them is expected to have the highest third ionization enthalpy **[2005]**

(a) Vanadium ($Z = 23$) (b) Chromium ($Z = 24$)

(c) Iron ($Z = 26$) (d) Manganese ($Z = 25$)

11. Which of the following statements about the interstitial compounds is **incorrect** **[2013]**

(a) They have higher melting points than the pure metal

(b) They retain metallic conductivity

(c) They are chemically reactive

(d) They are much harder than the pure metal

12. Which of the following ions is the most stable in aqueous solution **[2007]**

(a) Cr^{3+} (b) V^{3+}

(c) Ti^{3+} (d) Mn^{3+}

(At. no. $Ti = 22$ $V = 23$, $Cr = 24$, $Mn = 25$)

13. 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 **[2011]**

(a) $Cr > Mn > Co > Fe$ (b) $Mn > Fe > Cr > Co$

(c) $Fe > Mn > Co > Cr$ (d) $Co > Mn > Fe > Cr$

(At. no. $Cr = 24, Mn = 25, Fe = 26, Co = 27$)

14. Which one of the following does not correctly represent the correct order of the property indicated against it **[2008; 2012]**

(a) $Ti < V < Cr < Mn$; increasing number of oxidation states

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

(c) $Ti < V < Cr < Mn$; increasing melting points

(d) $Ti < V < Mn < Cr$; increasing 2^{nd} ionization enthalpy

15. The pair of compounds that can exist together is **[2014]**

(a) $FeCl_2, SnCl_2$ (b) $FeCl_3, KI$

(c) $FeCl_3, SnCl_2$ (d) $HgCl_2, SnCl_2$

16. Which of the following pairs has the same size **[2010]**

(a) Zn^{2+}, Hf^{4+} (b) Fe^{2+}, Ni^{2+}

(c) Zr^{4+}, Ti^{4+} (d) Zr^{4+}, Hf^{4+}

17. Mercury is the only metal which is liquid at $0°C$. This is due to its **[1995]**

(a) Very high ionisation energy and weak metallic bond

(b) Low ionisation potential

(c) High atomic weight

(d) High vapour pressure

18. Lanthanoids are **[2004]**

(a) 14 elements in the sixth period (atomic no. = 58 to 71) that are filling 4*f* sublevel

(b) 14 elements in the seventh period (atomic no. = 58 to 71) that are filling 4*f* sublevel

(c) 14 elements in the sixth period (atomic no. = 90 to 103) that are filling 4*f* sublevel

(d) 14 elements in the seventh period (atomic no. = 90 to 103) that are filling 4*f* sublevel

19. Which of the following oxidation states is the most common among the lanthanoids **[2010]**

(a) 4 (b) 2

(c) 5 (d) 3

20. Identify the incorrect statement among the following **[2007]**

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

(b) Lanthanoid contraction is the accumulation of successive shrinkages

(c) As a result of lanthanide contraction, the properties of the 4th series of the contraction element have no similarities with the 5d series of elements

(d) Shielding power of 4f element of electron is quite weak

21. Reason of lanthanoid contraction is **[2014]**

(a) Decreasing nuclear charge

(b) Decreasing screening effect

(c) Negligible screening effect of '*f*' orbitals

(d) Increasing nuclear charge

22. Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii **[2015]**

(a) *Zr*(40) and *Nb*(41) (b) *Zr*(40) and *Hf*(72)

(c) *Zr*(40) and *Ta*(73) (d) *Ti*(22) and *Zr*(40)

23. Which of the following exhibits only +3 oxidation state **[2012]**

(a) *U* (b) *Th*

(c) *Ac* (d) *Pa*

24. Which of the following lanthanoid ions is diamagnetic

(At. no. *Ce* = 58, *Sm* = 62, *Eu* = 63, *Yb* = 70) **[2013]**

(a) Yb^{2+} (b) Ce^{2+}

(c) Sm^{2+} (d) Eu^{2+}

25. Which one of the following statements related to lanthanons is incorrect **[2016]**

(a) All the lanthanons are much more reactive than aluminium

(b) *Ce*(+4) solutions are widely used as oxidizing agent in volumetric analysis

(c) Europium shows +2 oxidation state

(d) The basicity decreases as the ionic radius decreases from Pr to *Lu*

26. The electronic configurations of *Eu*(Atomic No 63), *Gd*(Atomic No 64) and *Tb* (Atomic No. 65) are **[2016]**

(a) $[Xe]4f^7 6s^2, [Xe]4f^8 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

