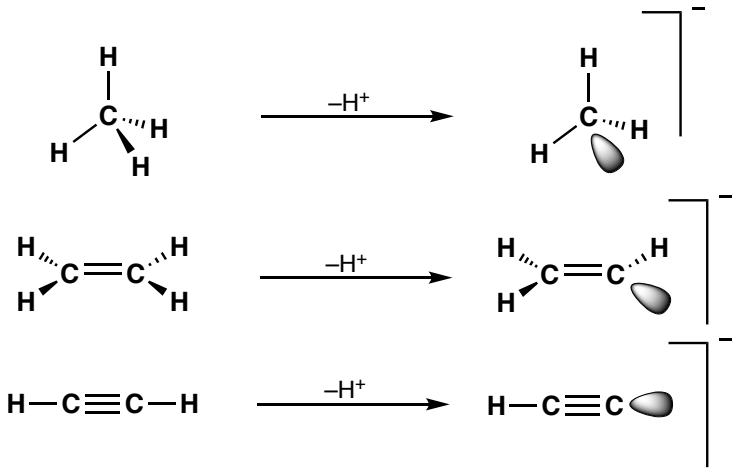
Chapter 2 Exercises

1. Using Slater's rules, calculate the values of S and Z^* for an outermost electron in the elements B, F, Mg and P.

Answer. For B: S = 2.40 and Z^* = 2.60.
For F: S = 3.80 and Z^* = 5.20.
For Mg: S = 9.15 and Z^* = 2.85.
For P: S = 10.80 and Z^* = 4.80.

2. Considering the electronegativity of sp, sp^2 and sp^3 hybrid orbitals noted in Section 2.5, account for why terminal alkynes are more readily deprotonated than alkanes.

Answer. Since electrons are more tightly held in *n*s orbitals than in *n*p orbitals (i.e. they are lower in energy), we can speak of s orbitals being more electronegative than p orbitals. In terms of sp^n hybrid orbitals, this means that those with a greater degree of s character are more electronegative such that sp > sp^2 > sp^3. Alternatively, we can say that sp^n orbitals with more s character will be better able to stabilise a negative charge. Thus, in terms of deprotonation, the negative charge associated with the conjugate base is more stabilised in a sp hybrid orbital than in a sp^2 hybrid etc. as shown in the diagram below where stability increases downwards.



3. What is the difference between electron affinity and electronegativity?

Answer. Electron affinity is simply a measure of the enthalpy of electron attachment as shown in Eqn. (2.5) in the text. Electronegativity is defined (after Pauling) as '*the ability of an atom to attract electron density towards itself in a molecule*'. There are numerous ways of measuring this, some of which are described in the text.