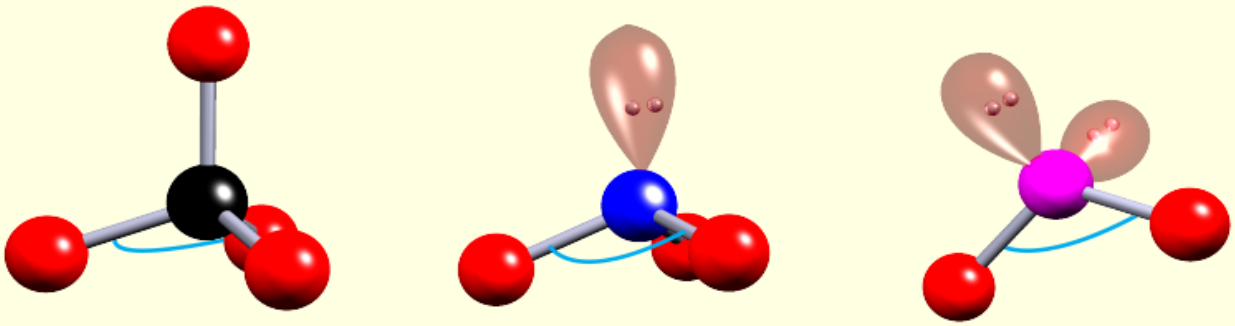
Using VSEPR
Finding the lone pairs

Answer the questions below then check your answers

1. Explain why lone pairs of electrons take up more space than bonding pairs of electrons.

2. The three molecules shown below all have a structure based on a tetrahedral arrangement around the central atom.

a. Complete the bond angles shown in the diagram below to indicate the affect lone pairs have on the shape of a molecule.



b. The first molecule above has a tetrahedral shape. What shapes do the second and third molecules have?

3. Work out the shapes of the following two molecules clearly indicating the presence of any lone pairs present.

a. $AlCl_3$ and PCl_3

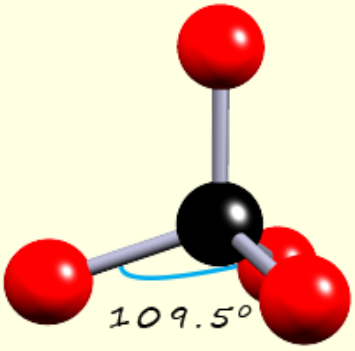
Lone pairs and shapes of molecules

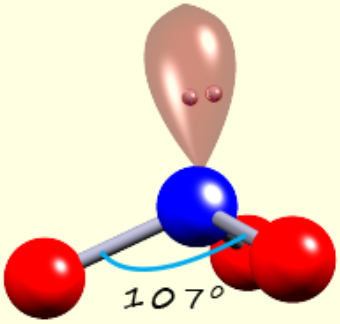
Answers

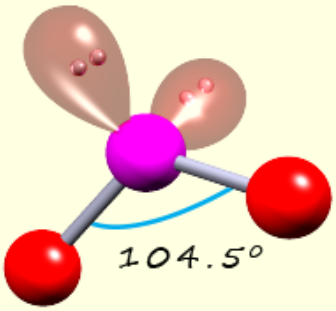
1. Explain why lone pairs of electrons take up more space than bonding pairs of electrons.

   The 2 electrons in a bonding pair are held by the attraction from the two positively charged nuclei from the two atoms in the covalent bond. In a lone pair there is only one nucleus attracting both electrons, so they are not held as tightly.

2. The three molecules shown below all have a structure based on a tetrahedral arrangement around the central atom.







a. Complete the bond angles shown in the diagram below to indicate the affect lone pairs have on the shape of a molecule.

b. The first molecule above has a tetrahedral shape. What shapes do the second and third molecules have?

Second molecule has a pyramidal shape.

Third molecule is bent or V-shaped.

3. Work out the shapes of the following two molecules clearly indicating the presence of any lone pairs present.

a. $AlCl_3$ and PCl_3

$AlCl_3$	PCl_3
Central atom Al = 3e	Central atom p =5e
3xCl = 3e	3xCl= 3e
Total 6e	Total 8e
6e will be needed for the three Al-Cl bonds. So no lone pairs present. Molecule has a trigonal planar shape.	6e will be needed for the 3 P-Cl bonds, this leaves 2e for a lone pair. Molecule shape will be based on a tetrahedral structure with one lone pair. So shape is pyramidal.