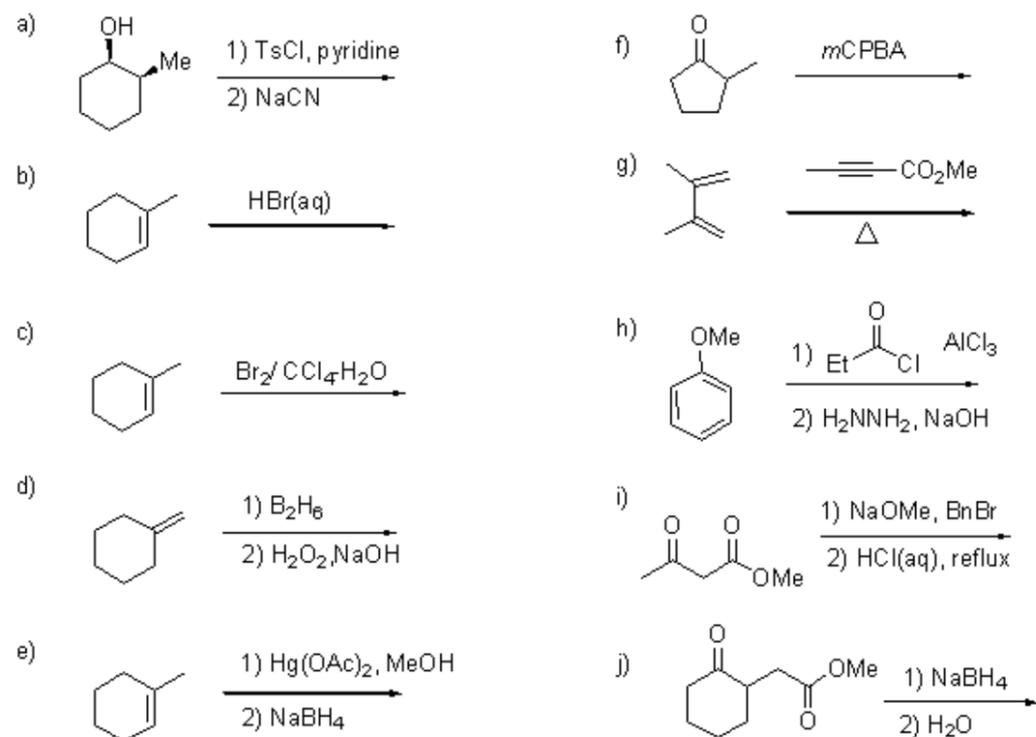


國立嘉義大學 100 學年度
應用化學系碩士班(甲組)招生考試試題

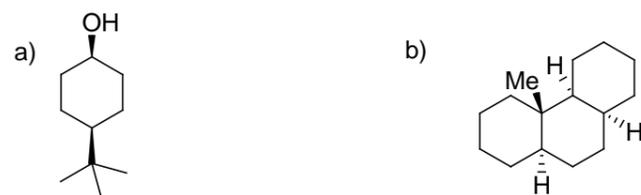
科目：綜合化學(I)

一、有機化學

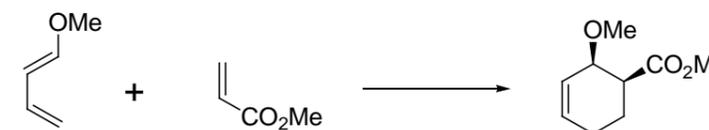
1. Please complete the following reactions. (Giving the major product with correct stereochemistry, if applicable.) (30 points, 3 points for each reaction.)



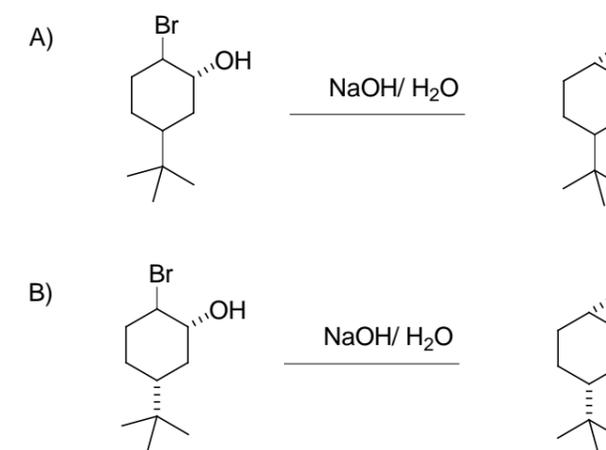
2. Please draw the most stable conformation for the following two compounds.
(4 points, 2 points for each compound.)



