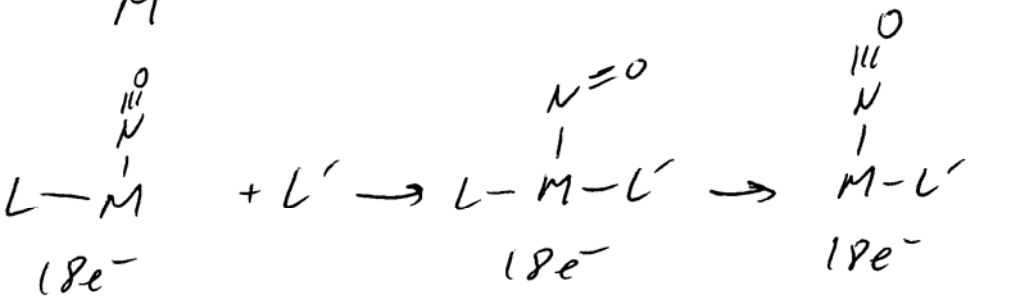
CHEM361 Test 1 2 July 2005 Model Answers

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) $n = 4$
(d) $n = 2$
(e) $n = 4.5$

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

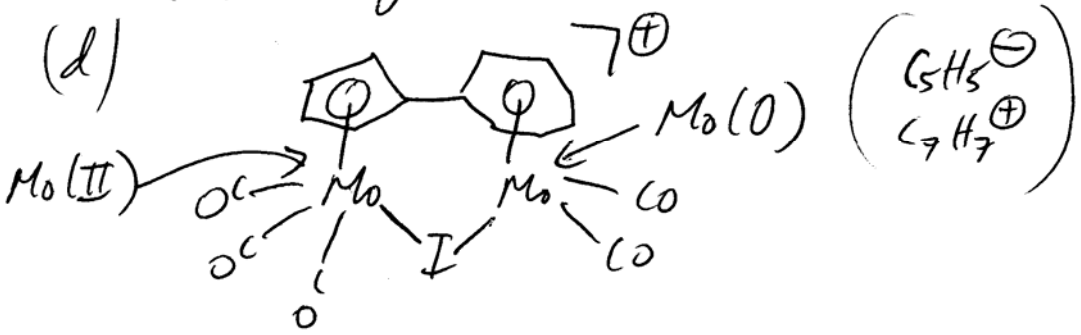
(b)



Indenyl goes via the ~~η⁵~~ η³ intermediate shown in part (a).

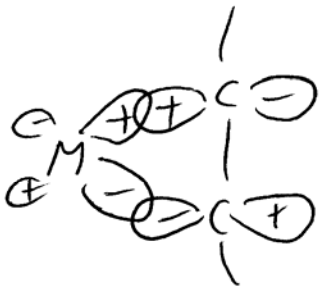
(c) (i) Steric crowding prevents dimerisation
(ii) late transition metal: d^8, 16 e⁻, square planar complex.
(iii) Early TM with a high O.S.

(d)



4. (a)

σ donor



π acceptor

π donor

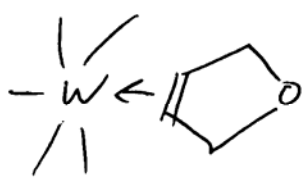
δ acceptor

(b) $Cp'V(CO)_2(RC{\equiv}CR)$ will show the longest C–C distance since it has a 4e⁻ donor alkyne ligand (σ and π).

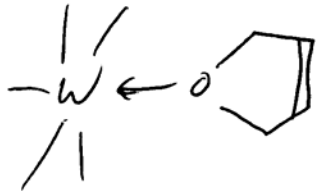
(c) Require – a β-H atom
– coplanar M–C–C–H atoms
– vacant site in cis position
– electronically unsaturated metal (< 18 e⁻s).

$-CH_2CMe_3$, $-CH_2Ph$, $-CH_2SiMe_3$, $-C{\equiv}C-H$
$-CH_3$

5. (i)



I



II

(ii) A = III

B = II

C = I

cyclohexane is a very weak ligand and is rapidly replaced – however it is in large excess. II is a good σ donor and so gives the lowest ν(CO).

(iii) cyclohexane is a weak σ donor

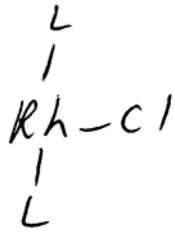
O – C_4H_6O is a strong σ donor

C,C – C_4H_6O is a σ donor/π acceptor

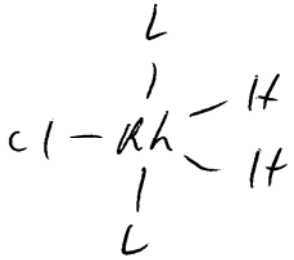
(iv) W has a low oxidation state and prefers π-acceptor ligands

(v) Sterically, it is easier for one O atom to get in and displace the cyclohexane than it is for 2 carbon atoms.

