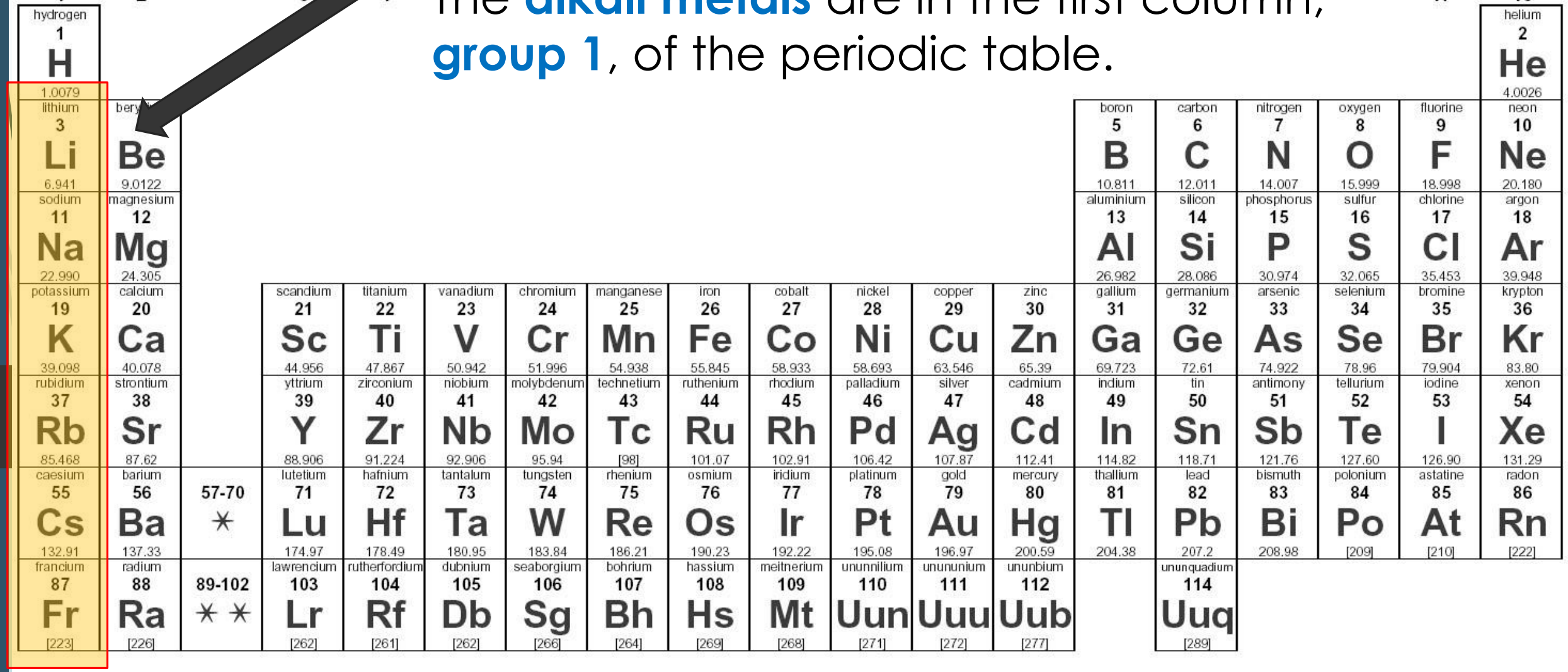
THE ALKALI METALS

The **periodic table** contains all the known elements.

The **alkali metals** are in the first column, **group 1**, of the periodic table.



Cutting into sodium

Potassium reacting with water

DEMO: REACTION OF THE ALKALI METALS WITH WATER

Name of alkali metal	Appearance before reaction	Observations for reaction with water
Lithium	*Dull dark grey on outside, but shiny and silver when cut.*	*Floats and moves around, fizzing. The solution turns blue when universal indicator is added.*
Sodium	*Dull light grey, but shiny silver when cut.*	*Floats and moves around. Fizzes and melts into a sphere. Solution turns blue when UI solution is added.*
Potassium	*Dull dark grey, but shiny inside. Tarnishes very quickly.*	*Floats and moves around quickly, fizzing and crackling. Gives off a lilac flame as it reacts. Solution turns blue when UI solution is added.*

1 Can you spot a pattern in the reactions? *The reaction is more vigorous going down the column/group, but they all react in a similar way and react quite violently with water.*

2 Why are they called the "alkali metals"? *The y produce an alkali when they react with water, shown by the blue colour when universal indicator solution is added.*

Conclusion

Elements in the same group of the periodic table react in a similar way.

