CHEMISTRY: **Max.Marks : 60**

SECTION I

Single Correct Answer Type

This section contains **10 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

21. The overall formation constant of the $\left[Co(NH_3)_6\right]^{2+}$ ion in aqueous solution is 10^5 and the standard potentials for the reduction of $Co^{3+}(aq)$ and $\left[Co(NH_3)_6\right]^{3+}(aq)$ are as follows

$Co^{3+}(aq)+e^- \rightleftharpoons Co^{2+}(aq)$ $E^\circ = +1.9V$

$\left[Co(NH_3)_6\right]^{3+}(aq)+e^- \rightleftharpoons \left[Co(NH_3)_6\right]^{2+}(aq)$ $E^\circ = +0.1V$

Calculate the nearest overall formation constant of the $\left[Co(NH_3)_6\right]^{3+}$ ion

A) 10^{30} B) 10^{33} C) 10^{35} D) 10^{38}

22. A compound with empirical formula $Fe(H_2O)_4(CN)_2$ has a magnetic moment corresponding to $2\frac{2}{3}$ unpaired electrons per iron. The molecular formula of the complex may be

A)$[Fe(H_2O)_4(CN)_2]$ B) $[Fe(H_2O)_6][Fe(CN)_6]$

C) $[Fe(H_2O)_6]_4[Fe(CN)_6]_3$ D) $[Fe(H_2O)_6]_2[Fe(CN)_6]$

23. Which of the following substances can react to give products, under suitable conditions

A) $Cr^{2+}(aq)+Fe^{3+}(aq)\rightarrow$ B) $CrO_4^{2-}(aq)+MoO_2(s)\rightarrow$

C) $MnO_4^-(aq)+Cr^{3+}(aq)\rightarrow$ D) All of these

24. The enthalpy of sublimation of Re(s) is 704 kJ mol^{-1} where as that of Mn(s) is 221 kJ mol^{-1} because

A) Re atoms are smaller in size than Mn atoms

B) Re has higher ionization energy than Mn

C) Re belongs to 5d series in which metal – metal bonding is stronger

D) Mn has stable $3d^5$ electronic configuration

25. Arrange in increasing order of acidic nature

(I) $\left[Na(H_2O)_6\right]^+$ (II) $\left[Sc(H_2O)_6\right]^{3+}$ (III) $\left[Mn(H_2O)_6\right]^{2+}$ (IV) $\left[Ni(H_2O)_6\right]^{2+}$

A) IV < III < II < I B) I < II < III < IV

C) I < III < IV < II D) IV < II < III < I

26. False statement about the trend in oxidation states of transition element is

A) There exists a general trend of lesser number of oxidation states at each end of the series and a higher number in the middle

B) there is reduced tendency of higher oxidation states towards the end of the series

C) The stability of the higher oxidation states decreases going down the group

D) The highest oxidation states are often stabilized in the oxide and fluoride compounds

27. Point out the false statement regarding transition metals

A) in general the second and third row elements exhibit higher coordination numbers

B) stable oxidation states form oxides and halides

C) strongly reducing states probably do not form fluorides and / or oxides but may well form the heavier halides

D) strongly oxidizing states form oxides and fluorides but not iodides

28. The strength as oxidizing agents of the following species in acidic medium decreases in the order

A) $S_2O_8^{2-} > Cr_2O_7^{2-} > MnO_4^-$ B) $Cr_2O_7^{2-} > S_2O_8^{2-} > MnO_4^-$

C) $MnO_4^- > Cr_2O_7^{2-} > S_2O_8^{2-}$ D) $S_2O_8^{2-} > MnO_4^- > Cr_2O_7^{2-}$

29. Two moles of glycine NH_2CH_2COOH is added to a solution of one mole of aqueous copper acetate. Then which of the following observation is found

A) conductivity of solution increases

B) conductivity of solution decreases

C) conductivity of solution remain constant

D) conductivity of solution will be doubled

30. Which of the following statement is correct

A) Cr(III) – SCN bonded thiocyanate complexes slowly rearrange to give the N – bonded Cr(III) – NCS isothiocyanate complex

B) Cr(III) – NCS bonded isothiocyanate complexes slowly rearrange to the S – bonded Cr(III) – SCN thiocyanate complex

C) Neither Cr(III) – SCN bonded thiocyante nor Cr(III) – NCS bonded isothiocyanate complexes rearrange

D) Both Cr(III) – SCN bonded thiocyanate and N – bonded Cr(III) isothiocyanate are in equilibrium