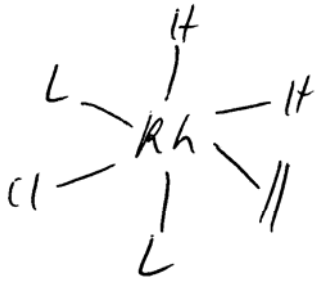
6. (a)



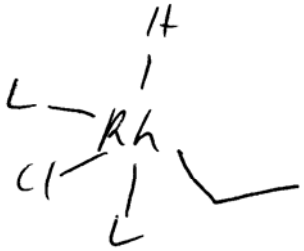
(A)



(B)



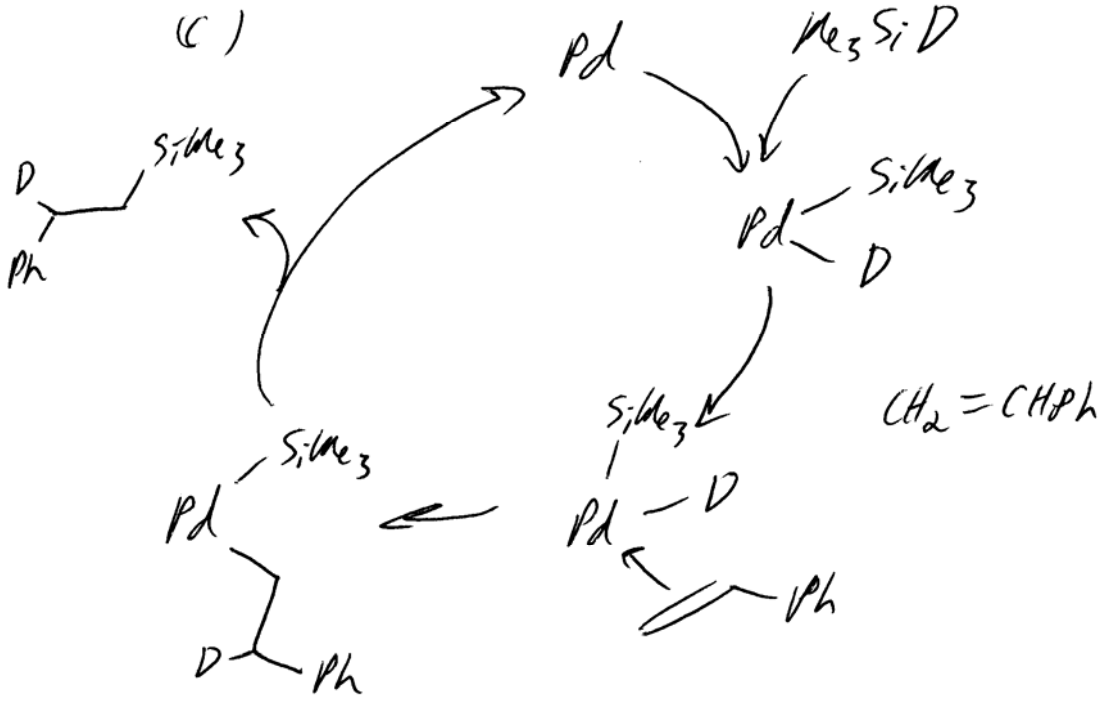
(C)



(D)

(b) ① oxidative addition
② ligand coordination
③ reductive elimination

(c)



7. (a) $Mn_2(CO)_{10} + Na(Hg)$

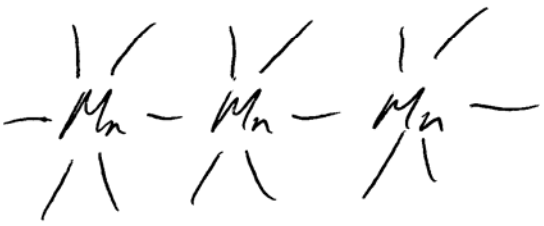
(b) $Mo(CO)_6 + Cp^-$

(c) $Co_2(CO)_8 + Br_2$

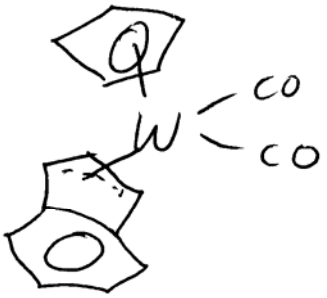
(d) $Cr(CO)_6 + PhLi \rightarrow \quad + Me_3O^+$

(e) $Fe(CO)_5 + cod$

8) (a)

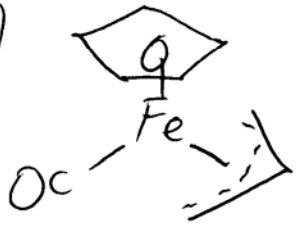


(b)



(c)

(d)



(e)