(b) $[Xe]4f^7 5d^1 6s^2, [Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(c) $[Xe]4f^6 5d^1 6s^2, [Xe]4f^7 5d^1 6s^2$ and $[Xe]4[f^8 5d^1 6s^2$

(d) $[Xe]4f^7 6s^2, [Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

27. The correct order of ionic radii of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is **[2003]**

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

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

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

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

(Atomic no. $Y = 39$, $La = 57$, $Eu = 63$, $Lu = 71$)

28. The reason for greater range of oxidation states in actinoids is attributed to **[2017]**

(a) The radioactive nature of actinoids

(b) Actinoid contraction

(c) 5*f*, 6*d* and 7*s* levels having comparable energies

(d) 4*f* and 5*d* levels being close in energies

29. Amongst $TiF_6^{2-}, CoF_6^{3-}, Cu_2Cl_2$ and $NiCl_4^{2-}$ (Atomic number $Ti = 22$, $Co = 27$, $Cu = 29$, $Ni = 28$). The colourless species are **[1995, 2009]**

(a) CoF_6^{3-} and $NiCl_4^{2-}$ (b) TiF_6^{2-} and CoF_6^{3-}

(c) Cu_2Cl_2 and $NiCl_4^{2-}$ (d) TiF_6^{2-} and Cu_2Cl_2

30. Reaction between the following pairs will produce H_2 except **[1998]**

(a) *Na* + ethyl alcohol (b) *Fe* + steam

(c) $Fe + H_2SO_{4\,(aq.)}$ (d) $Cu + HCl_{(aq.)}$

31. Which of the following pairs of metals is purified by van Arkel method **[2011]**

(a) *Ni* and *Fe* (b) *Ga* and *In*

(c) *Zr* and *Ti* (d) *Ag* and *Au*

32. Acidified $K_2Cr_2O_7$ solution turns green when Na_2SO_3 is added to it. This is due to the formation of **[2011]**

(a) $CrSO_4$ (b) $Cr_2(SO_4)_3$

(c) CrO_4^{2-} (d) $Cr_2(SO_3)_3$

33. Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution **[2016]**

(a) The solution turns blue

(b) The solution is decolourized

(c) SO_2 is reduced

(d) Green $Cr_2(SO_4)_3$ is formed

34. Which of the statements is **not** true **[2012]**

(a) On passing H_2S through acidified $K_2Cr_2O_7$ solution, a milky colour is observed

(b) $Na_2Cr_2O_7$ is preferred over $K_2Cr_2O_7$ in volumetric analysis

(c) $K_2Cr_2O_7$ solution in acidic medium is orange

(d) $K_2Cr_2O_7$ solution becomes yellow on increasing the *pH* beyond 7

35. Which of the following does not give oxygen on heating **[2013]**

(a) $(NH_4)_2Cr_2O_7$ (b) $KClO_3$

(c) $Zn(ClO_3)_2$ (d) $K_2Cr_2O_7$

36. $KMnO_4$ 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 addings **[2013]**

(a) SO_2 (b) HCl

(c) KOH (d) CO_2

37. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives **[2014]**

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

(c) Mn^{4+} and O_2 (d) Mn^{2+} and O_2

38. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified $KMnO_4$ for complete oxidation **[2015]**

