Q $Re_2(CO)_{10} + Br_2 \longrightarrow$ (A) $\xrightarrow{S_N1}$ (B) $\longrightarrow$ Δ, −CO → (C)

(A): $[Re(CO)_5Br]$

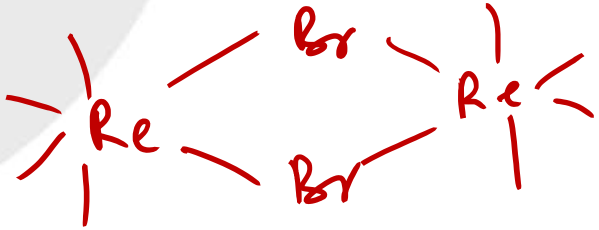
$18e^-$

S_N1: Dissociative step.

(B): $[Re(CO)_4Br]$

M–M bond = 0

(C): $[Re_2(CO)_8Br_2]$



Thank you

☺

IfAS

(1st slide)

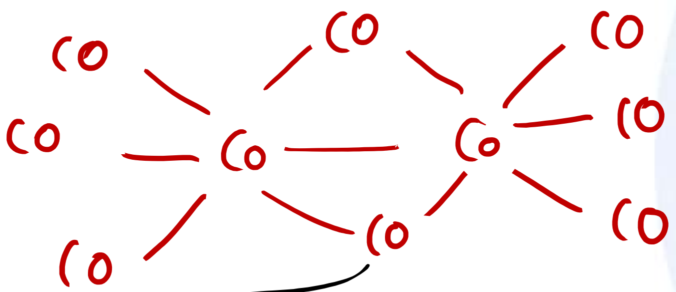
αNCC

① $Co_2(CO)_8$

Solid

Terminal CO

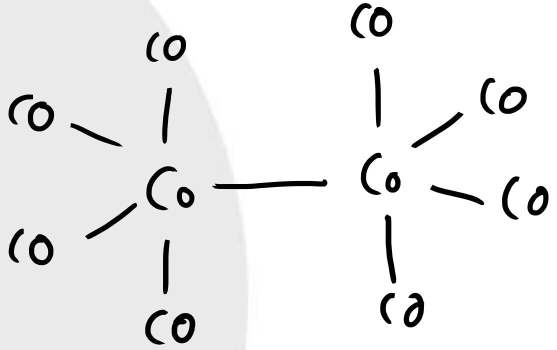
2100–1860



C_{2v}

1860 — 1700 cm^{-1}

n-Hexane →



D_{3d}

① No. of Bridging CO = 2

② Terminal CO = 6.

