

# Chemical Equations

A chemical equation is a written representation of a chemical reaction.

In a chemical reaction:

- The reactants are on the left and react together to form products which are on the right.



- State symbols are written with elements and compounds which tells us about their existing states at r.t.p conditions

25°C / 298 K Temperature

1.013 x 10<sup>5</sup> Pa / 1 atm Pressure

Metals are monoatomic solids except Mercury (Hg)  
eg: Na(s), K(s), Mg(s), Al(s), Zn(s) e.t.c.

Some non-metals are monoatomic solids  
eg: C(s), Si(s), P(s), S(s) e.t.c.

Some non-metals are diatomic molecules

eg: H<sub>2</sub>(g), N<sub>2</sub>(g), O<sub>2</sub>(g), F<sub>2</sub>(g), Cl<sub>2</sub>(g), Br<sub>2</sub>(l), I<sub>2</sub>(s), At<sub>2</sub>(s)

Some compounds exist as solids eg Ionic Compounds like NaCl(s), MgO(s), KBr(s), CaCO<sub>3</sub>(s)

Some compounds exist as liquids eg H<sub>2</sub>O(l), C<sub>2</sub>H<sub>5</sub>OH(l)

Some compounds exist as gases eg NH<sub>3</sub>(g), HCl(g)

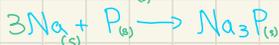
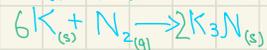
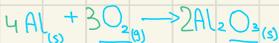
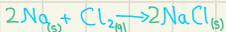
CO<sub>2</sub>(g), CO(g), NO<sub>2</sub>(g), SO<sub>2</sub>(g), SO<sub>3</sub>(g)

Compounds which are soluble in water are called aqueous

eg: NaCl(aq), MgSO<sub>4</sub>(aq), Al(NO<sub>3</sub>)<sub>3</sub>(aq), NaOH(aq), KOH(aq)

HCl(aq), H<sub>2</sub>SO<sub>3</sub>(aq), H<sub>2</sub>SO<sub>4</sub>(aq), H<sub>2</sub>CO<sub>3</sub>(aq), HNO<sub>3</sub>(aq)

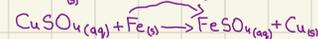
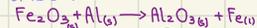
- In a chemical equation, the reactants must exactly be equal to the products so in order to do that we must balance the chemical equation.



## Displacement Reactions

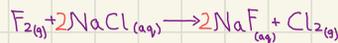
### Displacement Reaction of Metals

A more reactive metal displaces a less reactive metal from its aqueous solution of its salt or its oxide.



### Displacement Reaction of Halogens

A more reactive halogen displaces a less reactive halogen from an aqueous solution of its salt.



# Salt Formation

## Soluble Salts

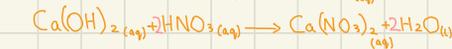
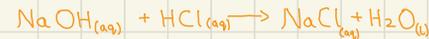
Metal + Acid  $\longrightarrow$  Salt + Hydrogen gas



Metal Oxide + Acid  $\longrightarrow$  Salt + Water



Metal Hydroxide + Acid  $\longrightarrow$  Salt + Water



Metal Carbonates + Acid  $\longrightarrow$  Salt + Water + Carbon dioxide



## Insoluble Salts

### Precipitation

Insoluble salts are formed by precipitation as we take two soluble salts to form a soluble salt and an insoluble salt.

NO<sub>3</sub><sup>-</sup> All Nitrates are soluble

SO<sub>4</sub><sup>2-</sup> All Sulphates are soluble

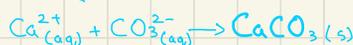
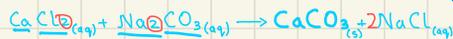
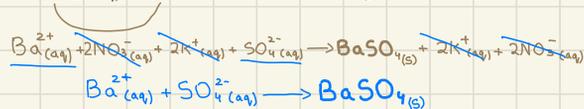
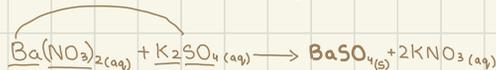
except Barium Sulphate (BaSO<sub>4</sub>)  
Lead Sulphate (PbSO<sub>4</sub>)  
Calcium Sulphate (CaSO<sub>4</sub>)

Cl<sup>-</sup> All Chlorides are soluble

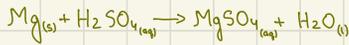
except Silver Chloride (AgCl)  
Lead Chloride (PbCl<sub>2</sub>)  
Mercury Chloride (HgCl)

CO<sub>3</sub><sup>2-</sup> All Carbonates are insoluble

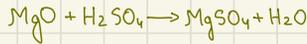
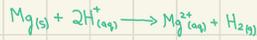
except Potassium Carbonate (K<sub>2</sub>CO<sub>3</sub>)  
Sodium Carbonate (Na<sub>2</sub>CO<sub>3</sub>)  
Ammonium Carbonate [(NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>]



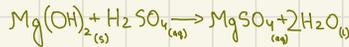
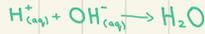
# Magnesium Sulphate $MgSO_4$



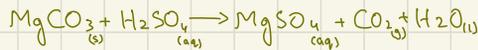
Ionic Equation



Ionic Equation



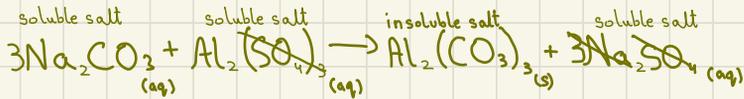
Ionic Equation



Ionic Equation



# Aluminium Carbonate $Al_2(CO_3)_3$ (s)



Ionic Equation

