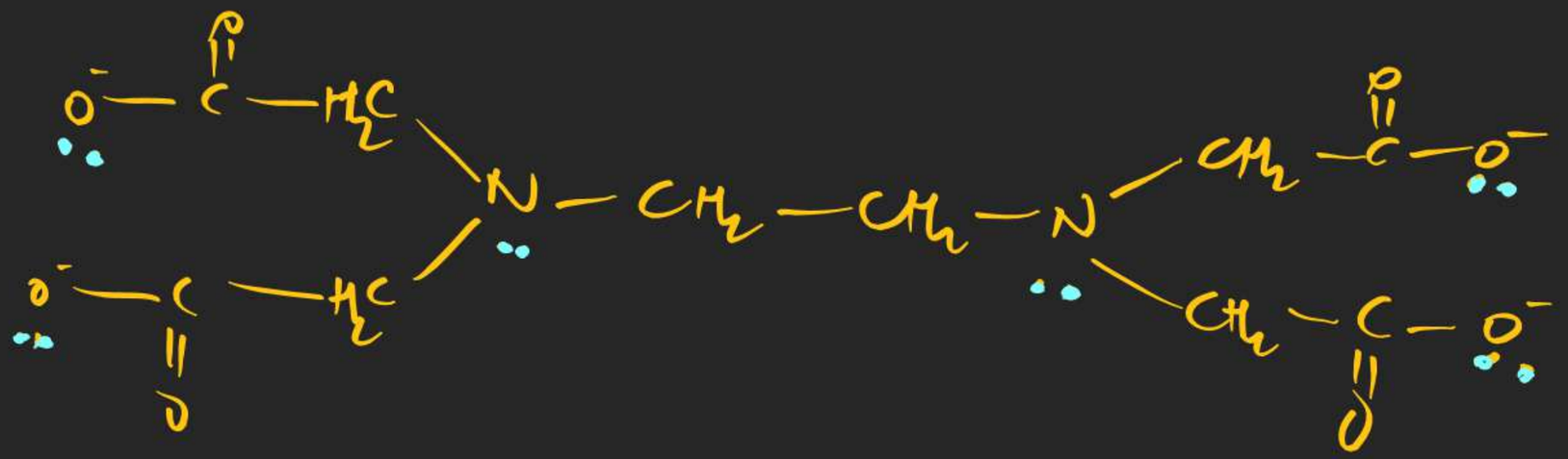
Nishant Jindal

COORDINATION CHEMISTRY

C.N = no of l.p accepted by Metal Cation/atom

	number of ligand	C.N
$[Ni(CO)_4]$	4	4
$[Fe(CO)_5]$	5	5
$[Ni(en)_3]^{+3}$	3	6
$[Pt(NH_3)_4][PtCl_4]$	4, 4	4, 4
$[Co(EDTA)]^{\ominus}$	1	6



no of ligand = 1

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E.A.N [Effective atomic number]

total number of e^- of metal cation or atom after accepting electrons from ligand.

$$E.A.N = Z - O.S + (2 \times C.N)$$

$2 \times C.N$ → total number of e^-

$[Ni(CO)_4]$

$E.A.N = 28 + 2 \times 4$

$= 28 + 8$

$= 36$

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$Fe(CO)_5$

$26 + 5 \times 2$

$= 36$

$[Ni(en)_3]^{+2}$

$28 - 2 + 2 \times 6$

$= 26 + 12$

$= 38$

28

$[Ni(en)_3]^{+2}$

$x + 3 \times 0 = +2$

$x = +2$

$[Fe^{+3}(ox)_3]^{-3}$

$= x + 3(-2) = -3$

$x = +3$

$= 26 - 3 + 2 \times 6$

$23 + 12$

$= 35$

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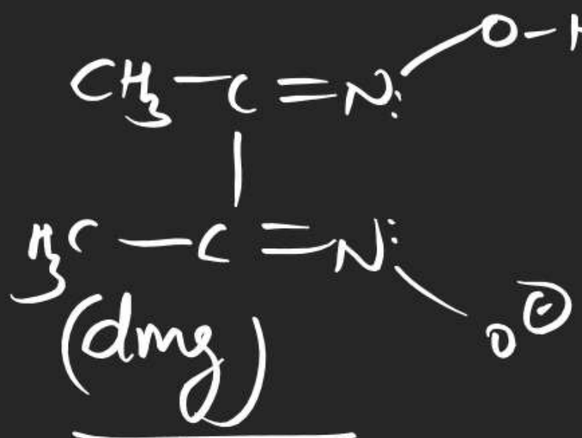
Keypoint



