



Box 1: Keywords

Displacement reaction	a reaction in which a more reactive element takes the place of a less reactive element in one of its compounds.
Ore	rock which contains enough metal to make it economically worthwhile to extract the metal.
Oxidation	a reaction where oxygen is added to a substance / or when electrons are lost from a substance
Reactivity series	a list of elements in order of their reactivity
Redox reaction	: a reaction where both reduction and oxidation take place.
Reduction	a reaction in which oxygen is removed or electrons are gained
Salt	a compound formed when some or all of the hydrogen in an acid is replaced by a metal

Box 2: Key skills

- Explain reduction and oxidation in terms of loss or gain of oxygen
- Deduce an order of reactivity of metals based on experimental results.
- Interpret or evaluate specific metal extraction processes when given appropriate information

Box 3: Reactivity series

Metal	Reaction with cold water	Reaction with dilute acids	Reactivity
Potassium	Violent	Violent	 Most reactive
Sodium			
Lithium			
Calcium	Fast	Rapid	
Magnesium	Very slow		
(Carbon)			
Zinc	Usually no reaction	Slow	
Iron	Rusts slowly		
(Hydrogen)			
Copper	No reaction	No reaction	
Gold			

Reactions of metals with water

When a metal reacts with water, a metal hydroxide and hydrogen are formed.

General equation:

Metal + water → **metal** hydroxide + hydrogen
e.g. Sodium + water → sodium hydroxide + hydrogen

Reactions of metals with acids

When a metal reacts with water, a metal salt and hydrogen are formed.

General equation:

Metal + **acid** → **metal salt** + hydrogen
e.g. Magnesium + hydrochloric acid → magnesium chloride + hydrogen

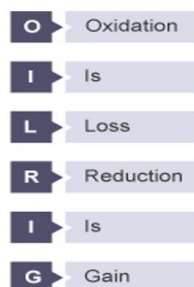
Box 4: Redox reactions

Reduction is the loss of oxygen from a substance.

HT Reduction is gain of electrons

Oxidation is the gain of oxygen from a substance

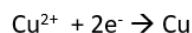
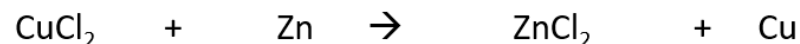
HT Oxidation is lost of electrons (doesn't have to be oxygen)



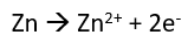
When carbon is used to reduce a compound carbon dioxide is produced, we use carbon to extract metals from there ore that are **below** carbon on the reactivity series.

Metals above carbon are reduced using electrolysis to extract from ores.

copper (II) chloride + zinc → zinc (II) chloride + copper



Copper is **reduced** (gains electrons)



Zinc is **oxidised** (loses electrons)

The chloride ions don't take part in the reaction so are called spectator ions

Box 5: Displacement reactions

In displacement reactions more reactive metals displace less reactive metals from their compounds

↑	Potassium
	Sodium
	Lithium
	Calcium
	Magnesium
	Aluminium
	Zinc
	Iron
	Tin
	Lead
	Copper
	Silver
	Gold

Example 1:

copper sulfate + **magnesium** → magnesium sulfate + copper

Reaction does occur.

Magnesium is more reactive so is able to displace copper.

Example 2:

copper sulfate + **silver** → ~~silver sulfate + copper~~

No reaction occurs.

Silver is less reactive so is unable to displace copper.

Box 6: Pathway

Previous knowledge: KS3 chemical reactions, metal reactions, KS4 Periodic table – group 1 metals

Future links: Electrolysis, phytomining and bioleaching

Careers: chemical engineers, electroplaters, manufacturers of plastics, polymer scientists, electrochemical engineers, corrosion engineers

Box 7: Cross curricular links

Geography – geology ores