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 $[Cr(H_2O)_6]^{3+}$ (O_h)　$[OsF6]^{4-}$(O_h)　and　$Ni(CO)_4$ (T_d) find　(12%)
   (a) The number of unpaired electrons
   (b) Magnetic moment
   (c) Ligand field stabilization energy (LFSE)
   (d) Ground state term symbol

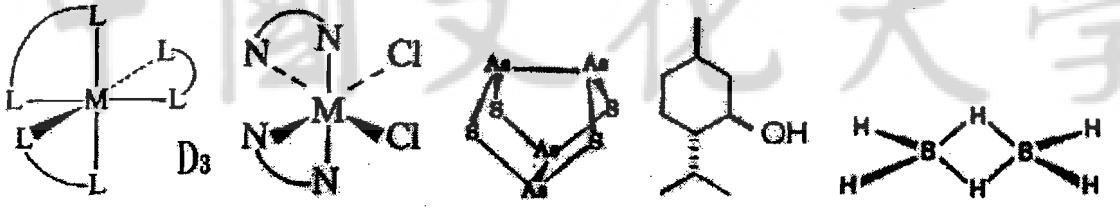
2. For $[Cr(H_2O)_6]^{3+}$ (O_h) find : (a) The number of UV-visible absorption peaks, and show how to estimate Δ_o.
   (b) Predict and explain the reactivity of $[Cr(H_2O)_6]^{3+}$ exchange with water ligand, inert or labile, explain your answer.　(14%)

3. Classify the following compound by structure type:
   (i) $Os_5C(CO)_{15}$　(ii) Ge_9^{4-}　(iii) $C_2B_3H_5(CoCp)_2$　(15%)

4. Find the metal-metal bond orders for $[Mo_2(SO_4)_4]^{3-}$　(10%)

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

(a)　(b)　(c)　(d)　(e)



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) $H_2SO_4 + HClO_4 \rightarrow H_3SO_4^+ + ClO_4^-$
   (2) $NH_3 + Na \rightarrow NH_2^- + Na^+$
   (3) $CaC_2 + H_2O \rightarrow C_2H_2 + Ca^{2+} + OH^-$　(12%)

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