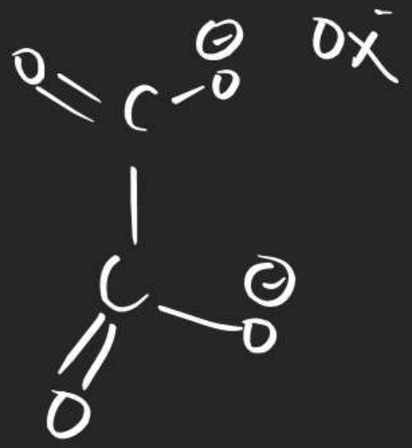
(dmg)

en
Ph
Bn
tn
Phen
dipy

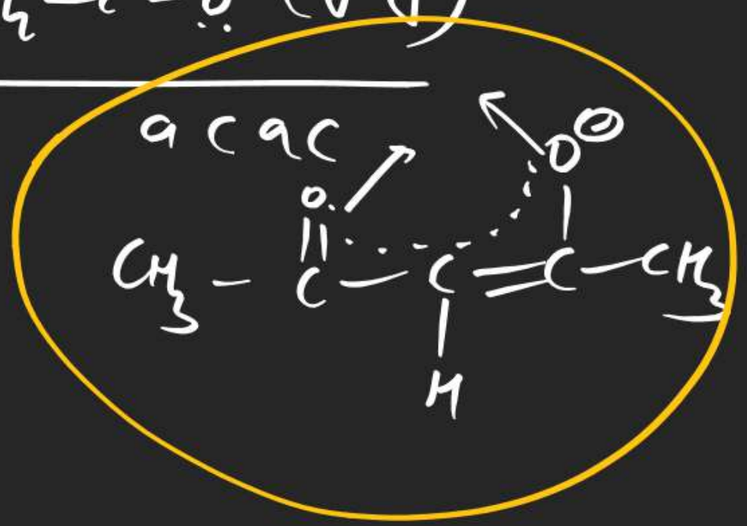
bidentate
donoar atom – N
neutral

$NH_2-CH_2-\overset{O}{\overset{\|}{C}}-\ddot{O}$ (gly)

tn, acac



ox



27 $[Co(EDTA)]^{\ominus}$

$x + (-4) = -1$

$x = +3$

$27 - 3 + 12$

$= 24 + 12$

$= \underline{36}$

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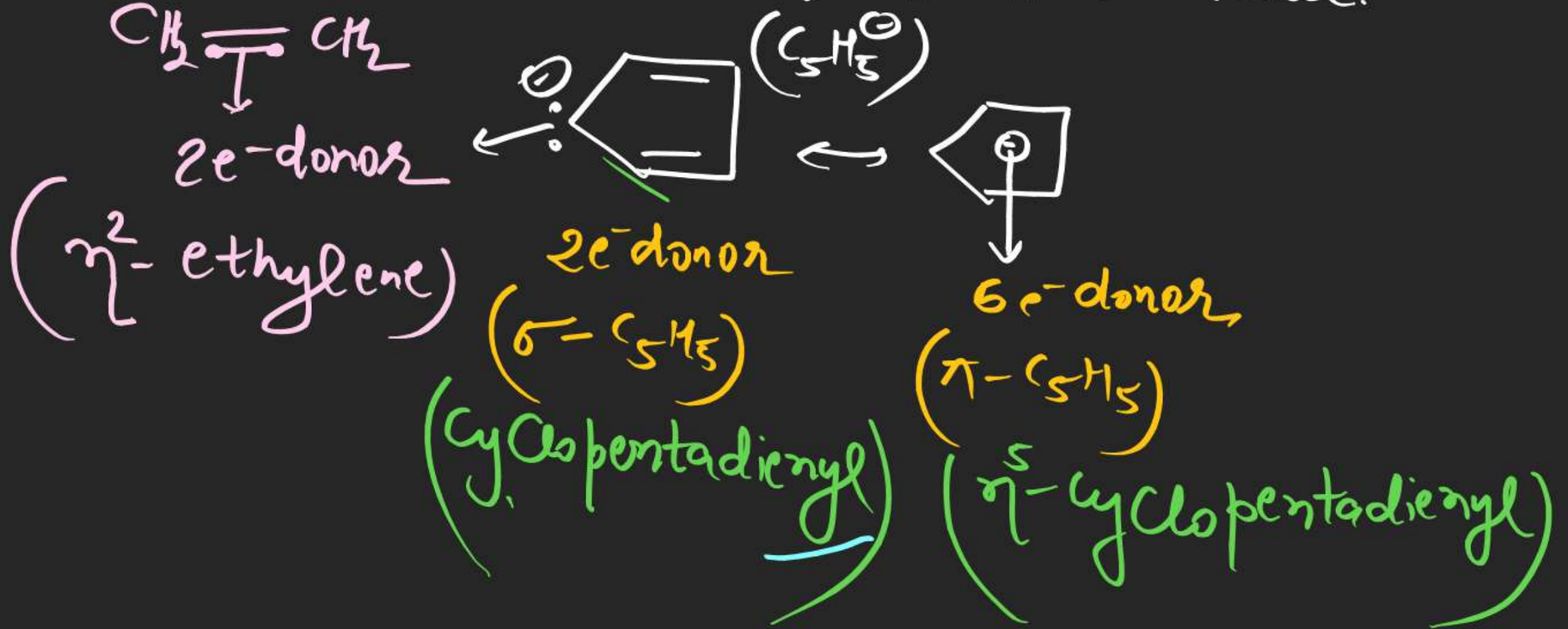
Imp ⇒ there are many Kind of ligand in which no l.p present on donor atom still they act as ligand because they may donate their π e⁻ cloud.



