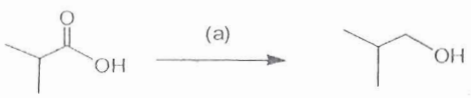
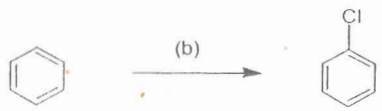
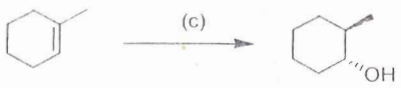
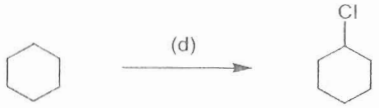
有機化學的部份（總分 50 分）

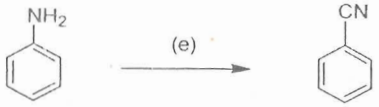
一、 （20 分）在下列的每一小題中請填入所需的試劑。

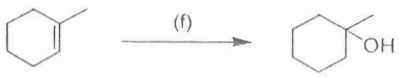
(1) 

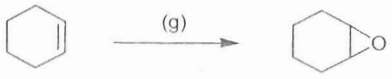
(2) 

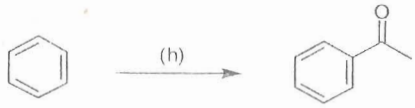
(3) 

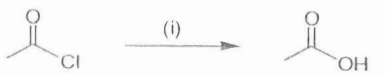
(4) 

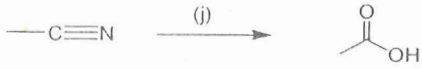
(5) 

(6) 

(7) 

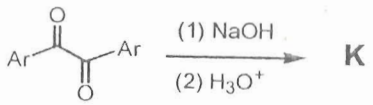
(8) 

(9) 

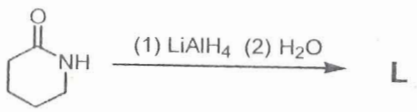
(10) 

二、(16 分) 在下列的每一小題中請填入所產生的產物

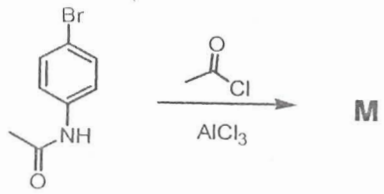
(1)



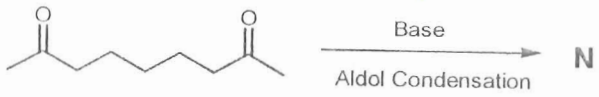
(2)



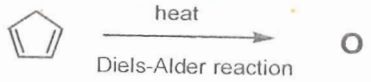
(3)



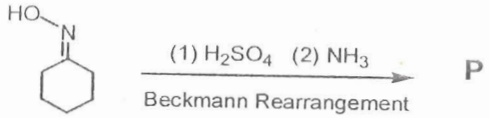
(4)



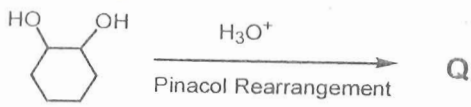
(5)



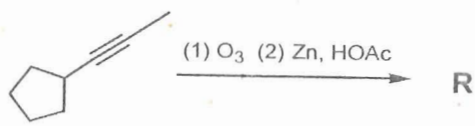
(6)



(7)

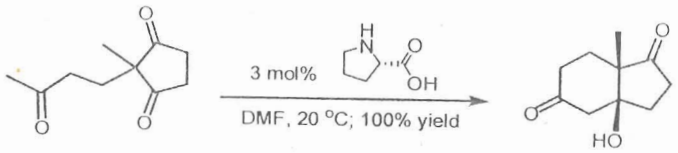


(8)

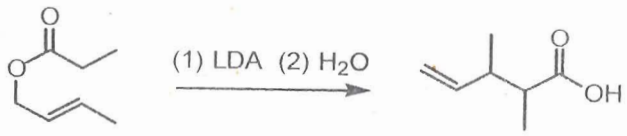


三、（10 分）在下列的每一小題中，請寫出其反應機構。

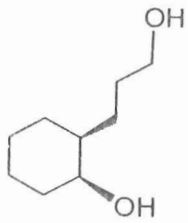
(1)



(2)



