

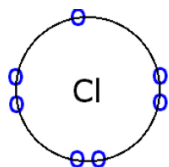
Chem Masterpiece **Key points to learn**

**1. Dot-cross diagrams**

Represents the outer shell electrons on an atom or compound.

Electrons are often shown with dots or crosses hence the name.

Dot-cross diagram of chlorine is shown on the left the electrons are represented by dots.



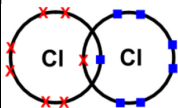
**2. Covalent bonds**

When chlorine is bonded to another chlorine a covalent bond forms.

One electron in each chlorine atom shares its electron with the other.

Produces full outer shells

It is arranged this way due to electron pair repulsion between negatively charged bonding electrons and positively charged nuclei.

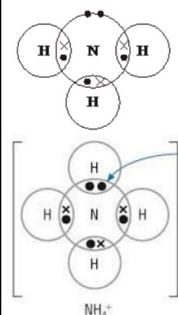


**3. Dative covalent bonds**

When a molecule has a lone pair such as nitrogen in NH<sub>3</sub>, a dative covalent bond can be formed.

An additional H<sup>+</sup> ion can use the lone pair to gain a full outer shell and make NH<sub>4</sub><sup>+</sup>.

Because the hydrogen is sharing two nitrogen electrons the molecule becomes a positively charged ion.



Chem Masterpiece **Key points to learn**

**4. Linear**

**Example: BeCl<sub>2</sub>**

2 bonded pairs of electrons which repel as far away as possible.

**2bp's + no Lp's = Linear + bond angle of 180°**



LINEAR

**5. Trigonal**

**Example: BF<sub>3</sub>**

3 bonded pairs of electrons which repel as far as possible.

**3 bp's + no Lp's = Trigonal Planar + bond angle of 120°**



TRIGONAL PLANAR

**6. Tetrahedral**

**Example: CH<sub>4</sub>**

4 bonded pairs of electrons that repel as far as possible.

**4 bp's + no Lp's = Tetrahedral + bond angle of 109.5°**



TETRAHEDRAL

**7. Pyramidal**

**Example: NH<sub>3</sub>**

3 bonding pairs and 1 lone pair that repel as far as possible. Lone pairs repel more strongly.

**3bp's + 1 Lp = pyramidal + bond angle of 107°**



PYRAMIDAL

**Elements of life**

**Bond Angles**

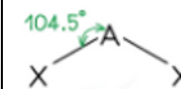
Chem Masterpiece

**8. Bent/Angular**

**Example: H<sub>2</sub>O**

2 bonding pairs and 2 lone pairs that repel as far as possible.

**2bp's + 2 Lp's = Bent/angular + bond angle of 104.5**



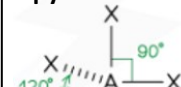
NON-LINEAR (BENT)

**9. Trigonal bipyramidal**

**Example: PF<sub>5</sub>**

5 bonded pairs that repel as far as possible

**5bp's + no Lp's = Trigonal bipyramidal + bond angles of 90° and 120°**



TRIGONAL BIPYRAMIDAL

**10. Octahedral**

**Example: SF<sub>6</sub>**

6 bonded pairs of electrons that repel as far as possible.

**6bp's + no Lp's = Octahedral + bond angle of 90°**



TRIGONAL BIPYRAMIDAL

**Key points:**

- Amount of electron density and the total number of bonding pairs determines bond angle and shape.
- Lone pairs repel more strongly compared to bonded pairs.