

系所組：化學系應用化學碩士班

日期節次：99 年 3 月 13 日 第 2 節 11:00 -12:30

科目：無機化學

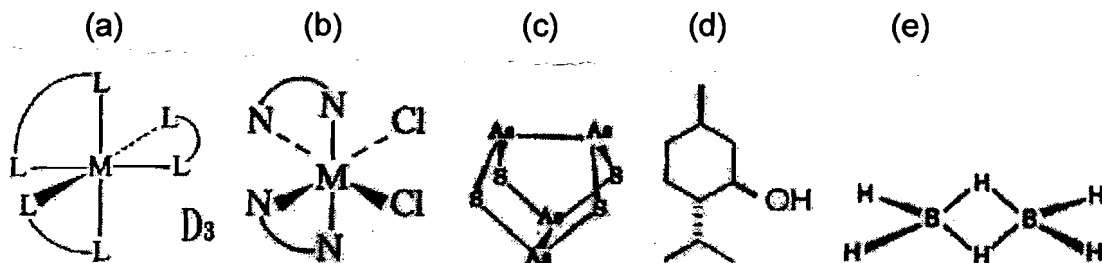
1. For $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (O_h) $[\text{OsF}_6]^{4-}$ (O_h) and $\text{Ni}(\text{CO})_4$ (T_d) find (12%)
- The number of unpaired electrons
 - Magnetic moment
 - Ligand field stabilization energy (LFSE)
 - Ground state term symbol

2. For $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (O_h) find : (a) The number of UV-visible absorption peaks, and show how to estimate Δ_0 . (b) Predict and explain the reactivity of $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ exchange with water ligand, inert or labile, explain your answer. (14%)

3. Classify the following compound by structure type:
 (i) $\text{Os}_5\text{C}(\text{CO})_{15}$ (ii) Ge_9^{4-} (iii) $\text{C}_2\text{B}_3\text{H}_5(\text{CoCp})_2$ (15%)

4. Find the metal-metal bond orders for $[\text{Mo}_2(\text{SO}_4)_4]^{3-}$ (10%)

5. Determine the point groups of the following molecules : (15%)



6. (a) Prepare a molecular orbital energy level diagram for Cl_2 ,
 (b) Label HOMO and LUMO for Cl_2 .
 (c) Predict the bond order for Cl_2 .
 (d) Find term symbol for Cl_2 molecule. (10%)

7. Identify the acid and base in the reactants of the following reactions:
 (1) $\text{H}_2\text{SO}_4 + \text{HClO}_4 \rightarrow \text{H}_3\text{SO}_4^+ + \text{ClO}_4^-$
 (2) $\text{NH}_3 + \text{Na} \rightarrow \text{NH}_2^- + \text{Na}^+$
 (3) $\text{CaC}_2 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_2 + \text{Ca}^{2+} + \text{OH}^-$ (12%)

8. Choose and explain: (12%)
- strongest Lewis acid: BH_3 BF_3 BBr_3 BCl_3
 - least stable: SCN^- OCN^- CNO^- I_3^-