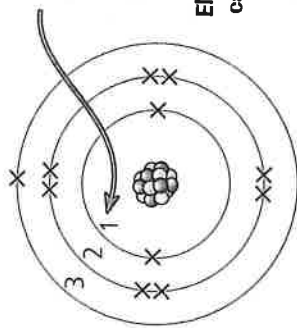


Electronic Configurations and Ions

Electronic Configurations

Electrons occupy shells — sometimes called energy levels.

Electrons fill each shell up before occupying a new one, starting with the lowest energy.



Lowest energy shells are closest to the nucleus.

Shell	Electrons allowed in shell
1	2
2	8
3	8

Electronic configurations can also be represented using numbers — this one is 2.8.1.

Forming Ions

IONS — charged particles made when electrons are transferred.

Charge on ion = number of electrons gained or lost.

	Electron transfer	Group	Charge of ion
Metals	lose electrons to form positive ions (cations)	1 2	1+ 2+
Non-metals	gain electrons to form negative ions (anions)	6 7	2- 1-

E.g. 2+ means 2 electrons lost (so there are 2 more protons than electrons).

The ions formed by elements in these groups have full outer shells.

Ionic Formulas

The overall charge of any ionic compound is zero.



Overall charge is 0 as there are 2 nitrate ions for each calcium ion.

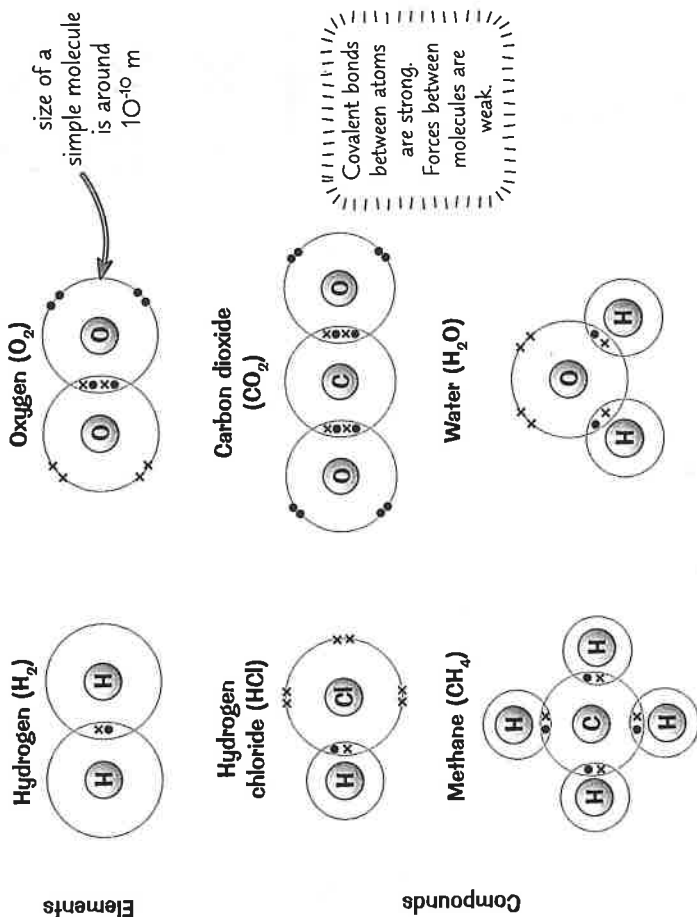
Name ends in...	Anion contains...
-ate	...oxygen and at least one other element.
-ide	...Only one element.

Except for hydroxide ions, OH⁻.

Molecular Substances

Simple Molecular Substances

COVALENT BOND — a shared pair of electrons between two non-metal atoms.
Simple molecular substances are made up of molecules containing a few covalently-bonded atoms.



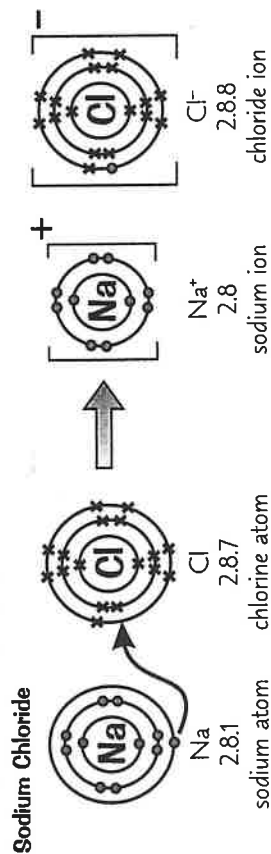
Three Properties of Simple Molecular Substances

- 1 Low melting and boiling points — mostly gases or liquids at room temperature.
 - 2 Don't conduct electricity — there are no charged particles to carry charge.
 - 3 Some are soluble in water, and some aren't.
- These properties are also typical of non-metal elements.
- As molecules get smaller, less energy is needed to break the weaker forces between them.

