

Molecule shapes and bond angle QUESTION

Question: Carbon atoms can bond with different atoms to form many different compounds. The following table shows the Lewis structure for two molecules containing carbon as the central atom, CCl_4 and COCl_2 . These molecules have different bond angles and shapes. Evaluate the Lewis structure of each molecule to determine why they have different bond angles and shapes.

In your answer you should include:

- The approximate bond angle in each molecule
- The shape of each molecule
- Factors that determine the shape and bond angle for each molecule.

Molecule	CCl_4	COCl_2
Lewis structure	<pre> :Cl: :Cl-C-Cl: :Cl: </pre>	<pre> :O: :Cl-C-Cl: :Cl: </pre>

ANSWER

1. for first molecule (name) state number of regions of negative charge around the central atom (name central atom)	In each CCl_4 molecule, there are four negative electron clouds / regions around the central C atom.
2. state the Valence shell electron pair repulsion (VSEPR) theory	These regions of negative charge repel each other as far away from each other as possible around the central C atom
3. state the base arrangement of negative regions and the bond angle they form	in a tetrahedral (base) arrangement, resulting in a 109.5° bond angle
4. state the number of bonded and non-bonded regions <u>AND</u> the final shape of the first molecule	All of these regions of electrons are bonding, without any non-bonding regions, so the final shape of the molecule is tetrahedral.
5. for second molecule (name) state number of regions of negative charge around the central atom (name central atom)	In each COCl_2 molecule, there are three negative electron clouds / regions around the central C atom.
6. state the Valence shell electron pair repulsion (VSEPR) theory	These regions of negative charge repel each other as far away from each other as possible around the central C atom
7. state the base arrangement of negative regions and the bond angle they form	in a triangular / trigonal planar (base) shape, resulting in a 120° bond angle.
8. state the number of bonded and non-bonded regions <u>AND</u> the final shape of the second molecule	All of these regions of electrons are bonding, without any non-bonding regions, so the final shape of the molecule is trigonal planar.
9. compare differences in bond angle linked to number of regions of negative charge.	Both molecules have <u>no</u> non-bonding pairs but because CCl_4 has 4 regions of negative charge around the central atom compared to the 3 regions that COCl_2 has, then CCl_4 has a smaller bond angle of 109.5° compared to the 120° bond angle of COCl_2

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.