



Cambridge (CIE) A Level Chemistry



Dot & Cross Diagrams

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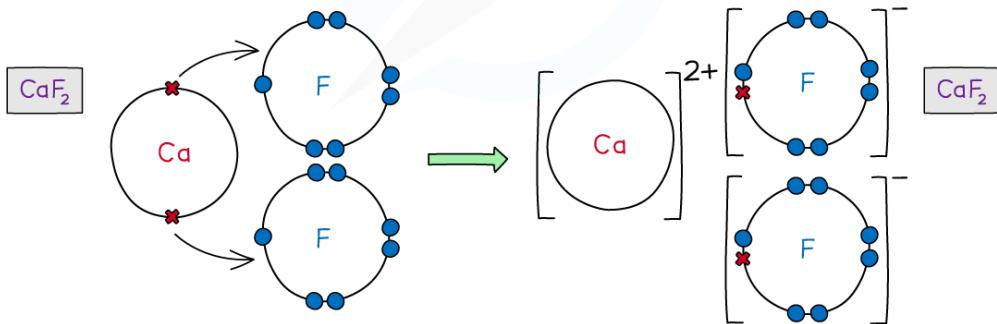
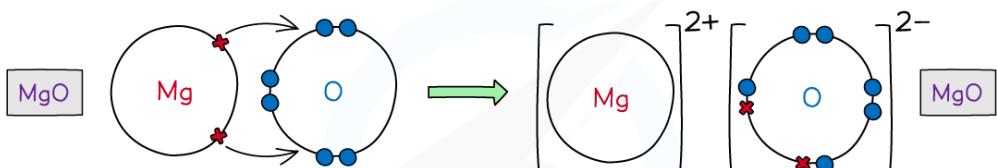
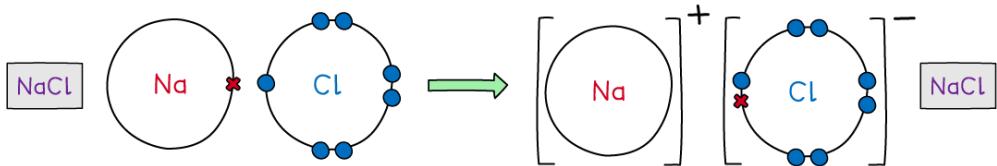
Dot & Cross Diagrams

- **Dot and cross diagrams** are diagrams that show the arrangement of the outer-shell electrons in an **ionic** or **covalent** compound or element
 - The electrons are shown as dots and crosses
 - In a dot and cross diagram:
 - Only the outer electrons are shown
 - The charge of the ion is spread evenly which is shown by using brackets
 - The charge on each ion is written at the top right-hand corner

Ionic compounds

- Ionic bonds are formed when **metal** transfer electrons to a **non-metal** to form a positively charged and negatively charged ion
- The atoms achieve a **noble gas** configuration

