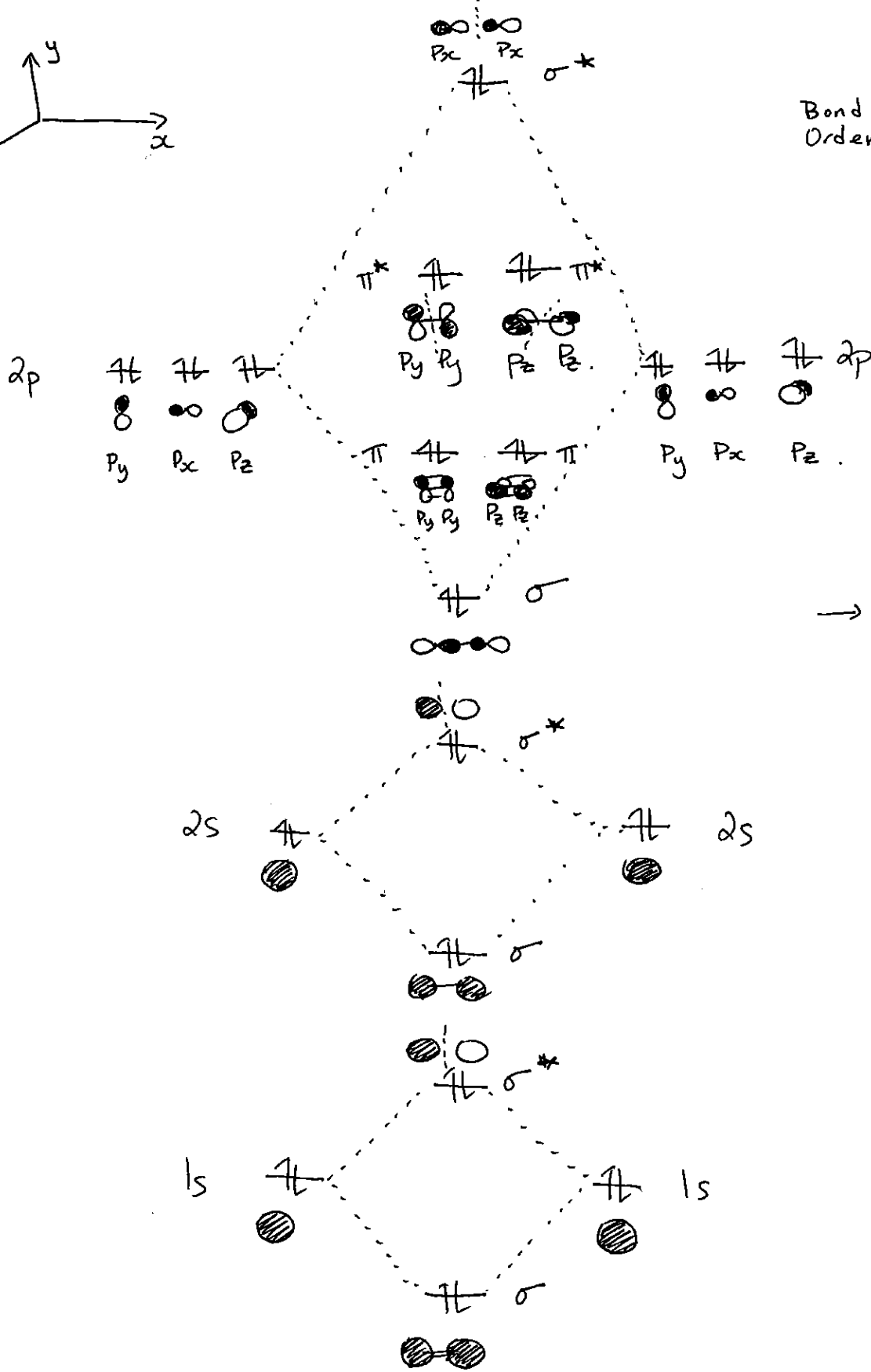
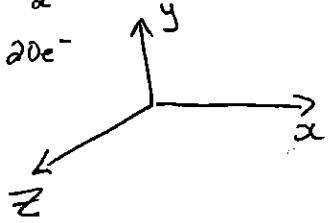


Chemistry 2500
Assignment #8 — Bonding — Answer Key.

