Chemistry

Bonding

An atom is called an **ion** if it doesn't have the same number of protons and neutrons. A **metal** ion is a **cation**, and a **nonmetal** ion is an **anion**. **Isotopes** are different atoms of the same element that have the same atomic number (number of protons) but different mass number (number of protons and neutrons).

An **ionic bond** is one that is formed between two ions of the opposite charge. It is when electrons are transferred from one atom to another.

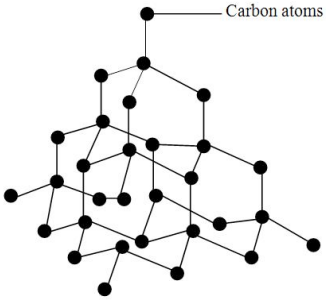
Some compound ions are hydroxide, nitrate, sulphite, carbonate, sulphate, phosphate, ammonium ion, bicarbonate and bisulphate.

Properties of ionic compounds

1. High melting and boiling point - This is due to the strong attractive forces between ions of opposite charges.
2. All exist as crystalline solids, which are regular patterns of ions (lattice)
3. Most are soluble in water - This is because water molecules can get between the ions
4. Conduct electricity in.. A) molten state B) aqueous state (in solution) because the ions are free to move.

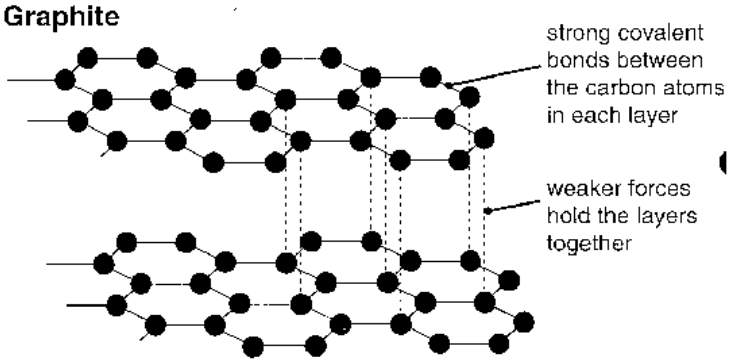
Covalent bonding takes place between nonmetal atoms. Covalent bonding is due to an attraction between the shared electron pair and the nuclei of the combining atoms. The number of electrons it needs, it shares. All covalent substances exist as **molecules**.

Therefore, elements from Group 1 to 3 form ionic compounds, and Group 4 to 7 form covalent compounds.

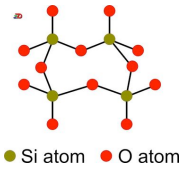


Giant covalent bonds include diamond, graphite and silica. **Diamond** is made of carbon atoms. Each carbon atoms is covalently bonded to four other carbon atoms, forming a **tetrahedron**. This tetrahedron repeats itself billions of times to give a giant covalent structure. Diamond is a hard substance, its melting point is 3550 degrees Celsius. It does not conduct electricity.

Graphite also contains carbon atoms, which are covalently bonded to three other carbon atoms. It forms a **hexagonally layered** structure. It **conducts electricity** because each carbon atom has one free electron. Therefore it is used for electrodes in cells. It is **soft** and slippery because the hexagonal layers can slide past eachother. Therefore it is used in pencil lead and clay. It is also used as a lubricant and has a melting point of 1500 degrees celsius.



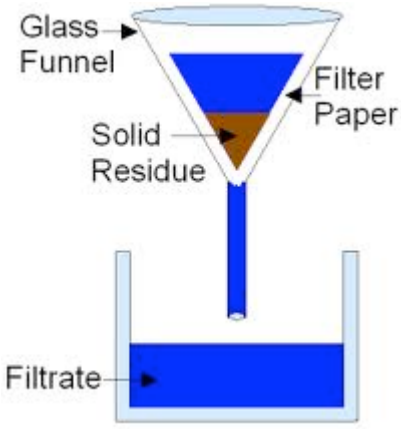
Silica contains silicon and oxygen atoms. Each sillicon atoms is covalently bonded to four oxygen atoms. In turn, each oxygen atom is covalently bonded to two silicon atoms. It forms a tetrahedron shape.

