EDEXCEL TOPIC 4: Extracting metals and equilibria 1

Oxidation Is Loss (of electrons) **Reduction Is Gain** (of electrons)

Obtaining and using metals

Oxidation and reduction in terms of electrons (HT ONLY)

Ionic half equations (HT only)

For displacement reactions	***Ionic half equations show what happens to each of the reactants during reactions***	For example: 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: **$Cu^{2+} + 2e^- \rightarrow Cu$**

Reactions of acids and metals

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

Reactions with acids	***metal + acid → metal salt + hydrogen***	**magnesium + hydrochloric acid → magnesium chloride + hydrogen** **zinc + sulfuric acid → zinc sulfate + hydrogen**

Acids react with some metals to produce salts and hydrogen.

Extraction of metals and reduction

Unreactive metals, such as gold, are found in the Earth as the metal itself. They can be mined from the ground. More reactive metals are obtained by displacement or electrolysis.

Extraction using carbon

Metals less reactive than carbon can be extracted from their oxides by reduction.	For example: **zinc oxide + carbon → zinc + carbon dioxide**

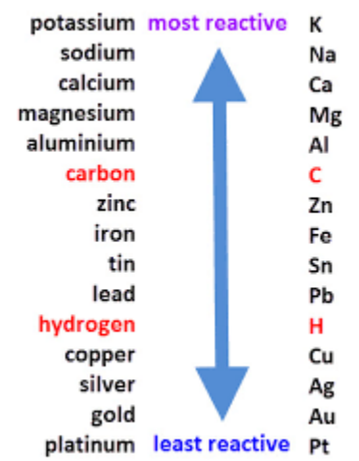
Metals ores	***These resources are limited***	Copper ores especially are becoming sparse. New ways of extracting copper from low-grade ores are being developed.
Phytomining	***Plants absorb metal compounds***	These plants are then harvested and burned; their ash contains the metal compounds.
Bioleaching	***Bacteria is used to produce leachate solutions that contain metal compounds***	The metal compounds can be processed to obtain the metal from it e.g. copper can be obtained from its compounds by displacement or electrolysis.

Obtaining and using metals

The reactivity series

	Reactions with water	Reactions with acid
Group 1 metals	***Reactions get more vigorous as you go down the group***	***Reactions get more vigorous as you go down the group***
Group 2 metals	***Do not react with water***	***Observable reactions include fizzing and temperature increases***
Zinc, iron and copper	***Do not react with water***	***Zinc and iron react slowly with acid. Copper does not react with acid.***

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 (their tendency to form positive ions).
Carbon and hydrogen	***Carbon and hydrogen are non-metals but are included in the reactivity series***	These two non-metals are included in the reactivity series 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 chloride → Sodium nitrate + Silver chloride



Metal oxides

Metals and oxygen	***Metals react with oxygen to form metal oxides***	**magnesium + oxygen → magnesium oxide** $2Mg + O_2 \rightarrow 2MgO$
Reduction	***This is when oxygen is removed from a compound during a reaction***	e.g. metal oxides reacting with hydrogen, extracting low reactivity metals
Oxidation	***This is when oxygen is gained by a compound during a reaction***	e.g. metals reacting with oxygen, rusting of iron