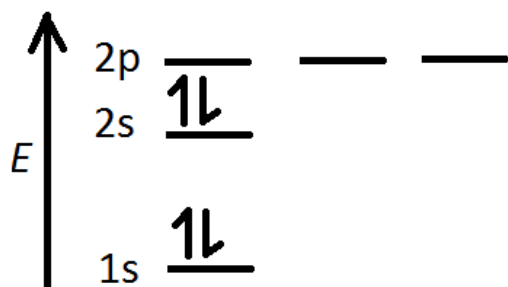


IB HL Molecular orbitals and bonding

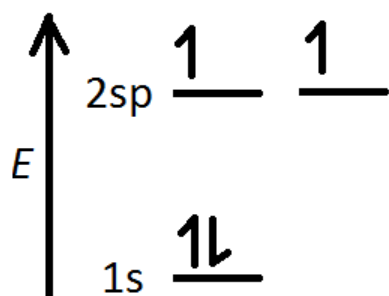
A student asked me how beryllium chloride, BeCl_2 , can form covalent bonds.

If you think about the electrons in the outer shell, this is a good question! Consider the electronic configuration of Be as $1s^2 2s^2$. You can visualise this as follows:



As you can see, the outer electrons (in the $2s$ shell) are paired, so they should not be able to take part in a covalent bond. So how is forming a covalent bond possible?

The answer is in hybridisation. Instead of the outer electrons being paired in a $2s$ shell, two hybrid $2sp$ orbitals are formed which hold one unpaired electron each. You can visualise this as follows:



With this in place we can now see how BeCl_2 is formed. The two unpaired electrons in the $2sp$ orbitals in Be can now form a bond with the unpaired electron from two Cl atoms. The electronic configuration of chlorine is $1s^2 2s^2 2p^6 3s^2 3p^5$.

Here is the diagram for chlorine for anyone who cannot visualise why chlorine has one unpaired electron which can take part in a bond:

