

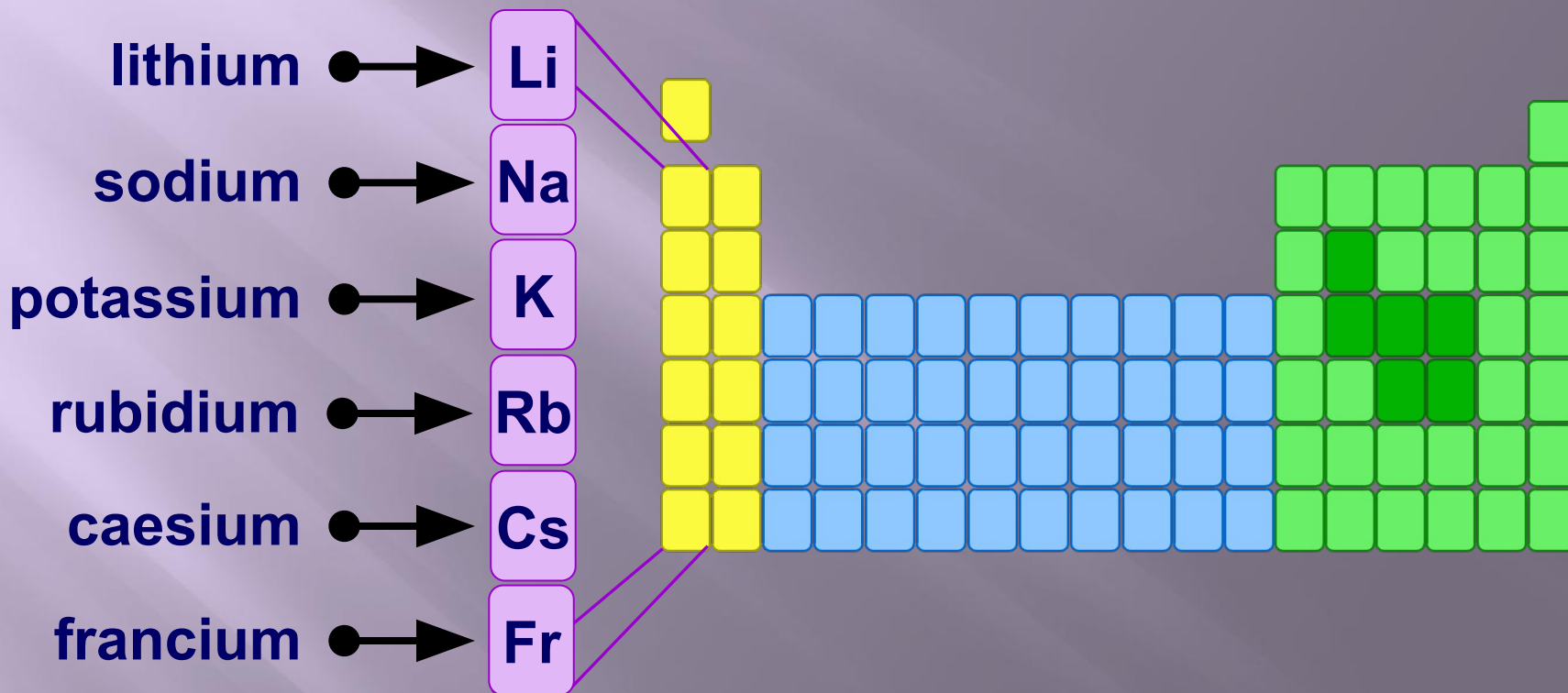


THE ALKALI METALS





Where are the alkali metals?





Why are they called the 'alkali metals'?

The alkali metals are so reactive that, as elements, they have to be stored in oil. This stops them reacting with oxygen in the air.

The alkali metals are unlike most other metals, which are usually hard and dense.



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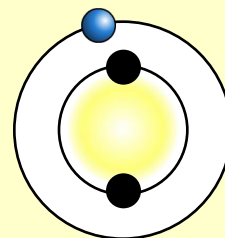
What is the electron structure of alkali metals?