The alkali metals are **all very reactive**, and react quickly with oxygen in the air and with water.

REACTION WITH OXYGEN IN THE AIR:

The shiny metal quickly **tarnishes** (goes dull) as it reacts with **oxygen in the air** when it is cut. The dull layer is the **metal oxide** formed. This is an **oxidation** reaction.

metal + oxygen → metal oxide

eg. *lithium + oxygen → lithium oxide*

sodium + oxygen → sodium oxide

REACTION WITH WATER:

The metal react quickly with water producing **hydrogen gas** and a **metal hydroxide** (an alkali).

metal + water → metal hydroxide + hydrogen

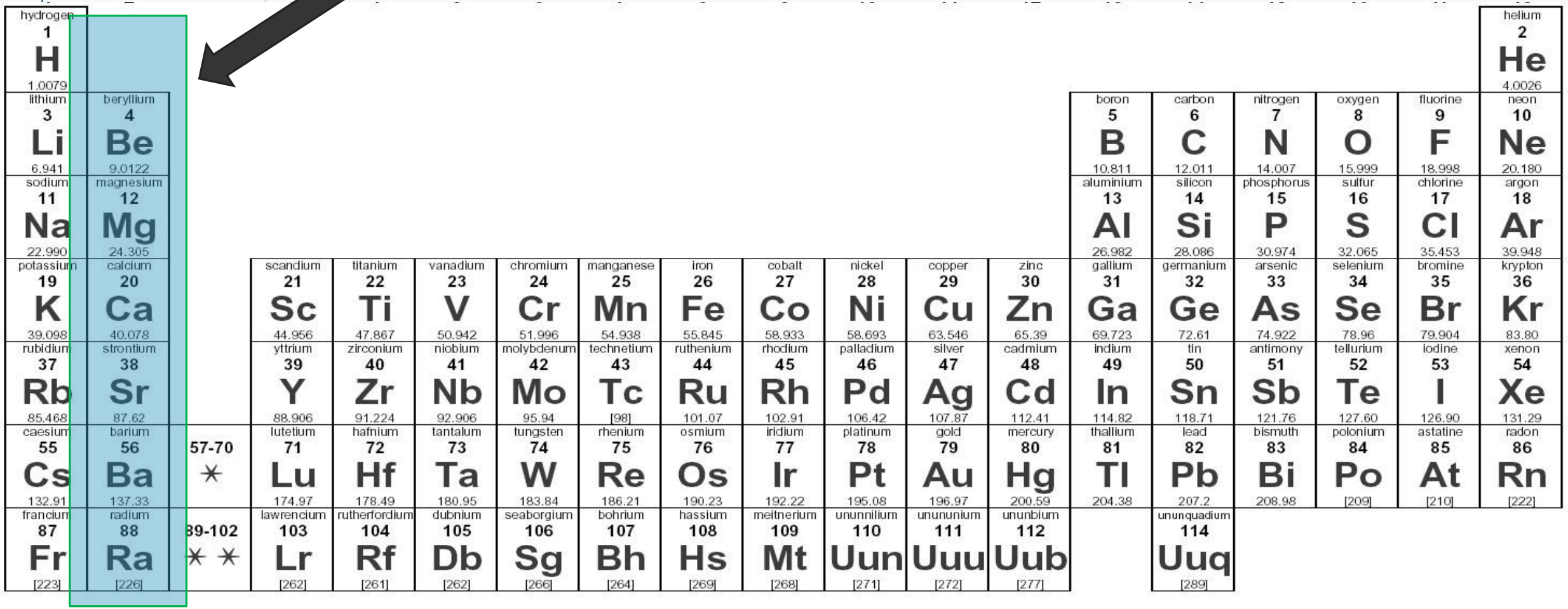
eg. *lithium + water → lithium hydroxide + hydrogen*

