24. Non-Bonding Orbitals

When two atoms come together, not all orbitals are able to bond. Specifically, unless the two orbitals are in the same dimensional line (x, y, or z), the orbitals do not interfere and they do not form a bond. For example, the diagram below shows one 2p<sub>y</sub> atomic orbital and one 2p<sub>x</sub> atomic orbital. When they overlap, there is no net interference. As a result, these two orbitals are non-bonding.

From each of the examples below, determine whether or not the two atomic orbitals result in bonding orbitals, anti-bonding orbitals, or non-bonding orbitals. If they are bonding or anti-bonding, draw the resulting molecular orbital.

1) One, 2p<sub>x</sub> atomic orbital and one, 1s atomic orbital

2) One, 2p<sub>x</sub> atomic orbital and one, 1s atomic orbital

3) One, 2p<sub>y</sub> atomic orbital and one, 1s atomic orbital

4) One, 3d atomic orbital and one, 2p<sub>x</sub> atomic orbital

5) In reality, the interactions in (1) and (2) happen concurrently. Of these two, which interaction results in the higher energy MO? Why?