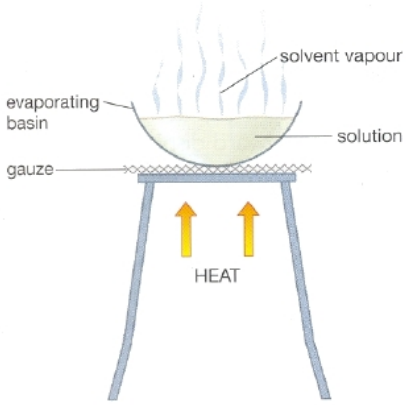


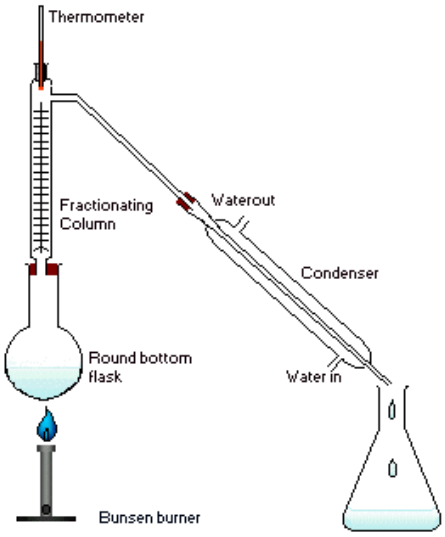
The third type of bonding is **metallic bonding**. This is a bond between metal ions and electrons. The metal atoms are very tightly packed, It appears as if the electrons are squeezed out, creating the attractive force between the bed of metal ions and sea of electrons. Metallic bonds have a very high melting and boiling point. They **conduct electricity** and are insoluble in water. They are **malleable** (can be hammered into different shapes), **ductile** (can be drawn into tin wire) and **lattice** (regularly arranged shape) because the metal ions are arranged in layers and can thus slide past eachother.

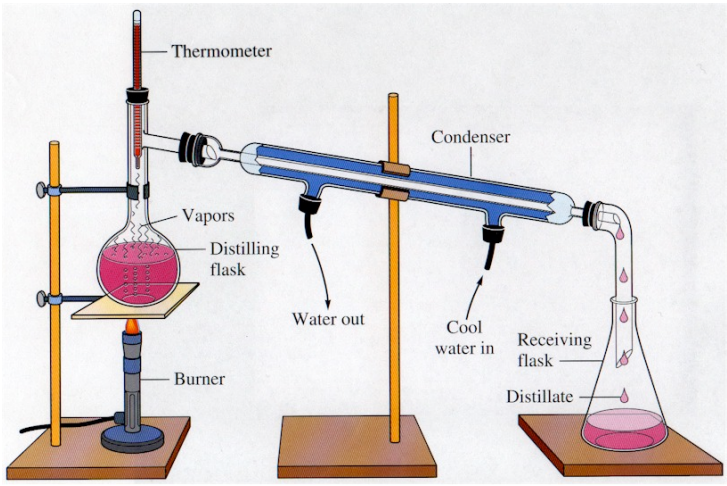
Separation techniques

- **Filteration**: solid from a liquid
- **Evaporation**: solid from a solution -then followed by crystallization
- **Distillation**: solvent from a solution - simple distillation. Two different liquids - fractional distillation









Simple distillation is a mix of evaporation and condensation. Since you are trying to get the solvent from the solution, you first evaporate the solution. Vapours of the solvent rise into the air, but then undergo condensation in the Liebig's condenser to return back their normal liquid form.

Fractional distillation makes use of the two different boiling points. He fractionating column is packed with glass beads, which works as different condensers. Substances with high boiling pts condense at the bottom and ones with low boiling pts condense at the top.

Stoichiometry

Relative atomic mass is the mass of an atom of an element in comparison to a standard carbon atom. The RAM of an element is the average mass of its isotopes, compared to a standard carbon atom. **Relative molecular mass** is the RAM's added together.

Percentage composition of an atom or ion in a compound can be found by dividing the mass of that atom/ion by the total mass of the compound x 100.

1 mole of atoms is the RAM of that atom in grams. 1 mole is equivalent to 6.02 x 10^23 atoms. To find the number of moles, divide the mass by the molar mass.

Empirical formula represents the smallest ratio between the combining atoms. To find empirical formula, you have to follow this table...
Eg. Compound X is 80% Carbon and 20% Hydrogen. Calculate empirical formula.

Element	Mass %	RAM	# of moles	Ratio	EF
C	80	12	80/12 = 6.67	6.67/6.67 = 1	CH_3
H	20	1	20/1 = 20	20/6.67 = 3	CH_3

Empirical formula x n = molecular formula
Molecular formula/empirical formula = n

Concentration refers to the number of moles of a solute present in 1dm^3.
Concentration = number of moles of solute/volume
1M = 1 molar solution = 1mole/dm^3

1 mole of any **gas** at room temperature and pressure occupies a volume of 24dm^3.

% yield of a compound is experimental value/theoretical value x 100. The experimental value is given to you (usually in test qns) and you have to work out the theoretical value.

% purity is mass of pure substance/mass of impure substance x 100.

The limiting reagent decides the amount of product formed. The limiting reagent is all used up in a reaction.