

Ionic	<i>Particles are oppositely charged ions</i>	Occurs in compounds formed from metals combined with non metals.
Covalent	<i>Particles are atoms that share pairs of electrons</i>	Occurs in most non metallic elements and in compounds of non metals.
Metallic	<i>Particles are atoms which share delocalised electrons</i>	Occurs in metallic elements and alloys.

<i>High melting and boiling points</i>	This is due to the strong metallic bonds.
<i>Pure metals can be bent and shaped</i>	Atoms are arranged in layers that can slide over each other.
<i>Good conductors of electricity and heat</i>	Delocalised electrons transfer energy.

<i>Low melting and boiling points</i>	Small amounts of energy needed to overcome the intermolecular forces.
<i>Poor conductors of electricity</i>	No free electrons to transfer energy.

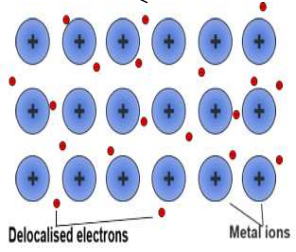
<i>High melting and boiling points</i>	Large amounts of energy needed to break the bonds.
<i>Do not conduct electricity when solid</i>	Ions are held in a fixed position in the lattice and cannot move.
<i>Do conduct electricity when molten or dissolved</i>	Lattice breaks apart and the ions are free to move.

Metallic bonding	
<i>Giant structure of atoms arranged in a regular pattern</i>	Electrons in the outer shell of metal atoms are delocalised and free to move through the whole structure. This sharing of electrons leads to strong metallic bonds.

Size of atoms and molecules	<i>Simple molecular structures consist of atoms joined by strong covalent bonds. This means that atoms are smaller than simple molecules.</i>
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Ion	<i>An atom with a positive or negative charge</i>	Ionic bonding
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Types of substances
Combined Science CC5-7 Bonding



Electrons are transferred so that all atoms have a noble gas configuration (full outer shells).	<i>Metal atoms lose electrons and become positively charged ions</i>	Group 1 metals form +1 ions Group 2 metals form +2 ions
	<i>Non metals atoms gain electrons to become negatively charged ions</i>	Group 6 non metals form -2 ions Group 7 non metals form -1 ions

Covalent bonding

Atoms share pairs of electrons

Can be small molecules e.g. ammonia

Dot and cross :
+ Show which atom the electrons in the bonds come from
- All electrons are identical

2D with bonds:
+ Show which atoms are bonded together
- It shows the H-C-H bond incorrectly at 90°

3D ball and stick model:
+ Attempts to show the H-C-H bond angle is 109.5°

Can be giant covalent structures e.g. polymers

Simple polymers consist of large chains of hydrocarbons.

Dot and cross diagram

Giant structure

● Na⁺ ● Cl⁻

Ionic compounds	Cation	<i>Positively charged ion</i>
	Anion	<i>Negatively charged ion</i>

Compound suffixes

Structure	<ul style="list-style-type: none"> <i>Lattices consist of a regular arrangement of atoms</i> <i>Held together by strong electrostatic forces of attraction between oppositely charged ions</i> <i>Forces act in all directions in the lattice</i> 	-ide	<i>If a compound name ends in -ide, it usually contains only two elements.</i>	For example: calcium + oxygen → calcium oxide
		-ate	<i>If a compound name ends in -ate, it usually contains three or more elements one of which is always oxygen.</i>	For example: Calcium + carbon + oxygen → calcium carbonate

Used for cutting tools due to being very hard.

<p><i>Each carbon atom is bonded to four others</i></p>		Very hard.	Rigid structure.
		Very high melting point.	Strong covalent bonds.
		Does not conduct electricity.	No delocalised electrons.

<p><i>Each carbon atom is bonded to three others forming layers of hexagonal rings with no covalent bonds between the layers</i></p>		Slippery.	Layers can slide over each other.
		Very high melting point.	Strong covalent bonds.
		Does conduct electricity.	Delocalised electrons between layers.

**Combined Science CC5-7
Bonding and types of substance**

Graphene	<p><i>Single layer of graphite one atom thick</i></p>	Excellent conductor.	Contains delocalised electrons.
		Very strong.	Contains strong covalent bonds.

Fullerenes		<p>Buckminsterfullerene, C₆₀ First fullerene to be discovered.</p>	<p>Hexagonal rings of carbon atoms with hollow shapes. Can also have rings of five (pentagonal) or seven (heptagonal) carbon atoms.</p>
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Giant covalent structures	Graphite	Used for electrodes as is inert.
	Diamond, graphite, silicon dioxide	<p><i>Very high melting points</i></p> <p>Lots of energy needed to break strong, covalent bonds.</p>