

KPI 9CR 1: Use patterns of reactivity to make predictions for chemical reactions

The reactivity series



The reactivity series shows a list of metals in the order of how reactive they are. The metals towards the top of the list react readily with air and water and violently with acid.

The metals towards the bottom of the list do not even react with acid.

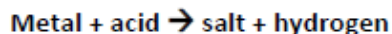
The order of the reactivity series can be remembered using a mnemonic.

"Pond slime can make a zoo interesting - the long crinkly sort goes purple."

Metal	Reaction with acid
Potassium Sodium	Explosive, very exothermic reaction – should not be carried out in the school laboratory
Calcium	Violent reaction, produces large amounts of hydrogen quickly
Magnesium	Rapid reaction, produces hydrogen gas readily
Aluminium Zinc	Fast reaction, noticeable amounts of gas evolved.
Iron Tin	Slow reaction, gas evolved very slowly. Reaction more noticeable in concentrated acid.
Lead Copper Silver Gold Platinum	No observable reaction

Reactions of metals with acid

The general equation for the reaction of a metal with acid is:

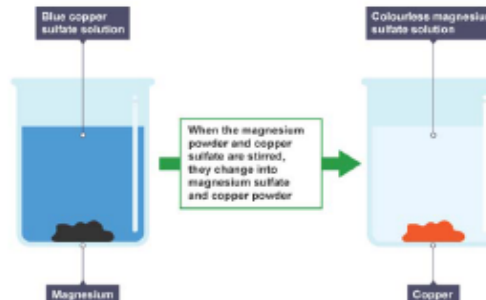


The test for hydrogen is sometimes called the squeaky pop test. Hydrogen makes a small 'pop' when it is placed near a lit wooden splint.

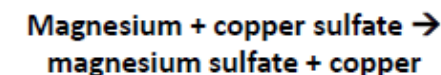
Displacement reactions

Displacement reactions involve a reaction between a metal and a compound of a different metal.

A more reactive metal will displace a less reactive metal from its compounds.

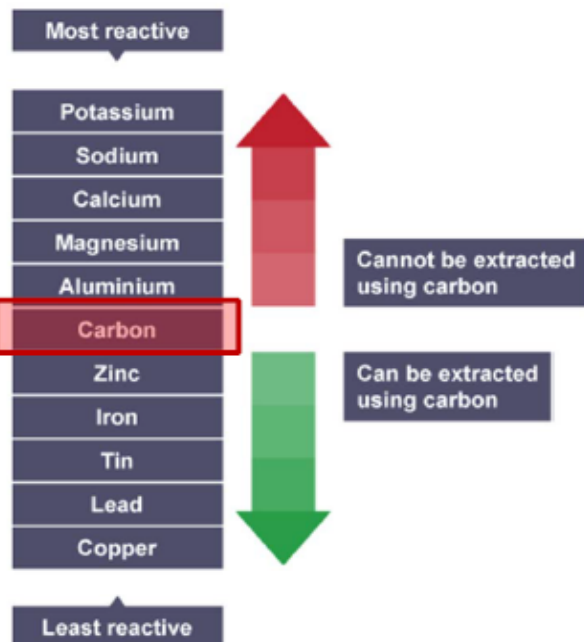


For example the more reactive magnesium will displace the less reactive copper from the copper sulfate solution.



KPI 9CR 2: link the properties and uses of a metal to its position in the reactivity series

Reacting metals with carbon



Carbon can be placed into the reactivity series.

Metals which are less reactive than carbon can be extracted by reduction with carbon.

Metals that can be extracted by this method are zinc, iron, tin, lead and copper.

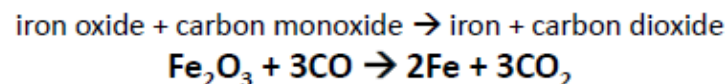
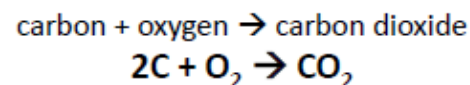
The general equation for this reaction is:



Obtaining iron from iron oxide

Iron can be extracted by the reaction with carbon in a container called a blast furnace. The blast furnace heats iron oxide with carbon in the form of coke (coal).

As the coke burns it forms carbon monoxide which is able to displace the oxygen from the iron oxide.



Properties of metals and non-metals

Property	Metals	Non-metals
Appearance	Shiny	Dull
State at room temp	Solid (except mercury)	Half are solids, half are gases, one is liquid (bromine)
Density	High	Low
Strength	Strong	Weak
Malleable or brittle	Malleable (can bend without breaking)	Brittle (will shatter when hammered)
Conduction (heat/electricity)	Conduct both well	Poor (graphite only non-metal conductor)
Magnetic	Only iron, cobalt and nickel	None

Extraction of metals high in the reactivity series

Metals that are higher than carbon in the reactivity series have to be extracted by a process known as **ELECTROLYSIS**.

ELECTROLYSIS literally means pulling apart with electricity and can only be done on compounds that have been melted or dissolved in a substance called an electrolyte. Aluminium is the most common example of a metal extracted by this method.