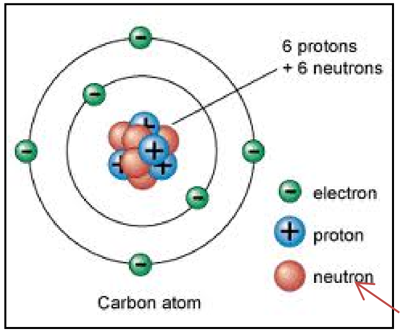
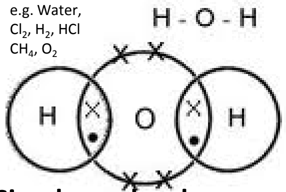
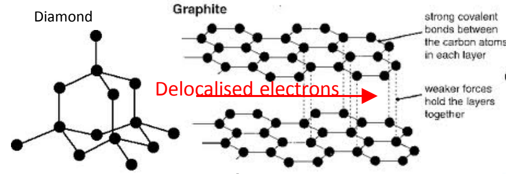


No charge



Simple molecules

- Low melting and boiling points
- Weak intermolecular forces
- Does not conduct electricity



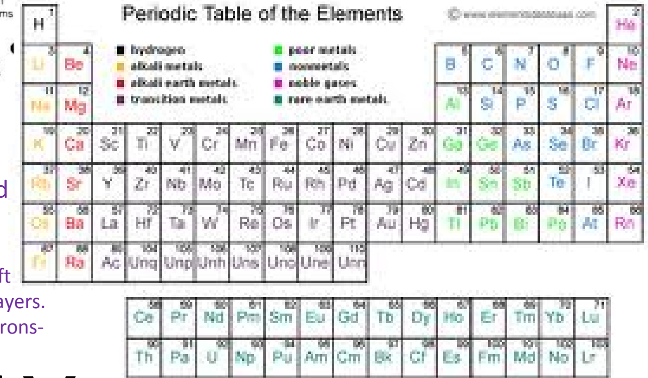
Giant Covalent Structure

- High melting and boiling points, hard
- Strong covalent bonds

Graphite only:
Conducts electricity, soft and slippery between layers.
-it has delocalised electrons-

Covalent Bonding

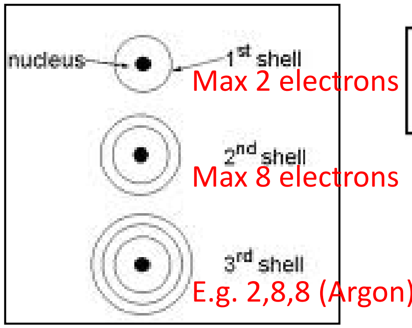
Non-metals sharing elections

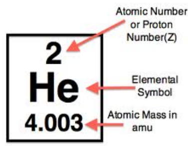


An atom:
Number of Protons = Number of Electrons
Mass number = Protons + Neutrons

C2 Chemistry

Periodic table arranges elements by **ATOMIC NUMBER** (proton number/the small one)

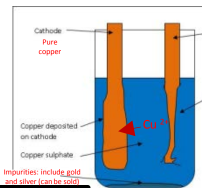




Protons and neutrons both have a mass of 1

OIL RIG

Oxidation is lose (of electrons)
Reduction is gain (of electrons)

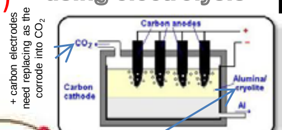


Describe this! Copper purification

The number of outer shell electrons match the group the element is found in.
E.g. Lithium 2,1 is a group 1 element.

Remember: Atoms like to end up with full outer shells.

Extracting Aluminium using electrolysis



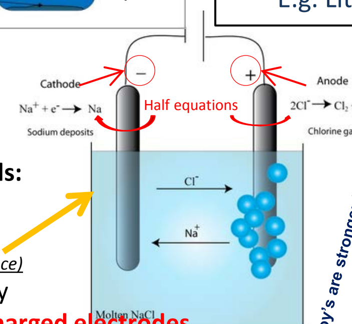
Add **cryolite** to lower melting point.

