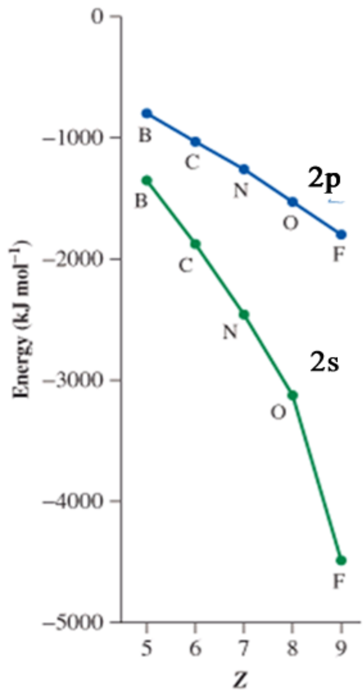
1. **Why is *s-p* mixing more important in Li_2 than in F_2?**

The extent of orbital mixing is *inversely* proportional to their energy separation. The energy gap between the 2*s* and 2*p* orbital in the elements becomes larger as the atomic number increases. It is *larger* in F than in Li so the importance of *s-p* mixing is *smaller*.

In H (or in a H-like ion), there is no energy difference between 2*s* and 2*p*. The energy of an orbital is dependent only on the *n* quantum number.

In atoms with more than one electron, 2*s* is lower in energy than 2*p*. An electron in a 2*s* orbital is less well shielded by the other electrons than an electron in a 2*p* orbital. (Equivalently, the 2*s* orbital is more penetrating.) The 2*s* electron experiences a higher nuclear charge and drops to lower energy.

As the nuclear charge increases across the Li – F period, both 2*s* and 2*p* lower in energy due to the increased nuclear charge but the 2*s* is affected to a larger degree, as shown in the figure opposite.



2. **How many core, σ-bonding, and π-electrons are there in**

(a). Acetylene

C_2H_2: total electron count = (2 × 6 (C) + 2 × 1 (H)) = 14.
- Each C has a $1s^2$ core: there are 2 × 2 core electrons. Total for core = 4.
- There are 3 σ bonds (2 × C-H and 1 C-C), each requiring 2 e^-. Total for σ bonding = 6.
- There are 2 π bonds in the triple bond, each requiring 2 e^-. Total for π bonding = 4.
- Check: 4 (core) + 6 (σ) + 4 (π) = 14.

(b). Ethylene

C_2H_4: total electron count = (2 × 6 (C) + 4 × 1 (H)) = 16.
- Each C has a $1s^2$ core: there are 2 × 2 core electrons. Total for core = 4.
- There are 5 σ bonds (4 × C-H and 1 C-C), each requiring 2 e^-. Total for σ bonding = 10.
- There is 1 π bond in the double bond, requiring 2 e^-. Total for π bonding = 2.
- Check: 4 (core) + 10 (σ) + 2 (π) = 16.

(c). Benzene

C_6H_6: total electron count = (6 × 6 (C) + 6 × 1 (H)) = 42.
- Each C has a $1s^2$ core: there are 6 × 2 core electrons. Total for core = 12.
- There are 12 σ bonds (6 × C-H and 6 C-C), each requiring 2 e^-. Total for σ bonding = 24.
- There are 3 π bonds, each requiring 2 e^-. Total for π bonding = 6
- Check: 12 (core) + 24 (σ) + 6 (π) = 42.

(d). Buckminsterfullerene

C_{60}: total electron count = 60 × 6 (C) = 360.

- Each C has a $1s^2$ core: there are 60 × 2 core electrons. Total for core = 120.
- Each C uses 3 valence electrons for σ bonds. Total for σ bonding = 60 × 3 = 180.
- Each C uses 1 valence electron for π bonds. Total for π bonding = 60 × 1 = 60.
- Check: 120 (core) + 180 (σ) + 60 (π) = 360.