No. Bridging CO = 0

Terminal CO = ⑧

② $Fe_3(CO)_{12}$

$$M\text{-}M = \frac{18n - TVE}{2}$$

$$= \frac{54 - 48}{2}$$

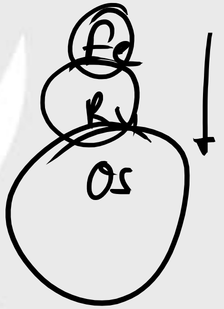
$$= \frac{6}{2} = 3$$

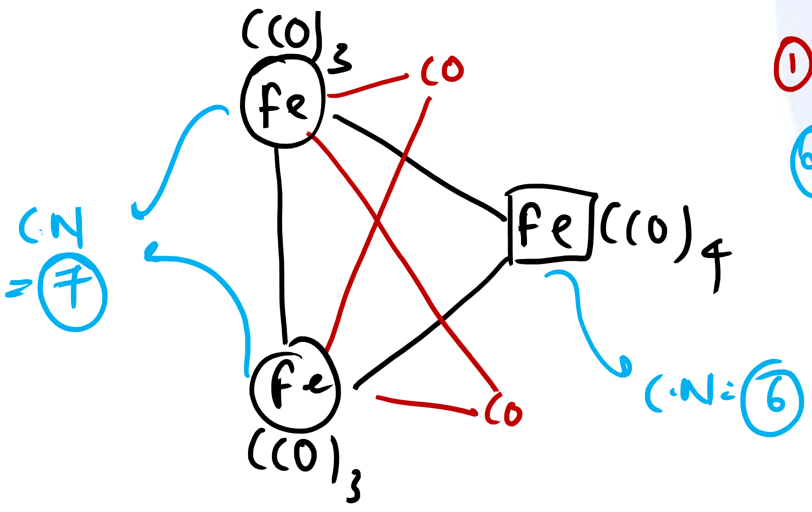
$18 \rightarrow 18(1)$

$36 \rightarrow 18(2)$

$54 \rightarrow 18(3)$

$72 \rightarrow 18(4)$





① C_{2v}

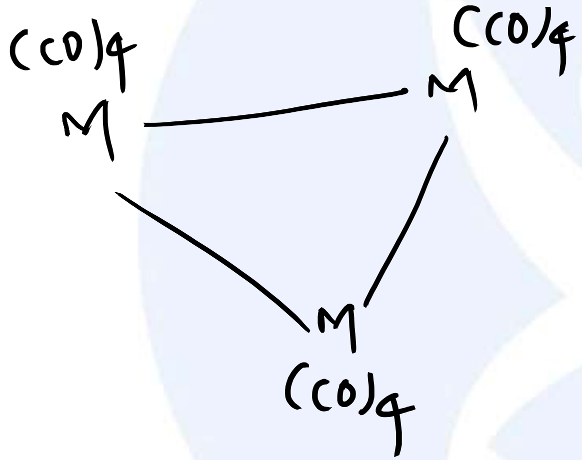
② Bridging CO = 2

③ Terminal CO = 10

④ Mossbauer Signal = 2

③ $M_3(CO)_{12}$

M: Ru, Os → 8 $ve^{\ominus}$



* ① M–M = 3

② TVE = 48.

① Terminal = 12

② Bridging CO = 0

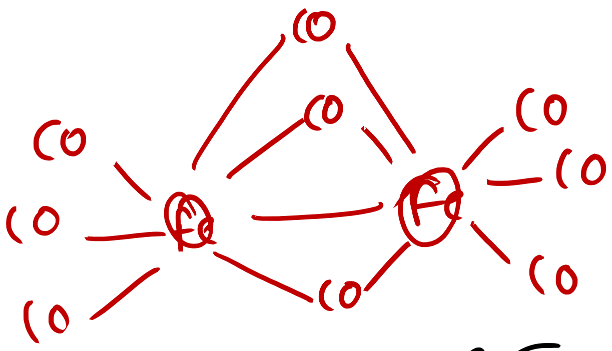
③ D_{3h}

Size ↑

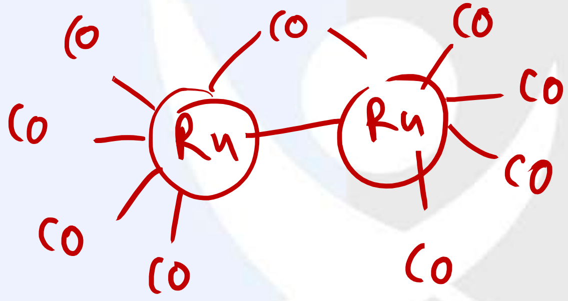
Bridging formation ability ↓

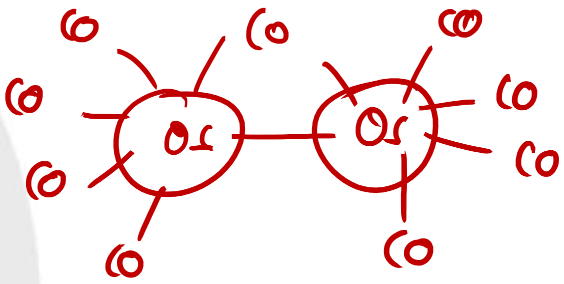
④

	$Fe_2(CO)_9$	$Ru_2(CO)_9$	$Os_2(CO)_9$
① TVE =	34	34	34
② M–M =	1	1	1.