Dot-and-cross diagrams of ionic compounds



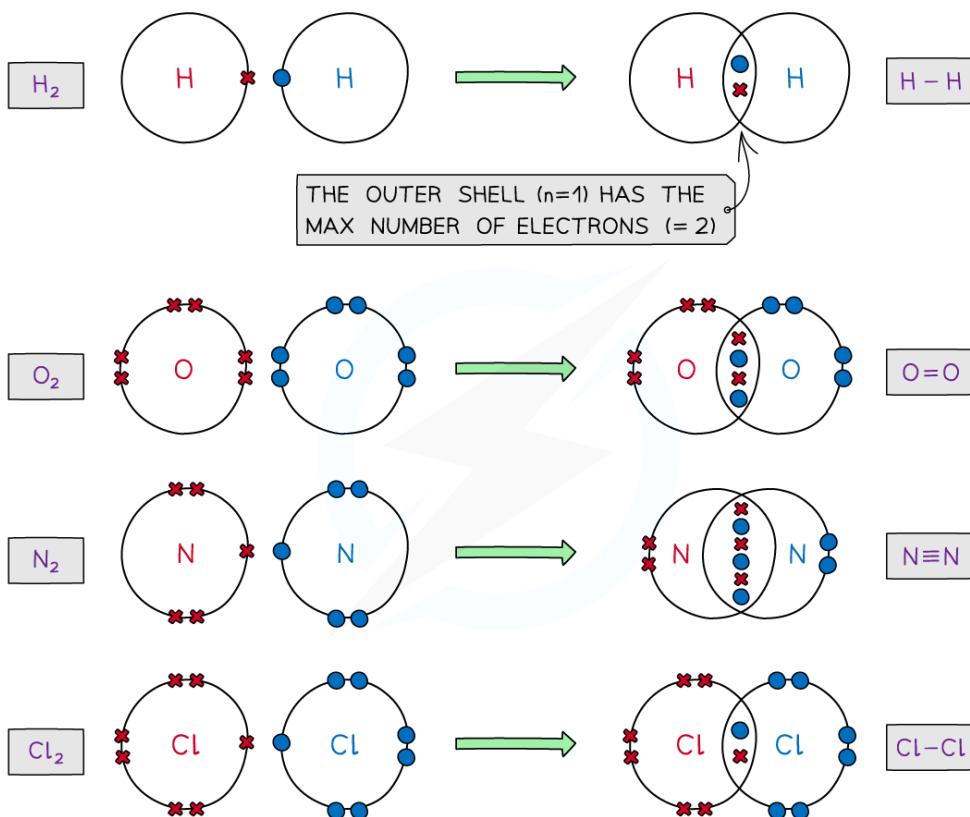
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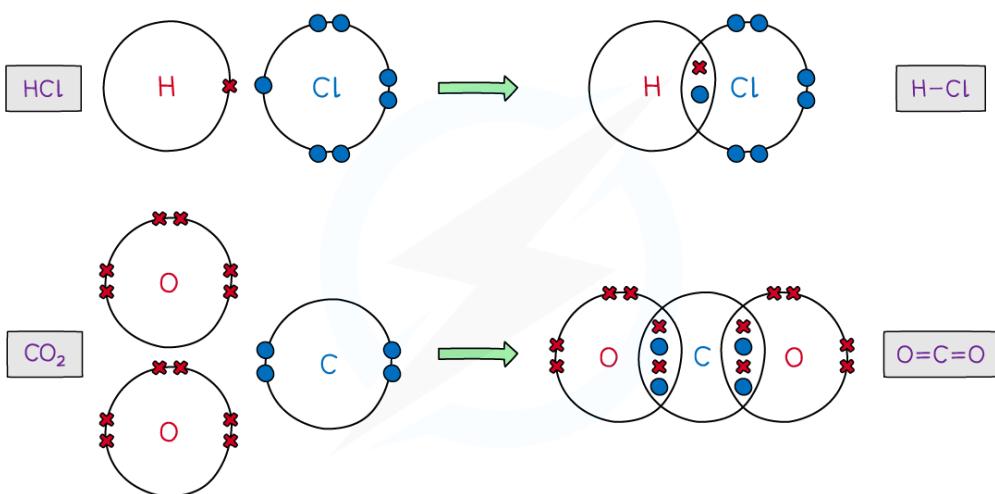
Covalent compounds

- The atoms in covalent compounds will **share** their outer valence electrons to achieve a **noble gas** configuration

