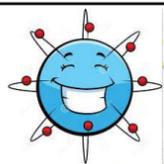


Start

Make sure you understand Topic 1 - Structure of the atom

Lesson 1 Ions

Atoms are more stable with a full outer shell of electrons and they will lose or gain electrons to achieve this

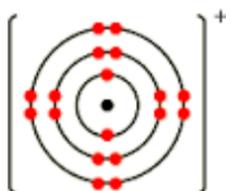


Atoms that lose electrons (metals) gain a positive charge. Atoms that gain electrons (non-metals) gain a negative charge. An ion is an atom with a charge

Trends for Ionic Charge

+1	+2	+3	-3	-2	-1	0
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	Zn	Ga	Ge	As	Se
Rb	Sr	Ag	Cd	In	Sn	Sb
Cs	Ba	Hg	Tl	Pb	Bi	Po
Fr	Ra					

You can work out charges on ions from the position of atoms in the Periodic Table.



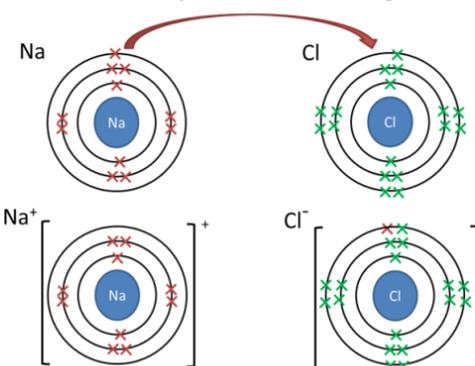
You need to be able to calculate the number of protons, neutrons and electrons in different ions and draw electron structure of ions showing their charge outside of brackets.

CC5,6,7: Structure and bonding knowledge organiser (H)

Lesson 2 Ionic bonds

Ionic bonds form between metals and non-metals. Metals have extra electrons and they **lose** them to form positive ions. Non-metals have electron gaps and they **gain** electrons to form negative ions.

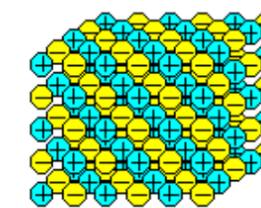
In an ionic bond the metal 'gives' its electrons to the non-metals to form positive and negative ions



An ionic bond is the electrostatic attraction between a positive and negative ion.

Lesson 3 Ionic compounds

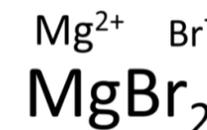
Ionic compounds consist of regular arrangements of positive and negative ions called an ionic lattice



Ionic lattice structure

Positive and negative ions combine in fixed ratios to give neutral compounds.

You can work out the charge on most positive and negative ions from their position in the periodic table and then use the cross over rule to give the formula of the compound



Sulphate SO₄²⁻
Carbonate CO₃²⁻
Nitrate NO₃⁻
Hydroxide OH⁻

The formulas of some polyatomic anions you just have to learn!

Lesson 6 Simple molecular compounds

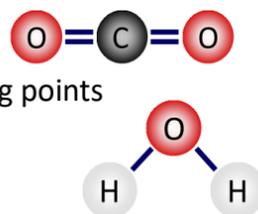
Covalent bonds are found in two types of structures – Simple molecules and giant covalent structures. Most common gases are simple molecules. A **molecule** is a small group of atoms that go around together. Simple molecular compounds have strong covalent bonds holding the atoms together in a molecule. Between the molecules there are weak intermolecular forces which are much more easily broken.

Properties

- Gases and liquids with low melting and boiling points
- Do not conduct electricity

Keywords to describe simple molecules

Shared electrons, strong covalent bonds between atoms, simple molecules, weak **intermolecular forces** between molecules



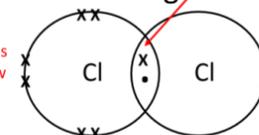
Lesson 5 Covalent bonds

Covalent bonds form between two non-metals. Non-metals have spaces for electrons and they are able to **share** electrons so it is 'as if' both atoms have a full outer shell.

You need to be able to draw covalent bonds between two atoms using 'dot and cross' diagrams and stick diagrams



For dot cross diagrams you only need to draw the outer shell electrons



A covalent bond is a pair of electrons shared between the two atoms. A double covalent bond (double bond) consists of 4 shared electrons

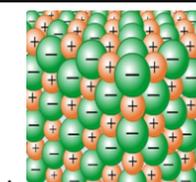


Covalent bonds are strong bonds

Lesson 4 Properties of ionic compounds

Ionic compounds-

1. Form crystals with high melting points
2. Dissolve in water to give solutions
3. Conduct electricity when dissolved in solution or molten but not when solid

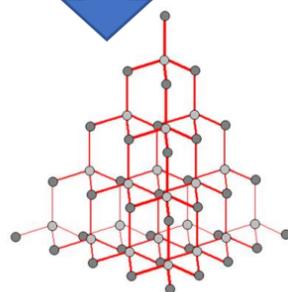


You need to be able to use the structure of an ionic compound (Lesson 3) to **explain** why ionic compounds have these properties. Use the following **keywords / ideas**

- Giving / receiving electrons
- Ions / positive ion / negative ion
- Giant ionic structure / ionic lattice
- Strong electrostatic force (+ve attracts -ve)
- Fixed ions in solid/ free ions in solution / when molten
- Dissolves in water / water solvates (surrounds) ions

Lesson 7 Giant covalent structures

In giant covalent structures every atom is joined to other atoms with a strong covalent bond.



