STUDY PACK 2 A

Pearson Edexcel

GROUP 1

ALKALI METALS

Lithium	2.1
Sodium	2.8.1
Potassium	2.8.8.1
Rubidium	2.8.18.1
Cesium	2.8.18.18.1
Francium	2.8.18.32.18.1

Since 2005
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The Group I Elements (alkali metals)
(Lithium, Sodium & Potassium)

The Common properties of Alkali metals are as follows,

- They are all reactive metals. Sodium and Potassium has to be stored under oil to stop them reacting with oxygen & water vapour in the air.
- They are soft & can be cut with a knife.
- They have low densities. Lithium, sodium & potassium all float on water.
- They form uni positive cations. (Li^+, Na^+, K^+)
- They all react strongly & directly with non-metals to form salts. These salts are all white, crystalline, ionic solids that dissolve in water.

The reaction of the alkali metals with water.

The increase in chemical reactivity with increasing atomic number down the group can be illustrated by the reactions of the alkali metals with water.

All the alkali metals react spontaneously with water to produce hydrogen gas & the metal hydroxide. The reactions are **exothermic** (heat is given out)

Metal + water ⟶ **metal hydroxide + hydrogen gas**

Element	Reaction with water	Reactivity
Lithium		Reacts steadily
Sodium		Reacts strongly
Potassium		Reacts violently

Observations:

All float on water. Solid dissolves and a gas is given off. Sodium & Potassium reacts vigorously, turns to a silvery ball and fizzes around water resulting an alkaline solution.

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The above similarities provide evidence for their recognition as a family of elements belonging to the same group.

The reaction of the alkali metals with Air.

The alkali metals exhibit a distinct gradation in reactivity when exposed to air or oxygen and form their metal oxides. (Oxides, peroxides, super oxides) All these oxides are white powders. Metallic oxides are usually **basic** hence dissolves in water to form **alkaline solutions**.

Metal lithium, unlike the others in the group needs to be warmed in order metal oxide to form. Sodium & Potassium will react with oxygen when exposed to air.

$4\,Li + O_2 \xrightarrow{\triangle} 2\,Li_2O$ tarnishes slowly

$4\,Na + O_2 \longrightarrow 2\,Na_2O$ tarnishes quickly

$4\,K + O_2 \longrightarrow 2\,K_2O$ tarnishes very quickly

- **Explain why the relative reactivities of the elements in group I increase down the group?**

Down the group the distance between the nucleus and the outermost electron increases due to the increase energy levels/ shells. This results in decrease effective nuclear attraction to the outermost electron down the group.

As the metal losses electron/s to gain the noble gas configuration down the group the ability to lose electrons increases due to decrease effective nuclear attraction. Thus the reactivity increases down the group.

- **Base on the above understanding of group I chemistry predict the properties of the other alkali metals below Potassium in group I (Rb,Cs & Fr)**

As the trend in reactivity increases down the group, they react much vigorously and tarnishes much rapidly when compared to the elements above them thus exhibit much more violent and explosive reactions.