RPS 9 Eighteen electrons

Do the following compounds follow the 18 electron rule

\[
\begin{align*}
\text{Ni(CO)}_4 & \quad \text{V(CO)}_6^- & \quad \text{Cr(H}_6\text{C}_6\text{)(CO)}_3 \\
\text{Mn}_2(\text{CO})_{10} & \quad \text{Fe(\text{CO})}_4^{2-} & \quad \text{Re(\text{CO})}_5^- \\
\text{Cr(\text{CO})}_5^{2-} & \quad (\text{RCO})\text{Fe(\text{CO})}_4^- & \quad \text{HCo(\text{CO})}_4 \\
\text{HCo(\text{CO})}_4 & \quad \text{CpFe(\text{CO})}_2^- & \quad (\text{CO})_5\text{CrHCr(\text{CO})}_5^- \\
\end{align*}
\]

For the following compounds determine \( n \) by using the 18 electron rule:

\[
\begin{align*}
\text{Cr(\text{CO})}_n & \quad \text{Ni(\text{CO})}_n & \quad \text{Co}_2(\text{CO})_n \\
\text{Mn}_2(\text{CO})_n & \quad \text{Fe}_3(\text{CO})_n & \quad \text{W(\text{CO})}_n(\text{cp})_2 \\
\text{Fe}(\eta^2-\text{C}_4\text{H}_4)(\text{CO})_n & \quad \text{Mn(cp)}(\text{CO})_4 & \quad V(\text{CO})_6^{n+} \\
\text{CpFe(\text{CO})}_2^{n-} & \quad \text{CpFe(\text{CO})}_2\text{R} & \quad \text{Ir}_4(\text{CO})_n \\
\end{align*}
\]

Draw the following compounds:

\[
\begin{align*}
(\eta^4-\text{COT})\text{Fe(\text{CO})}_3 & \quad (\eta^6-\text{C}_7\text{H}_8)\text{Cr(\text{CO})}_3 & \quad \text{Mo(\text{CO})}_4(\eta^3-\text{C}_3\text{H}_3)^- \\
\text{CpCo(\eta^4-\text{COT})} & \quad \text{Cr(cp)}_2^{2-} & \quad (\text{cp})\text{Fe(\eta}^1\text{-cp)}(\text{CO})_2 \\
\text{Co((\text{CO})}_3(\eta^3-\text{C}_3\text{H}_3) & \quad \text{Co}_2(\text{CO})_8 \text{ (2 structures)} & \quad \text{Fe}_2(\text{CO})_9 = \\
\text{Cr}_2(\text{CO})_{10}\text{H} & \quad (\text{C}_7\text{H}_7)\text{Cr(Cp)} & \quad (\text{Cp})_2\text{Ti(\text{C}_2\text{H}_4)}\text{H} \\
\end{align*}
\]
Do the following compounds follow the 18 electron rule

Ni(CO)_4 Ni has 10 e\(^-\) and 2 for each CO \(\Rightarrow\) 10+8=18

V(CO)_6 V has 5 and 2 for each CO and one more for the charge \(\Rightarrow\) 5+12+1=18

Cr(H\(_6\)C\(_6\))(CO)_3 Cr has 6 and 6 for H\(_6\)C\(_6\) (2 from each double bond) and 6 from COs \(\Rightarrow\) +6+6=18

Mn\(_2\)(CO)\(_{10}\) (CO)\(_5\)Mn-Mn(CO)\(_5\) Mn has 7 one from other Mn and 10 from COs \(\Rightarrow\) 18

Fe(CO)_4 \(^2-\) Fe has 8 + 8 from COs and 2 more for neg charge \(\Rightarrow\) 18

Re(CO)_5 Re has 7 + 10 from COs and one for neg charge \(\Rightarrow\) 18

Cr(CO)_5 \(^2-\) Cr has 6 + 10 from COs and 2 for neg charge \(\Rightarrow\) 18

(RCO)Fe(CO)_4 Fe has 8 + 8 from COs +1 for neg charge + 2 from RCO’s double bond \(\Rightarrow\) 19

HCo(CO)_4 Co has 9 one from H and 8 from COs \(\Rightarrow\) 18

CpFe(CO)_2 Fe has 8 + 4 from COs + 1 neg charge +5 from Cp \(\Rightarrow\) 18

(CO)\(_5\)CrHCr(CO)\(_5\) \(^-\) Cr has 6 + 10 from COs and 1 from other Cr and H\(^-\) donates 1 to each Cr \(\Rightarrow\) 18

For the following compounds determine n by using the 18 electron rule:

Cr(CO)_n 18=6+n*2 \(\Rightarrow\) n=6
Ni(CO)ₙ 10+2*n=18 => n=4

Co₂(CO)ₙ 9+2*(n/2)=18 => n=9; There must be one (or 3 bridging COs) such as

However it could have a Co–Co bond such as;

Mn₂(CO)ₙ If you have an Mn–Mn bond they you need 5 COs on each Mn (or some could bridge

Fe₃(CO)ₙ Put the Fe a triangle so it has 8 + 2(1 from each of the other Fe) and then it will need 4 more COs on each Fe thus n=12.

W(CO)ₙ(cp)₂ W has 6 Cp has 5 each so n=1

Fe (η²-C₄H₄)(CO)ₙ Fe has 8 and η²-C₄H₄ contributes 2 thus need 10 more and n=5

Mn(Cp)(CO)₄ Mn has 7 CO has 8 thus Cp must contribute 3 so it is η³

V(CO)₆ n: V has 5 and 12 form COs so n=1;

CpFe(CO)₂ n: Fe has 8 COs 4 Cp 5 n=1;

CpFe(CO)₃ R• Fe *, COs 4 Cp 5 then R must contribute one

Ir₄(CO)ₙ If Ir is pyrimide and so each Ir has an electron contributed by the other Ir then Ir has 9 +3(from other IrS) and need 6 from COs for each Ir. Thus n=3*4=12

Draw the following compounds:
(η⁴-COT)Fe(CO)₃

(η⁶-C₇H₈)Cr(CO)₃

Mo(CO)₄(η₃-C₃H₃)

CpCo(η⁴-COT)

Cr(cp)₂²⁻

(cp)Fe(η¹-cp)(CO)₂

Co((CO)₃(η³-C₃H₃)

Co₂(CO)₆ (2 structures)

Fe₂(CO)₉ =

Cr₂(CO)₁₀H⁺

(C₇H₇)Cr(Cp)

(Cp)₂Ti(C₂H₄)H⁺