Dot-and-cross diagrams of covalent compounds

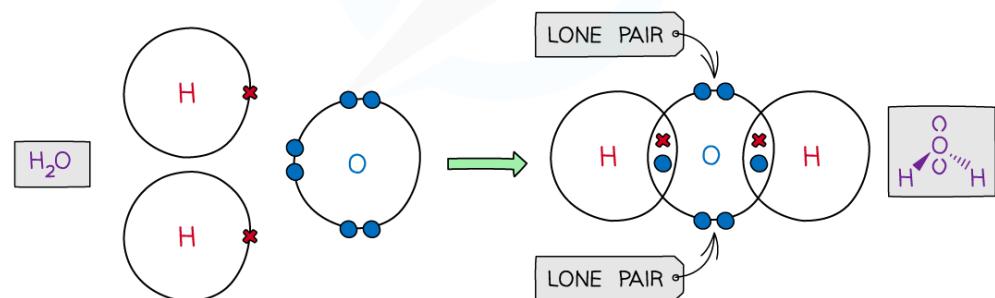
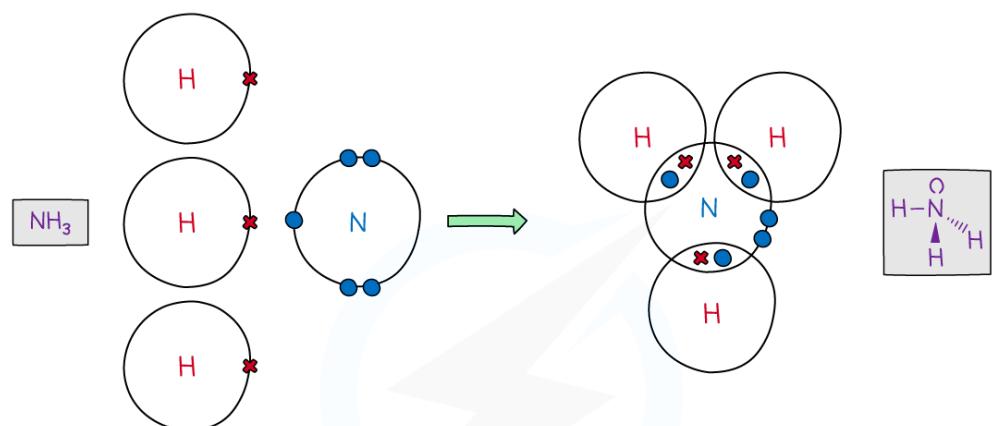


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Your notes

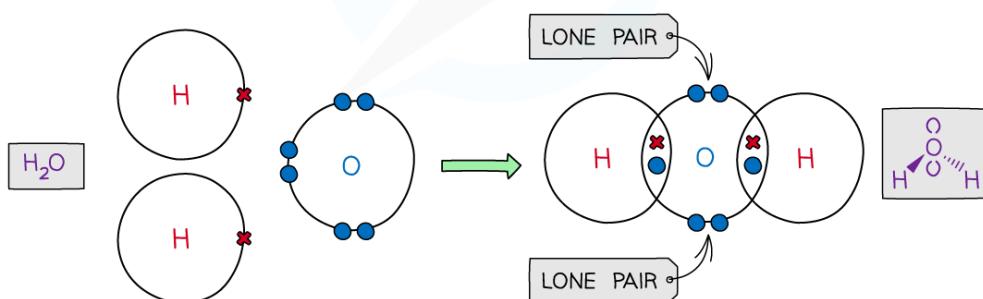
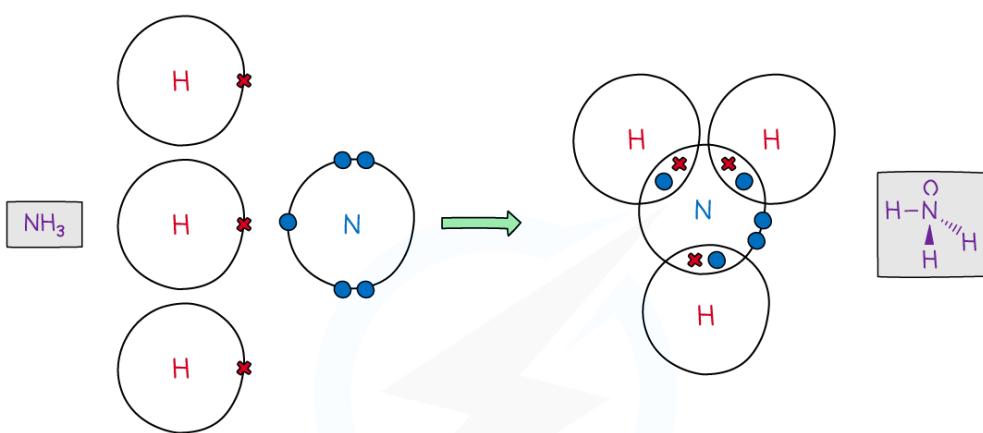
