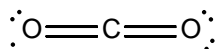


Answers to Exercise 4.3

Linear Combination of Atomic Orbitals: Planar Molecules

1.

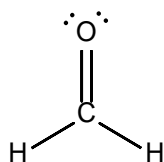
(a)



linear therefore two pi systems:

- one from $2p_x(C)$ and the two $2p_x(O)$
- one from $2p_y(C)$ and the two $2p_y(O)$

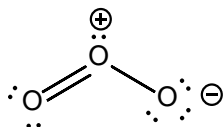
(b)



planar therefore one pi system:

- from $2p_z(C)$ and $2p_z(O)$

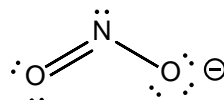
(c)



planar therefore one pi system:

- from the three $2p_z(O)$

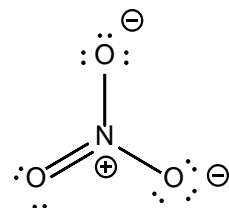
(d)



planar therefore one pi system:

- from $2p_z(N)$ and the two $2p_z(O)$

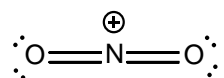
(e)



planar therefore one pi system:

- from $2p_z(N)$ and the three $2p_z(O)$

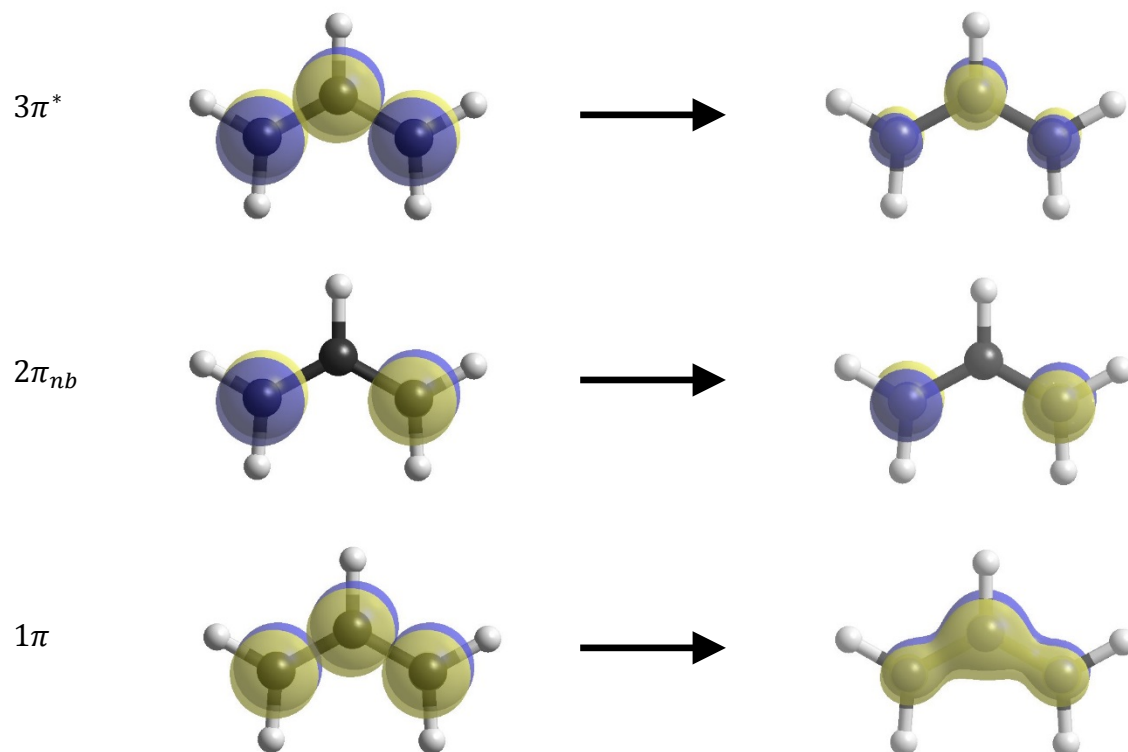
(f)



linear therefore two pi systems:

- one from $2p_x(N)$ and the two $2p_x(O)$
- one from $2p_y(N)$ and the two $2p_y(O)$

2.



It is very important that your pi orbitals are pointing in the correct direction. Since this is a planar cation, the only pi MOs are made from the 2p orbitals that point forward-and-backward (toward you and away from you). This is the only way that they can have a node that passes through all atoms in the cation.