注意:請依序作答

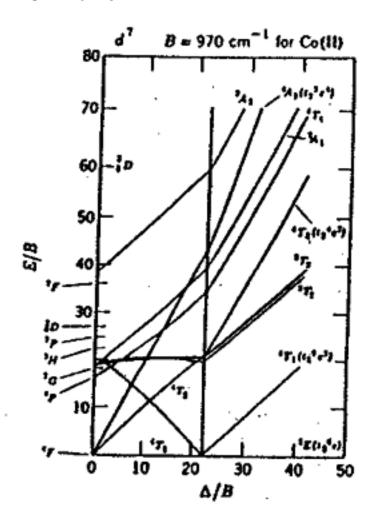
- 1. What is the point group of the following species: (10%)
 (a) B₂H₆ (b) XeOF₄ (c) PCl₃F₂ (d) Ni(CN)₄²⁻ (e) B₁₂H₁₂²⁻
- 2. Draw the molecular structure of the following species: (10%)
 - (a) H_3PO_2 (b) B_4H_{10} (c) $S_4N_4F_4$ (d) $Pt(C_2H_4)Cl_3$
 - (d) Fe₂(CO)₉
- 3. Predict the major product(s) for the following reactions: (10%)
 - (a) $Ag^+ + N_3^- \rightarrow$
 - (b) PCl₅ + 4H₂O→
 - (c) B₃N₃H₆ + 3HCl→
 - (d) Closo- $C_2B_9H_{11} + 2e^- \rightarrow$
 - (e) Mn₂(CO)₁₀ + H₂→
- 4. Choose and explain: (16%)
 - (a) Higher first ionization energy: F or F2
 - (b) Better oxidizing agent: F2 or Cl2
 - (e) Stronger reducing agent in aqueous solution: Li or Na
 - (d) Better π-acceptor ligand: CS or CO
- Which of the following is more basic? Explain. (8%)
 - (a) (CH₃)₂O or (SiH₃)₂O (b) CH₃ Or CH₃ N
- 6. Answer the following:
 - (a) Which of the following reactions would you expect to have the larger rate at room temperature? Why? (4%)

$$2Ce^{4+}_{(aq)} + Hg_2^{2+}_{(aq)} \rightarrow 2Ce^{3+}_{(aq)} + 2Hg^{2+}_{(aq)}$$

 $H_3^*O^*_{(aq)} + OH^*_{(aq)} \rightarrow 2H_2O_{(l)}$

- (b) Why is {(η⁵-C₅H₅)₂Fe}⁺PF₆⁻ a good oxidizing reagent while (η⁵-C₅H₅)₂Co is a good reducing reagent? (4%)
- (c) When visible light passes through a solution of nickel(II) sulfate, a green solution results. What are the spin allowed transitions responsible for this color? Would you expect a Jahn-Teller distortion for this complex? (6%)
- (d) The ligand-to-metal charge transfer bands increase in energy in the series: [CoI₄]⁻ < [CoCI₄]⁻ < [CoCI₄]⁻. Explain. (6%)

7. In complexes with weak field ligands (Δ/B=10) octahedral Co²⁺ exhibit a spectrum with three well separated bands. Make a tentative assignment using the Tanabe-Sugano diagrams and list the assignments in order of decreasing frequency. Would the spectrum of a strong field complex be any different? Describe the spectrum you would expect for a strong field complex. (8%)



- 8. Find organic fragments isolobal with: (4%)
 (a) Cr(CO)₆ (b) Mn(CO)₅⁺ (c) Ni(CO)₃ (d) Co(CN)₅³⁻
- 9. Classify the following oxides as normal spinels or inverse spinels. (6%) 答錯例扣 (a) Fe₃O₄ (b) Mn₃O₄ (c) MnCr₂O₄
- (η⁶-C₆H₆)W(CO)₃ has C_{3v} symmetry. How many infrared-active carbonyl stretching bands would you predict for this compound? (8%)

C,,	E	2C,	3σ,		<u> </u>
Aı Aı E	1	1	-1	z R ₄	$x^{2} + y^{2}, z^{2}$ $(x^{2} - y^{2}, xy)(xz, yz)$