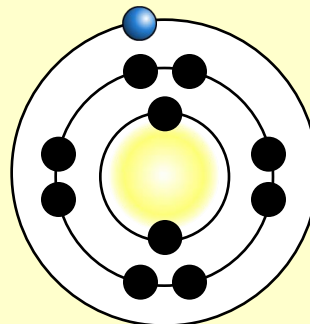
The alkali metals all have **one electron** in their outer shell.

This means that:

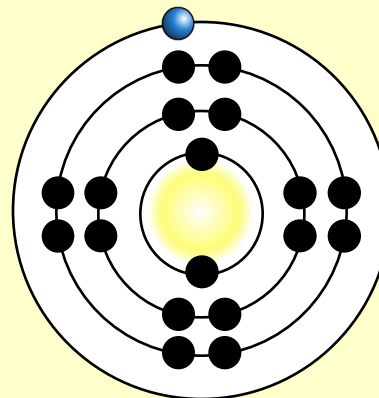
- They are found in group 1 of the periodic table.
- They have similar physical and chemical properties.
- They can readily lose the outer shell electron to form **positive ions** with a +1 charge and a full outer shell.



lithium
2,1



sodium
2,8,1



potassium
2,8,8,1





What are the properties of the alkali metals?



The characteristic properties of the alkali metals are:

- They are **soft** and can be cut by a knife.
Softness increases going down the group.
- They have a **low density**.
Lithium, sodium and potassium float on water.
- They have **low melting and boiling points**.



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What is the trend in density?

The alkali metals generally become **more dense** going down the group, but the trend is not perfect because potassium is less dense than sodium.

Element	Density (g/dm ³)
lithium	0.53
sodium	0.97
potassium	0.86
rubidium	1.53
caesium	1.87





What is the trend in melting and boiling point?

The melting points and boiling points of alkali metals **decrease** going down the group.

Element	Melting point (°C)	Boiling point (°C)
lithium	181	1342
sodium	98	883
potassium	64	760
rubidium	39	686
caesium	28	671





How do the alkali metals react with oxygen?

All alkali metals react with oxygen in the air to form **metal oxides**. This produces a layer of dull oxide on the surface of the metal, called **tarnish**.





What is the equation for the reaction with oxygen?

The reaction between an alkali metal and oxygen is an example of an **oxidation** reaction:

alkali metal + oxygen ☐ alkali metal oxide

The word and chemical equations for the reaction between lithium and oxygen are:

lithium + oxygen ☐ lithium oxide

$4\text{Li(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{Li}_2\text{O(s)}$

What are the word and chemical equations for the reaction that causes sodium to tarnish?

sodium + oxygen ☐ sodium oxide

$4\text{Na(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{Na}_2\text{O(s)}$





How do the alkali metals react with water?



board
works





What does the reaction with water produce?



All the alkali metals react vigorously with water.

The reaction with water becomes more vigorous as you go down the group.

It is an **exothermic** reaction as it releases a lot of heat.



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What is the equation for the reaction with water?

This reaction creates **alkaline hydroxide** ions.

This is why the group 1 elements are called the alkali metals.

The general equation for the reaction between an alkali metal reacting with water is:

alkali metal + water \square alkali metal + hydrogen
hydroxide





How does lithium react with water?

Lithium is the least reactive of the alkali metals.

When added to water, it fizzes and moves around slowly across the surface of the water.

What is the equation for this reaction?



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lithium + water ☐ lithium hydroxide

lithium + hydrogen

$2\text{Li(s)} + 2\text{H}_2\text{O(l)} \quad \square \quad 2\text{LiOH(aq)} + \text{H}_2\text{(g)}$





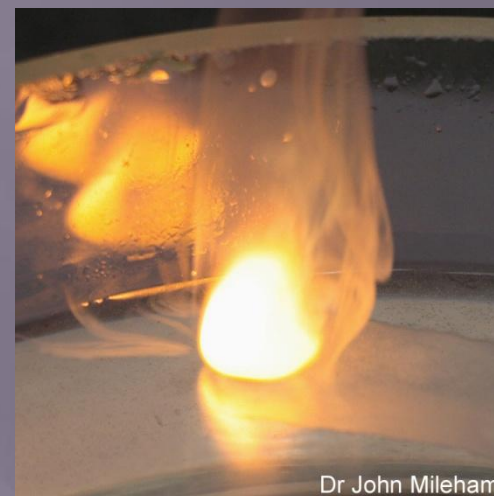
How does sodium react with water?

