

## Answer on Question #54370 – Chemistry – General chemistry

### Question:

Based on molecular orbital theory, draw the energy patterns for NO<sup>+</sup> ion and CO molecule. Between these two, point out the similarities with respect to bond order and magnetic character and, the dissimilarity with respect to energy pattern of orbitals.

### Answer:

For NO<sup>+</sup> MO diagram is represented:

The bond order equals:

$N = (B - A)/2$ , where B – the number of electrons sitting on the bonding MO orbitals and A – the number of electrons on the antibonding MO orbitals.

Thus,  $N = (8 - 2)/2 = 3$ . There is a triple bond between N and O (N≡O<sup>+</sup>). Since there are no unpaired electrons the cation is diamagnetic.

Considering CO molecules it is known that the bond order is 3 and molecule is diamagnetic:

There is only the difference in energies of  $\pi_{2p}$  and  $\sigma_{2p}$  orbitals:

$E(\pi_{2p}) < E(\sigma_{2p})$  for CO and  $E(\pi_{2p}) > E(\sigma_{2p})$  for  $\text{NO}^+$ .

The  $\pi$  -interactions are more stable for elements with a half-completed or containing less than 4 electrons at the outermost level (Carbon). On the other hand,  $\sigma$ -bonds are more stable for elements having more than 4 electrons (Nitrogen).