NATIONAL 4 CHEMISTRY
SUMMARY NOTES
Unit One: Chemical Changes and Structure

4. Bonding, Structure and Properties

Covalent Bonding
This occurs between 2 non-metal atoms.
A covalent bond is a shared pair of electrons.

In Molecular Elements
There are 8 diatomic elements (2 atoms held by covalent bonding):
Hydrogen (H_2), Oxygen (O_2), Nitrogen (N_2) and all of the Group 7 elements (Halogens).

In molecular compounds
When non-metal atoms join! Eg. Water (H_2O), ammonia (NH_3), Methane (CH_4) or the diatomic elements. These have specific shapes because of the covalent bonds.

Covalent molecular substances tend to have low melting and boiling points because they have **weak** bonds between the molecules.
However, the **covalent** bonds between the atoms are **strong**!

Covalent network substances (carbon in the form of **diamond** and **graphite, silicon dioxide, silicon carbide)** have high melting and boiling points because all the atoms are interlinked by strong covalent bonds which take a lot of energy to break.

Ionic Bonding
This is formed between a metal and a non-metal atom forming charged particles called ions.
The **metal** loses its outer electrons to form a **positive** ion.
The **non-metal** takes these electrons to form a **negative** ion.

In both cases the ion ends up with a **full outer electron shell**, like the Noble gases.
The electrostatic force of attraction holds these oppositely charged ions together very tightly. This is why ionic compounds tend to have high melting and boiling points. The structure is a large **lattice**.

Metallic Bonding
Found in metal elements. The atoms lose their outer electrons which are then **free to move** from one metal ion to the next. This free movement of electrons is why metals conduct electricity.

Solubility
LIKE DISSOLVES LIKE
Ionic compounds dissolve in polar solvents, like water.
Covalent compounds (like candle wax) dissolve in covalent solvents (like hexane).
A **solution** is produced when a **solute** (solid) dissolves in a **solvent** (liquid).

Electrical Conductivity
Metals conduct when solid or liquid.
Covalent compounds don't conduct at all.
Ionic compounds only conduct when molten (liquid) or in solution because the ions are then free to move.

Type of bonding	**Electrical conductivity**			**Melting/boiling points**
	Solid	Liquid	Aqueous	
Metallic	yes	yes	insoluble	High
Ionic	no	yes	yes	High
Covalent molecules	no	no	no	Low

An **electrolyte** is used to **complete the circuit** and is usually a solution of an **ionic** compound. This allows charge to flow.

5. Chemical Symbols & Formulae

All elements have a chemical symbol with one capital letter and a small letter if a second is needed.

Naming Compounds

The rules for naming compounds are:

1. The names of the elements are written from left to right as they appear on the Periodic Table.
2. If there are only 2 elements in the compound the name of the 2nd element ends in '_ide'.
3. If the compound contains oxygen plus at least 2 other elements the second name ends in '_ate' and oxygen is not used in the name, eg. copper sulphate.

Working out formulae

To work out the chemical formula of a compound you use the **valency** (number of bonds it makes) of the atoms present.

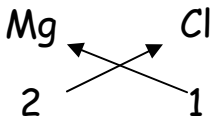
Group No.	1	2	3	4	5	6	7	8
Valency	1	2	3	4	3	2	1	0

Eg. Magnesium chloride

1. Write the symbols of the elements

2. Write the valencies

3. Swap the numbers over to give the number of each element in the compound (if equal to 1, the number does not need to be put in).



$MgCl_2$

If prefixes are used, these tell us the number of each type of atom in a compound, eg. Dinitrogen tetraoxide = N_2O_4.

Prefix	Meaning
Mono	One
Di	Two
Tri	Three
Tetra	Four
Penta	Five
Hexa	Six

Chemical Equations

A word equation shows the reactants on the LHS and the products on the RHS of an arrow.

hydrogen + oxygen → water

A formula equation replaces the words with the symbols and formulae.

$H_2 + O_2 \rightarrow H_2O$

6. Formula Mass

The Formula Mass is the total of the relative atomic masses (RAMs found in the databook) in a formula of a substance. This is in atomic mass units (amu).

Example

Water has the formula H_2O.

Its formula mass is worked out as follows:

2 x RAM of Hydrogen = 2 x 1 = 2

1 x RAM of Oxygen = 1 x 16= 16

Total = 18 amu = Formula mass of water