1. F_2^{2-}



$$\text{Bond Order} = \frac{10 - 10}{2}$$

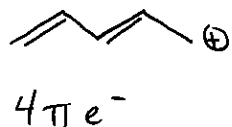
$$= 0$$

\therefore molecule is not predicted to exist (no net bonding between the 2 F atoms).

\rightarrow molecule is diamagnetic \therefore singlet.

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Assignment # 8 - Bonding - Answer Key.

2.

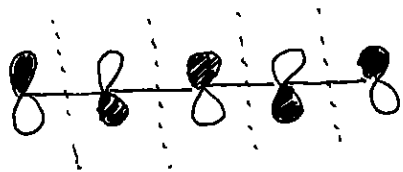


→ linear system.

→ 5 p-orbitals ∴ 5 π molecular orbitals

→ 5 different energy levels.

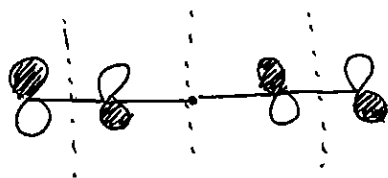
π^* —



→ 4 nodes

→ all adjacent p-orbital interactions are antibonding

π^* —



→ 3 nodes

→ adjacent pairs of p-orbitals are antibonding.

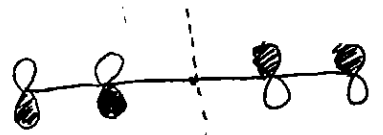
π_{nb} —



→ 2 nodes

→ no adjacent p-orbitals interacting ∴ non-bonding.

π $\uparrow\uparrow$



→ 1 node.

→ the 2 pairs of adjacent p-orbitals are bonding.