四、（4 分）請寫出合理的實驗步驟來合成下列化合物(起始物的結構需合理、穩定且所含的碳原子數不能大於 6)。



科目：無機化學的部份

共 17 題，1 - 7 題每題 2 分，8 - 14 題每題 3 分，15 - 17 題每題 5 分，合計 50 分。

1. Write the electron configuration for Cr^{3+}.

2. Write the ground-state term for the f^2 configuration.

3. Determine the point group of $[Co(en)_3]^{3+}$. (en: ethylenediamine)

4. Which is the strongest protonic acid of the following species:
$[Fe(H_2O)_6]^{3+}$, $[Fe(H_2O)_6]^{2+}$, H_2O.

5. What is the expected structure of $[F_2ClO_3]^-$?

6. Determine the number of unpaired electrons for $[CoF_6]^{3-}$.

7. Which metal does play a significant role in vitamin B_{12} ?

8. List the following substances in order of increasing boiling point:
CH_4, CsI, NH_3, SiC, Xe.

9. Draw the structure of cyclic silicate anion $[Si_3O_9]^{6-}$.

10. Give equation to explain why adding ammonium acetate to solid zinc amide in liquid ammonia causes the solid to dissolve.

11. ^{63}Cu has I = 1/2. When CuI is dissolved in $P(OMe)_3$, the ^{63}Cu NMR spectrum shows a five line pattern with relative intensities 1:4:6:4:1.What inference can be made about the environment of Cu in this solution ?

12. Which of the following compounds obey the 18-electron rule ?
(a) $Rh(C_2H_4)(PPh_3)_2Cl$, (b) $Cp^*_2ZrCl_2$, (c) $(\eta^6\text{-}C_6H_6)_2Mo$,
(d) $(\eta^3\text{-allyl})_2Ni$, (e) $[Ta(CO)_6]^-$.

13. Predict the product of the reaction of $W(CO)_6$ with C_6H_5Li.

14. How can you stabilize the solution of Na^- anion in ethylenediamine ?

15. For a square planar transition metal complex (for example, $PtCl_4^{2-}$), using the following character table to determine the types of orbital hybridization possible for the metal center.

D_{4h}	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$		
A_{1g}	1	1	1	1	1	1	1	1	1	1		x^2+y^2, z^2
A_{2g}	1	1	1	−1	−1	1	1	1	−1	−1	R_z	
B_{1g}	1	−1	1	1	1	1	−1	1	1	−1		x^2-y^2
B_{2g}	1	−1	1	1	1	1	−1	1	−1	1		xy
E_g	2	0	2	0	0	2	0	−2	0	0	(R_x, R_y)	(xz, yz)
A_{1u}	1	1	1	1	1	−1	−1	−1	−1	−1		
A_{2u}	1	1	1	1	−1	−1	−1	−1	1	1	z	
B_{1u}	1	−1	1	1	1	−1	1	−1	−1	1		
B_{2u}	1	−1	1	1	1	−1	1	−1	1	−1		
E_u	2	0	−2	0	0	−2	0	2	0	0	(x, y)	

16. LiBr has the NaCl crystal structure and a density of 3.464 g/cm^3. Calculate the interionic distance between Li^+ and Br^-.

17.

In the ^{13}C NMR spectrum of $CH_3{}^*CMn((CO)_5$, the CO groups *cis* to Me absorb at 213.8 ppm and the *trans* CO absorbs at 211.3 ppm. When this labeled sample was heated, $CH_3Mn(CO)_5$ was produced. The ^{13}C NMR spectrum of the product showed dramatic signal enhancement at only the 213.8 ppm position. What conclusion can you draw about the mechanism of CO loss?

The Periodic Table

1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 H 1.00794	2 2A																2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.81	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.998403	10 Ne 20.1797
11 Na 22.98977	12 Mg 24.305	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 Al 26.98154	14 Si 28.0855	15 P 30.97376	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.41	49 In 114.82	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.9045	54 Xe 131.29
55 Cs 132.9054	56 Ba 137.33	57 *La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.9665	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.9804	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0254	89 †Ac 227.0278	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq				

*Lanthanide series	58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66 Dy 162.50	67 Ho 164.9304	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.967
†Actinide series	90 Th 232.0381	91 Pa 231.0359	92 U 238.0289	93 Np 237.048	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)