

EB Education Revision Guide



How to work with Alkali Metals

Alkali Metals

Li	Lithium
Na	Sodium
K	Potassium
Rb	Rubidium
Cs	Cesium
Fr	Francium


Reactivity Increases

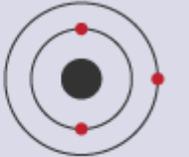
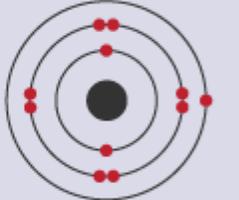
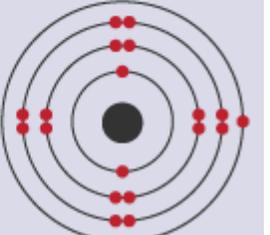
Reactivity

Why are they reactive?

Alkali metals are very reactive. This is because they easily lose their one outer electron to form a 1+ ion.

As you go down the group, the metals become more reactive. This is because as the atom gets larger it is easier to lose the outer electron, as it is further away from the nucleus. This happens due to the fact that the electron is not as strongly attracted to the nucleus by electrostatic forces, and so less energy is needed to remove it.

Alkali metals are so reactive they are stored in oil, to stop them reacting with the oxygen in the air and water.

Atomic number	Name	Electronic configuration	Diagram of atom
3	Lithium	2.1	
11	Sodium	2.8.1	
19	Potassium	2.8.8.1	

Reacting with water

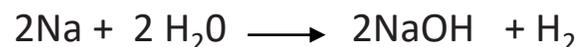
How do they react?

Alkali metals react vigorously when they are placed in water.

They react to produce a metal hydroxide and hydrogen gas.

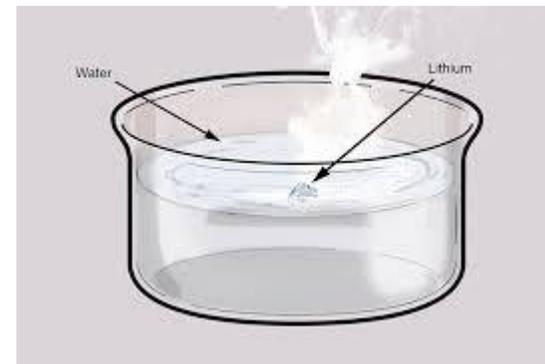
metal + water \longrightarrow metal hydroxide + hydrogen

sodium + water \longrightarrow sodium hydroxide + hydrogen



You can test for hydrogen by using a lit splint – you will hear a squeaky pop.

If you place Universal Indicator into the water after it has reacted with the alkali metal - it will turn blue or purple. This is because metal hydroxides are alkaline.



Lithium: Fizzes around the surface of the water.

Sodium: Melts to form a small ball, and then fizzes rapidly.

Potassium: Quickly melts to form a ball, burns violently with sparks and a lilac flame, disappearing rapidly, often with a small explosion.

All the alkali metals will float on water, as they are less dense than water.

Your turn:

2 Lithium, sodium and potassium are metals in group 1 of the periodic table. They are good conductors of heat and electricity. The freshly-cut metals are shiny.

(a) (i) Give another physical property of all three of these metals.

(1)

(ii) Explain, in terms of electrons in their atoms, why lithium, sodium and potassium are in group 1 of the periodic table.

(2)

(b) A small piece of potassium is added to water.

(i) Describe what you would **see** in this reaction.

(2)

(ii) Which of these is the balanced equation for this reaction?

Put a cross (☒) in the box next to your answer.

(1)

- A $2\text{K} + 2\text{H}_2\text{O} \rightarrow \text{K}_2\text{O} + 2\text{H}_2$
- B $2\text{K} + \text{H}_2\text{O} \rightarrow \text{K}_2\text{O} + \text{H}_2$
- C $4\text{K} + 3\text{H}_2\text{O} \rightarrow 4\text{KOH} + \text{H}_2$
- D $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$

(c) There is an increase in reactivity of these group 1 metals from lithium to potassium.

Explain this increase in reactivity.

(2)

Answers:

1 Lithium, sodium and potassium all react with cold water.

(a) Lithium, sodium and potassium are in group 1 of the periodic table.

Complete the sentence by putting a cross (☒) in the box next to your answer.

These elements are

- A halogens
 B noble gases
 C transition metals
 D alkali metals

(1)

(b) When sodium is added to cold water, it forms a molten ball which floats on the surface of the water.