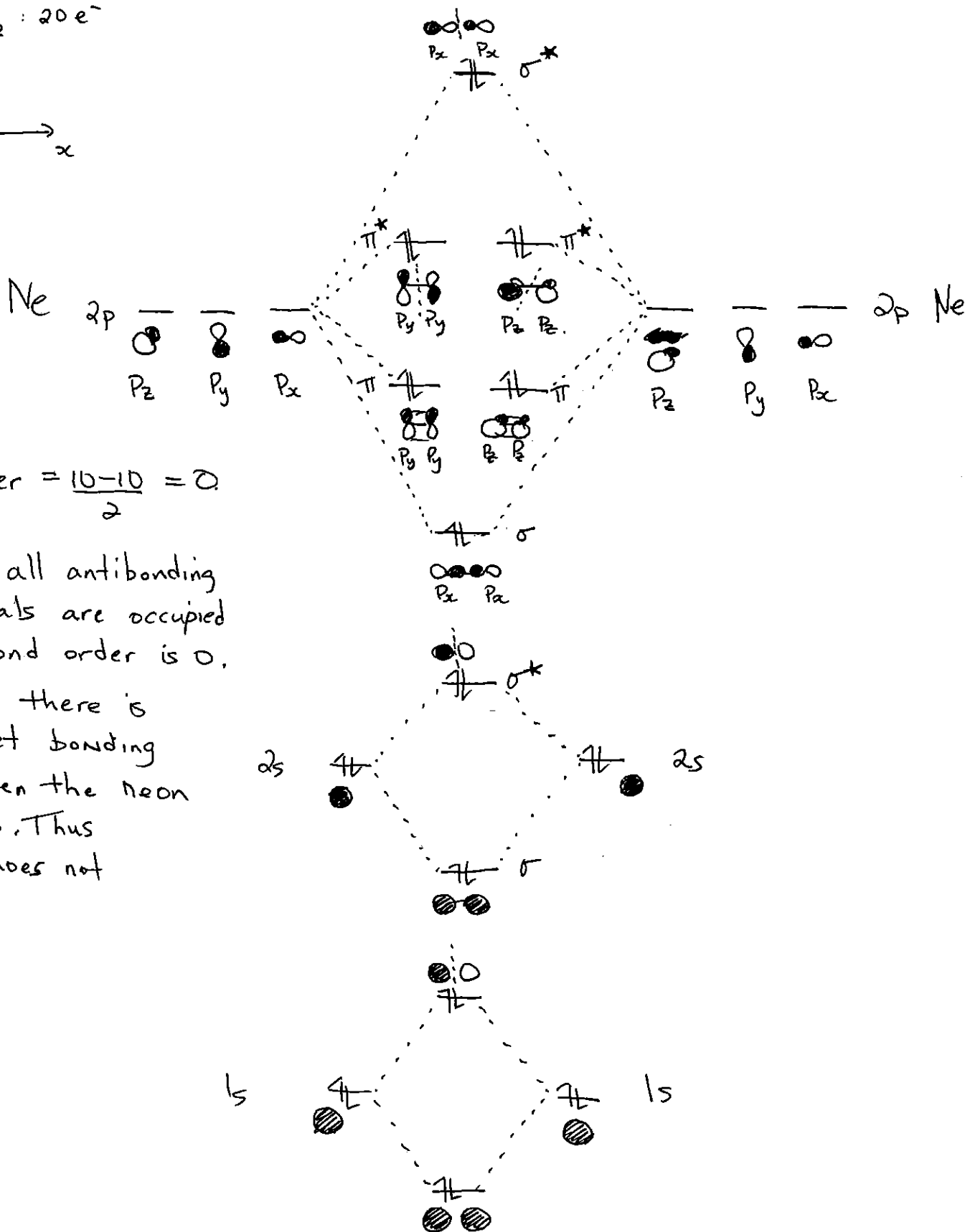
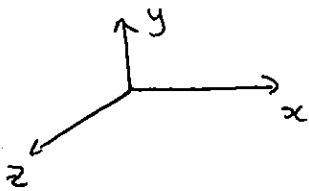
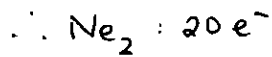
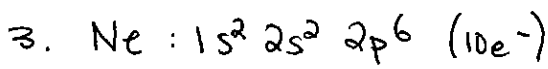
π $\uparrow\uparrow$



→ 0 nodes.

→ all interactions between adjacent p-orbitals are bonding.


Chemistry 2500
 Assignment # 8 — Bonding — Answer Key.