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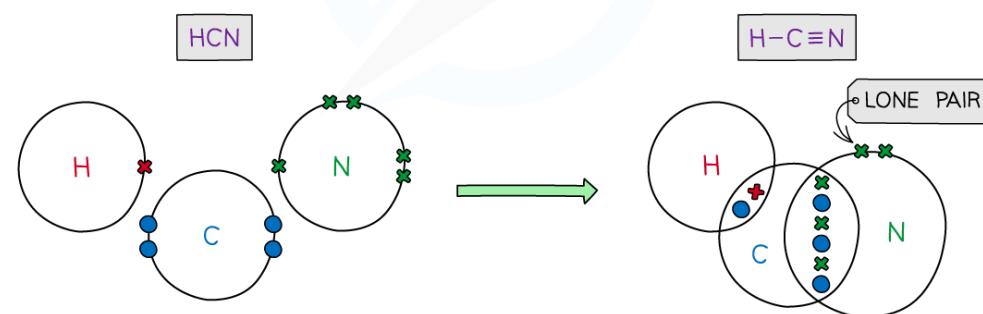
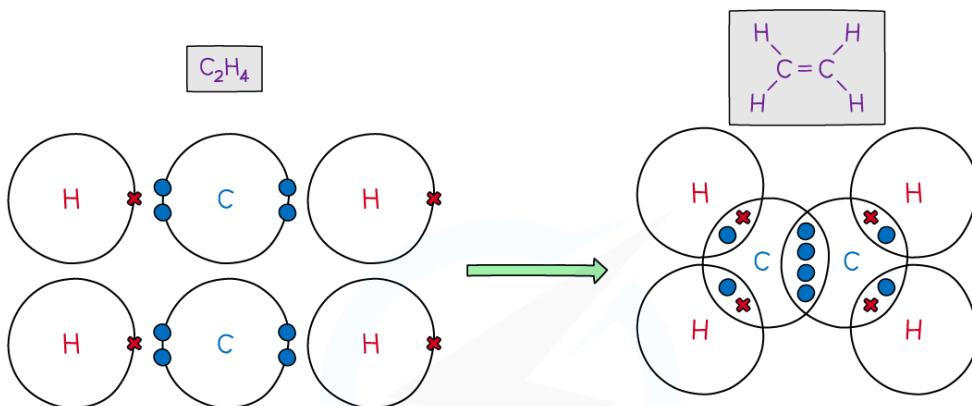
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Dot-and-cross diagrams of covalent compounds show how atoms share their outer / valence electrons

