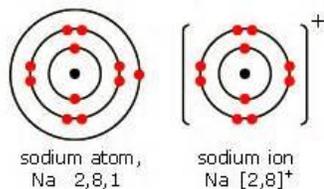


Chemistry Knowledge Organiser

Structure, Bonding and Materials

Ions

All atoms want to have a full outer shell of electrons, some atoms will lose electrons, these are metals. Some atoms will want to gain electrons, these are **non metals**. An ion is an atom with a positive or negative charge, these are formed by an atom gaining or losing electrons. For example, Sodium has one electron in its outer shell, it therefore loses one electron to form a Na^{+1} ion. We represent ions with square brackets around the ion and the charge in the top right corner.

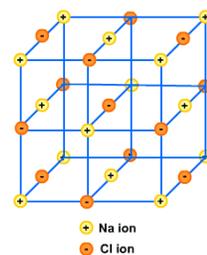


The **group number** indicates how many electrons an atom would have to lose or gain to get a full outer shell of electrons. See below to see what ions different groups form

Group	What happens to the electrons?	Charge on ions
1	Loose 1	+1
2	Loose 2	+2
3	Loose 3	+3
5	Gain 3	-3
6	Gain 2	-2
7	Gain 1	-1

Ionic Lattice

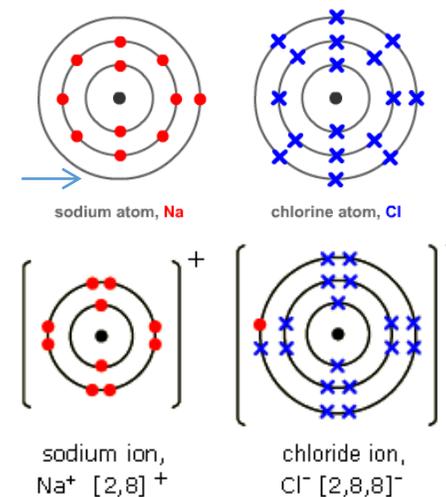
Ionic compounds have **regular structures (giant ionic lattices)** in which there are strong **electrostatic forces** of attraction in all directions between oppositely charged ions.



Key Terms	Definitions
Metal	An element which loses electrons to form positive ions
Non Metal	An element which gains electrons to form negative ions
Ion	An atom with a positive or negative charge, due to loss or gain of electrons
Ionic Bond	A bond formed by the electrostatic attraction of oppositely charged ion
Electrostatic	The force between a positive and negative charge.

Ionic Bonding

When a metal atom reacts with a non-metal atom electrons in the outer shell of the **metal atom are transferred to the non metal atom**. This means the metal has a positive charge and the non metal has a negative charge. This means there is an **electrostatic attraction** between the two ions, this is what forms an ionic bond. Both atoms will have a **full outer shell** (this is the same as the structure of a Noble gas) see example below of sodium chloride.

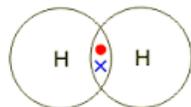


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Structure, Bonding and Materials

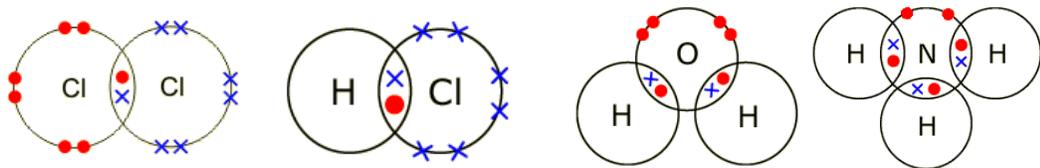
Covalent Bonding

Covalent bonding occurs between two non metals, **electrons are shared between the atoms**, so that they have a full outer shell. Covalent bonds are strong and require a lot of energy to break. The simplest example is hydrogen, both hydrogen atoms have **one electron in their outer shell. Therefore both hydrogen atoms share one electron each**, to give them both a full outer shell, we can show this bond on a dot and cross diagram.

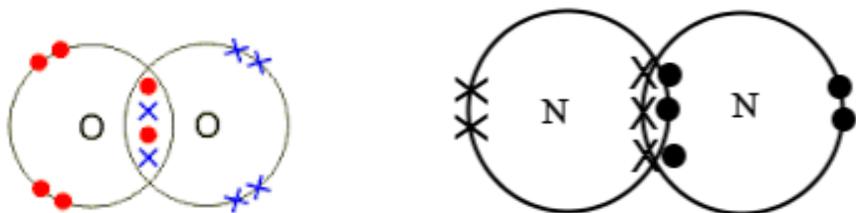


When drawing covalent molecules we use "dot cross diagrams" as we do with ionic compounds, it is important to represent the electrons on one atom with a dot and on the other atom with an X.

The first five examples, **hydrogen, chlorine, water, hydrogen chloride and ammonia (NH₃)** all share one electron per atom in a to make a full outer shell of electrons on each atom.



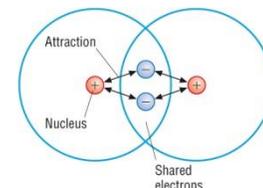
Some atoms need more than one electron to give them a full outer shell, for example oxygen needs 2 electrons to complete its outer shell, oxygen therefore shares two electrons per atom to **make a double bond**. Nitrogen needs three electrons to complete its outer shell, this forms a triple bond between the two **nitrogen atoms, to make a nitrogen molecule**



Key Terms	Definitions
Covalent Bonding	Bonding between 2 atoms where electrons are shared
Molecule	A substance which contains two or more bonded atoms
Lone Pair	A pair of electrons that are not part of the covalent bond

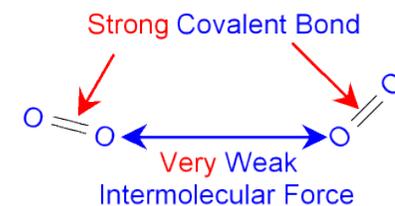
The nature of a Covalent Bond

Covalent bonds are strong because there is electrostatic attraction between the electrons in the covalent bond and the positively charged nucleus. This means a lot of energy is required to break a covalent bond.



Properties of Simple Covalent Compounds

Covalent compounds have low melting points and are often gases at room temperature, for **example oxygen and carbon dioxide**. Although the covalent bonds between the atoms are strong, the **intermolecular forces between the molecules are weak**. **It is very important to remember that covalent bonds are strong but the intermolecular forces are weak**. This means that only a small amount of energy is required to break these weak bonds.



Please see the next page for more properties of covalent compounds.