Ionic Substances and Bonding Models

Ionic Bonding

IONIC BONDING — the electrostatic attraction between oppositely charged ions.
Ionic bonds form when electrons are transferred from metal atoms to non-metal atoms.



Giant Ionic Lattice

Strong electrostatic forces of attraction between oppositely charged ions act in all directions.

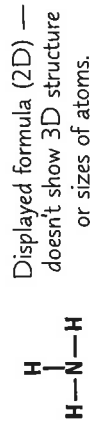
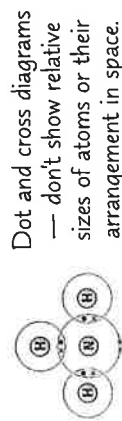
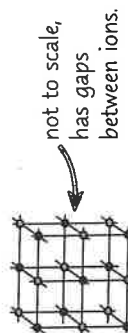
Closely-packed regular arrangement of ions.

Three Properties of Ionic Compounds

- 1 High melting and boiling points — lots of energy needed to overcome the strong attraction between the ions.
- 2 Soluble in water.
- 3 Conduct electricity only when molten or dissolved — ions free to move and carry electric charge.

Models

Ball and stick diagrams:



More Covalent Substances

Giant Covalent Structures

GIANT COVALENT STRUCTURES — solids containing atoms which are all bonded to each other by strong covalent bonds.

High melting and boiling points — lots of energy needed to overcome strong covalent bonds.

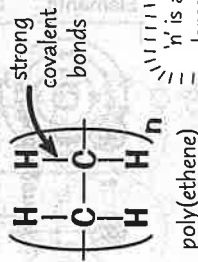
Don't conduct electricity (with a couple of exceptions) — no charged particles to carry charge.

Not soluble in water.

Examples include diamond and graphite.

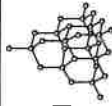
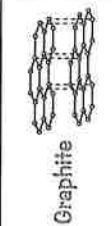
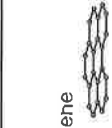
Polymers

POLYMERS — very long chains of covalently bonded carbon atoms.



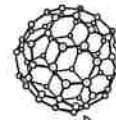
'n' is a large number.

Carbon Allotropes

			
Bonding	C atoms form four covalent bonds	C atoms form three covalent bonds. No covalent bonds between layers	C atoms form three covalent bonds
Properties	Very hard	Soft, slippery	Strong, light
Conductivity	Doesn't conduct electricity	Conducts electricity and thermal energy	Conducts electricity
Uses	Cutting tools	Electrodes, lubricant	Each carbon atom in graphite and graphene has one delocalised electron.

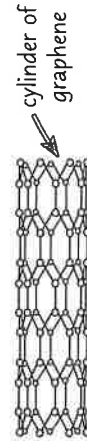
FULLERENES — have hollow shapes, giving them large surface areas.

rings of 6 carbon atoms (sometimes 5 or 7)



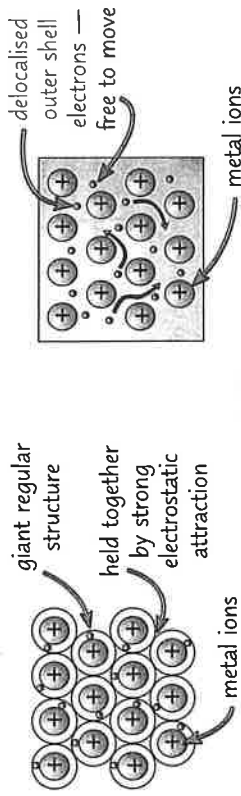
Buckminsterfullerene (C₆₀) is spherical.

Nanotubes are cylindrical fullerenes. They have delocalised electrons so they can conduct electricity.









Metallic Bonding, Metals & Non-Metals

Metallic Bonding



Six Properties of Metals

-  High melting and boiling points as lots of energy needed to overcome strong metallic bonds. Generally solids at room temperature.
-  High density — ions are packed close together.
-  Not soluble in water.
-  Shiny appearance.
-  Good electrical conductors — delocalised electrons carry charge.
-  Soft and malleable — layers in metals slide over each other.



Chemical Properties of Metals and Non-Metals

METALS — outer shell under half-filled, lose electrons to get a full outer shell.

NON-METALS — outer shell over half-filled, gain electrons to get a full outer shell.