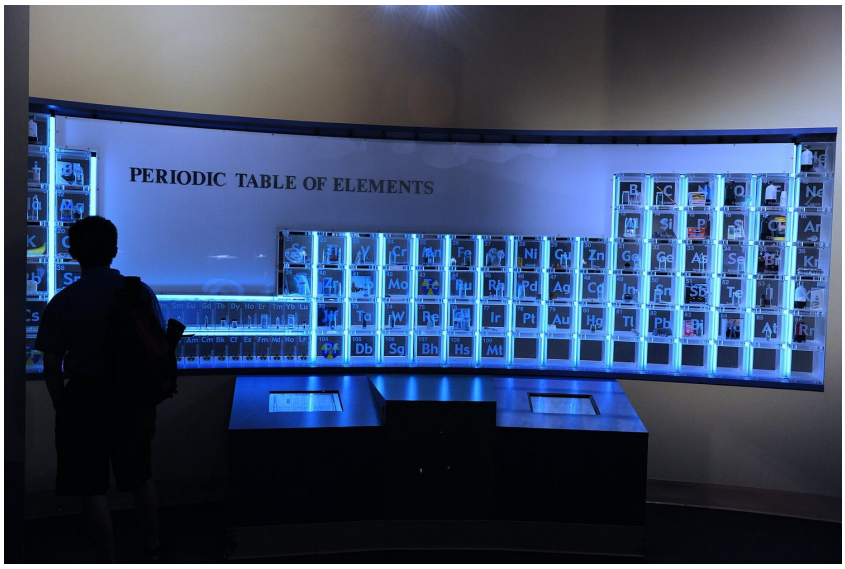
The Periodic Table

IGCSE Chemistry

Arrangement of the elements



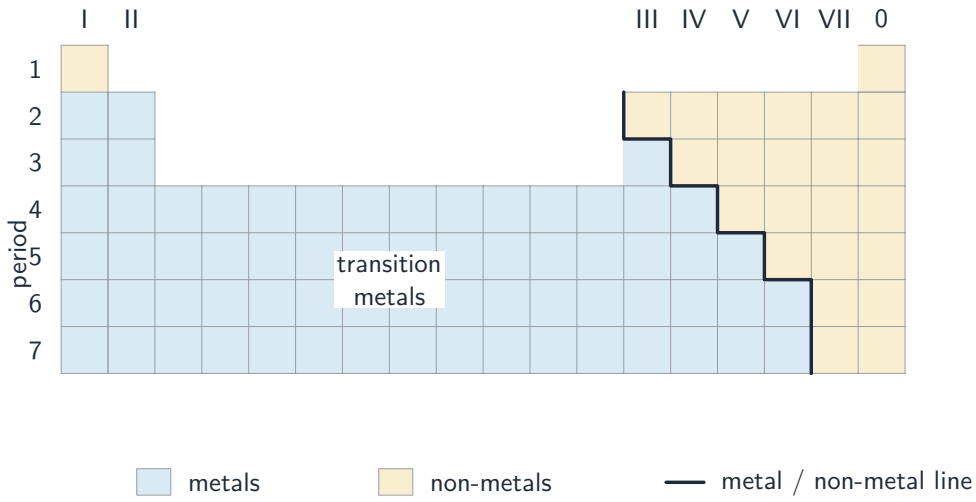
The periodic table arranges the elements in order of atomic number.

The **Periodic Table** 周期表 arranges all the **elements** 元素 in order of increasing **proton number** 质子数 (the **atomic number** 原子序数). The horizontal rows are called **periods** 周期 and the vertical columns are called **groups** 族.

A few key patterns:

- Across a period, the elements change from **metals** 金属 on the left to **non-metals** 非金属 on the right.
- The group number tells you the charge of the **ions** 离子 that the elements form. Group I forms +1 ions, Group II forms +2 ions, and Group VII forms −1 ions.
- Elements in the same group have similar chemical properties. This is because they have the same number of outer-shell **electrons** 电子 (the same outer **electronic configuration** 电子排布).