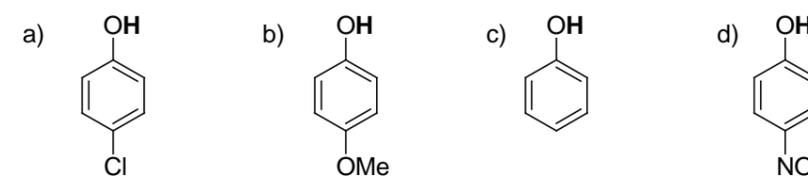
3. Please explain the observations of regio- and stereo-selectivity of the following Diels-Alder reaction. (6 points)



4. Which of the following reaction occurs most rapidly, why? (5 points)



5. Please rank the acidity of the following four phenols, from the most acidic to the less acidic. (5 points)



背面尚有試題



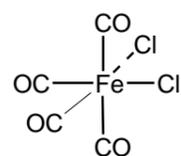
二、無機化學

1. Please explain the following terms: (12 points)

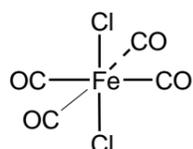
- Solvent Isomerism
- Werner's Coordination Theory
- Jahn-Teller effect
- Isoelectronic molecules
- Leveling effect
- Orbital mixing

2. For the following molecules, determine the point groups and the number of IR-active C-O stretching vibrations. (10 points)

a.



b.

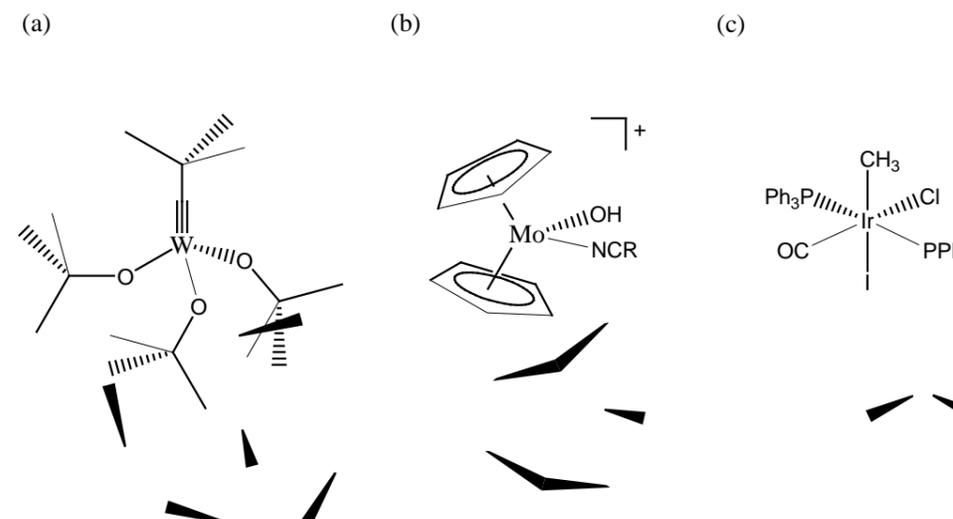


3. (a) Prepare a molecular orbital energy-level diagram for NO, showing clearly how the atomic orbitals interact to form MOs (b) Predict the bond order and the number of unpaired electrons (c) Compare the bond orders of NO^+ and NO^- with NO; Which of the three would you predict to have the shortest bond? Why? (16 points)

4. For each of the following groups of molecules state which one is likely to have the highest boiling point. Briefly explain the reason why? (6 points)

- CCl_4 , GeCl_4 , SiCl_4
- PH_3 , NH_3
- HCl , HBr , HI , HF

5. For the following molecules, give the valence electron count and the formal oxidation state of the metal. (6 points)



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

C_{3v}	E	$2C_3$	$3\sigma_v$		
A_1	1	1	1	z	$x^2 + y^2, z^2$
A_2	1	1	-1	R_z	
E	2	-1	0	(x, y), (R_x, R_y)	$(x^2 - y^2, xy), (xz, yz)$

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)	

D_{5h}	E	$2C_5$	$2C_5^2$	$5C_2$	σ_h	$2S_5$	$2S_5^3$	$5\sigma_v$		
A_1'	1	1	1	1	1	1	1	1		$x^2 + y^2, z^2$
A_2'	1	1	1	-1	1	1	1	-1	R_z	
E_1'	2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	0	2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	0	(x, y)	
E_2'	2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	0	2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	0		$(x^2 - y^2, xy)$
A_1''	1	1	1	1	-1	-1	-1	-1		
A_2''	1	1	1	-1	-1	-1	-1	1	z	
E_1''	2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	0	-2	$-2 \cos 72^\circ$	$-2 \cos 144^\circ$	0	(R_x, R_y)	(xz, yz)
E_2''	2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	0	-2	$-2 \cos 144^\circ$	$-2 \cos 72^\circ$	0		