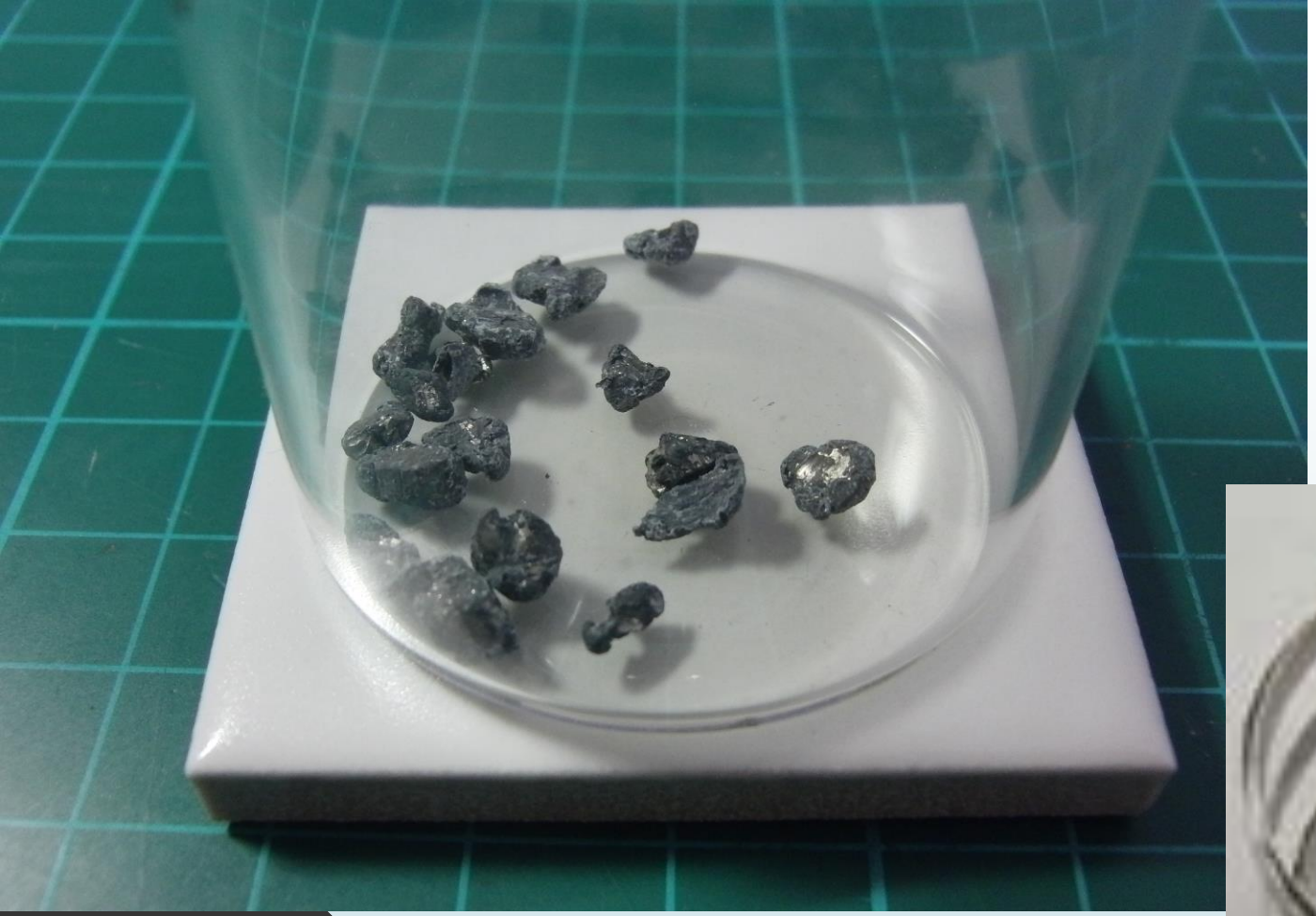
sodium + water → sodium hydroxide + hydrogen

potassium + water → potassium hydroxide + hydrogen

THE ALKALINE EARTH METALS

Group 2 (column 2) of the periodic table contains the **alkaline earth metals**.