- Giant covalent structures
- Hard, strong, high melting point

	PROPERTY	EXPLANATION
Melting & boiling points	VERY HIGH	Need to break all strong covalent bonds
Electrical conductivity	DOES NOT CONDUCT	No mobile charged particles
Strength	STRONG	Rigid arrangement of atoms held by covalent bonds
Solubility in water	INSOLUBLE	

Lesson 8 Allotropes of carbon

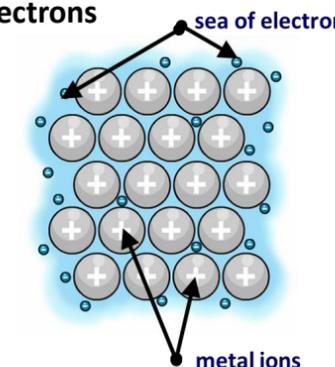
Material	Structure	Bonding	Properties	Uses
Diamond	 Giant covalent	Every carbon atom bonded to 4 other carbon atoms with strong covalent bonds. Carbon atoms form tetrahedral shapes	Hard, strong High melting point Does not conduct electricity Does not dissolve	Cutting equipment
Graphite	 Giant covalent	Every carbon bonded to 3 other carbon atoms to form hexagons which form layers. Strong covalent bonds in the layers Weak forces of attraction between layers	Forms layers which slide over each other High melting point Conducts electricity along layers Does not dissolve	Pencil lead Electrodes Lubricant
Graphene	 Giant covalent	Every carbon bonded to 3 other carbon atoms to form hexagons in a single layer. A single layer of graphite	Strong but flexible High melting point Conducts electricity along sheet	
C ₆₀	 Simple molecular	Large molecule with 60 atoms. In the molecule every carbon bonded to 3 other carbons with strong covalent bonds. Weak intermolecular forces between molecules	Molecules are strong Low melting points	

Lesson 9 Metallic bonding and the properties of metals

Metallic bonds form between metal atoms and metals from giant metallic structures

The structure of a metal consists of a regular arrangement of metal **ions** surrounded by a sea of **delocalised electrons**

	PROPERTY	EXPLANATION
Melting & boiling points	HIGH	Strong attraction between nucleus of atoms and delocalised e ⁻ s
Electrical conductivity	CONDUCTS	Outer shell electrons free to move
Strength	STRONG	Layers can slide while maintaining metallic bonding
Solubility in water	INSOLUBLE	



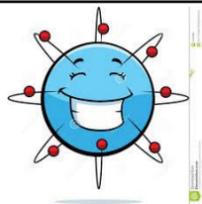
Start

Make sure you understand Topic 1 - Structure of the atom

CC5,6,7: Structure and bonding knowledge organiser (S)

Lesson 1 Ions

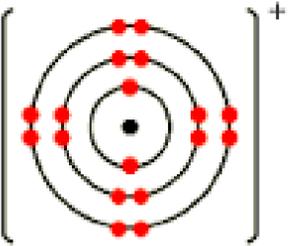
An ion is an atom with a charge
Atoms are more stable with a full outer shell of electrons



Metals atoms lose electrons and gain a positive charge to become positive ions.

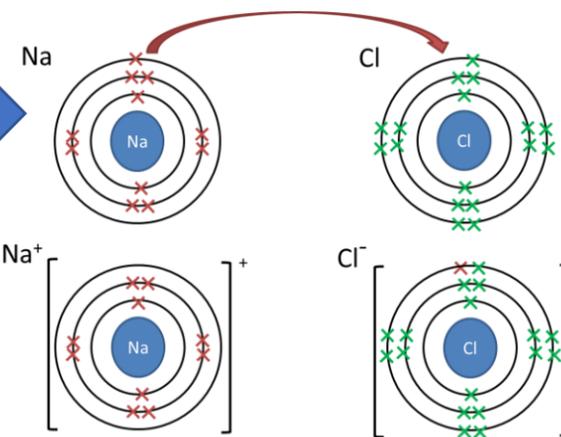
Non-metal atoms gain electrons and gain a negative charge to become negative ions.

