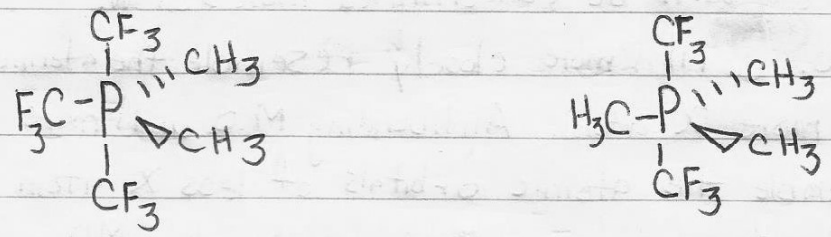
Chapter 5

1) $(CH_3)_2P(CF_3)_3$ $(CH_3)_3P(CF_3)_2$

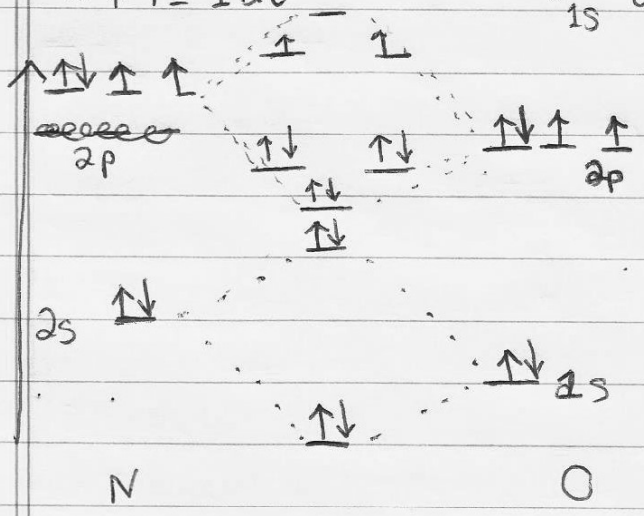


CF_3 is more X than CH_3, so it is more likely to bind to orbitals on P that have less s character so that the competition for e^-s is minimized. The CF_3 groups will occupy the axial positions. The barrier to pseudorotation will be fairly great because the CF_3's will not "care" to occupy the equatorial ~~Sites~~ sites. Those sites have more s character on the P hybrids.

2) NO$^-$

5 + 7 = 12e$^-$

$\sigma_{1s}^2\ \sigma^*_{1s}{}^2\ \sigma_{2s}^2\ \sigma^*_{2s}{}^2\ \sigma_{2p_z}^2\ \pi_{2p_x}^2\ \pi_{2p_y}^2\ \pi^*_{2p_x}{}^1\ \pi^*_{2p_y}{}^1$



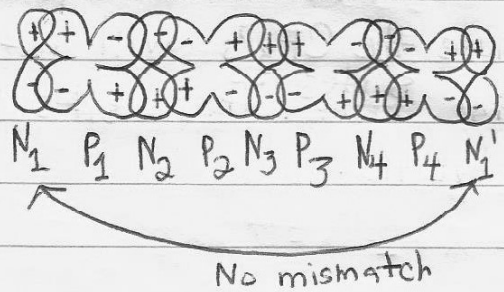
9. Bond order: $\frac{1}{2}(8-4) = 2$

b. B.O. : 2.5 will be shorter for NO.

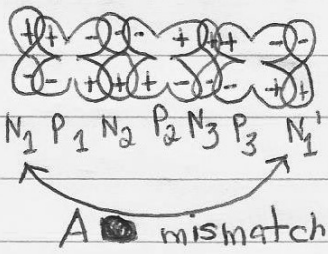
c. 2 unpaired e^- for NO^-.

d. The unpaired e^- will be concentrated more on N.
Bonding M.O. will more closely resemble the atomic orbitals of more X atom. Antibonding M.O. will more closely resemble the atomic orbitals of less X atom
The unpaired e^- are in antibonding M.O. and will be thus more concentrated on N.

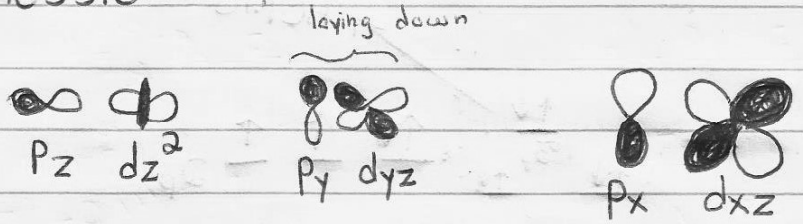
3. $(PNCl_2)_4$



$(PNCl_2)_3$



4) Miessler 5.1.