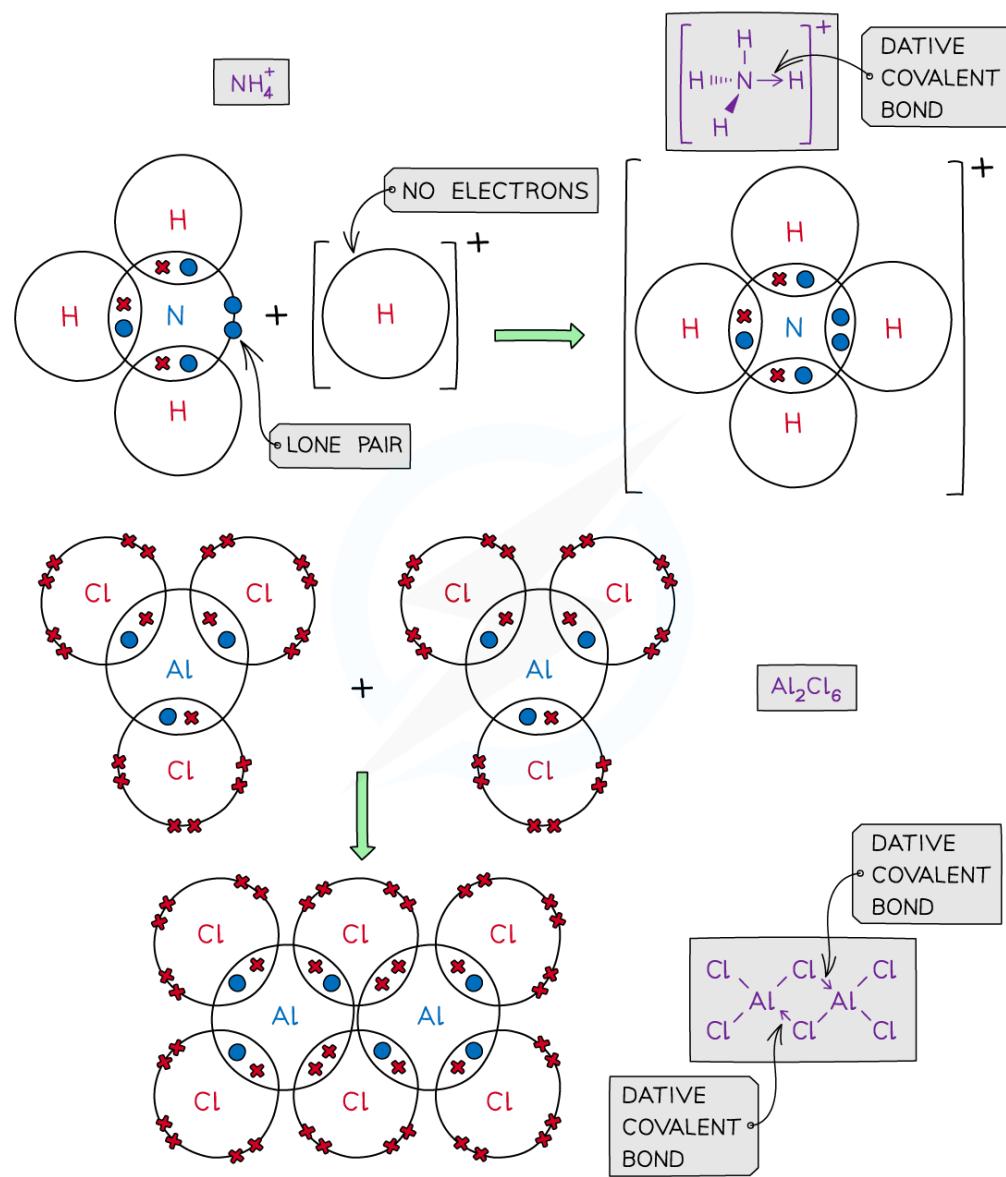
Coordinate bonding



Your notes

- Coordinate bonding or also called dative covalent bonding is formed when one atom provides **both** the electrons needed for a covalent bond
- In a displayed formula, the dative covalent bond is represented by an **arrow**
- The **head** of the arrow points away from the lone pair that forms the bond

Dot-and-cross diagrams of coordinate / dative covalent compounds



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Dot-and-cross diagrams of coordinate / dative covalent compounds show how one of the atoms provides both the electrons in a coordinate / dative covalent bond