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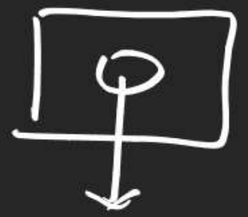
6 e⁻ donor

(η^6-benzene)



4 e⊖

η^4-cyclobutadiene

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$$\left[Ti(\sigma-C_5H_5^{-1})_2(\pi-C_5H_5^{-1})_2\right]$$

22

$= 22-4+4+12$

$= \underline{34}$

$K\left[Pt Cl_3(C_2H_4)\right]$

$1+x+3(-1)+0=0$

$x=+2$

$= 78-2+2\times3+2$

$= 76+6+2$

$= \underline{84}$

Pt → 78

Sidgwick Rule

acc. to Sidgwick Rule Metal Cation/atom try achieve its nearest Noble gas conf. and become more stable but it is not always true.

acc. to C.F.S.E

$K_4[Fe(CN)_6]$ < $K_3[Fe(CN)_6]$

E.A.N = 36 E.A.N = 35

(oxidising agent) $[Mn(CO)_5] + e^- \longrightarrow [Mn(CO)_5]^{\ominus}$ (Reduction)

$25 + (5 \times 2)$

35

(Reducing agent) $[Mn(CO)_6]^{\cdot} \longrightarrow [Mn(CO)_6]^{+}$ (oxidation)

37

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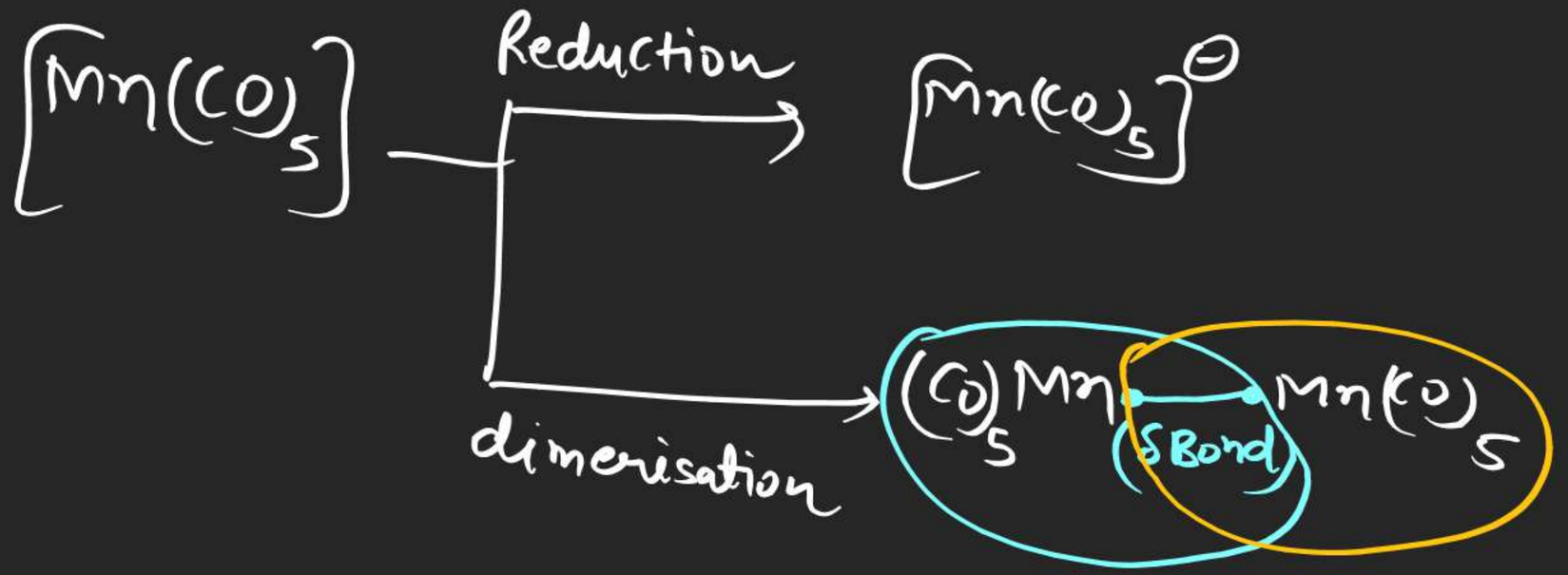

