CHEM 321 Test 1 2 July 2005

Model Answers.

1. (a) 20 e⁻, d^8

(b) 18 e⁻, d^6

(c) 16 e⁻, d^8

(d) 18 e⁻, $4s^2 3d^{10}$

(e) 8 e⁻, d^0

2. (a) $n = 2$

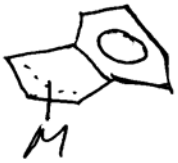
(b) $n = 3$

(c) $n = 5$

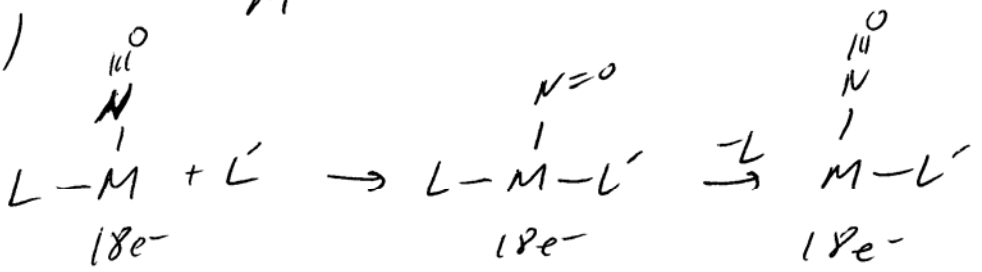
(d) $n = 2$

(e) $n = 5$

3. (a) aromatic stabilisation of the 6-membered ring:



(b)



indenyl goes via η^3 intermediate shown in part (a).

(c) (i) Steric crowding prevents dimerisation.

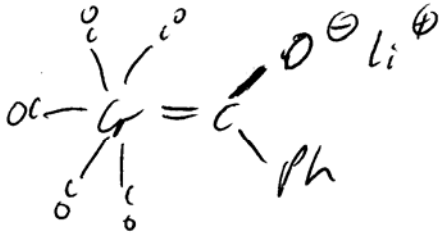
(ii) late transition metal: d^8, 16 e⁻, square planar complex.

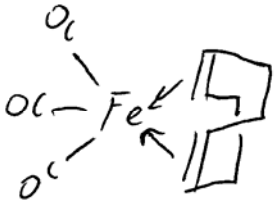
(iii) early TM with high O.S.

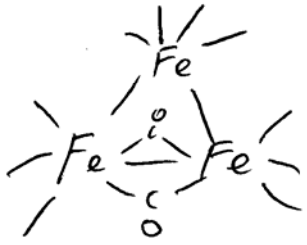
4. (a) $Mn(CO)_5^-$

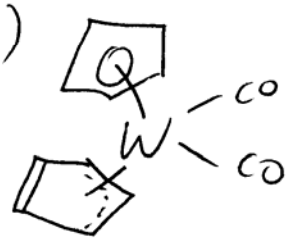
(b) $CpMo(CO)_3^-$

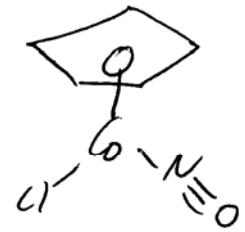
(c) $Co(CO)_4Br$

(d) 

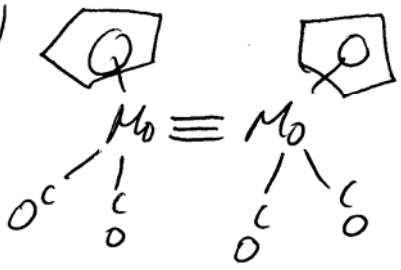
(e) 

5. (a) 

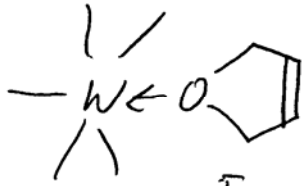
(b) 

(c) 

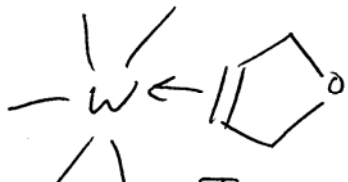
(d) 

(e) 

6. (i)



I



II

(ii) A = III

B = I

C = II

cyclohexane is a v. weak ligand and is rapidly replaced. I is a good σ donor and put more e⁻ density on W and so gives the lowest ν(CO).

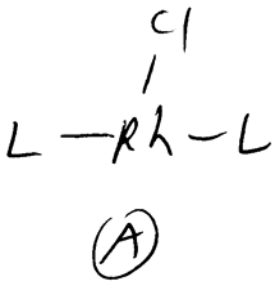
(iii) cyclohexane – weak σ donor

O – C_4H_6O – strong σ donor

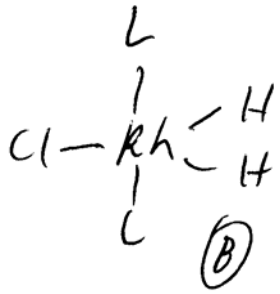
C,C – C_4H_6O – σ donor/π acceptor

(iv) W has a low oxidation state and is a soft metal – prefers π-acceptor ligands.

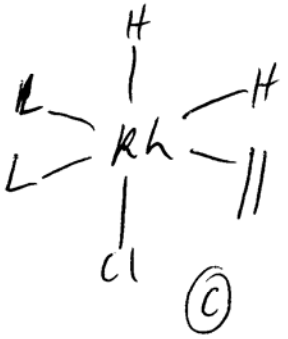
7. (a)



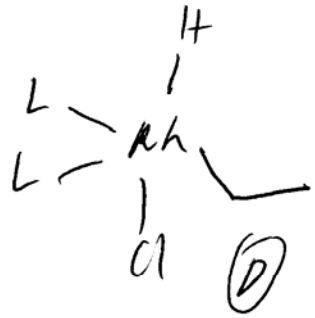
(A)



(B)



(C)

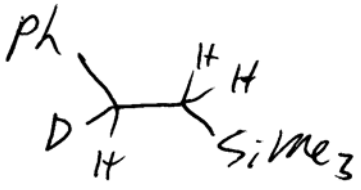


(D)

(b)

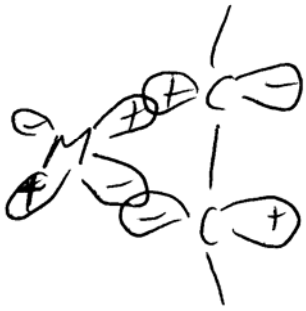
① – oxidative addition
② ligand coordination
③ reductive elimination

(c)



8. (a)

σ donor



π acceptor

π donor

δ acceptor

(b) For $Cp^{Mn}(CO)_2(RCCR)$: 2e donor σ donor, π acceptor

For $CpV(CO)_2(RCCR)$: 4 e- donor σ donor, π acceptor, π donor

(c) Require — a β-H atom
— coplanar M-C-C-H atoms
— vacant site in cis position
— electronically ~~saturated~~ unsaturated metal

To prevent β-elimination one should use ligands with no β-H atom, in which a β-H atom ~~cannot~~ can't approach the metal, or a complex which has 18 e-s or is sterically saturated.