Ions will always have a full outer shell of electrons and the charge is shown outside of square brackets



Lesson 2 Ionic bonds

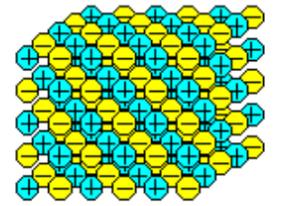
Ionic bonds form between metals and non-metals. In an ionic bond the metal 'gives' its electrons to the non-metals to form positive and negative ions



An ionic bond forms between the positive and negative ions.

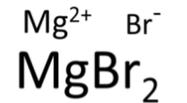
Lesson 3 Ionic compounds

Ionic compounds consist of positive and negative ions in an **ionic lattice**



Ionic lattice structure

The formula of an ionic compound tells you which ions and how many of them they contain



Sulphate SO₄²⁻
Carbonate CO₃²⁻
Nitrate NO₃⁻
Hydroxide OH⁻

Some ions consist of more than one atom and you should know them

Lesson 6 Simple molecular compounds

Most common gases are simple molecules.

A **molecule** is a small group of atoms that go around together.

Simple molecular compounds have strong covalent bonds between atoms, weak **intermolecular forces** between molecules



Properties

- Gases and liquids with low melting and boiling points
- Do not conduct electricity

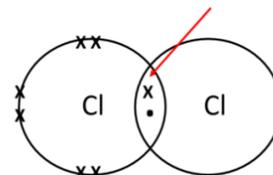
Lesson 5 Covalent bonds

Covalent bonds form between two non-metals.

Non-metals **share** electrons so it is 'as if' both atoms have a full outer shell.



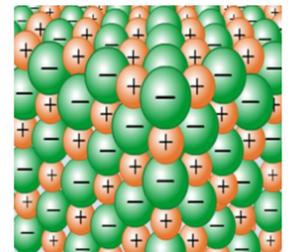
For dot cross diagrams you only need to draw the outer shell electrons



A covalent bond is a pair of electrons shared between the two atoms.

Covalent bonds are strong bonds

Lesson 4 Properties of ionic compounds

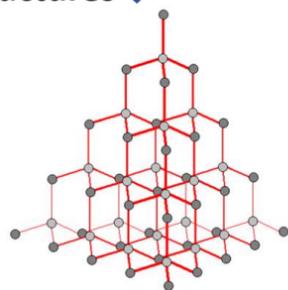


Ionic compounds-

1. Form crystals with high melting points
2. Dissolve in water to give solutions
3. Conduct electricity when dissolved in solution or molten but not when solid

Lesson 7 Giant covalent structures

In giant covalent structures every atom is joined to other atoms with a strong covalent bond. E.g. Diamond



Properties

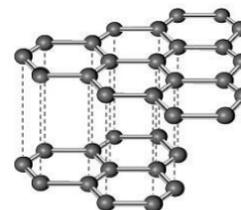
- Hard, strong, high melting point
- Do not conduct electricity
- Do not dissolve

Lesson 8 Allotropes of carbon

Carbon can form 4 different structures:

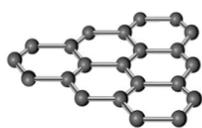


diamond

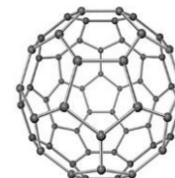


graphite

Diamond is hard and strong and doesn't conduct electricity but graphite is soft, forms layers and does conduct electricity



graphene

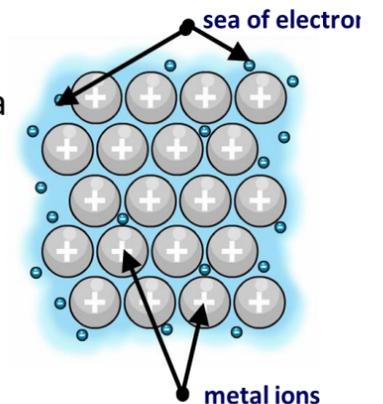


C₆₀

Lesson 9 Metallic bonding and the properties of metals

Metallic bonds form between metal atoms and metals form giant metallic structures

The structure of a metal consists of metal **ions** surrounded by a sea of **delocalised electrons**



Properties

- High melting point
- Conduct electricity
- Do not dissolve

Start

Make sure you understand Topic 1 - Structure of the atom

CC5,6,7: Structure and bonding knowledge organiser (C)

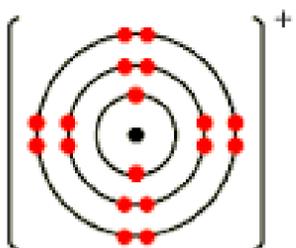
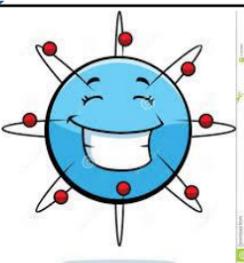
Lesson 1 Ions