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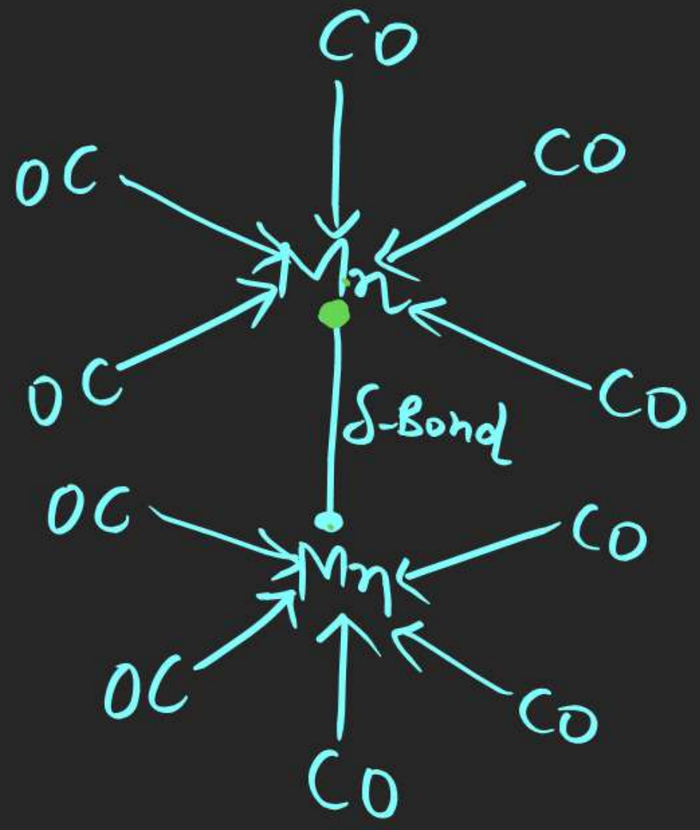
E.A.N of Polynuclear or bridging complex



$Mn_2(CO)_{10}$

total no of e^- of two Mn = 2×25

total no of e^- of 10CO = 2×10

two e^- from δ Bond = 02

72

E.A.N of one Mn = $\frac{72}{2}$ = 36

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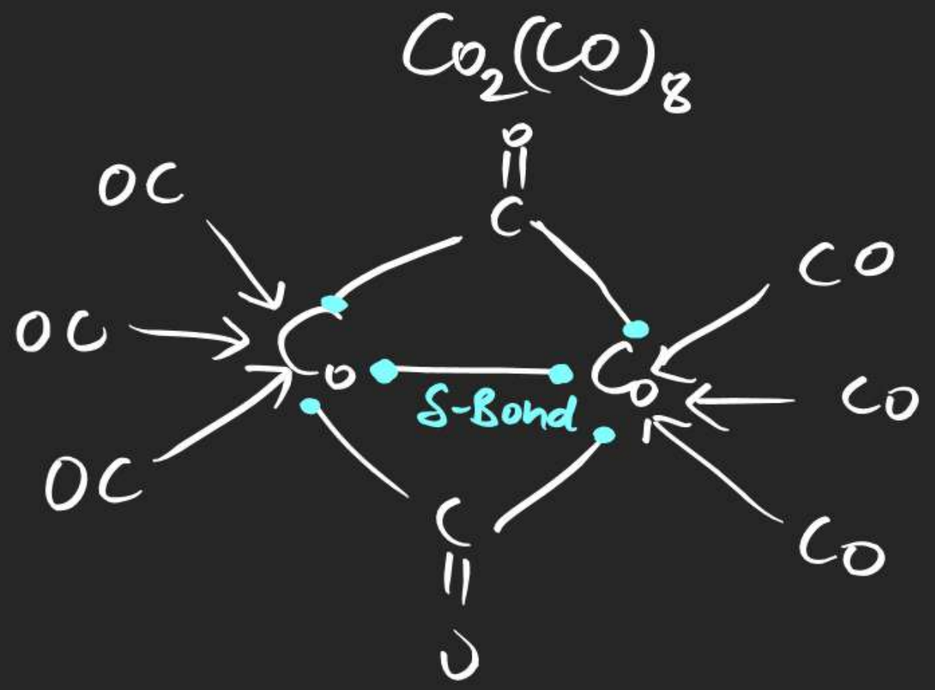