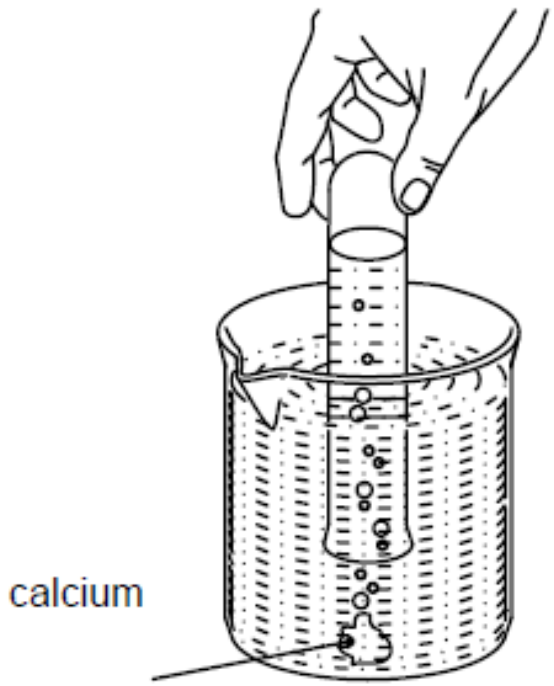


We only need to know about calcium and magnesium at this stage.

magnesium ribbon

PRACTICAL: REACTING CALCIUM WITH WATER

A lump of calcium is added to water and a test tube full of water is held above the reaction.



Observations

The calcium sinks to the bottom and bubbles of gas are produced and fill the test tube. The solution gradually turns white and cloudy.

When a lit splint is held above the mouth of the test tube, a squeaky pop is heard.

When the solution is tested with universal indicator solution, it turns blue.

Conclusion

Calcium reacts with water in a similar way to the alkali metals, but more gently. **Hydrogen** gas and an **alkali** is produced.

calcium + water → calcium hydroxide + hydrogen

The calcium hydroxide produced is not very soluble and causes the solution to turn white and cloudy.

OTHER METALS:

Some other metals react with water too, but much more slowly than the alkali metals or calcium. Some only react when the water is heated or even turned to steam. Magnesium is an example of a metal that only reacts with steam and not cold water.

Metals only react with water if they are more **reactive than hydrogen**.

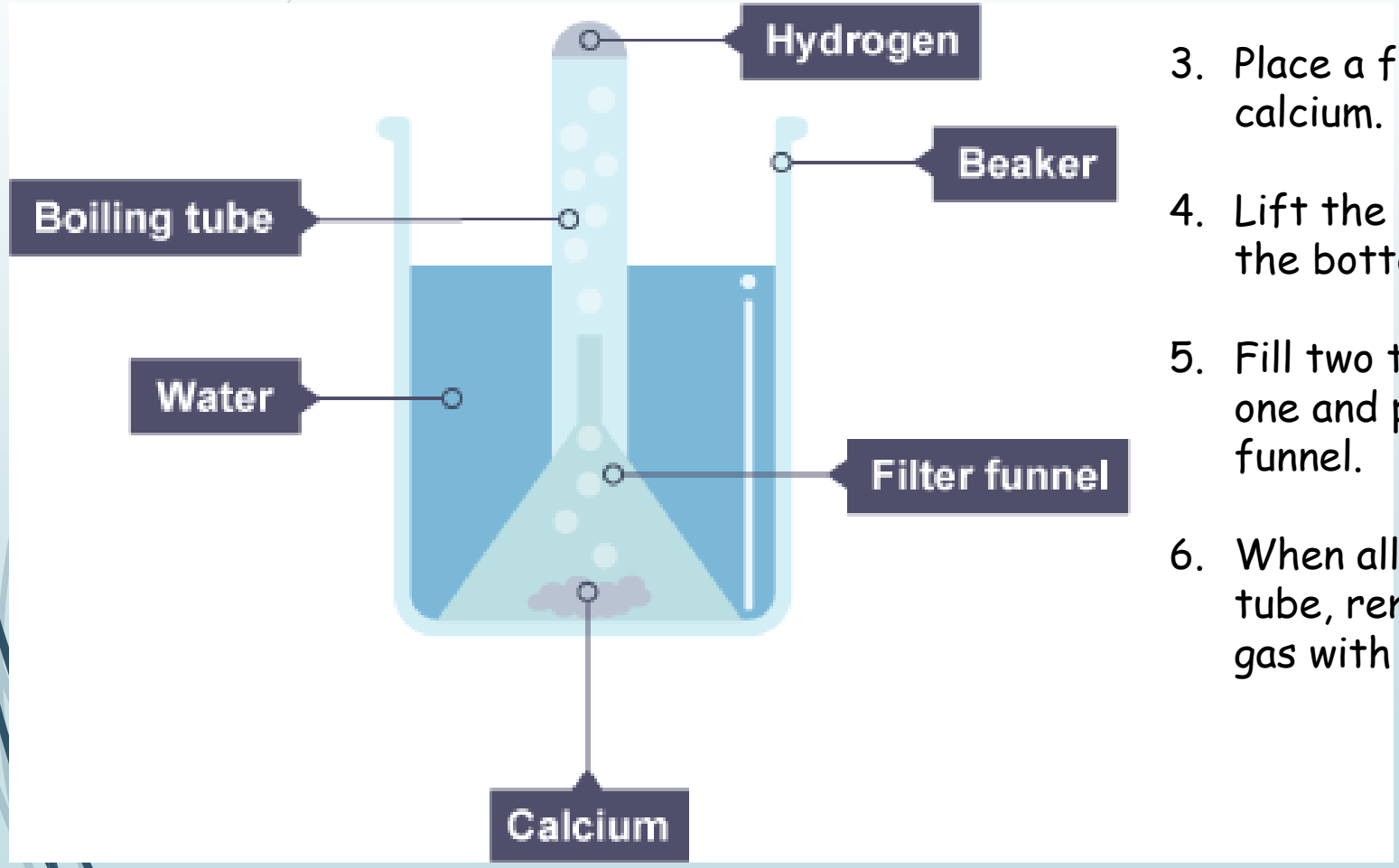
Task: write a word equation for the following reaction

