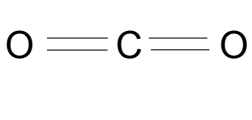
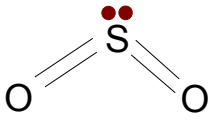
SHAPES OF MOLECULES AND IONS (including double bonds)

1. Carbon dioxide is linear, while sulphur dioxide is bent (V-shaped).





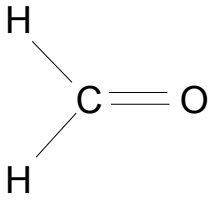
In the carbon dioxide, the two double bonds try to get as far apart as possible, and so the molecule is linear.

In sulphur dioxide, as well as the two double bonds, there is also a lone pair on the sulphur. To minimise repulsions, the double bonds and the lone pair get as far apart as possible, and so the molecule is bent.

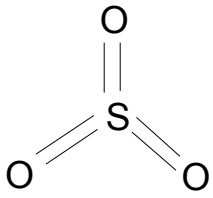
Notice that you weren't asked to show in detail how you worked out the shapes, but in case you need it, you will find the full explanation for both on the Chemguide page you have just read.

2. Carbon has 4 electrons in its outer level. The two single bonds to the hydrogens add 2 more, and the double bond to the oxygen a further 2, making 8 in all. There are therefore 4 pairs of electrons and 4 bonds. There aren't any lone pairs.

You treat the double bond to the oxygen as a single unit. That and the two bonds to hydrogens will arrange themselves as far apart as possible into a trigonal planar shape.

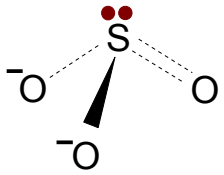


3. a) Sulphur has 6 outer electrons, and the total of 6 bonds (in three sets of double bonds) to the oxygens will add 6 more, making 12 in all. That's 6 pairs. Since there are also 6 bonds, there can't be any lone pairs. The three sets of double bonds will arrange themselves as far apart as possible in a trigonal planar shape.



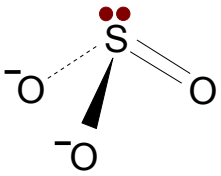
b) Sulphur has 6 outer electrons, and a total of 4 bonds to oxygens (2 single and 1 double) adding 4 more electrons, making 10 in total. You don't have to worry about the negative charges because they aren't on the sulphur. So there are 5 electron pairs. Since there are only 4 bonds, there must also be a lone pair.

You think of the double bond as a single unit. So around the sulphur there are 2 ordinary bonding pairs, the double bond unit, and a lone pair. These will arrange themselves tetrahedrally to get as far apart as possible.



It doesn't matter where you may have drawn the negatively-charged oxygens or the double-bonded oxygen as long as you show the correct shape – which is pyramidal. It does, however, make the diagram much clearer to draw the lone pair at the top.

You could equally have drawn the double bond as two normal lines:



The ion has simply been rotated a bit to bring the double bond into the plane of the paper. You will still have one of the other bonds sticking out towards you, and the other going back away from you.