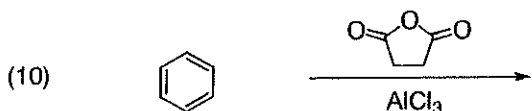
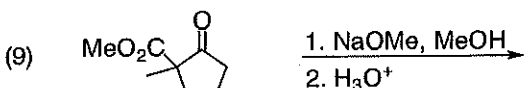
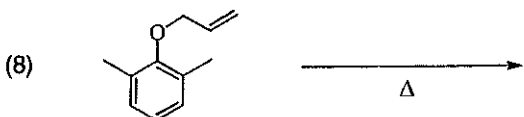
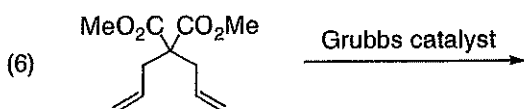
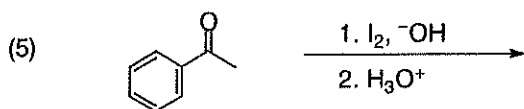
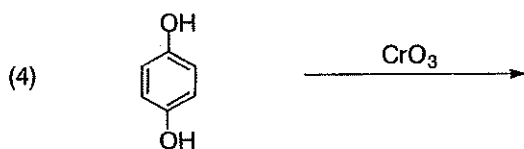
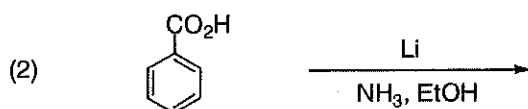
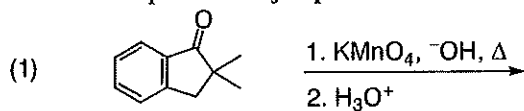
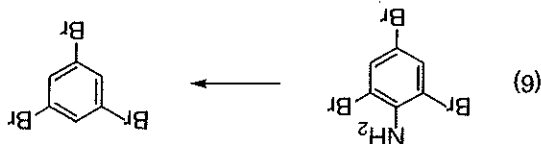
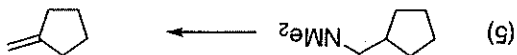


一、『有機化學』部份 總分 50 分

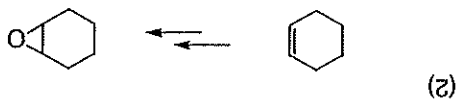
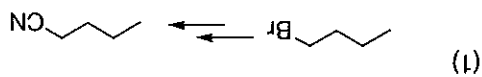
1. Give the expected major product of the following reactions. (2 pts each, 20 pts)



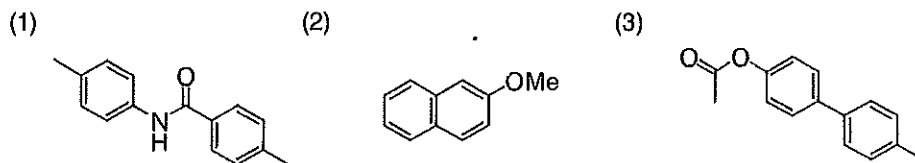
2. Suggest a reagents (or a series of reagents) that can be used to accomplish the following one transformation (2 pts each, 12 pts)



3. Provide two fundamentally different methods for each of the following transformations. (4 pts each, 8 pts)



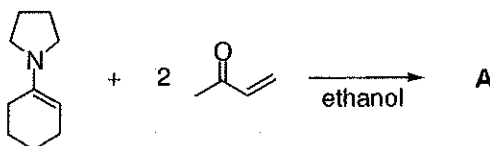
4. What monobromination product would you expect to obtain when the following compounds undergo ring bromination with Br_2 and FeBr_3 . (1 pt each, 3 pts)



5. What is the molecular formula of the following compound? (2 pts)

m/z	intensity
73 M^+	100.0
74	3.72
75	0.23

6. Deduce the structure of product **A**, which is highly symmetrical. (5 pts)



The following are selected spectral data for **A**:

MS (m/z): 220 (M^+)

IR (cm^{-1}): 2930, 2860, 1715.

