

SEM4_C9_SUGGESSTION

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CHEMISTRY
INORGANIC CHEMISTRY-III
CORE-9

Time Allotted: 2 Hours

Full Marks: 25

GROUP-A1. Answer any *ten* questions from the following:

1×10 = 10

- (a) Find out the electronic state of an ion with 3F ground term.
- (b) Cite an example of tetragonally compressed molecule.
- (c) What would be spin only magnetic moment of Mn^{3+} in $[\text{Mn}(\text{H}_2\text{O})_6]\text{Cl}_3$
- (d) Identify the metal ion(s) able to show Jahn-Teller effect in their high spin state: Cr(II), Fe(II), Ni(II), Mn(IV), Mn(III)
- (e) Find out the number of unpaired electron(s) in Gd ($z=64$).
- (f) Arrange the following ligands in a spectrochemical series: H_2O , NH_2^- , F^- , OH^- , CN^- , CO .
- (g) Give one example of Zinc containing metalloenzyme.
- (h) Ce^{3+} acts as oxidising agent -why?
- (i) Write the formulae of the following complexes : μ -hydroxo- μ -imidobis[tetraamminecobalt(III)] Chloride.
- (j) Why do transition metals act as good catalysts ?
- (k) Name the following complexes according to the IUPAC system of nomenclature: $[\text{Pt}(\text{py})_4][\text{PtCl}_4]$
- (l) Name the type of isomerism in the following complexes: $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$ and $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}\cdot\text{H}_2\text{O}$
- (m) What is the oxidation state of iron in $\text{Na}_3[\text{Fe}(\text{CN})_5\text{NO}]$?
- (n) Name one eluting agent that could be used in separation of lanthanides in ion exchange method.
- (o) What will be the ground state term for $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$?
- (p) Give one use of a lanthanide element or its compound.
- (q) Give an example of high spin cobalt (III) octahedral complex.
- (r) Predict the sources of colour in $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ and CrO_4^{2-} .
- (s) Write the ground state electronic configuration of Ce (At. No. – 58).
- (t) Identify the complex with higher CFSE : $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
- (u) Cite an example of dynamic Jahn-Teller distortion.
- (v) Write the formulae of the following complexes : ammoniumtetrachloroplatinate(II)
- (w) What is opposing of chelate effect?
- (x) Name the type of isomerism in the following complexes: $[\text{Pt}(\text{II})(\text{NH}_3)_4][\text{Pt}(\text{IV})\text{Cl}_6]$ and $[\text{Pt}(\text{IV})(\text{NH}_3)_4\text{Cl}_2][\text{Pt}(\text{II})\text{Cl}_4]$
- (y) Why have Nb and Ta almost same ionic radii?

GROUP-BAnswer any *one* question from the following

5×1 = 5

2. (a) $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ are octahedral complexes of Fe(II). Comment on their (i) crystal field stabilization energy and (ii) magnetic properties. 3
- (b) Cite one example each for 'kinetically labile' and 'kinetically inert' complexes. 2
3. (a) Using CFSE indicate whether MnCr_2O_4 is a normal or inverted spinel. 2

- (b) Point out the reason why lanthanide complexes give sharp electronic spectra. 3
4. (a) Both $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ are diamagnetic but they have different geometries. Explain.
 (b) Define lability and inertness with specific examples. 3+2
5. (a) For $[\text{CoX}_6]^{3-}$, where X is a monodentate, uninegative ligand, $\Delta_0 = 15000 \text{ cm}^{-1}$ and $P = 18000 \text{ cm}^{-1}$, calculate CFSE for the complex.
 (b) $[\text{NiCl}_4]^{2-}$ is tetrahedral but $[\text{PtCl}_4]^{2-}$ is square planar.— Explain. 3+2

GROUP-C

Answer any **one** question from the following

10×1 = 10

6. (a) What is tetragonal distortion? Which d^n configurations would lead to weak and strong Jahn-Teller distortion in octahedral complexes? 3
 (b) Draw all the possible isomers of the complex MA_3B_3 , where A and B are monodentate ligands. 2
 (c) Actinides show variety of oxidation states while lanthanides exhibit uniform (+3) oxidation state. Why is it so? 2
 (d) Explain the variation of hydration energy of M^{2+} ion in 3d transition series. 3
7. (a) $10 Dq$ for $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$ is known from electronic spectrum as 21000 cm^{-1} . The pairing energy of Mn(III) is 28800 cm^{-1} . Predict whether the complex is high spin or low spin and also calculate the CFSE. Value. 3
 (b) Explain the exceptional stability of +2 oxidation state of Eu ($z = 63$) and Yb ($z = 70$). 2
 (c) Explain the term 'Bohr Effect' in connection to release of O_2 from Haemoglobin. 3
 (d) Name the metal ions present in the active site of the following biomolecules (i) Carbonic anhydrase (ii) Carboxypeptidase. 2
8. (a) How will you separate lanthanides using ion-exchange methodology? 3
 (b) Calculate the spin-only magnetic moment of Co^{2+} (High Spin and Low Spin) and Ni^{2+} ions. 2
 (c) How many electronic transitions are possible for an octahedral Ni(II) complex? Explain with Orgel diagram. 3
 (d) The third ionization energy for Eu and Yb are comparatively higher than other lanthanides. — Explain. 2
9. (a) What is lanthanide contraction? Explain why Zr and Hf have similar properties although they belong to different periods. 3
 (b) Explain with examples the 'Essential' and 'Beneficial' elements in living system. 2
 (c) Aqueous solution of Mn^{2+} is faintly coloured whereas aqueous solution of MnO_4^- is intensely coloured. — Explain. 3
 (d) Point out the biological role of Na and Zn in the human body. 2