When added to water, sodium fizzes more than lithium, and moves quickly across the surface of the water.

The sodium melts as it reacts, and it becomes spherical and shiny, like a ball bearing.

The hydrogen sometimes catches fire because of the heat from the reaction.

What is the equation for this reaction?



sodium + water ☐
hydroxide

sodium + hydrogen





How does potassium react with water?

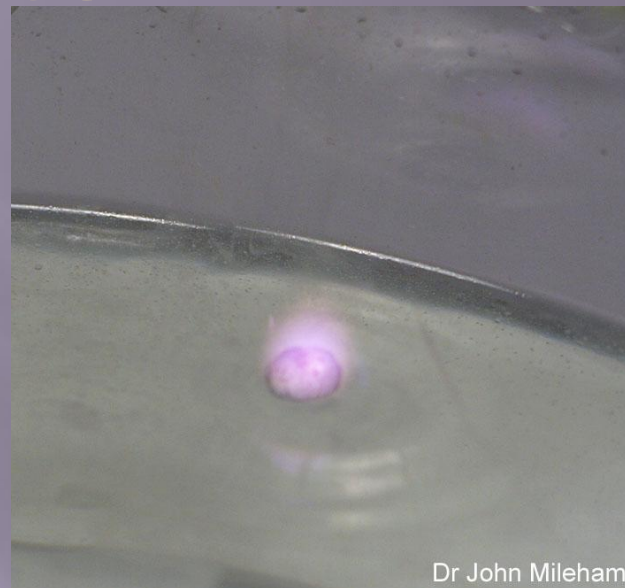
When added to water, the potassium moves across the surface of the water very quickly.

The reaction produces so much heat that the hydrogen given off catches alight.

What colour would the flame be?

Like sodium, it melts with the heat of the reaction.

What is the equation for this reaction?



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potassium + water ☐ potassium + hydrogen
hydroxide

