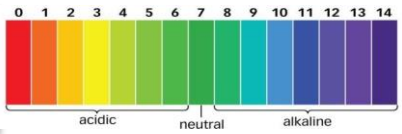
AQA C4a Chemical Changes: Metal & acid reactions
Combined Higher
RP – Making salts



Reactivity Series

Metals form positive ions when they react	***The reactivity of a metal is related to its tendency to form positive ions***	The reactivity series arranges metals in order of their reactivity
Carbon and hydrogen	***Carbon and hydrogen are non-metals but included in the reactivity series***	These 2 non-metals are included as they can be used to extract some metals from their ores, depending on their reactivity.
Displacement	***A more reactive metal can displace a less reactive metal from a compound.***	Silver nitrate + Sodium → Sodium nitrate + Silver

Strong & Weak acids

Strong acids	Completely ionise in water
Weak acids	Partially ionise in water
Hydrogen Ions	As pH decreases by 1, H^+ concentration goes up x10

$H^+ + {}^-OH \rightleftharpoons H_2O$

Metal salt production

Acid Name	Salt Name
Hydrochloric acid	Chloride
Sulfuric acid	Sulfate
Nitric acid	Nitrate

From most to least reactive	Reaction with water	Reaction with dilute acid	Extraction Method
Potassium	Bubbles, gives off hydrogen and leaves an alkaline solution	Explode	Electrolysis
Sodium			
Lithium			
Calcium		Bubbles, gives off hydrogen and forms a salt	
Magnesium	**Carbon** Very slow reaction		
Aluminium			
Zinc			Reduction (removal of oxygen) with carbon
Iron			
Tin	Slight reaction with steam	Slow reaction with warm acid	
Lead			
Copper	**Hydrogen** No reaction	No reaction	Found as native metal
Silver			
Gold			

Neutralisation of acids

Neutralisation	***Acids can be neutralised by bases***	A **base** is a substance that neutralises an acid e.g. a metal carbonate, metal oxide. or soluble metal hydroxide, An **alkali** is a soluble base e.g. a metal hydroxide.

Acid + Base → Metal Salt + Water

Ionic Half Equations

Displacement Reactions	***Ionic half equations show what happens to each of the reactants during reactions***	The ionic equation for the reaction between iron and copper (II) ions is: **$Fe + Cu^{2+} \rightarrow Fe^{2+} + Cu$** The half-equation for iron (II) is: **$Fe \rightarrow Fe^{2+} + 2e^-$** The half-equation for copper (II) ions is: **$Cu^{2+} + 2e^- \rightarrow Cu$**

Oxidation, Reduction and Metal Oxides

Metals and oxygen	***Metals react with oxygen to form metal oxides***	**magnesium + oxygen → magnesium oxide** **$2Mg + O_2 \rightarrow 2MgO$**
Reduction	***When oxygen is removed during a reaction***	e.g. metal oxides reacting with hydrogen, extracting low reactivity metals
Oxidation	***When oxygen is gained during a reaction***	e.g. metals reacting with oxygen, carbon during extraction of some metals from their ores

Reactions between metals and acids are ***redox reactions***. The metal donates electrons to the hydrogen ions. This displaces hydrogen as a gas while the metal ions are left in the solution.

OIL RIG - Oxidation Is Loss (of electrons), Reduction Is Gain (of electrons)

Reactions of Acids

Acid + Metal → Metal Salt + Hydrogen
Sulfuric acid + Iron → Iron sulfate + Hydrogen

Acid + Metal Oxide → Metal Salt + Water
Sulfuric acid + Iron Oxide → Iron sulfate + Water

Acid + Metal Hydroxide → Metal Salt + Water
Sulfuric acid + Iron Hydroxide → Iron sulfate + Water

Acid + Metal Carbonate → Metal Salt + Water + Carbon Dioxide
Sulfuric acid + Iron carbonate → Iron sulfate + Water + Carbon dioxide