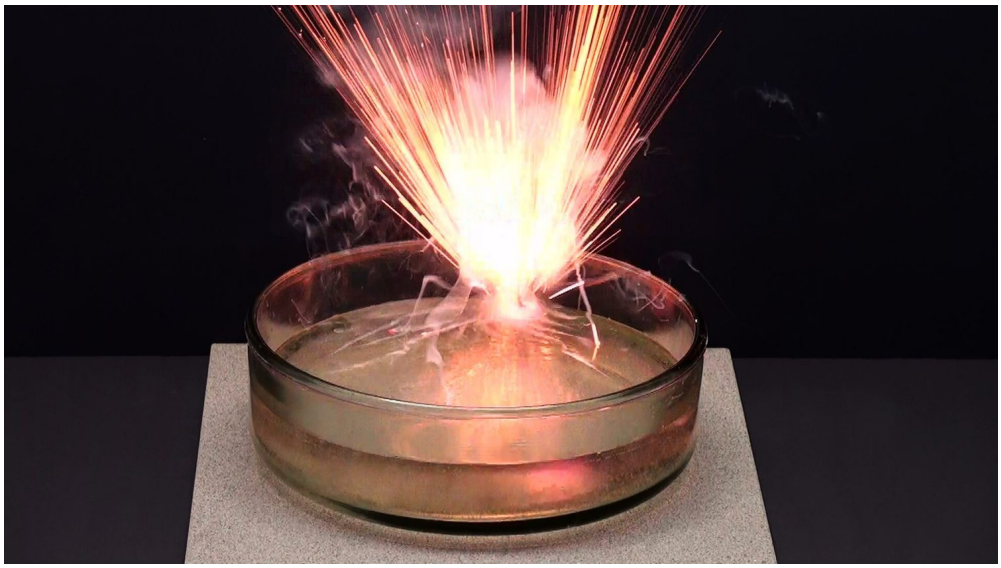
Because of these patterns, you can use an element's position to predict its properties.



Groups are the columns and periods are the rows; metals lie to the left of the staircase, non-metals to the right

Group I —the alkali metals

Group I elements are the **alkali metals** 碱金属: **lithium** 锂, **sodium** 钠 and **potassium** 钾. They are **soft** 柔软 metals (you can cut them with a knife).



Potassium reacts violently with water, giving off hydrogen that burns with a lilac flame —reactivity increases down Group I

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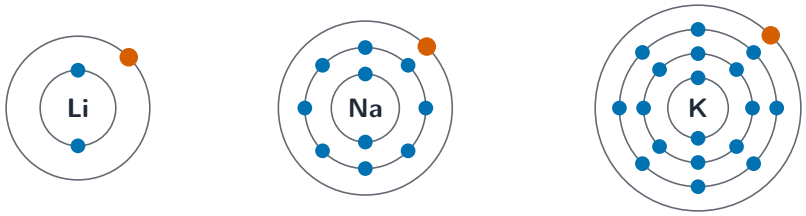

every Group I atom has **one** electron in its outer shell (shown in orange), so they react in similar ways

Every Group I atom has one electron in its outer shell, which is why they react in similar ways

Going down the group, there are clear **trends** 趋势:

Property	**Trend going down the group**
melting point 熔点	decreases
density 密度	increases
reactivity 活泼性	increases

You can use these trends to predict the properties of other Group I elements. For example, rubidium (below potassium) would be even more reactive and have an even lower melting point.

Group VII —the halogens

Group VII elements are the **halogens** 卤素: **chlorine** 氯气, **bromine** 溴 and **iodine** 碘. They are **diatomic** 双原子 non-metals (each molecule is made of two atoms, such as Cl_2).

Their appearance at room temperature and pressure:

Halogen	**Appearance**
chlorine	a pale yellow-green gas
bromine	a red-brown liquid
iodine	a grey-black solid

Going down the group, the density increases but the reactivity **decreases** (the opposite trend to Group I).

Group I gets more reactive down the group, while Group VII gets less reactive down — opposite trends

Displacement reactions

A more reactive halogen pushes out (displaces) a less reactive **halide** 卤化物 ion from its solution. This is a **displacement reaction** 置换反应.

For example, chlorine is more reactive than bromine, so chlorine displaces bromine from potassium bromide:

$$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$$

Transition elements

The **transition elements** 过渡元素 are the block of metals in the middle of the Periodic Table. Compared with Group I metals, they:

- have high densities;
- have high melting points;
- form **coloured** 有色 **compounds** 化合物;
- often act as catalysts, both as elements and in compounds.

They can also have **variable** 可变 **oxidation numbers** 氧化数. For example, **iron** 铁 forms both iron(II) and iron(III) compounds.

Group VIII —the noble gases

The Group VIII **noble gases** 稀有气体 are **unreactive** 不活泼, **monatomic** 单原子 gases (they exist as single atoms, not as molecules).

They are unreactive because they already have a full outer shell of electrons. This makes them stable, so they do not need to gain, lose or share electrons.