(a) $FeSO_4$ (b) $FeSO_3$

(c) FeC_2O_4 (d) $Fe(NO_2)_2$

39. The most convenient method to protect bottom of ship made of iron is **[2001]**

(a) White tin plating

(b) Coating with red lead oxide

(c) Connecting with '*Pb*' block

(d) Connecting with '*Mg*' block

40. To protect iron against corrosion, the most durable metal plating on it, is **[1994]**

(a) Nickel plating (b) Tin plating

(c) Copper plating (d) Zinc plating

41. A blue colouration is not obtained when **[1989]**

(a) Ammonium hydroxide dissolves in copper sulphate

(b) Copper sulphate solution reacts with $K_4[Fe(CN)_6]$

(c) Ferric chloride reacts with sodium ferrocyanide

(d) Anhydrous $CuSO_4$ is dissolved in water

42. When copper is heated with conc. HNO_3 it produces **[2016]**

(a) $Cu(NO_3)_2$ and NO_2

(b) $Cu(NO_3)_2$ and NO

(c) $Cu(NO_3)_2$, NO and NO_2

(d) $Cu(NO_3)_2$ and N_2O

43. Copper sulphate solution reacts with KCN to give **[2002, 06]**

(a) $Cu(CN)_2$ (b) $CuCN$

(c) $K_2[Cu(CN)_4]$ (d) $K_3[Cu(CN)_4]$

44. Percentage of silver in German silver is **[2000]**

(a) 0% (b) 1%

(c) 5% (d) None of these

45. Which of the following metal is obtained by leaching out process using a solution of $NaCN$ and then precipitating the metal by addition of zinc dust **[1989]**

(a) Copper (b) Silver

(c) Nickel (d) Iron

46. Parke's process is used to extract **[1992]**

(a) Silver using $NaCN$

(b) Copper using $CuFeS_2$

(c) Silver from argentiferrous lead

(d) Silver by forming amalgam

47. German silver is an alloy of **[1980; 2000]**

(a) Copper, zinc and nickel (b) Copper and silver

(c) Copper, zinc and tin (d) Copper, zinc and silver

48. Zn gives hydrogen gas with H_2SO_4 and HCl but not with HNO_3 because **[2002]**

(a) NO_3^- is reduced in preference to H_3O^+

(b) HNO_3 is weaker acid than H_2SO_4 and HCl

(c) Zn acts as oxidising agent when reacts with HNO_3

(d) In electrochemical series Zn is placed above the hydrogen

49. When calomel react with NH_4OH solution the compound formed is **[1996;]**

(a) $NH_2-Hg-Cl$ (b) $Hg_2Cl_2NH_3$

(c) $Hg(NH_3)_2Cl_2$ (d) $HgCl_2NH_3$

50. Name the gas that can readily decolourise acidified $KMnO_4$ solution **[2017]**

(a) CO_2 (b) SO_2

(c) NO_2 (d) P_2O_5

5. AIIMS

1. Highest (+7) oxidation state is shown by **[1999]**

(a) Co (b) Cr

(c) V (d) Mn

2. Which ion has maximum magnetic moment **[1983]**

(a) V^{+3} (b) Mn^{+3}

(c) Fe^{+3} (d) Cu^{+2}

3. The general electronic configuration of transition elements is **[2001]**

(a) $(n-1)d^{1-5}$ (b) $(n-1)d^{1-10}ns^1$

(c) $(n-1)d^{1-10}ns^{1-2}$ (d) $ns^2(n-1)d^{10}$

4. Which of the following electronic configuration is that of a transitional element **[2000]**

(a) $1s^2, 2s^2p^6, 3s^2p^6d^{10}, 4s^2p^6$

(b) $1s^2, 2s^2p^6, 3s^2p^6d^{10}, 4s^2p^1$

(c) $1s^2, 2s^2p^6, 3s^2p^6d^2, 4s^2$

(d) $1s^2, 2s^2p^6, 3s^2p^6, 4s^2$

5. Which one of the following organisation's iron and steel plant was built to use charcoal as a source of power, to start with, but later switched over to hydroelectricity **[2004]**

(a) The Tata Iron and Steel Company

(b) The Indian Iron and Steel Company

(c) Mysore Iron and Steel Limited

(d) Hindustan Steel Limited

6. The basic character of the transition metal monoxides follows the order **[2007]**

(a) $TiO > VO > CrO > FeO$

(b) $VO > CrO > TiO > FeO$

(c) $CrO > VO > FeO > TiO$

(d) $TiO > FeO > VO > CrO$

(Atomic no. $Ti = 22, V = 23, Cr = 24, Fe = 26$)