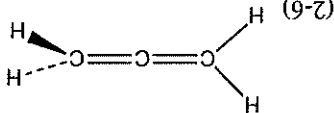
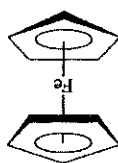
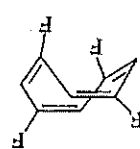
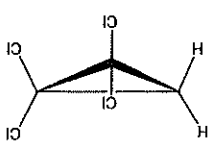
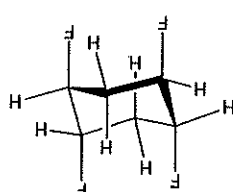
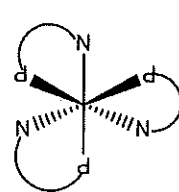
^1H NMR (δ): 1.25 (m), 1.29 (m), 1.76 (m), 1.77 (m), 2.14 (s), and 2.22 (t);
(area ratios 2:1:2:1:2:2, respectively)

^{13}C NMR (δ): 23 (CH_2), 26 (CH_2), 27 (CH_2), 29 (C), 39 (CH), 41 (CH_2), 46 (CH_2), 208 (C)

二、Inorganic Chemistry (共 50 分)

- 1) Give Lewis dot structure and sketch the shape with reasonable formal charge distribution, and determine point group for each of the following: (with lone pairs and chemical bonds, and giving resonance structures if necessary) (8 分)
- (1-1) N_3^- (1-2) $XeOF_5^+$ (1-3) XeO_2F_2 (1-4) P_4O_{10}

2) Determine point groups for the following: (6 分)



- 3) *cis*-Fe(CO)₂Cl₂ has C_{2v} symmetry. Use character table to determine the number and symmetry (for example, A_1, A_2 etc) of IR-active C—O stretching vibrations. (4 分)

C_{2v}	E	C_2	$\sigma_v(xz)$	$\sigma_v'(yz)$
A_1	1	1	1	1
A_2	1	1	-1	-1
B_1	1	-1	1	-1
B_2	1	-1	-1	1
x^2, y^2, z^2	A_1	A_1	A_1	A_1
xy	A_2	A_2	B_1	B_2
xz	B_1	B_2	A_2	A_1
yz	B_2	B_1	A_2	A_1

4) Which of the following are paramagnetic? (2 分)

- (a) NO (b) NO_2 (c) B_2 (d) C_2^- (e) O_2^- (f) O_2 (g) O_2^+ (h) O_3

5) The following reaction is considered as Lewis acid-base reaction for the formation of BrF_3 .

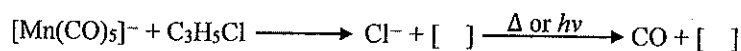


(5-1) The ions in brackets contain both bromine and fluorine. Write the most likely formulas of

these ions. (4 分)

(5-2) What are the point groups of the anion and cation identified in (5-1)? (2 分)

- 6) Answer the following questions regarding the complex diaquadiiododinitritopalladium(IV).
- (6-1) How many stereoisomers does this complex have? (2 分)
 (a) 2 (b) 3 (c) 4 (d) 5 (e) 6 (f) 7 (g) 8 (h) 9 (i) 10 (j) 11 (k) 12
- (6-2) How many pairs of enantiomers does this complex have? (2 分)
 (a) 0 (b) 1 (c) 2 (d) 3 (e) 4 (f) 5 (g) 6 (h) 7 (i) 8 (j) 9 (k) 10
- 7) In ligand field theory, spectrochemical series compares the relative strength of ligand field. Please answer the following questions.
- (7-1) Which of the following is correct for the order of ligand field strength (2 分)
 (a) $F^- > Cl^- > CN^- > NH_3$
 (b) $CN^- > F^- > Cl^- > NH_3$
 (c) $F^- > NH_3 > Cl^- > CN^-$
 (d) $CN^- > NH_3 > F^- > Cl^-$
 (e) None of these
- (7-2) Does H_2O or OH^- have larger ligand field? Why? (3 分)
- 8) For octahedral complexes in high-spin state, which two of the following electron configurations have large Jahn-Teller distortion? (2 分)
 (a) d^1 (b) d^2 (c) d^3 (d) d^4 (e) d^5 (f) d^6 (g) d^7 (h) d^8 (i) d^9 (j) d^{10}
- 9) Which two of the following do not obey 18-electron rule? (3 分)
 (a) $(\eta^5-Cp^*)Re(=O)_3$ (b) $Os(CO)(\equiv CPh)(PPh_3)Cl$ (c) $[Rh(bipy)_2Cl]^+$ (d) $(\eta^5-Cp)_2Co$
 (e) $[(\eta^3-C_3H_5)(\eta^5-Cp)Mn(CO)]^-$
- 10) Write the formulas and draw the structures of the products in the brackets. (4 分)



- 11) Draw the structure of the metal-containing products. (6 分)