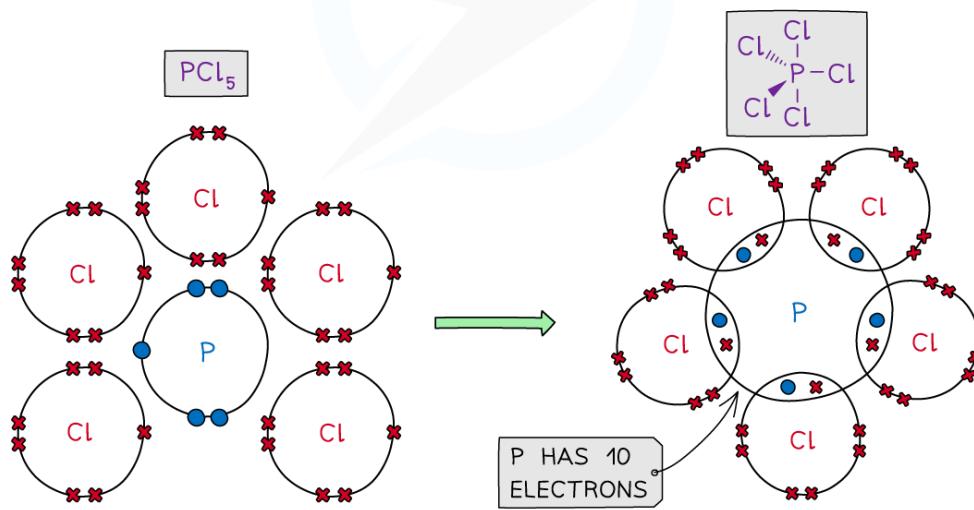
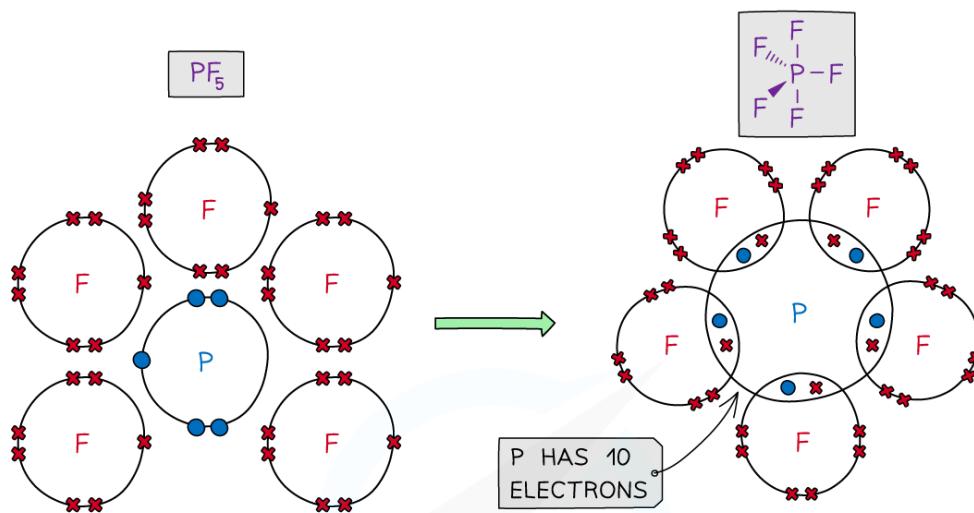
Incomplete & expanded octet rule

- Some species may contain **more** (expanded) or **less** (incomplete) than eight electrons in their outer shell



Your notes

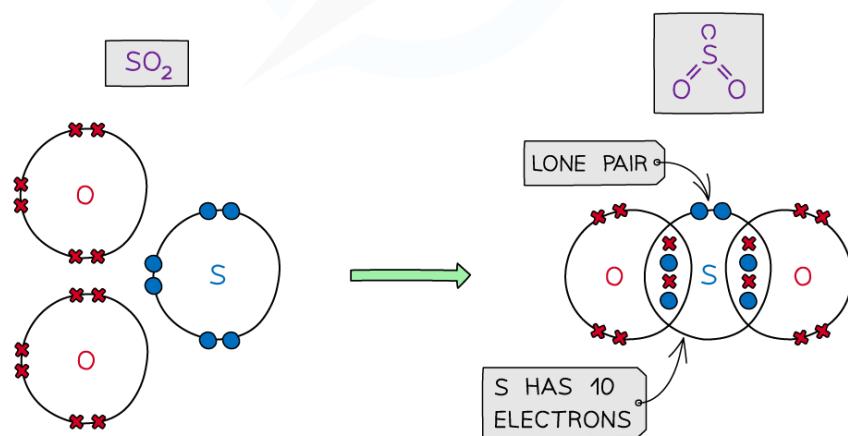
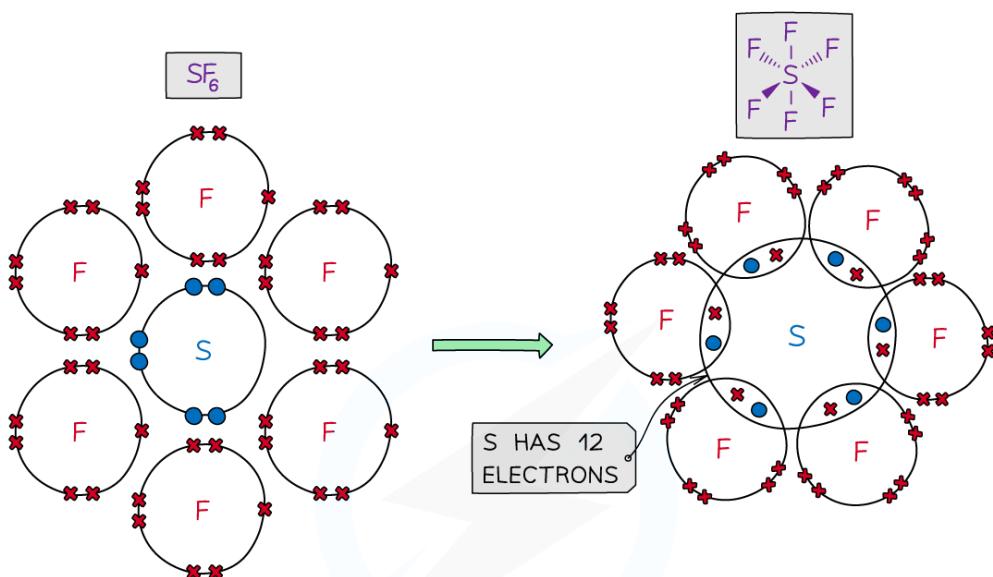
Dot-and-cross diagrams for the expanded octet rule



