

(乙)

1. A diamagnetic ion always contains an even number of electrons, but a paramagnetic ion does not always contain an odd number of electrons. Explain. (5)
2. Describe the nodal surfaces of a 3p orbital. (6)
3. The bromine atom in BrF_5 is below the plane of the base of the tetragonal pyramid. Explain. (5)
4. Draw the structures and determine the point groups of the following molecules: a) OPCl_3 b) P_4O_6 (10)
5. What are the symmetry species of the 3d orbitals of sulfur in SF_6 ? (6)
6. Which of the following pairs might be expected to be more ionic? Give your reasons. a) CaCl_2 or MgCl_2 ; b) NaCl or CuCl ; c) NaCl or CaCl_2 . (7)
7. For each of the following pairs of isomers, indicate clearly how the two species can be distinguished from each other: a) $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$; b) $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ and $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$; c) $\text{cis-}[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ and $\text{trans-}[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$. (9)
8. The following effective magnetic moments (μ_{eff}) have been recorded: $\text{K}_3\text{Fe}(\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$, 5.85–5.95; $\text{K}_3[\text{Fe}(\text{CN})_6]$, 2.3–2.4. Discuss metal-ligand bonding in these two species in terms of these magnetic data. (6)
9. Is the following reaction endothermic or exothermic? Give your reasons.
 $\text{HgF}_2 + \text{BeI}_2 \rightarrow \text{BeF}_2 + \text{HgI}_2$ (6)
10. The high-spin d^4 complex ion $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is labile, but the low-spin d^4 complex ion $[\text{Cr}(\text{CN})_6]^{4-}$ is inert. Explain. (8)
11. Draw all the isomers possible for the complexes, MX_4Y_2 in trigonal prism geometry. (6)
12. The $\text{Mn}(\text{H}_2\text{O})_6^{2+}$ ion has an extremely pale pink color. Explain. (8)
13. Draw the structures of ferrocene, and $\text{Ir}_4(\text{CO})_{12}$ ($\text{Ir}(\text{CO})_3$ is isolobal with P). (8)
14. Describe how chlorofluorocarbons (such as F_3CCl) are responsible for depletion of ozone layer (e.i. the formation of ozone hole). (10)