1. Does the following molecule, C₃H₄, have all of its atoms in the same plane? (note: it can be drawn two ways—is the answer different depending?)

   NO, neither structure has all atoms in the same plane.

   Tetrahedral geometry $\Rightarrow$ not planar.

   Back-to-back $\pi$ bonding causes the 2 Hs on left to be in a perpendicular plane to the 2 Hs on the right $\Rightarrow$ not planar.

2. For the following, give the hybridization on each atom, and the number of sigma and pi bonds:

   a. PF₅

      $P: sp^{3}d$  5$\sigma$, 0$\pi$ bonds

      $F: sp^{3}$

   b. $6\sigma$, 3$\pi$ bonds

   c. 25$\sigma$, 4$\pi$ bonds
3. Draw the different types of molecular orbitals.

4. Draw the MO diagrams, determine the number of unpaired electrons and the bond order for the following:

5. Put the above in order of bond length.

6. For which of the molecules or ions in #4 would the bond strength increase if an electron was removed?

   only for $O_2$

   (because you'd remove an antibonding $\text{e}^-$)