Not isostructural

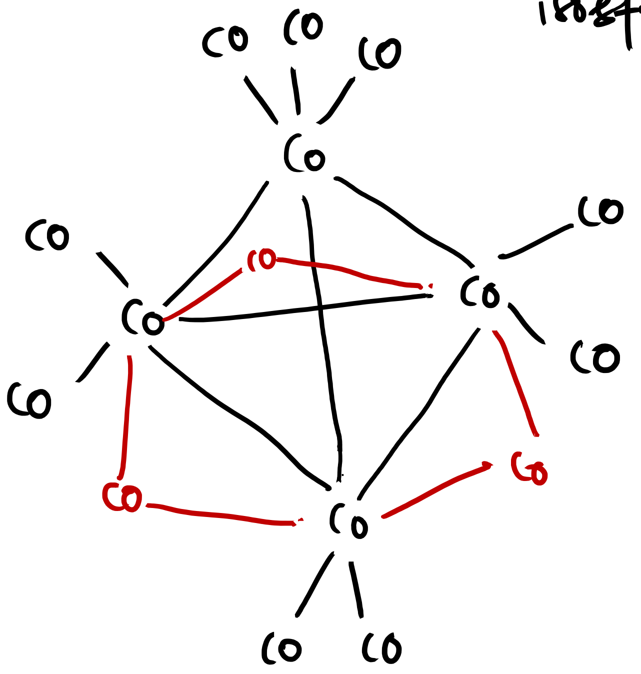


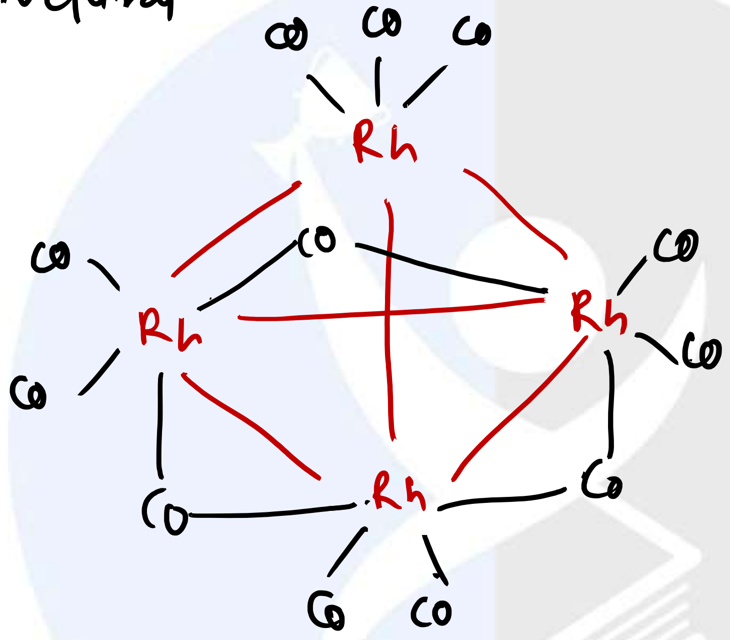


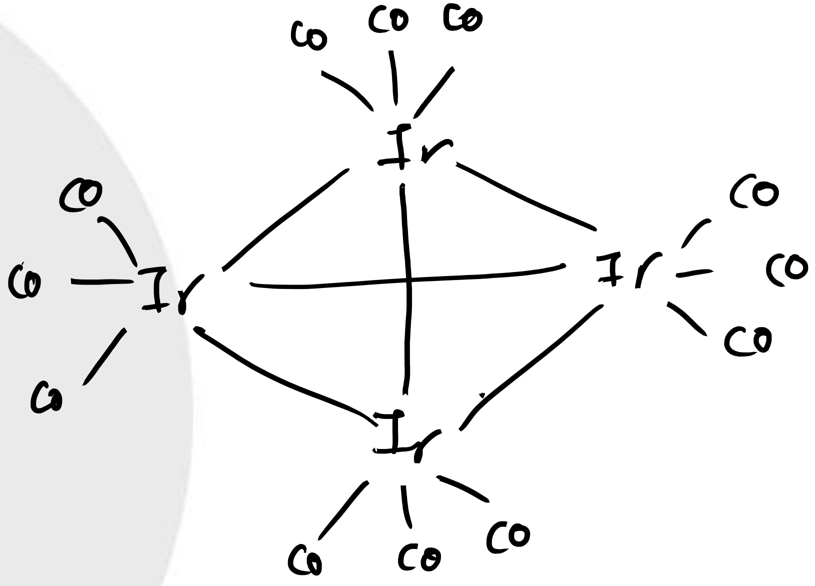
Isostructural

	$Fe_2(CO)_9$	$Ru_2(CO)_9$	$Os_2(CO)_9$
③ Bridging CO =	3	1	1
④ Terminal CO =	6	8	8