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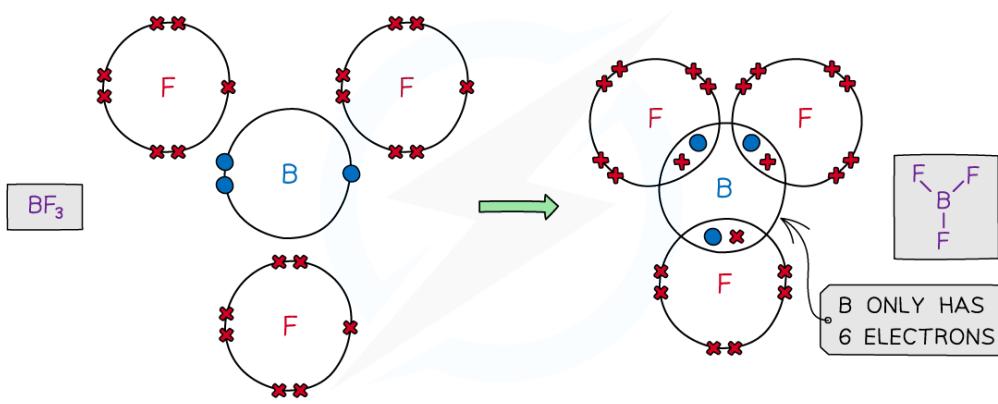
Your notes



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Dot-and-cross diagrams can show how atoms follow the expanded octet rule

Dot-and-cross diagrams for the incomplete octet rule



Dot-and-cross diagrams can show how the atoms in an electron deficient compound follow the incomplete octet rule

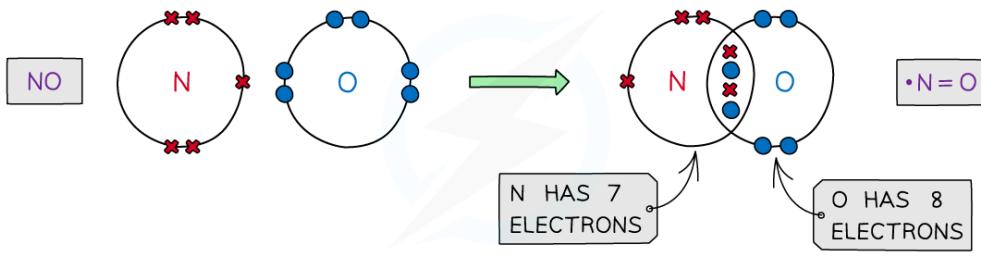
Odd number of electrons

- Some atoms in compounds may have an **odd number** of electrons in their valence shell



Your notes

Dot-and-cross diagrams for compounds containing atoms with odd numbers of outer / valence electrons



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Dot-and-cross diagrams can show how some compounds contain atoms with odd numbers of outer / valence electrons