$Co_2(CO)_8$

2×27
2×8
02
72

E.A.N of one $Co = \frac{72}{2}$

$= \underline{36}$

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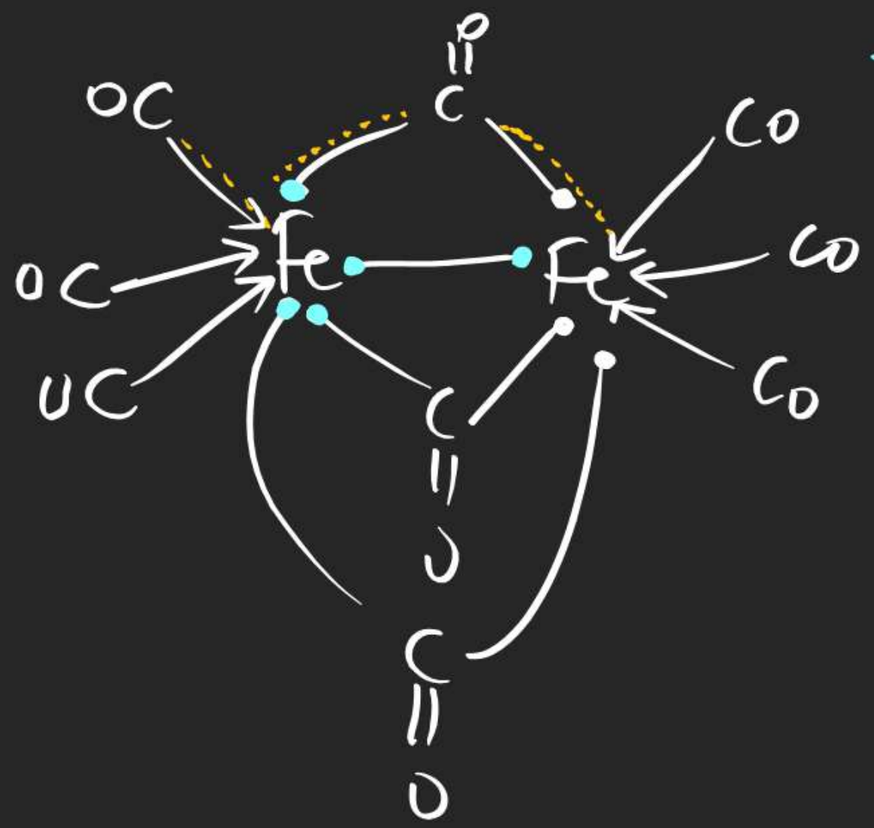
$Fe_2(CO)_9$



2×26
2×9
$0\ 2$
72

E.A.N.O

η one Fe $= \frac{72}{2}$

$= 36$

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find the value of x in $Ni(CO)_x$

$Ni(CO)_x$

$E.A.N = Z - O.S + 2x(.N$

$36 = 28 + 2x$

$x = 4$

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$[Co_2(CO)_x]$

$E.A.N = 2 \times Z - O.S + 2 \times C.N + 2$

$72 = 2 \times 27 + 2x + 2$

$x = 8$

$Fe(CO)_x$

$E.A.N = Z - O.S + (2 \times C.N)$ (3 σ-Bond)

$36 = 26 + 2x$

$x = 5$

$Hg_x[Mn(CO)_5]$

$[Mn(CO)_5]^{-x}$

$E.A.N = Z - O.S + 2 \times C.N$

$36 = 25 - (-x) + 2 \times 5$

$x = 1$

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