(5) $Co_4(CO)_{12}$ ⟷ (isostructural) $Rh_4(CO)_{12}$ ⟷ (Not isostructural) $Ir_4(CO)_{12}$







		$Co_4(CO)_{12}$	$Rh_4(CO)_{12}$	$Ir_4(CO)_{12}$
(1)	M-M bond =	6	6	6
(2)	TVE =	60	60	60
(3)	Briding CO =	3	3	0
(4)	Terminal CO =	9	9	12

Q. Which of following molecule isolobal with. P_4O_6

(a) $(CH_2)_4 (CH_2)_6$

(b) $(CH)_4 (CH)_6$

(c) $(CH)_4 (CH_2)_6$ ✓

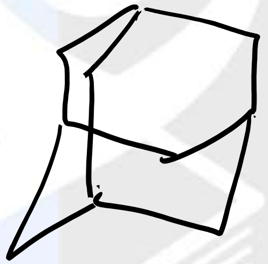
(d) $(CH)_4 (CH_3)_4$.

$(P)_4 \longleftrightarrow (CH)_4$

$5e^{\ominus}$ 4

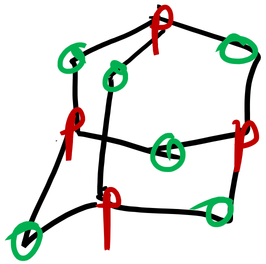
$(O)_6 \longleftrightarrow (CH_2)_6$

$6e^{\ominus}$ 6



$(CH)_4 (CH_2)_6$

$\longleftrightarrow$

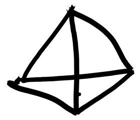
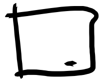


Geometry of HNCC / LNCC :-

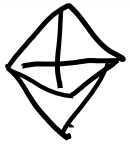
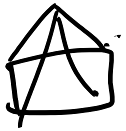
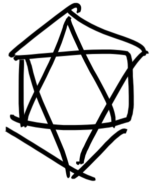
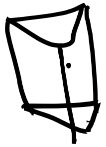
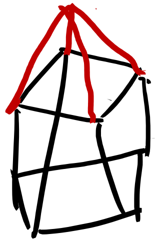
Metal	TUE	BMO
3M	48	$\frac{48}{2} = 24$
4M	60	30
4M	62	31
4M	64	$\frac{64}{2} = 32$