Electrolysis:
Splitting up a substance using electricity

When there are 2 possible products
The **less reactive** forms at the electrode

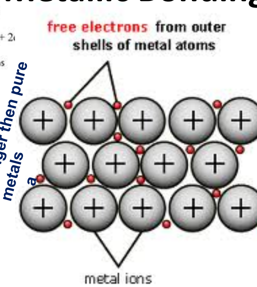
Electrolysis needs:

- 2 electrodes
- An electrolyte
(*Ionic or molten substance*)
- A power supply



Ions move toward oppositely charged electrodes

Metallic Bonding



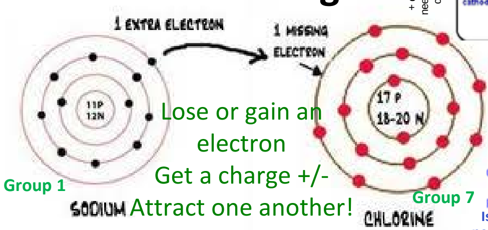
Alloy's are stronger then pure metals

Sea of delocalised electrons

Can carry a charge so metals conduct electricity

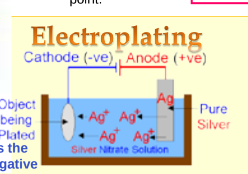
Metal ions only arranged in layers
ELECTROSTATIC ATTRACTION between +IONS and DELOCALISED ELECTRONS

Ionic Bonding

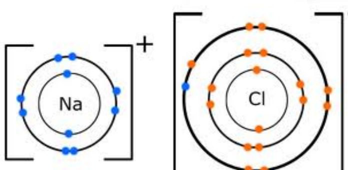


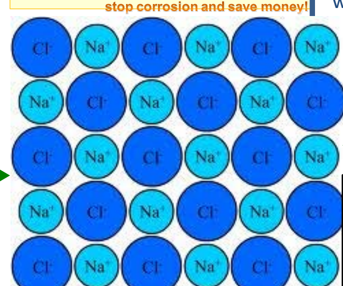
Lose or gain an electron
Get a charge +/-
Attract one another!

Group 1 and 7 elements make good ionic partners, so do group 2 and 6!



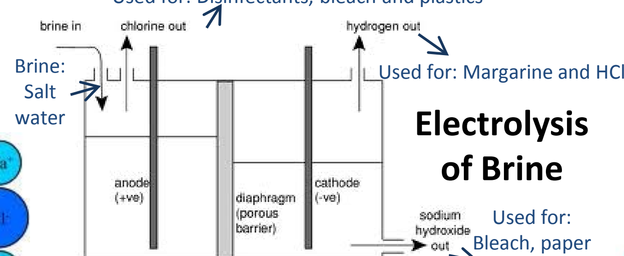
Use to improve: Appearance, stop corrosion and save money!





Giant Lattice Structure

Always metals with non-metals
+ ION and – ION attracted by
STRONG ELECTROSTATIC FORCES

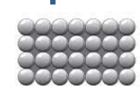


Used for: Disinfectants, bleach and plastics
Used for: Margarine and HCl
Brine: Salt water

Electrolysis of Brine

Used for: Bleach, paper and soap

As a solid: High melting and Boiling Point
Conducts electricity when **melted or dissolved**:
Ions move freely and carry a charge



Metal ions slide over one another making them MALLEABLE

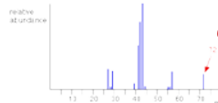
Metals conduct HEAT well

NANO-TECHNOLOGY

Means REALLY REALLY REALLY small !!!!!

Other techniques: **Gas chromatography** for separation, **Mass Spectroscopy** for identifying and finding molecular mass.

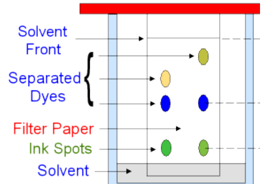
Molecular ion peak = peak with the largest mass



Experimental Analysis

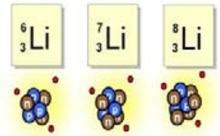
-Identifying what's in a mixture.

Paper chromatography



ISOTOPES

are atoms of the same element with different numbers of ***neutrons***



Why use a machine?

Advantages
- Quick
- Accurate
- Analyse small amounts

Disadvantages
- Expensive
- Needs special training
- Interpreted by comparison only

Additives improve appearance, taste and make food last longer!

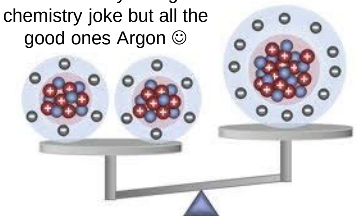
Relative formula Mass

Add the mass of each atom in the formula together

e.g. **$CaCO_3$**

40 + 12 + 16 + 16 + 16 = **100**

I'd love to tell you a good chemistry joke but all the good ones Argon ☺



We compare the mass of any atom to Carbon 12

Hand warmers and **self heating cans** use **exothermic reactions**.