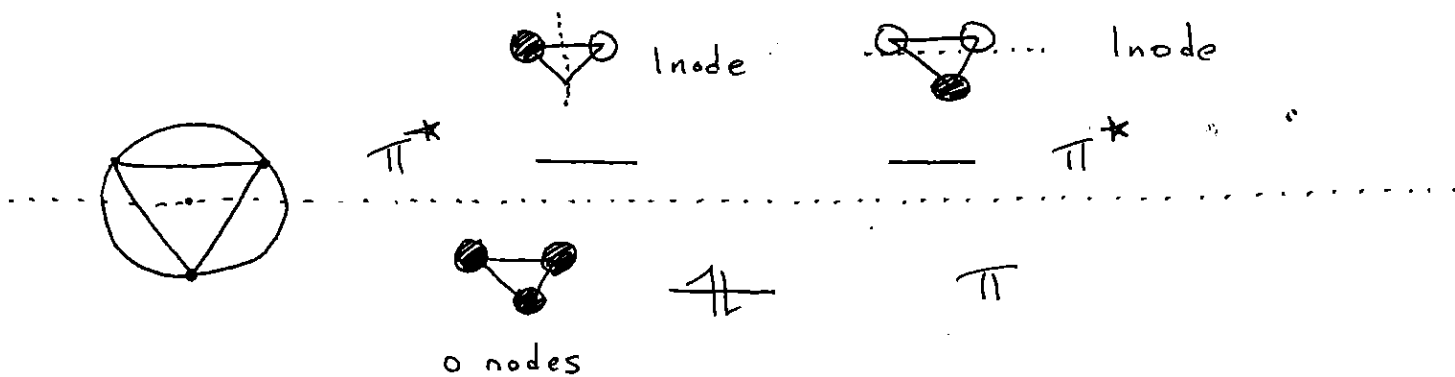


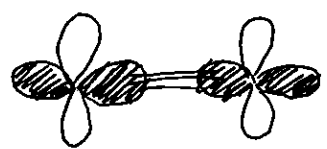
$$\text{Bond order} = \frac{10 - 10}{2} = 0$$


→ Since all antibonding orbitals are occupied the bond order is 0. Hence there is no net bonding between the neon atoms. Thus Ne_2 does not exist.

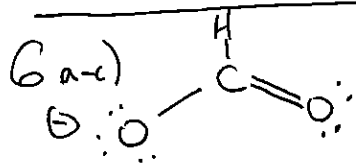
4. $C_3H_3^+$

 $\rightarrow 2\pi e^-$
 $\rightarrow 3p$ orbitals $\therefore 3\pi$ molecular orbitals.

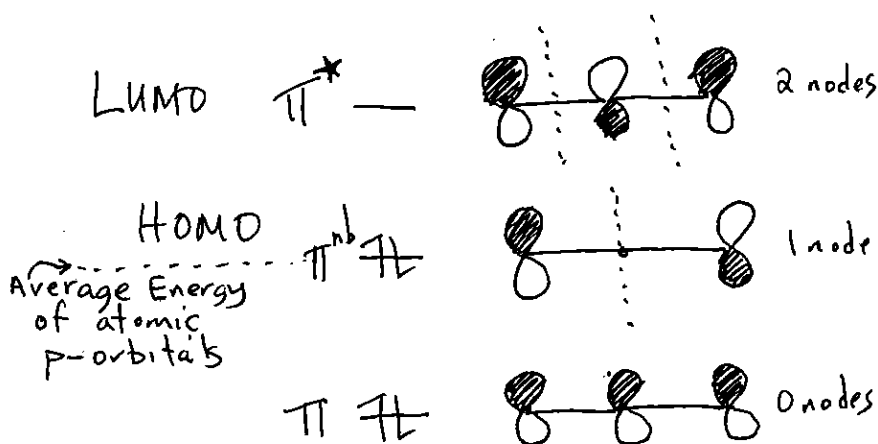


5.a)  σ -bond. $\rightarrow 0$ nodes
 \rightarrow head on orbital overlap.
 \rightarrow cylindrical symmetry.

b)  π -bond
 $\rightarrow 1$ node
 \rightarrow side on orbital overlap.



$\rightarrow 3p$ -orbitals $\therefore 3\pi$ molecular orbitals.
 $\rightarrow 4\pi e^-$ in system.
 \rightarrow linear $\therefore 3$ energy levels.



e) diamagnetic

f) the HOMO has equal probability of e^- density at both oxygens, and zero probability at the central carbon. Thus, protonation (which requires e^- from the formate) is equally likely to occur the 2 oxygen atoms and will not occur at carbon.

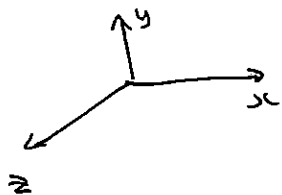
Chemistry 2500
Assignment #8 - Bonding - Answer Key.

