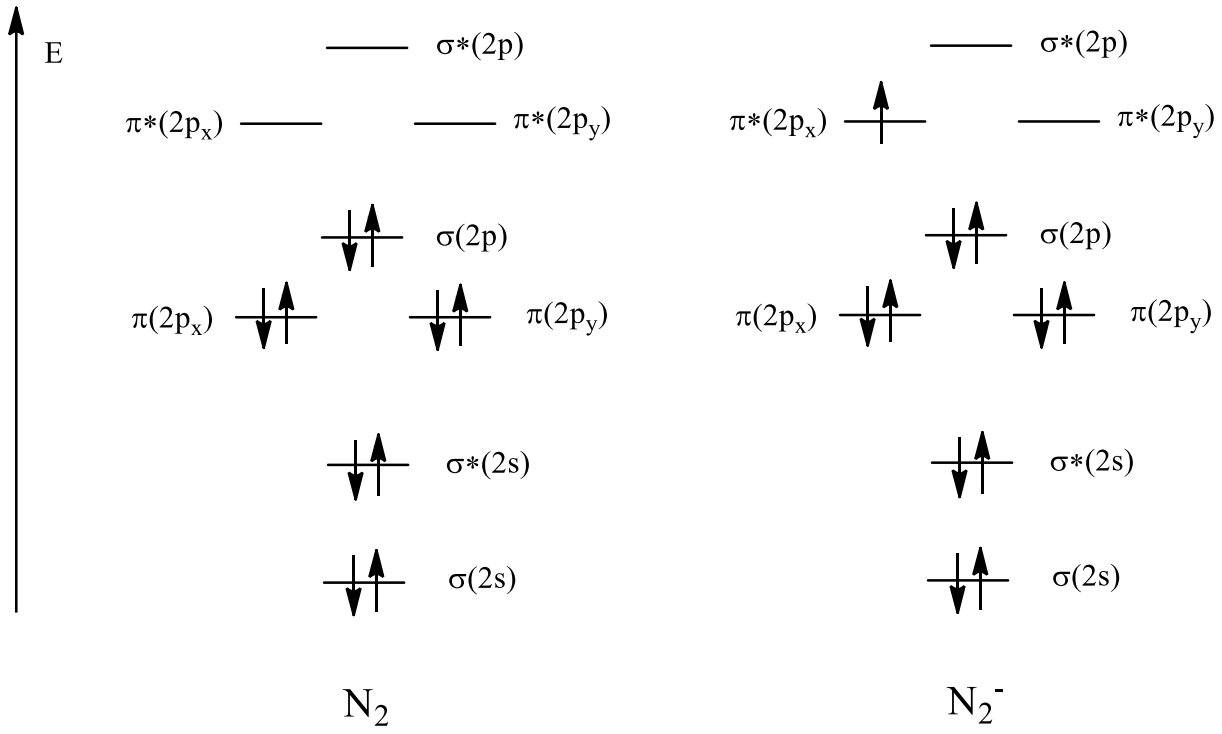
Answer on Question #55181 – Chemistry – General chemistry

Question:

The bond dissociation enthalpies for N2 and N2- are 945 kJ/mol and 765 kJ/mol respectively. (There is only a small difference between enthalpies and energies.) Using an argument based on MO theory, explain why N2- has a smaller bond dissociation energy than N2.

Answer:

In this case, we should draw MO diagram and calculate bond orders for N_2 and N_2^-:



Bond order = (8 - 2)/2 = 3

Bond order = (8 - 3)/2 = 2.5

As shown, in N_2^- one electron occupies antibonding orbital $\pi(2p_x)$ that decreases the bond order by 0.5 in comparison with N_2. Moreover, the value of ratio for bond orders is close to that for energies found experimentally:

$E(N_2)/E(N_2^-)$ = 945/765 = **1.24**

and

Bond order (N_2)/ Bond order (N_2^-) = 3/2.5 = **1.2**