Explain why this happens.

Sodium reacting with water is an exothermic reaction (releases heat). Sodium has a low melting point, so melts. It is less dense than water so it floats.

(2)

(c) Write the balanced equation for the reaction of sodium with water.



(3)

* (d) Sodium and potassium react with cold water to give similar products.

The electronic configuration of sodium is 2.8.1.

The electronic configuration of potassium is 2.8.8.1.

Explain the similarities and differences in the way sodium and potassium react with cold water by considering their reactions and their electronic configurations.

(6)

Similarities:

Both metals are in group 1, so they both have 1 electron in the outer shell. This means they both react in a similar way.

Both fizz and produce hydrogen.

Both produce metal hydroxides (alkaline solution)

Differences:

Potassium is more reactive – it will catch fire with a lilac flame.

The outer electron of potassium is further away from the nucleus (there are more shells) - so there is less attraction from the nucleus.

This means it is easier for the outer electron of potassium to be lost .

Remember to write your answer in good English using these points.

Answers:

- 2 Lithium, sodium and potassium are metals in group 1 of the periodic table.
They are good conductors of heat and electricity.
The freshly-cut metals are shiny.

(a) (i) Give another physical property of all three of these metals.

Low melting point/low boiling point/soft

(1)

(ii) Explain, in terms of electrons in their atoms, why lithium, sodium and potassium are in group 1 of the periodic table.

(2)

They all have 1 electron in the outer shell

(b) A small piece of potassium is added to water.

(i) Describe what you would see in this reaction.

(2)

Fizzing/bubbles

Potassium floating/moving across the surface
of the water

Melts/forms ball/lilac flame

(ii) Which of these is the balanced equation for this reaction?

Put a cross (☒) in the box next to your answer.

(1)

- A $2K + 2H_2O \rightarrow K_2O + 2H_2$
- B $2K + H_2O \rightarrow K_2O + H_2$
- C $4K + 3H_2O \rightarrow 4KOH + H_2$
- D $2K + 2H_2O \rightarrow 2KOH + H_2$

(c) There is an increase in reactivity of these group 1 metals from lithium to potassium.

Explain this increase in reactivity.

(2)

Increase in the number of shells, as the atom
gets larger

Less attraction from the nucleus for the outer
electron so it is easier to lose

Answers:

*(d) Group 1 of the periodic table contains the alkali metals lithium, sodium and potassium. The alkali metals show a pattern in their reactivity with water. This pattern is shown when small pieces of lithium, sodium and potassium are added separately to water.

Describe the reactions and what would be seen and explain the pattern in reactivity.

You may include equations as part of your answer.

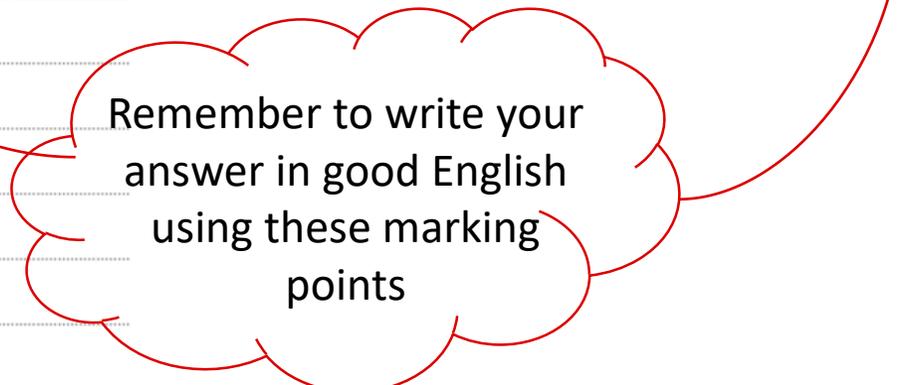
(6)

Description:

- Fizzing/bubbles
- Float/move on the surface
- Produce hydrogen and a metal hydroxide solution
- Metal gets smaller/disappears
- Reactivity increases as move down the group – potassium reacts more than sodium and lithium
- Sodium and potassium melt, potassium gives a lilac flame
- Universal Indicator turns the water blue/purple

Explanation:

- Group 1 metals react by losing one electron
- Electron is more easily lost as you go down the group as the outer electron is further away from the nucleus
- There is less attraction between the nucleus and the outer electron



Remember to write your answer in good English using these marking points

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