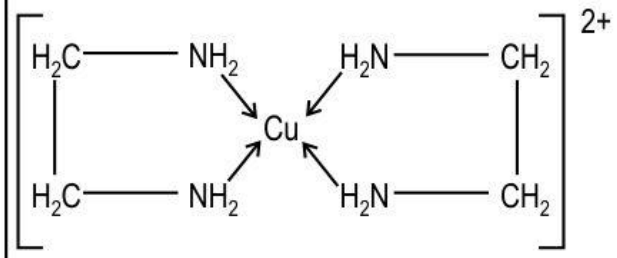
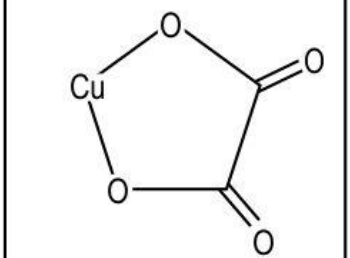
Coordination Compounds

Q.No.	Question	Marks
22	Which two compounds are expected to form same number of unique ions? (A) $K_4[Fe(CN)_6]$ and $KAl(SO_4)_2.12H_2O$ (B) $KAl(SO_4)_2.12H_2O$ and $K_4[Fe(CN)_6]$ (C) $FeSO_4.(NH_4)_2SO_4.6H_2O$ and $K_3[Fe(CN)_6]$ (D) $KCl.MgCl_2.6H_2O$ and $FeSO_4.(NH_4)_2SO_4.6H_2O$ ***[Skill: Mechanical]***	1
23	The number of moles of AgCl precipitated per mole of the compound cisplatin with excess $AgNO_3$ is _____. ***[Skill: Mechanical]***	1
24	Soumya observed that $[MnCl_6]^{-3}$ and $[Mn(CN)_6]^{-3}$ both contain Mn(III) as the central metal ion with a difference in the colour of their solutions. Which complex is coloured and which is colourless? Give a reason for your answer. ***[Skill: Understanding]***	2
25	Look at the two complexes given below and answer the questions that follow: **Complex I**  **Complex II**  (a) Identify the nature of the ligands in both the complexes. (b) Calculate the magnetic moment of complex I and complex II. (c) What are the electronic configurations of the t_{2g} and e_g orbitals of Cu^{+2} in both these complexes? (d) Can complex I show geometrical isomerism? Give a reason for your answer. ***[Skill: Application]***	1+1.5 +1 +1.5

Marking Scheme

Q No.	Rubric	Marks
22	**Correct Answer:** D Both compounds dissociate to form 5 ions thus these two compounds are expected to form the same number of ions.	1
	A: Students choosing this option may lack the understanding about the difference between the complex and double salts.	
	B: Students choosing this option may have got confused between the number of ions being furnished by these salts.	
	C: Students choosing this option may have got confused between the number of ions being furnished by these salts.	
23	2	1
24	In $[MnCl_6]^{-3}$ chloride is a weak field ligand, allowing d-d transitions to occur. These transitions are responsible for the colour of the complex. Hence, $[MnCl_6]^{-3}$ is coloured complex. *[1 mark for correct answer with reason.]* In $[Mn(CN)_6]^{-3}$, CN- is a strong field ligand. All the electrons pair up in the lower-energy t_{2g} orbitals. Thus, no unpaired electrons are available for d-d transitions, making the complex colourless. Hence, $[Mn(CN)_6]^{-6}$ is colourless complex. *[1 mark for correct answer with reason.]*	2
25	(a) -Complex I: Ligand is both chelating and bidentate -Complex II: Ligand is both chelating and bidentate *[0.5 marks to be awarded if either chelating or bidentate is mentioned.]*	1
	(b) The oxidation state of copper in both the complexes is +2, so, its EC is $3d^9$. Thus, in both the complexes the number of unpaired electrons is 1. *[0.5 marks]* So, the magnetic moment of both the complex is = $\sqrt{n(n+2)}$ [n is the number of unpaired electrons *[0.5 marks]* = $\sqrt{1(1+2)} = \sqrt{3} = 1.73$ BM *[0.5 marks]*	1.5
	(c) The electronic configuration of the t_{2g} and e_g orbitals in complexes I and II will be t_{2g}^6, e_g^3 as in both these complexes, the ligands are strong field ligands. *[1 mark]*	1
	(d) None of the complexes will show geometrical isomerism because the ethane-1,2-diamine and the dioxime ligands are bidentate and form rigid chelate rings that prevent cis and trans forms from existing. *[Award 0.5 marks for writing not possible and 1 mark for writing the correct reason]*	1.5