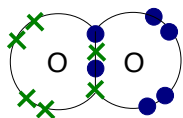


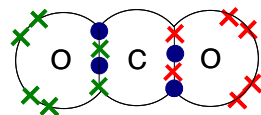
Chemguide – answers

COVALENT BONDING (double bonds)

1. a)

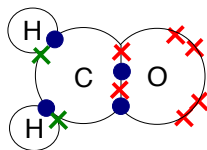


b)

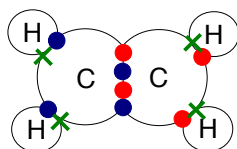


It doesn't matter what colours or dots or crosses you use as long as the different electrons around the carbon are fairly obvious.

c)

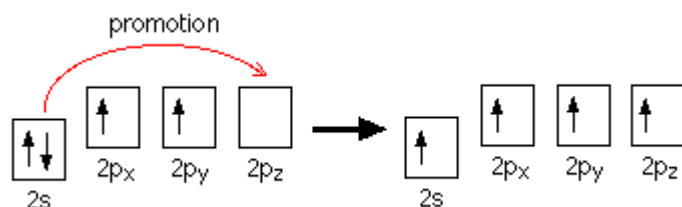


d)



2. a) $1s^2 2s^2 2p_x^1 2p_y^1$

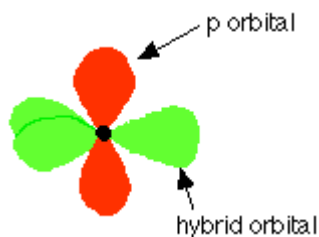
b)



c) Hybridisation rearranges the electrons into new orbitals ready for bonding. In this case, the 2s orbital and two of the 2p orbitals are rearranged to make three sp^2 hybrids. The other 2p orbital isn't changed at this point.



These orbitals are arranged with the three sp^2 hybrid orbitals in a plane and the p orbital at right angles to them.



Chemguide – answers

d) A sigma bond is formed when two atomic orbitals overlap end-to-end. Sigma bonds are just simple single covalent bonds. Each of the three sp^2 hybrid orbitals overlaps with the 1s orbital from one of the hydrogen atoms . . .

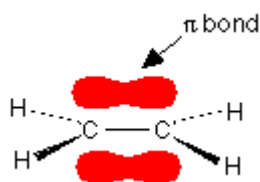


. . . to give:



The diagram shows five sigma bonds in brown. The p orbitals are still sticking up at right angles to these. The black dots show the various nuclei.

e) A pi bond is formed by a sideways overlap between touching atomic orbitals – in this case, between the two unhybridised p orbitals. They overlap to give a molecular orbital which has parts above and below the plane of the rest of the molecule.



The sigma bonds are shown by ordinary lines joining the atoms. A simple line shows a bond in the plane of the paper (or screen). A dotted line shows a bond going back into the paper away from you. A wedge shows the bond coming out towards you.

NOTE: Whatever your syllabus wants in terms of hybridisation, you *will* be expected to know about pi bonds and sigma bonds in compounds like ethene, including the shape of the pi bond, and where it is found relative to the rest of the molecule.