7. Among the following pairs of ions, the lower oxidation state in aqueous solution is more stable than the other in **[2005]**

(a) Tl^+, Tl^{3+} (b) Cu^+, Cu^{2+}

(c) Cr^{2+}, Cr^{3+} (d) V^{2+}, VO^{2+}

8. Which of the following does not have valence electron in $3d$-subshell **[2002]**

(a) Fe (III) (b) Mn (II)

(c) Cr (I) (d) P (0)

9. Lanthanide for which +II and +III oxidation states are common is **[2003]**

(a) La (b) Nd

(c) Ce (d) Eu

10. Which metal is present in brass, bronze and German silver **[1999]**

(a) Zn (b) Mg

(c) Cu (d) Al

11. Which of the following compounds is coloured **[2008]**

(a) $TiCl_3$ (b) $FeCl_3$

(c) $CoCl_2$ (d) All of these

12. F_2 is the formed by reacting K_2MnF_6 with **[2005]**

(a) SbF_5 (b) MnF_3

(c) $KSbF_6$ (d) MnF_4

13. Bessemer converter is used for **[2015]**

(a) Steel (b) Wrought iron

(c) Pig iron (d) Cast iron

14. On adding excess of NH_3 solution to $CuSO_4$ solution, the dark blue colour is due to **[1982]**

(a) $[Cu(NH_3)_4]^{++}$ (b) $[Cu(NH_3)_2]^{++}$

(c) $[Cu(NH_3)]^{+}$ (d) None of the above

15. Impurities of lead in silver are removed by **[1987]**

(a) Parke's process (b) Solvay process

(c) Cyanide process (d) Amalgamation process

16. Which of the following does not react with $AgCl$ **[1997]**

(a) $NaNO_3$ (b) Na_2CO_3

(c) $Na_2S_2O_3$ (d) NH_4OH

17. Lucas reagent is **[1980, 82]**

(a) Anhydrous $ZnCl_2 + conc.HCl$

(b) Hydrous $ZnCl_2 + dil.HCl$

(c) Conc. HNO_3 + anhydrous $ZnCl_2$

(d) Conc. HNO_3 + anhydrous $MgCl_2$

18. The compound insoluble in water is **[2004]**

(a) Mercurous nitrate (b) Mercuric nitrate

(c) Mercurous chloride (d) Mercurous perchlorate

6. Assertion and Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

(e) If assertion is false but reason is true.

1. Assertion : Cuprous ion (Cu^+) has unpaired electrons while cupric ion (Cu^{++}) does not.

Reason : Cuprous ion (Cu^+) is colourless where as cupric ion (Cu^{++}) is blue in the aqueous solution. **[AIIMS 2002]**

2. Assertion : Cobalt-60 is useful in cancer therapy.

Reason : Cobalt-60 is source of γ-radiations capable of killing cancerous cell. **[AIIMS 2006]**

3. Assertion : Transition metals show variable valency.

Reason : Due to a large energy difference between the ns^2 and $(n-1)d$ electrons. **[AIIMS 1996]**

4. Assertion : The aqueous solution of $FeCl_3$ is basic in nature.

Reason : $FeCl_3$ hydrolyses in water. **[AIIMS 1998]**

5. Assertion : $AgCl$ dissolves in NH_4OH solution.

Reason : Due to formation of a complex. **[AIIMS 1998]**

6. Assertion : Pure iron is not used for making tools and machines.

Reason : Pure iron is hard. **[AIIMS 1998]**

7. Assertion : Solution of Na_2CrO_4 in water is intensely coloured.

Reason : Oxidation state of Cr in Na_2CrO_4 is +VI. **[AIIMS 2003]**

8. Assertion : Copper metal gets readily corroded in an acidic aqueous solution.

Reason : Free energy change for this process is positive. **[AIIMS 2004]**

9. Assertion : The free gaseous Cr atom has six unpaired electrons.

Reason : Half filled 's' orbital has greater stability. **[AIIMS 2004]**

10. Assertion : Mercury vapour is shining silvery in appearance.

Reason : Mercury is a metal with shining silvery appearance. **[AIIMS 2007]**

11. Assertion : Extraction of iron metal from iron oxide ore is carried out by heating with coke.

Reason : The reaction $Fe_2O_3(s) \rightarrow Fe(s) + \frac{3}{2}O_2(g)$ is a spontaneous process. **[AIIMS 2005]**