Geometry

(A) Triangular Arrangement

- Td 
- Butterfly arrngt 
- Square planar 

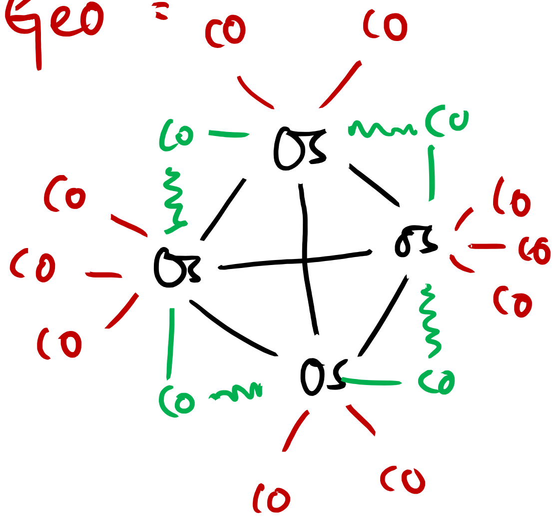
HNCC

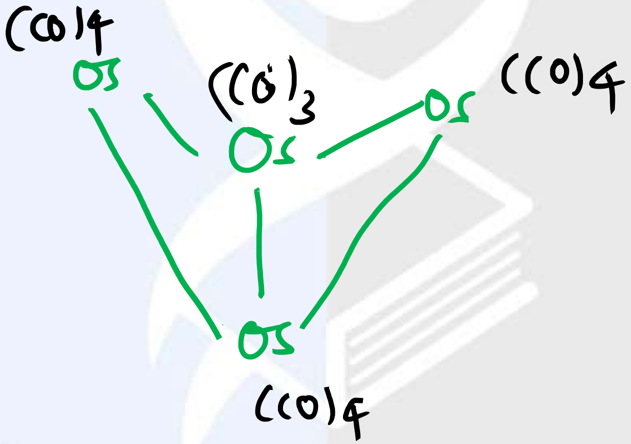
5M	72	36	TBP	
			square pyramidal	
5M	77	37		
6M	84	42 → 	Bicapped Td/ Monocapped TBP	
			Oh	
6M	86	43		
6M.	90	45	Trigonal Prismatic	
9M	130	65	Monocapped sq. antiprismatic	

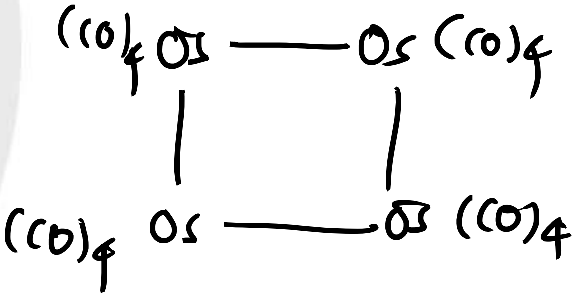
Ex:

	$Os_4(CO)_{14}$	$Os_4(CO)_{15}$	$Os_4(CO)_{16}$
① TVE	$8\times4 + 14\times2 = 60$ (Td)	$60+2 = 62$ Butterfly	$60+4 = 64$ sq. planar
② M-M bond:	⑥	⑤	④

③ Geo =







IfAS

HNCC :

① If metal is more than 4 called as HNCC

② $M-M = \frac{TVE - 18n}{2}$ is not applicable

③ Frame work molecule / Cage Bonding molecule } → Wade's Rule

④. Str of HNCC depends on TVE and skeleton $e^{\ominus}$ pair formula

$S = \frac{TVE - 12n}{2}$ → Wades Rule

⑤ In HNCC some element present in Encapsulated atom

Encapsulated atom → H, P, N, C, As, B

V.E → 1, 5, 5, 4, 5, 3

6. If H is greater than 1 they do not participate in Encapsulated atom.

7. Cage Bonding $e^{\ominus}$ pair / framework $e^{\ominus}$ pair / skeletal $e^{\ominus}$ pair (S). (SEP)

$$S = \frac{TVE - 12n}{2}$$

If SEP = n − 1 Super hyper Closo

= n Hyper Closo

= n+1 Closo

= n+2 Nido

= n+3 Arachno

n+4 → Hypo

n+5 → Klado

Eg : $H_2Ru_6(CO)_{18}$

TVE = 2 + 48 + 36 = 86 $e^{\ominus}$

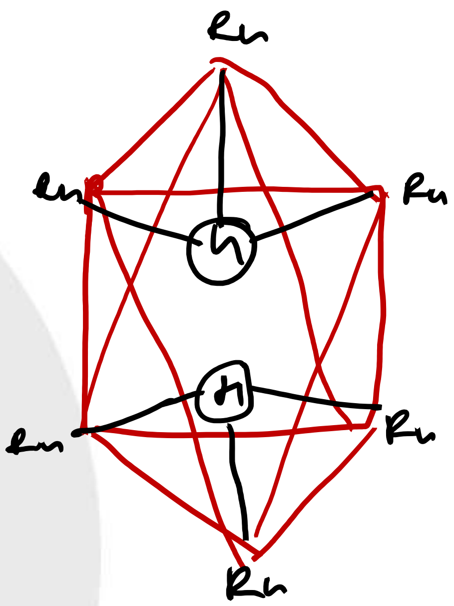
Geo = Oh geo

SEP = $\frac{TVE - 12n}{2} = \frac{86 - 72}{2}$ = 7 SEP

n = no. of metals = 6

SEP = 7 = n+1 → Closo Oh.