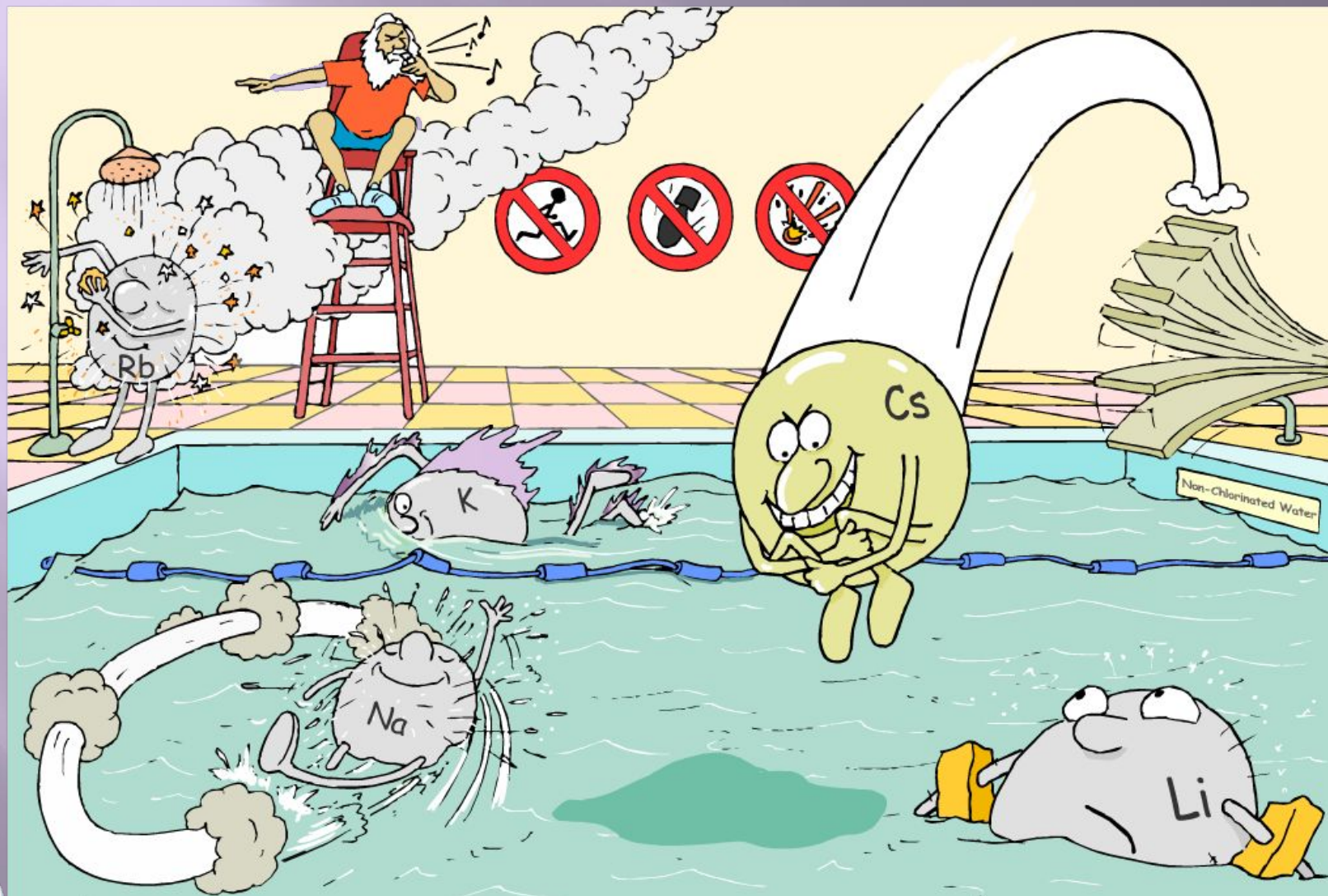




How do alkali metals react with water?



Which of the alkali metals will react most strongly with water?

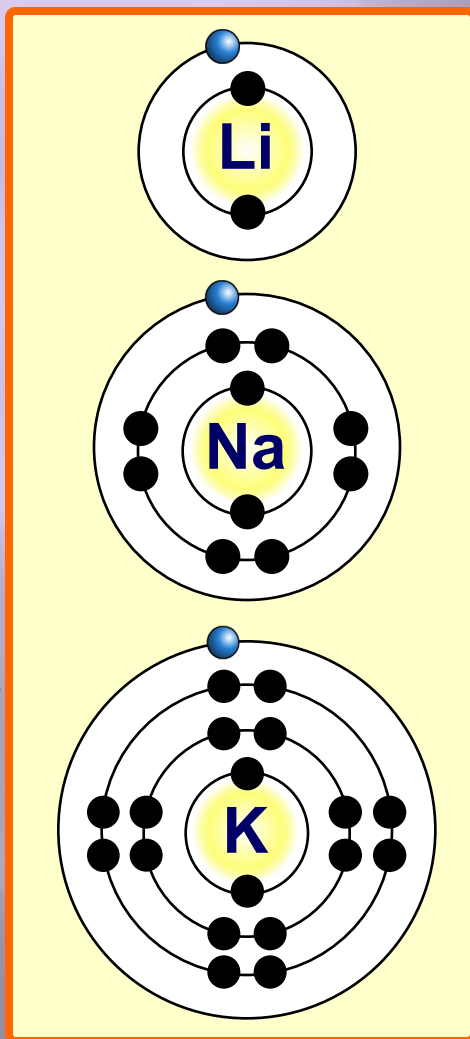




How does electron structure affect reactivity?

The reactivity of alkali metals **increases** going down the group. What is the reason for this?

increase in reactivity



- The atoms of each element get larger going down the group.
- This means that the outer shell electron gets further away from the nucleus and is shielded by more electron shells.
- The further an electron is from the positive nucleus, the easier it can be lost in reactions.
- This is why the reactivity of the alkali metals increases going down group 1.





How do alkali metals react with chlorine?

Alkali metals burst into flames when heated and added to chlorine. They form **metal chlorides**.

alkali metal + chlorine ☐ alkali metal chloride

The word and chemical equations for the reaction between lithium and chlorine are:

lithium + chlorine ☐ lithium chloride

$2\text{Li(s)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{LiCl(s)}$

What are the word and chemical equations for the reaction that produces sodium chloride?

sodium + chlorine ☐ sodium chloride

$2\text{Na(s)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{NaCl(s)}$





THANK YOU

FOR YOUR ATTENTION

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