25. d- and f - Block Elements – Answers Keys

1. General Characteristics

1	c	2	b	3	d	4	c	5	c
6	b	7	c	8	a	9	b	10	a
11	b	12	a	13	a	14	b	15	d
16	a	17	c	18	b	19	b	20	b
21	a	22	a	23	b	24	d	25	a
26	c	27	d	28	d	29	b	30	d
31	a	32	d	33	a	34	a	35	c
36	d	37	a	38	c	39	d	40	a
41	a	42	d	43	b	44	a	45	c
46	b	47	b	48	d	49	c	50	c
51	b	52	d	53	c	54	a	55	b
56	a	57	d	58	d	59	d	60	a
61	a	62	c	63	b	64	a	65	d
66	d	67	c	68	b	69	d		

2. Compounds of Transitional Elements

1	a	2	b	3	d	4	a	5	b
6	a	7	b	8	a	9	a	10	b
11	a	12	c	13	a	14	b	15	d
16	a	17	d	18	d	19	b	20	d
21	c	22	c	23	c	24	c	25	d
26	d	27	d	28	c	29	a	30	a
31	a	32	c	33	d	34	c	35	c
36	b	37	a	38	b	39	d	40	a
41	bd	42	c	43	c	44	b	45	a
46	a	47	a	48	a	49	a	50	d
51	c	52	b	53	a	54	a	55	d
56	a	57	c	58	b	59	a	60	d
61	a	62	c	63	b	64	a	65	c
66	c	67	b	68	c	69	b	70	b
71	c	72	d	73	b	74	b	75	a
76	b	77	c	78	c	79	c	80	b
81	c	82	a	83	c	84	c	85	a
86	a	87	a	88	b	89	a	90	c
91	a	92	b	93	a	94	a	95	c
96	b	97	d	98	b	99	d	100	b
101	d	102	d	103	d	104	a	105	a
106	a	107	d	108	a	109	a	110	a
111	a	112	b	113	a	114	b	115	d
116	c	117	b	118	c	119	d	120	d
121	b	122	c	123	b	124	a	125	b
126	a	127	d	128	c	129	d	130	d
131	b								

3. IIT-JEE/ AIEEE

1	a	2	c	3	b	4	b	5	c
6	a	7	d	8	b	9	a	10	a
11	c	12	d	13	d	14	c	15	a
16	c	17	c	18	d	19	a	20	c
21	b	22	a	23	b	24	a	25	c
26	e	27	a	28	a	29	d	30	c
31	d	32	d	33	c	34	b	35	b
36	d	37	c	38	c				

4. NEET/ AIPMT/ CBSE-PMT

1	d	2	d	3	c	4	b	5	d
6	a	7	d	8	d	9	a	10	d
11	c	12	a	13	b	14	c	15	a
16	d	17	a	18	a	19	d	20	c
21	c	22	b	23	c	24	a	25	a
26	d	27	c	28	c	29	d	30	d
31	c	32	b	33	d	34	b	35	a
36	d	37	d	38	a	39	a	40	d
41	b	42	a	43	d	44	a	45	b
46	c	47	a	48	a	49	a	50	b

5. AIIMS

1	d	2	c	3	c	4	c	5	a
6	a	7	a	8	d	9	a	10	c
11	d	12	a	13	c	14	a	15	a
16	a	17	a	18	c				

6. Assertion & Reason

1	e	2	a	3	c	4	e	5	a
6	c	7	a	8	d	9	c	10	d
11	d								