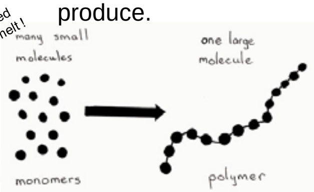
Mixing two chemicals to produce heat **(single use)** or the formation of crystals in a supersaturated solution **(reusable).**

Plastics

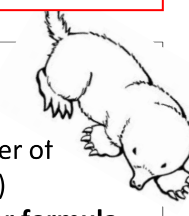
Using different monomers and conditions will change the type of polymer you produce.

Thermosoftening – melt easily when heated

Thermosetting – don't melt!



Moles



1 mole of any substance contains the same number of particles. ($6.02x10^{23}$)

Relative atomic mass or formula mass in grams is equal to one mole.

e.g. 12g of carbon is one mole of carbon

Mass of element / Total mass of compound x 100

= **Percentage Mass**

e.g. % mass of carbon (12) in ethane C_2H_6 (30)

All the carbon (12 + 12 = 24)

24 / 30 x 100 = 80%

Cool packs use **exothermic** reactions – Good for sport injuries!

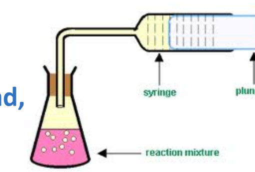
Exothermic reactions give out heat to the surroundings(get hotter) e.g. Respiration & Combustion

Endothermic reactions take in heat from the surroundings (get colder) e.g. Photosynthesis

When a reaction forms a **SOILD**(s) its called a **PRECIPITATE**

Too removed a solid (s) from a reaction you FILTER it out !

If you reaction gives you a dissolved product (aq) instead, you EVAPOURATE it out !



Catalysts - **speed up reactions without being used up**

- Increasing the rate of a reaction can save money!
- Different reactions need different catalysts!
- Catalysts are often metals

(if they escape they might harm the environment)

We can **measure the rate** of a reaction by looking at how fast solid **reactants are used** up, how quickly **gas is produced** or how **quickly light is blocked** (the disappearing cross)

Reversible Reaction

One way will be endothermic and the other will be exothermic

In a closed system forward and backward reaction occur at equal rates

e.g. Sulfuric Acid + Magnesium -> Magnesium sulfate+ Hydrogen

e.g. Nitric Acid + Copper Oxide -> Copper nitrate + Water

For this: Anything that's not a metal on its own is a base

Acid + Metal → Salt + Hydrogen

Acid + Base → Salt + Water

Acid	Salt
Hydrochloric Acid	Chloride
Sulfuric Acid	Sulfate
Nitric Acid	Nitrate

Collision Theory

The rate of a reaction is speed up by increasing the:
- **Temperature**
- **Surface area**
- **Concentration**
- **Or by adding a CATALYSIS**

IMPORTANT

When we **increase the concentration/surface area** we **increase the frequency of particles colliding and reacting**. Speeding up the reaction.

When we **we increase the temperature** the **particles move faster**, they are **more likely to collide** and do so **with sufficient energy to react**. Speeding up the reaction.

Acids & Bases (Alkalis)

Acids – H^+

Alkalis – OH^-

Bases **NEUTRALISE** acids

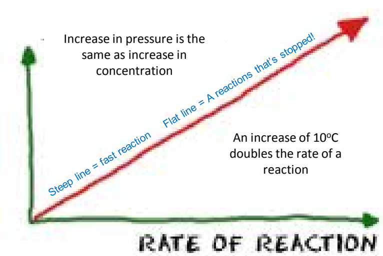
Alkalis are soluble bases

1	2	3	4	5	6	7	8	9	10	11	12	13	14

← increasingly acidic — neutral — increasingly alkaline →

pH Scale

Find the pH using **Universal Indicator**



For a reaction to take place we have to have the minimum amount of energy needed

The **ACTIVATION ENERGY**

Molecular Formula & Empirical Formula

***Molecular Formula** : The actual number of atoms of each element in an individual molecule*

***Empirical Formula** : The simplest whole number ratio of the elements in the molecule*

Calculating the Empirical Formula

1) Use the same table and method given for calculating reacting masses but remove the ratio row. The question will either provide the grams of each element or the percentage. Assume percentages are the same figure in grams.
e.g. 12% = 12g

Question: A substance contains 24% carbon and 64% hydrogen. Calculate the its empirical formula.

