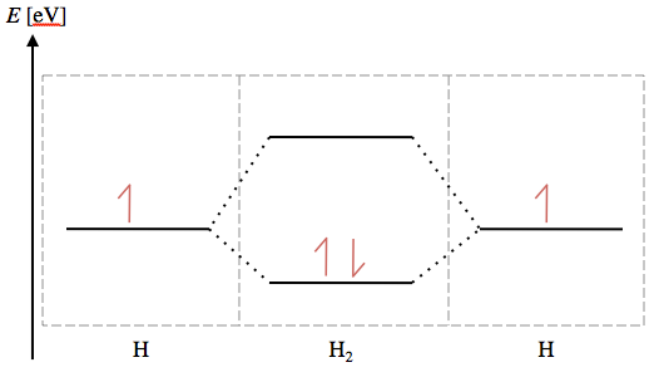
26. Correlation Diagrams: H_2 and He_2 Molecular Orbitals

Below is the correlation diagram for two hydrogen atoms and the resulting H_2 molecule.



Each atom has one electron before bonding. When the two hydrogen atoms bond, those two electrons occupy one of the two molecular orbitals that were created.

1) How does the energy of the two electrons in the H_2 molecule, compare to the two electrons in individual hydrogen atoms?

2) Based on this change, does the formation of a bond require energy or release energy?

*Note: here we use the term *orbitals* to mean 3D electron clouds

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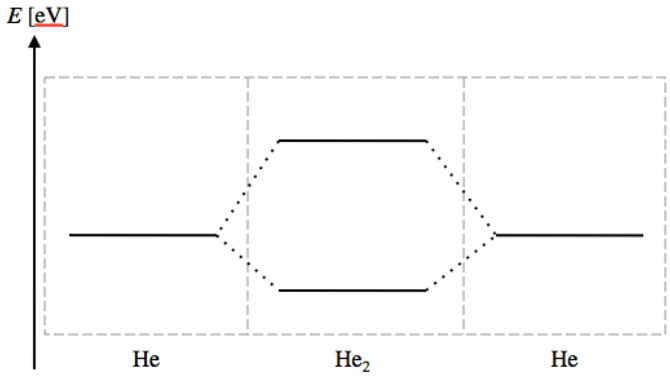
Below is the correlation diagram for two helium atoms and the resulting He_2 molecule. Notice that the anti-bonding orbital (σ*) is a greater increase in energy from the atomic orbital than the decrease in energy of the bonding orbital (σ).



3) Complete the correlation diagram above by appropriately placing the correct number of electrons into each atomic and molecular orbital.

4) How does the energy of the four electrons in the He_2 molecule, compare to the four electrons in individual helium atoms?

5) Based on this change, will the molecule He_2 exist? Out of the two molecular examples above (H_2 and He_2), which one(s) will form stable molecules, and which one(s) will not? Explain your answer.

6) Predict: will the molecular ion He_2^+ form?

*Note: here we use the term *orbitals* to mean 3D electron clouds

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