The Periodic Table

Group 1

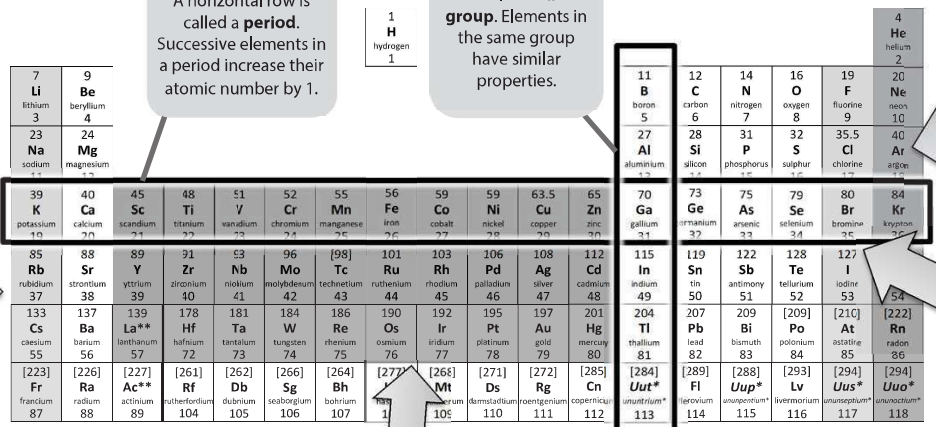
- Group 1 elements are called the **alkali metals**.
- They all have **1** electron in their outer shell which they **lose** when they react.
- They are all **very reactive**.
- They all have **metallic** structures.
- Reactivity **increases** down the group because the outer electron is **further** from the nucleus and **easier to lose**.

COMMON REACTIONS

1. All burn in **oxygen** to form **metal oxides**.
   e.g. **lithium + oxygen → lithium oxide**
   $4Li + O_2 \rightarrow 2Li_2O$
2. All react with **chlorine** to form **metal chlorides**.
   e.g. **lithium + chlorine → lithium chloride**
   $2Li + Cl_2 \rightarrow 2LiCl$
3. All react with **water** to form **metal hydroxides** and release **hydrogen gas**.
   e.g. **lithium + water → lithium hydroxide + hydrogen**
   $2Li + 2H_2O \rightarrow 2LiOH + H_2$

A horizontal row is called a **period**. Successive elements in a period increase their atomic number by 1.

A vertical column in the table is called a **group**. Elements in the same group have similar properties.



Group 0

- Group 0 elements are called the **noble gases**.
- They have a **full outer shell** of electrons and are, therefore, very **unreactive**.
- They all have **8** outer electrons except helium which has **2**.
- The boiling point **increases** down the group as the number of electron shells increases.

Group 7

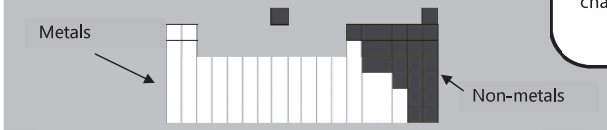
- Group 7 elements are called the **halogens**.
- They all have **7** electrons in their outer shell, and they **gain 1 more** when they react.
- They are all **reactive**.
- They all form **diatomic molecules**, e.g. Cl_2, Br_2.
- Melting/boiling point **increases** down the group.
- Reactivity **decreases** down the group because the outer electrons are **further** from the nucleus and it gets **harder to attract** an extra electron.
- They react with metals to form **ionic compounds**.
- They react with non-metals to form **covalent molecules**.

Transition Metals

The transition metals are found in the middle section of the table and are all **very similar**. They are commonly used as **catalysts** in industry because they can form ions with different charges.

Similarities with group 1	Differences from group 1
Conduct heat and electricity	Higher melting point
React with non-metals	Higher density
Shiny	Stronger and harder
React by forming ions	Coloured compounds (not white)
	Much less reactive

METALS VS NON-METALS



- **Over half** the elements in the periodic table are metals.
- All non-metals are in the **top-right corner** of the table.
- There are some elements along the dividing line which have properties of both metals and non-metals.
- This table shows the key differences in physical properties.

	Metals	Non-metals
Melting/boiling point	High	Low
Density	High	Low
Malleability	High	Low (brittle)
Properties of oxides	Basic	Acidic
Conductive	Yes	No
Ions	Positive	Negative

There are some exceptions to these rules, such as **carbon**, which has a very high melting point but is a non-metal.

WHICH COMPOUND WILL FORM?
Metal + Non-metal = Ionic compound
Non-metal + Non-metal = Covalent molecule
Metal + Metal = No reaction

Development of the Periodic Table

In the 1800s, scientists knew very little about atoms and didn't yet know that protons, neutrons and electrons existed. One of the biggest challenges faced by chemists was trying to find some kind of pattern in the properties of the elements.

John Dalton made a list of 20 of the currently known elements and put them in order of **atomic weight**.

1808

John Newlands found that **every eighth** element had similar properties and ordered elements into '**octaves**'. However, he **did not leave gaps** for undiscovered elements and this pattern broke down after the first 20 elements.

1864

Dmitri Mendeleev improved Newlands' theory by **leaving gaps** for undiscovered elements, and was able to predict some of their properties by looking at the group they were in. He also **changed the order** of some elements to make the properties match, putting them in order of **atomic number** instead of mass number. Later, the discovery of isotopes explained why ordering elements by atomic weight was wrong.

1869

EXAMPLE!

DISPLACEMENT REACTIONS

A less reactive halogen will get **displaced** from a halide compound by a **more reactive** halogen.

	Chlorine	Bromine	Iodine
Sodium chloride		✗	✗
Sodium bromide	✓		✗
Sodium iodide	✓	✓	

Chlorine + Sodium bromide → Bromine + Sodium chloride

Iodine + Sodium bromide → No reaction

DID YOU KNOW?
New elements are still being discovered, so the periodic table is still changing today!