CHM 330 - Worksheet 5
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Name_____ **Section**_____

1. Derive the Hamiltonian operator for the H_2^- molecular system.
   (a) Draw a box around the terms that go to zero in the Born-Oppenheimer approximation.
   (b) Draw a circle around the term(s) that make the solution unsolvable in a closed analytic form?

2. Using the valence electrons of the nitrogen atomic orbitals, s and p, sketch the electron correlation diagram for the orbitals to form the N_2 molecule. Be sure to include all labels and electron populations.
   (a) Which species has the longer bond length, N_2 or N_2^+
   (b) Which species has the longer bond length, N_2 or N_2^-
   (c) Which species is affected by a magnetic field, circle all that apply: N_2^+, N_2, N_2^-

3. Using the valence electrons of the carbon and oxygen atomic orbitals, s and p, sketch the electron correlation diagram for the orbitals to form the CO molecule. Be sure to include all labels and electron populations.
   (a) Which species has the longer bond length, CO or CO^+
   (b) Which species has the higher bond enthalpy, CO or CO^-
   (c) Which species is affected by a magnetic field, circle all that apply: CO^+, CO, CO^-
   (d) An electron in CO makes a $\pi \rightarrow \pi^*$ transition. How will the bond length of the exicited state be different than that of the ground state?