5.2.

a. Li_2 B.O. = 1.0 → shorter bond

Li_2^+ B.O. = 0.5

b. F_2 B.O. = 1.0

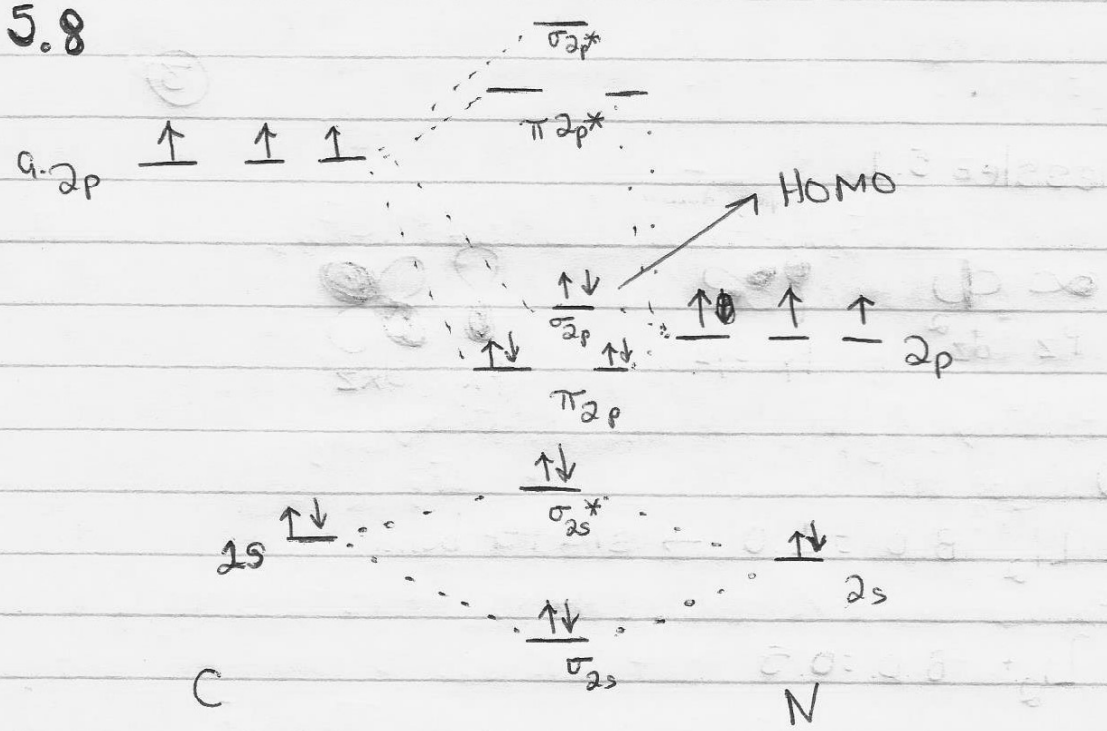
F_2^+ B.O. = 1.5 → shorter bond

c.

	Bonding electrons	Antibonding electrons	Bond order
He_2^+	2	1	0.5
HHe^+	2	0	1
H_2^+	1	0	0.5

Shortest bond

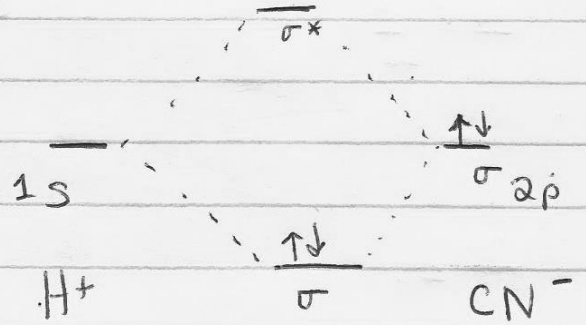
5.8



b. B.O. = $\frac{1}{2}[8-2] = 3$

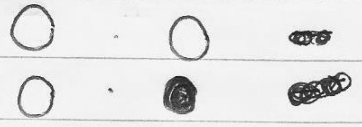
c. The HOMO is the σ_{2p} orbital, which can interact with the 1s of the H^+, as in the diagram at right. The bonding orbital has an energy near that of the π orbitals; the antibonding orbital becomes the highest energy orbital.

$H^+ + CN^- \rightarrow HCN$



5.14) CH_2

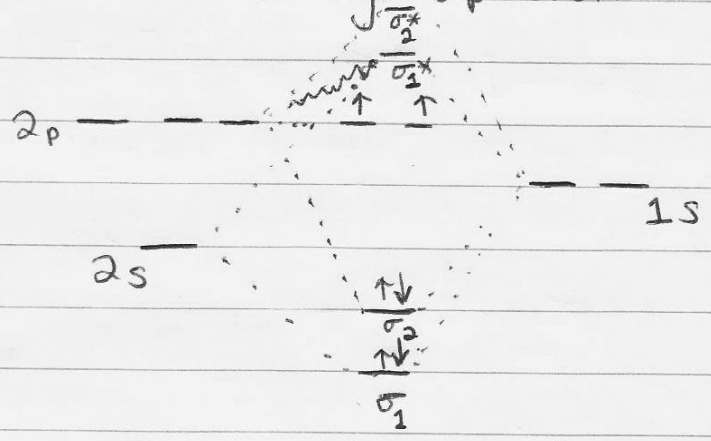
a. The group orbitals on hydrogen are



The first group orbital interacts with the 2s orbital on carbon.

And the second group orbital interacts with a 2p orbital on carbon.

Carbon's remaining 2p orbitals are nonbonding.



H-C-H

b. Linear CH_2 is a paramagnetic diradical, with one e^- in each of the p_x and p_y orbitals of carbon.