1	How metal clusters are classified and what are the bases of their classification? Write the main differences between these group clusters.	
2	Write about the characteristic properties of the metals those form clusters.	3
3	How do 'd' orbitals effect the cluster formation?	2
4	Metals form clusters at low oxidation state (-1 to +3). Why metals do not form of metal clusters at high oxidation states?	2
5	$[Re_2Cl_8]^{2-}$ cluster has very short Re-Re bond (224 nm) as compared to Re-Re distance (275nm) in metal crystal and chlorine atoms are eclipsed position. How would you explain these?	3
	Discuss about the structural features and nature of bonding of $[Re_2Cl_8]^{2-}$ clusters	3
	What do you understand by quadrupole bonding?	2
	Discuss about the trinuclear halides clusters of rhenium	2
	Discuss about the hexa-nuclear helo-cluster compound of Mo, Ta and Nb. What are the structural differences between them	3+2
	What is poly atomic zintle anions and cations? How theses zintle ions are prepared? Discuss about the structures of any three zintle ions.	1+1+3
	Both Bi_9^{5+} and Sn_9^{4-} are nine metal centered poly atomic zintle but their structures quite different. Write about their structural differences.	2
	Write about the preparation and structure of $Mo_4Cl_8(PR_3)_4$	3
	Discuss about the tetranuclear halo clusters of molybdenum and tungsten.	3
	Mo^{2+}, Nb^{3+} and Ta^{3+} all three form dinuclear class-II clusters. What are the structural pattern of these clusters.	3

6	Discuss about the carbonyl clusters of 1st transition series.	3
	Discuss about the class II type clusters of 1st transition series.	2
7	Give evidences to show that in hexa alkoxo dinuclear tungsten and molybdenum has M-M triple bonds.	3
8	All three elements of group -8 (Fe, Ru and Os) form di-nuclear carbonyl cluster but only iron cluster has two bridged CO not others. How this could be rationalized.	2
	In the ligand substitution reaction of square planar complexes, the plot of k_{obs} as function of nucleophile concentration gives slope and intercept. What does the slope and intercept signify?	3
	Ligand substitution reaction of square planar complexes showed two rate constants; one (k_1) is independent on nucleophile concentration and other (k_2) is dependent nucleophile concentration. Does the k_1 represent dissociative pathway of ligand substitution reaction? Justify your answer.	3
	Discuss about the role of solvent in the ligand substitution reaction of square planar complexes.	3
	Write about the complete reaction scheme of ligand substitution reaction of square planar complexes.	3
	Establish the general rate law of ligand substitution reaction of square planar complexes.	3
	Discuss about the characteristics of ligand substitution reaction of square planar complexes.	3
	Ligand substitution reaction of square planar complexes is 'stereo-selective'. What does it signify?	
	In general, substitution reaction of square planar complexes gives exclusively cis or trans product if starting complex is cis or trans respectively. Is it possible to get cis product from a trans reactant or vice-versa? Justify your answer with explanations.	2
	What are the evidences in favour of solvent assisted pathway of substitution reaction of square planar complexes.	
	What do you understand the terms 'trans-effect' and 'trans-influence'? What are the differences between these?	
	Discuss about the polarization theory of 'trans effect'. What are the evidences in favour of polarization theory? What are the drawbacks of the polarization theory?	3+ 1+2
	Discuss the detailed mechanism of the ligand substitution reaction of square planar complexes.	3
9	Rate of electron transfer of $[Co(NH_3)_6]^{+2}$ and $[Co(NH_3)_6]^{+3}$ is very slow (1.7×10^{-7} m^{-1}s^{-1}) but that for $[Ru(NH_3)_6]^{+2}$ complexes is very fast. How could you account for this difference in rate?	3
10	Reduction of $[Co(NH_3)_6]^{+3}$ by $[Cr(H_2O)_6]^{+2}$ is very much slow that the reduction with $[V(NH_3)_6]^{+2}$ is very fast how this could be explained.	3
	Cross electron transfer reaction of $[Co(phen)_3]^{3+}$ $[Co(phen)_3]^{2+}$ is very fast compared to that of $[Co(NH3)_6]^{3+}$ and $[Co(NH3)_6]^{2+}$ electron transfer reaction	
11	What are the evidences in favour of Inner Sphere Mechanism of electron transfer reaction?	3
12	Elucidate the detail mechanism of Outer Sphere Mechanism of electron transfer reaction	4
13	Write about the possible rate determining steps of Inner Sphere Mechanism of electron transfer Reactions?	3

#		Marks
14	Electron transfer reaction between $[Co(NH_3)_5SCN]^{+3}$ and $[Cr(H_2O)_6]^{+2}$ form two products 29%	4
	$[Cr(H_2O)_5SCN]^{+3}$ and 71% $[Cr(H_2O)_5NCS]^{+3}$. Write about electron transfer process and explain	2
	the reasons for two products.	1+3
15	The products of the reaction between $[IrCl_6]^{-2}$ and $Cr(H_2O)_6]^{+2}$ is $[IrCl_6]^{-3}$ and $Cr(H_2O)_6]^{+3}$. What	
	mechanism is followed, outer sphere or inner sphere? Give reasons.	1+2
	The intermediate $[Fe(SCN)(H_2O)_5]^{2+}$ is detected in the reaction of $[Co(NCS)(NH_3)_5]^{2+}$ with	
	$[Fe(H_2O)_6]^{2+}$ in the aqueous medium to produce $[Co(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{3+}$. Predict the reaction	
	mechanism with explanations.	3
16	Rate constant of the reduction of $[Co(NCS)(NH_3)_5]^{2+}$ $[Co(SCN)(NH_3)_5]^{2+}$ with $[Cr(H_2O)_6]^{2+}$ is 20.0 and	
	2×10^5 $M^{-1}s^{-1}$. Explain the hogher rate of the 2nd reaction	
17	'Presence of suitable bridging ligand in the coordination sphere of an inert oxidant does not ensure its	2
	Reduction by a reductant through the ISET path'. Explain with example. [Hint: A.K Das, 5th Vol p. 807]	2+4
18	$[CoNH_3)_5H_2O]^{2+}$ reduces with $[Cr(H_2O)_6]^{2+}$ at faster at higher pH. Why? [Hint: A.K Das, 5th Vol p. 803]	3
19	Redox reaction of $[Fe(H_2O)_6]^{3+}$ - $[Fe(H_2O)_6]^{2+}$ goes through OSET path at lower pH but at ISET	1
20	path at higher pH. Why? [Hint: A.K Das, 5th Vol p. 803]	
		4
21		2
		3
22		3
		2
23		2
24		3+2
25		3
		2
26		
27		
28		3
		3
29		
30		2+2