When reacting calcium with water, it will form a hydroxide group and hydrogen gas.

Practical aims:

- Safely react calcium with water
- Collect and test for the presence of hydrogen gas

Reacting calcium with water



1. Fill your beaker half-way with water,
2. Place several granules of calcium to the beaker.
3. Place a funnel upside down over the calcium.
4. Lift the funnel up slightly to suction to the bottom of the beaker.
5. Fill two test tubes with water. Invert one and place over the top of the funnel.
6. When all of the water has left the test tube, remove the tube and secure the gas with a bung.

PRACTICE TIME –ASSESS YOURSELF .....WHAT DO U KNOW?

1. Sodium is:

- ❑ A compound
- ❑ An element
- ❑ A gas

2. The formula for sodium hydroxide is:

- ❑ NaOH
- ❑ NaO
- ❑ SOH

3. The chemical symbol for potassium is:

- ❑ P
- ❑ Pt
- ❑ K

4. Which of the following is <u>not</u> a hydroxide?

- ❑ LiOH
- ❑ NaOH
- ❑ $Ca(OH)_2$
- ❑ Na_2CO_3

5. Fill in the blanks using the words provided:

hydroxide purple hydrogen alkaline squeaky-pop splint

When group 1 metals react with water they produce _____ gas and a metal _____. We can test for the gas by holding a lit _____ to it. If the gas is hydrogen it will make a _____-_____ sound. The metal hydroxide dissolves in the water to make the solution _____. Alkaline solutions turn blue or _____ when Universal Indicator is added.

6. All group 1 metals react with water to produce a metal hydroxide and hydrogen. Complete the following word equations for metal hydroxides reacting with water.

Example: lithium + water → lithium hydroxide + hydrogen

sodium + water → sodium hydroxide + _____

potassium + water → _____ hydroxide + _____

rubidium + _____ → _____ _____ + _____

7. Potassium in the school science lab is handled by the teacher behind a safety screen. Suggest why Rubidium and Caesium are not used in school science lessons.

_____

Write the word equations below:

Potassium + Water → Potassium hydroxide + Hydrogen

Lithium + Water → Lithium hydroxide + Hydrogen

Sodium + Water → Sodium hydroxide + Hydrogen

EXT: Balance the following equations:

$2K + 2H_2O \rightarrow 2KOH + H_2$

$2Na + 2H_2O \rightarrow 2NaOH + H_2$

$2Li + 2H_2O \rightarrow 2LiOH + H_2$

Word equations

When you react a metal with a non-metal in cold water it forms a hydroxide group (OH) and hydrogen gas

For example:

Lithium + water → lithium hydroxide + hydrogen

Complete the word equations given below:

Potassium + ? → Potassium hydroxide + Hydrogen

Lithium + Water → ? + Hydrogen

? + Water → Sodium hydroxide + Hydrogen

EXT: Balance the following equations:

$K + 2H_2O \rightarrow 2KOH + H_2$

$2Na + H_2O \rightarrow 2NaOH + H_2$

$2Li + 2H_2O \rightarrow LiOH + H_2$