Bond Angles

The bond angle is the angle made between atoms bonded to the central atom in a molecule

They are influenced by

1. Lone pairs of electrons
2. Bonding pairs of electrons
3. VSEPR Theory
    - Pairs of valence electrons will repel each other to get as far apart as possible
    - Lone pairs have a greater repulsive force than bonding pairs due to them being held closer to the central atom
    - Bond angles are based on the shape made by all electrons distributed around the central atom

Examples

1. Discuss the bond angles of CO_2

CO_2 has **2 regions of negative charge** about the central C atom.

These are both bonding regions and they **repel** each other into a symmetrical, **linear** arrangement and shape.

Therefore bond angles are **180^o**.

2. Discuss the bond angles of CH_4

CH_4 has **4 regions of negative charge** about the central C atom.

These are all bonding regions and they **repel** each other into a symmetrical, **tetrahedral** arrangement and shape.

Therefore bond angles are the normal tetrahedral angle of **109^o**.

3. Discuss the bond angles of NH_3

NH_3 has **4 regions of negative charge** about the central N atom.

These **repel** each other into a **tetrahedral** arrangement.

Three of these are **bonding** regions, **one** is **nonbonding**, therefore the shape of the molecule is **trigonal pyramidal**.

The non-bonding electron pair has a greater repulsive force than bonding regions, therefore the bond angle will slightly smaller than the normal tetrahedral angle of 109^o.

4. Discuss the relative bond angles of H_2O and CH_2O

H_2O has **4 regions of negative charge** about the central O atom.

These **repel** each other into a **tetrahedral** arrangement.

2 of these are **bonding** regions, **2** are **nonbonding**, therefore the shape of the molecule is **bent/angular**.

The non-bonding electron pairs have a greater repulsive force than bonding regions, therefore the bond angle will smaller than the normal tetrahedral angle of 109^o.

CH_2O has **3 regions of negative charge** about the central C atom.

These **repel** each other into a **trigonal planar** arrangement.

All **3** of these are **bonding** regions, therefore the shape of the molecule is **trigonal planar**.

Therefore the bond angle will be 120^o.