Chemical	Carbon	Hydrogen
Grams	24	64
M_r	12	16
Moles	2	4

2) To get the **simplest ratio** divide all moles by the smallest calculated value

2/2 = 4/2 =
1 : 2

This gives you the number of each element present and the empirical formula

$C\ H_2$

If you were told the compound had a mass of 28 you could <u>calculate the molecular formula</u>
The M_r of CH_2 is 14
28 /14 = 2
Therefore the molecular formula must be double the empirical one C_2H_4

Balanced Equations

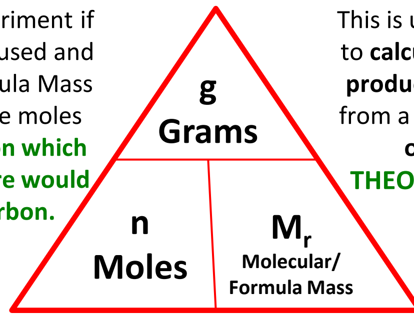
$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

C=1 | C=1
H=4 = H=4
O=4 | O=4

A balanced equation has the **same number of atoms** for each element **on both sides**

We can use this to find the **ratio of moles** that are **needed to react** with one another
e.g. 1 CH_4 molecule reacts with 2 O_2 molecules
1:2 ratio

When doing an experiment if we know the grams used and the Molecular/Formula Mass we can calculate the moles
e.g. In 24 g of carbon which has an M_r of 12 there would be 2 moles of carbon.
24/12 = 2



This is useful if we want to **calculate how much product** we would get from a **specific amount of reactant**
THEORETICAL YIELD

Percentage Yield

This is used to **compare** our **actual yield** with our **theoretical yield**.

$$\frac{\text{Amount of product actually produced}}{\text{Maximum possible yield (Theoretical yield)}} \times 100$$

Remember: Lots of waste reduces resources and cause extra pollution.

e.g. $\frac{200}{275} \times 100 = 72.73\ \%$

Its rare to get 100% yield
This is because some products can be left in apparatus or separating products from reactants is difficult.
Sometimes it's not everything reacts to begin with.

Working out chemical formula…

Use your data sheet!

2 Formulae of Some Common Ions	Positive ions		Negative ions	
	Name	Formula	Name	Formula
	Hydrogen	H^+	Chloride	Cl^-
	Sodium	Na^+	Bromide	Br^-
	Silver	Ag^+	Fluoride	F^-
	Potassium	K^+	Iodide	I^-
	Lithium	Li^+	Hydroxide	OH^-
	Ammonium	NH_4^+	Nitrate	NO_3^-
	Barium	Ba^{2+}	Oxide	O^{2-}
	Calcium	Ca^{2+}	Sulfide	S^{2-}
	Copper(II)	Cu^{2+}	Sulfate	SO_4^{2-}
	Magnesium	Mg^{2+}	Carbonate	CO_3^{2-}
	Zinc	Zn^{2+}		
	Lead	Pb^{2+}		
	Iron(II)	Fe^{2+}		
	Iron(III)	Fe^{3+}		
	Aluminium	Al^{3+}		

When you need to work out the ionic formula of a substance you will always need something from the **positive ion column** and something from the **negative ion column**.

The charges should always cancel out!

e.g. What is the formula for silver oxide?
1) First **identify** the two ions you need. (one from each column)
Ag^+ **and** O^{2-}
2) **Balance the charges**. Oxygen has 2 minus charges but silver only has a single positive charge.
This means you'll need two silvers to cancel out the one oxygen.
(+ +) $Ag^+\ Ag^+$ = O^{2-} (- -)
3) Write the formula. When you know how many of each ion you need use this in the formula and ignore the charges.
Ag_2O

What if you need something that already has a small number? **Put the whole ion in brackets!** Cu $(NO_3)_2$

Try to work out: Magnesium oxide and Calcium chloride…

Answers: MgO $CaCl_2$

Calculating Theoretical yield

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

Question: *How much CO_2 would be produced by burning 100g of Methane (CH_4) ?*

Chemical	CH_4	CO_2
Ratio	1	1
Grams	100	?
M_r	16	44
Moles	6.25	6.25

1) Put in the things you already know. You were **given the grams** of **methane** in the question. And can **calculate the** M_r using the periodic table.

2) Use the **triangle** to calculate the moles or methane used.

3) Use the **ratio** from **balanced equation** to provide the **moles** of CO_2
1 : 1 6.25 : 6.25

4) Now you have the M_r and the **moles** of CO_2 you can use the **triangle** to calculate the grams that will be produced.

44 x 6..25 = 275

Answer: 100g of methane would make 275 g of CO_2

All figures in example calculations refer to the burning of methane in oxygen as shown in the balanced equation