An ion is an atom with a charge

Atoms lose or gain electrons to get a full outer shell

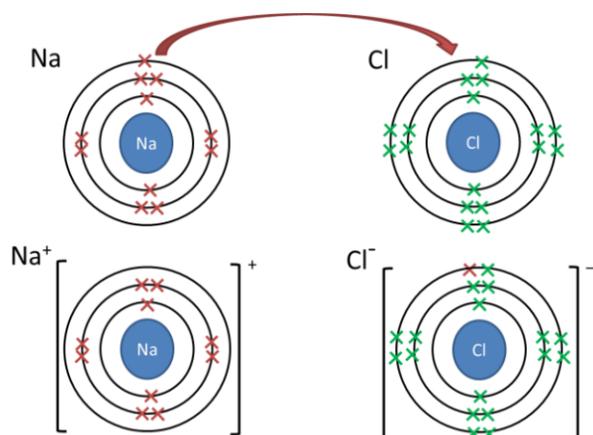
Metals atoms lose electrons to become positive ions.

Non-metal atoms gain electrons to become negative ions.



Lesson 2 Ionic bonds

Ionic bonds form between metals and non-metals. The metal 'gives' its electrons to the non-metals to form positive and negative ions

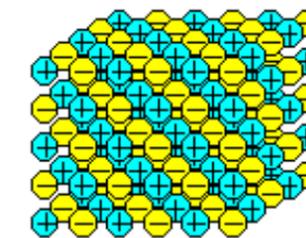


Lesson 3 Ionic compounds

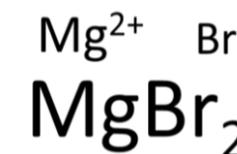
Positive and negative ions stick together in an **ionic lattice**

The formula of an ionic compound tells you which ions and how many of them they contain

e.g. $MgBr_2$ has
1 x Mg^{2+} ion
2 x Br^- ion



Ionic lattice structure



Lesson 6 Simple molecular compounds

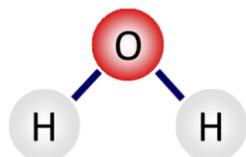
Most common gases are simple molecules.

A **molecule** is a small group of atoms that go around together.



Properties

- Gases and liquids
- low melting and boiling points
- Do not conduct electricity



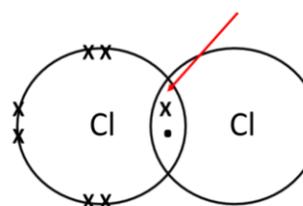
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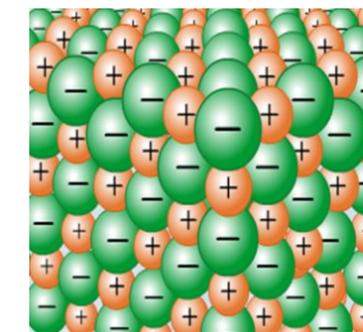


Covalent bonds are strong bonds

Lesson 4 Properties of ionic compounds

Ionic compounds-

1. High melting points
2. Dissolve in water
3. Conduct electricity when dissolved in solution or molten but not when solid

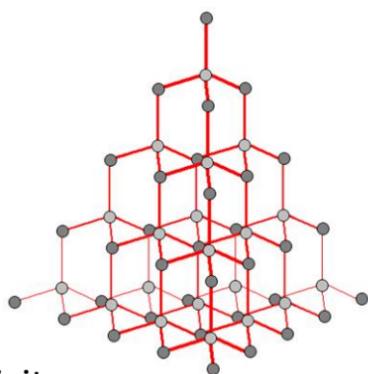


Lesson 7 Giant covalent structures

Giant covalent structures only strong covalent bonds. e.g. Diamond

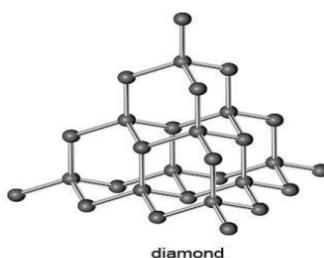
Properties

- Hard, strong,
- High melting point
- Do not conduct electricity
- Do not dissolve

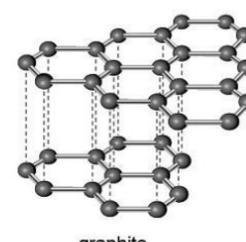


Lesson 8 Allotropes of carbon

Carbon can form 4 different structures:



diamond



graphite

Diamond is hard and strong and doesn't conduct electricity but graphite is soft, forms layers and does conduct electricity

Lesson 9 Metallic bonding and properties of metals

Metallic bonds form between metal atoms and metals from giant metallic structures

Properties of metals

- High melting point
- Conduct electricity
- Do not dissolve