Vertices = 6.

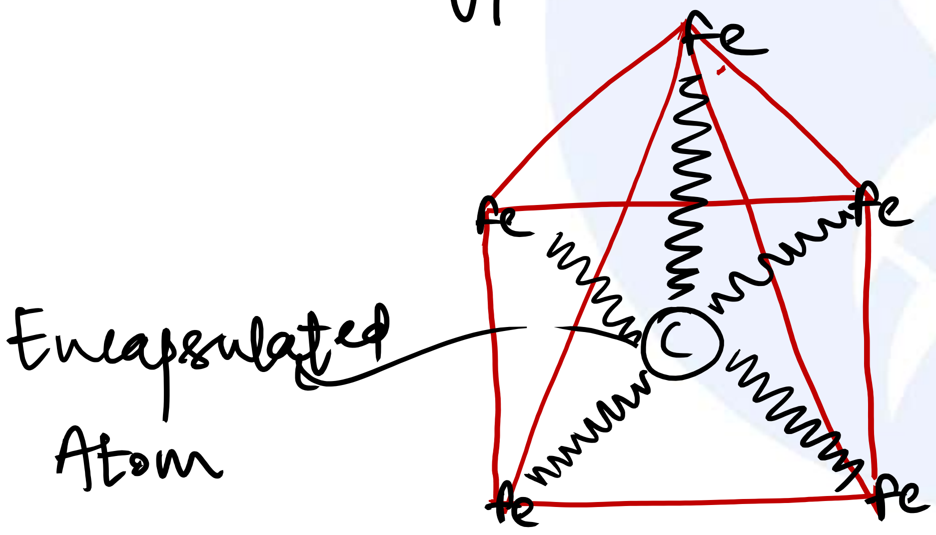


(2) $Fe_5C(CO)_{15}$ → n=5

(1) TVE = 40+30+4 = 74 → Sq. pyramidal

(2) SEP = $\frac{74-60}{2}$ = $\frac{14}{2}$ = 7 $e^{\ominus}$ pairs → (n+2)

(2) Cluster type = Nido



IfAS

HW

Compound	TVE/ TEC Total $e^{\ominus}$ count	n (no. of M)	SEP/ PEC Polyhedral $e^{\ominus}$ count	Predicted structure
① $Rh_6(CO)_{16}$				
② $Ru_6(CO)_{17}C$				
③ $Os_5(CO)_{15}C$				
④ $[Os_5(CO)_{15}]^{2-}$				
⑤ $[HOs_5(CO)_{15}]^{-}$				
⑥ $[H_2Os_5(CO)_{15}]$				
⑦ $Ru_5C(CO)_{16}$				

IfAS

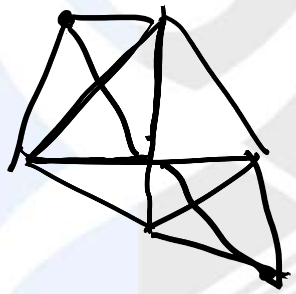
* (8) $[Fe_4(CO)_{12}C]^{2-}$

→ $S = \frac{TVE - 12n}{2}$

Capping Principal :—

If M: skeletal e^- pair or no. of metal greater than SEP. we use capping principle.

$$M \geq S$$



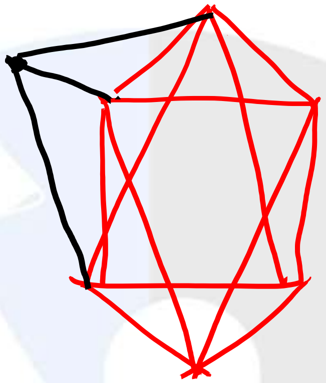
" Additional metal atoms are placed over triangular faces of basic polyhedron "

Ex: $Os_7(CO)_{21}$

TVE = 98

S = $7e^{\ominus}$

M = (7) → Hyper Closo



Monocapped Oh.

no. of metal M = S (SEP) → Use Capping principal.

HW

① $[Rh_7(CO)_{16}]^{3-}$

② $[Os_8(CO)_{22}]^{2-}$

③ $[Os_{10}(CO)_{24}C]^{2-}$

Thank you