1 – Acids and Bases	
Acid	A substance that **dissolves** in **water** and forms **H^+ ions**. **Solutions** have a **pH lower** than **7**.
Alkali	A substance that **dissolves** in **water** and forms **OH^- ions**. **Solutions** have a **pH higher** than **7**.
Base	A substance that can **neutralise** an **acid**. If the **base** is **soluble**, it is also known as an **alkali**.
Neutralisation	**acid** + **base** -> **salt** + **water** $H^+ + OH^- \rightarrow H_2O$
Strong acids (HT)	**Completely ionise** in **water** to **release H^+ ions**. E.g. **sulphuric**, **hydrochloric** and **nitric** acids.
Weak acids (HT)	**Partially ionise** in **water** to release **H^+ ions**. E.g. **ethanoic**, **citric** and **carbonic** acids.
pH in terms of H^+ (HT)	**pH** is a measure of **H^+ ion concentration** in **solution**. **Stronger** acid = higher **H^+ ion** concentration = lower **pH**.
	As the **pH decreases** by **one unit**, the **H^+ ion concentration** of the solution **increases** by a **factor** of **10**.

2 – Reactions of Acids with 3 Types of Bases	
Metal oxide	**acid** + **metal oxide** -> **salt** + **water**
Metal hydroxide	**acid** + **metal hydroxide** -> **salt** + **water**
Metal carbonate	**acid** + **metal carbonate** -> **salt** + **water** + **carbon dioxide**
Naming salts	1st word from **metal**, 2nd word from **acid**: nitric -> **nitrate**, hydrochloric -> **chloride**, sulphuric -> **sulphate**.

3 – Making Soluble Salts (e.g. copper sulphate) using Insoluble Bases	
Reaction	**Gently warm** sulphuric acid. Add insoluble copper oxide until **no more reacts**. **Filter** out the **excess** copper oxide to leave copper sulphate **solution**.
Crystallisation	**Gently heat** solution using a **water bath** to increase concentration. When **crystals** start to form, leave to
	cool. **Filter** out crystals. Leave crystals in a **warm place** to **dry**.

4 – Metal Reactions	
Reactivity series	Metals **react** by **losing electrons** and forming **positive ions**. More **reactive** metals **lose electrons** more **easily**.
Metal and acids	**metal** + **acid** -> **salt** + **hydrogen** (MASH)
	Only metals **more reactive** than **hydrogen** react.
Metal and water	**metal** + **water** -> **metal hydroxide** + **hydrogen**
	Potassium, **sodium**, **lithium** and **calcium** react **quickly** with **cold water**.
Oxidation	Substance **gains oxygen** (or substance **loses electrons** - OIL).
Reduction	Substance **loses oxygen** (or substance **gains electrons** - RIG).
Extraction from ores	**Less reactive** than **carbon** -> extract by **redcuction** with **carbon**.
	More reactive than **carbon** -> extract using **electrolysis**.
Displacement reaction	A **more reactive** metal **displaces** a **less reactive** metal from its compound.

Reactivity Series	
Potassium	K
Sodium	Na
Lithium	Li
Calcium	Ca
Magnesium	Mg
Carbon	*C*
Zinc	Zn
Iron	Fe
Hydrogen	*H*
Copper	Cu

5 – Electrolysis	
Electrolysis	Passing an **electrical current** through an **electrolyte** (a **molten** or **dissolved ionic compound**) to **split** it up.
Positive ions (cations)	Move towards **cathode** (negative electrode) -> **gain electrons** -> they are **reduced**.
Negative ions (anions)	Move towards **anode** (positive electrode) -> **lose electrons** -> they are **oxidised**.
Molten ionic solids	At the **cathode** -> **positive metal ions reduced**. At the **anode** -> **negative non-metal ions oxidised**.
Aqueous solutions (H^+ and OH^- present)	At the **cathode** -> **hydrogen** gas or pure **metal** produced (whichever is **least reactive**). At the **anode** -> **halogen** molecules (**Cl_2, Br_2, I_2**) produced if **halide ions** present. If **not**, **oxygen** gas is formed.

GCSE Science

Chemistry C4 – Chemical Changes