7. N_2^+

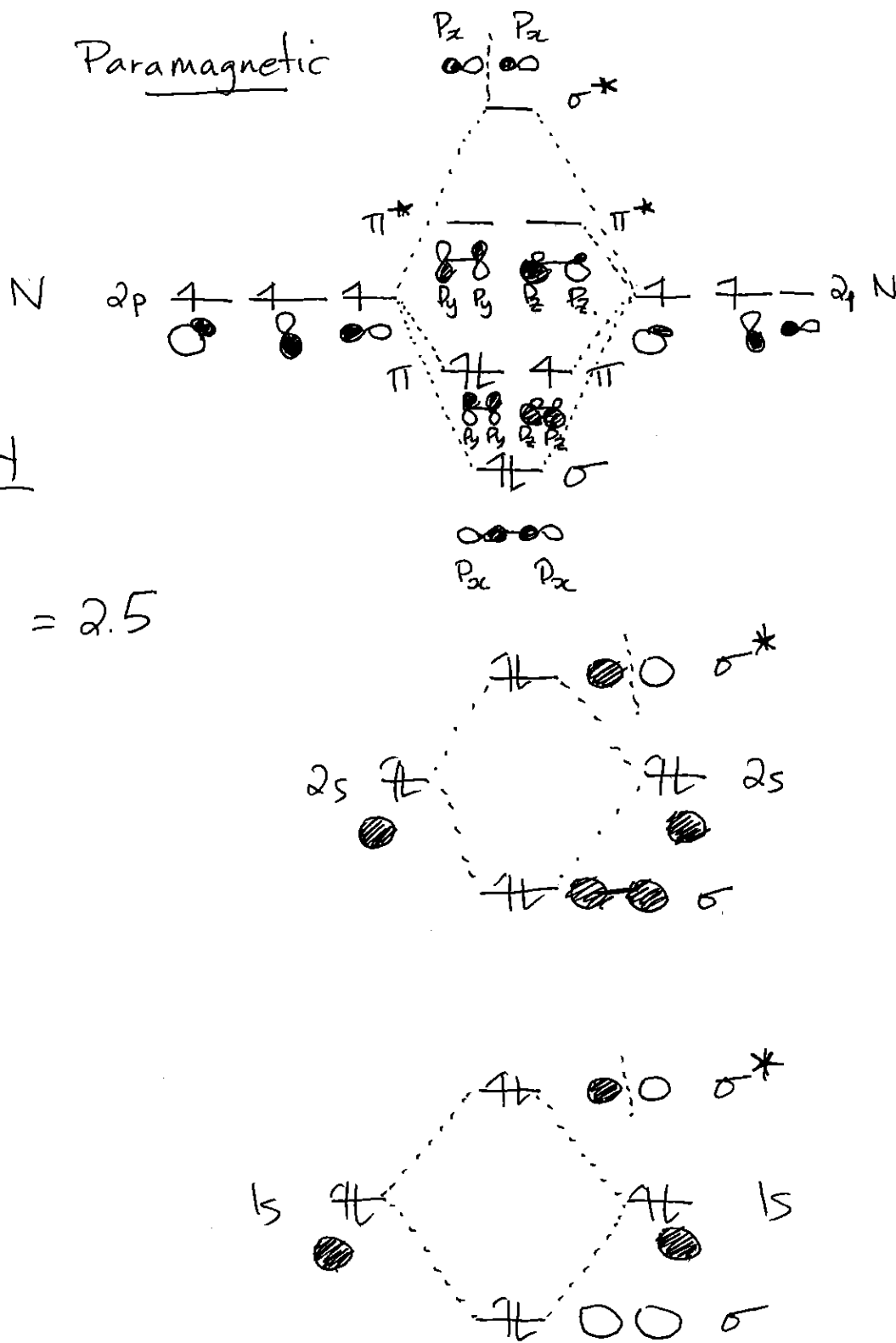
N: $1s^2 2s^2 2p^3$

$2 \times 7 = 14$

$14 - 1 = 13e^-$.



Paramagnetic



$$\text{Bond Order} = \frac{9 - 4}{2}$$

$$= \frac{5}{2} = 2.5$$