SECTION II

Multiple Correct Answer(s) Type

This section contains **5 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct.**

31. Co^{2+} ion can form the complexes $[CoCl_4]^{2-}$ and $[Co(H_2O)_6]^{2+}$ regarding these complexes which statement is correct

A) $[CoCl_4]^{2-}$ absorb a radiation of longer wavelength among the two compounds

B) $[Co(H_2O)_6]^{2+}$ absorb a radiation of shorter wavelength among the two compounds

C) $[CoCl_4]^{2-}$ has intense colour while $[Co(H_2O)_6]^{2+}$ light colored

D) Both complexes have same magnetic moment

32. Reaction of the octahedral complex $[Co(NH_3)_3(NO_2)_3]$ with NaCl yields a complex $[Co(NH_3)_3(H_2O)Cl_2]^+$ in which there are two chloride ions. Assume that all the three NO_2^- ligands are bonded to Co through the N – atom. Then which of the following statement is correct?

A) Facial isomer of $[Co(NH_3)_3\ (NO_2)_3]$ can give two geometrical isomers

B) Facial isomer of $[Co(NH_3)_3(NO_2)_3]$ can give only one isomer

C) Meridional isomer of $[Co(NH_3)_3(NO_2)_3]$ can give two geometrical isomers

D) One of the isomer of $[Co(NH_3)_3(NO_2)Cl_2]$ exhibit optical isomerism

33. Which are the true statements regarding ionization energy of d series elements ?

A) ionization energy of Mn is greater than Cr

B) Ionisation energy of Pd > Rh and Ag

C) (I.E), decrease from 3d to 4d transition series but it increases from 4d to 5d series

D) (I.E) of Mo is greater than (I.E) of W

34. Which of the following are correct about difference between the first row and other two rows of transition elements?

A) M – M bonding is quite rare in the first row transition elements. In the second and third row heavier elements M – M bonds are much more common

B) The higher oxidation states of the second and third row elements are much more stable than the higher oxidation states of 1^{st} row elements

C) Coordination number of 7 and 8 are uncommon for the first row but are common in the early members of the second and third rows

D) First row elements can form either a low spin or high – spin complexes where as the 2^{nd} and 3^{rd} transition elements tend to give low – spin complexes

35. Which of the following statement(s) is / are correct with reference to Fe^{2+} and Fe^{3+} ions ?

A) Fe^{3+} gives brown color with potassium ferricyanide

B) Fe^{2+} gives blue colour with potassium ferricyanide

C) Fe^{3+} gives red colour with potassium thiocyanate

D) Fe^{3+} gives blue colour with potassium ferrocyanide

SECTION III
Integer Answer Type

This section contains **5 questions.** The answer to each question is single digit integer, ranging from 0 to 9 (*both inclusive*).

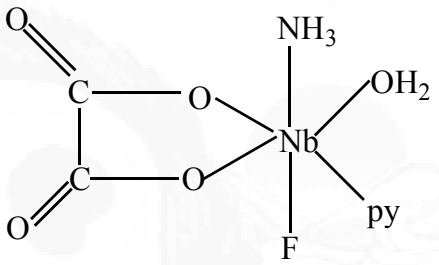
36. For how many of the following the weight increases in the applied magnetic field.

NO, NO_2 ,O_2, $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, KO_2, $MnSO_4$, $NiSO_4$, $CuSO_4$,$ZnSO_4$

37. A complex of composition $CoCl_3.5H_2O$ is known to contain six – coordinated chromium. Calculate the volume of 0.1N solution of $AgNO_3$ required to precipitate instantly the chloride ions from 20 mL of 0.01M solution of the complex salt, if the complex do not exhibit stereoisomerism

38. The number of 90^o $OCaO$ angles present in the complex formed by EDTA with Ca^{2+} ion

39. Below is drawn a neutral coordination compound of the metal niobium, Nb. Find total possible enantiomeric pair(s) of complex having same molecular formula



40. Find out total number of paramagnetic complexes which are inner orbital complexes:

$\left[Cr(NH_3)_6\right]Cl_3$, $\left[Co(NH_3)_6\right](NO_3)_2$, $\left[Ni(NH_3)_6\right]SO_4$, $K_2\left[PtCl_6\right]$,

$\left[V(H_2O)_6\right](SO_4)$, $\left[Mn(NH_3)_6\right](SO_4)$, $\left[Fe(H_2O)_5(NO)\right]SO_4$,

$K_3\left[CuCl_4\right]$, $Na_4\left[Fe(CN)_5(NOS)\right]$