



## Week 5: Acids and Metals

### Lesson 1: Metals and water

#### Complete Starter (in back of class jotter)

##### Starter

1. Name the three gases that contribute to acid rain
2. Name two causes of these gases being produced
3. Describe two effects of acid rain



##### Learning Outcomes

By the end of this lesson you should be able to:

- Describe the relative reactivity of metals with water
- Name products of reactions between metals and water
- Write word equations of reactions between metal and water

##### Success Criteria

You will have been successful in this lesson if you:

1. Read and learn the notes given
2. Watch the links provided
3. Complete questions provided

If you have any questions about the content of this lesson, you should ask your class teacher either through your class MS team or via email.

##### What to do

Complete tasks 1-6 - This involves watching selected videos, reading and highlighting your Pupil Notes, completing and submitting Homework 24 and answering questions in your class jotter.

Once completed, Extension activities and the answers to today's starter can be found at the end of the document.



## Task 1: Watch video on Metals and Water

Watch [this video](#)

## Task 2: Read the following passage and then answer the following questions in your class jotter under the heading Metals and Water

- 1) Potassium and sodium are metals that react vigorously with water even when a small amount of each metal is used.

The word equation of a metal reacting with water is:

Metal + water  $\rightarrow$  Metal hydroxide + hydrogen

What could you be used to test the pH of the products of this reaction?

- 2) James investigated how reactive some metals are when they react with water and the following observations were made:

Metal	Reaction with water
<b>lithium</b>	Bubbles of gas are given off quite quickly. When tested with universal indicator the water is now alkaline.
<b>sodium</b>	The sodium melts and skims over the surface producing a stream of small bubbles. Sometimes a yellow-orange flame appeared.
<b>potassium</b>	Potassium immediately produces a lilac flame as it skims around the surface making a fizzing noise.

- a) Which of these metals is the most reactive with water?  
b) Which of these metals is the least reactive with water?
- 3) James then reacted four other metals with water and the following observations were made:

Metal	Reaction with water
<b>magnesium</b>	Reacts slowly with cold water but reacts quickly with steam.
<b>copper</b>	No reaction.
<b>silver</b>	No reaction.
<b>gold</b>	No reaction.

Copper is used in plumbing and silver and gold in jewellery. Why are these unreactive metals suitable for such uses?

**Task 3: Read and highlight notes on Metals and Water (pg 46 and 47 printed notes)**

These do not need to be copied into jotter but read through and then highlight key sections of pages mentioned in printed notes.  
If you wish to add any detail to your printed notes, feel free.

## Reactions of Metals

### Metals and water

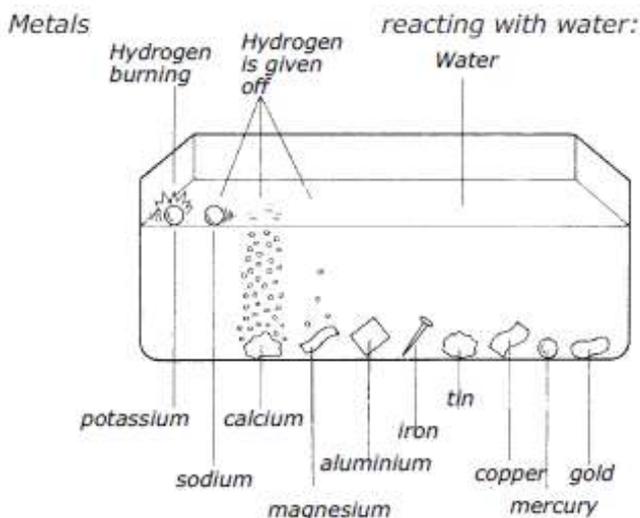
When calcium is added to water there are many signs of a chemical reaction. The water fizzes as a gas is made. The gas burns with a pop-it is hydrogen. The water gets very warm- chemical energy is being changed into heat energy during the reaction. Not all metals react with water.



**H<sub>2</sub>O**  
Water has the chemical formula H<sub>2</sub>O. This shows that in water there are two atoms of hydrogen for every one atom of oxygen.

### A reactivity series

We can use the metal- water reaction to make up a reactivity series for metals. Only 4 of the metals used in our labs react with water. Potassium reacts rapidly with water, so much energy is produced that the potassium burns. Sodium also reacts rapidly with water- though it produces less energy than potassium does.



Calcium reacts with water and magnesium reacts slowly. In all cases hydrogen gas is made. So Potassium is more reactive than sodium. We can make a reactivity series:



**NaOH**  
When sodium reacts with water it makes sodium hydroxide and hydrogen. Sodium hydroxide has the formula NaOH.

## Metal and water reaction

On page 42 we saw that calcium is one of the few metals which reacts with water.

Hydrogen gas is one of the products of the reaction.

The general word equation to represent the reaction when a metal reacts with water is:



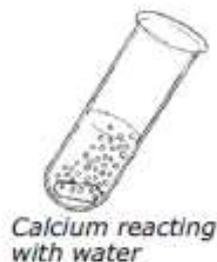
When the solution left in the test tube above was tested with universal indicator it was found to be an alkali.

It was is a solution of calcium hydroxide.

A word equation for the reaction is



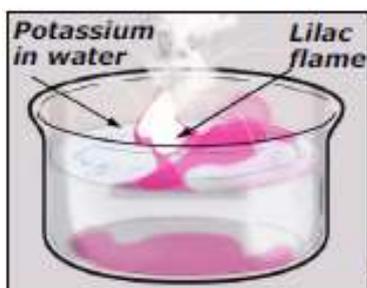
Calcium hydroxide is an alkali. In fact all hydroxides are alkalis.



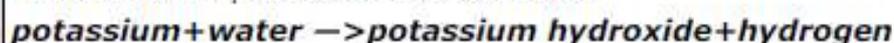
Calcium reacting with water



Aluminium is the main metal used to make aircraft because it is so light.



Potassium is very reactive with water. Again hydrogen is made when potassium reacts with water. The solution left behind is strongly alkaline-it is a solution of potassium hydroxide. The word equation for the reaction between potassium and water is:



## Group One- The alkali metals

On page three we saw that elements in the same group in the periodic table have similar chemical properties.

Group one show this very well. All of the group one metals react with water to produce an alkali and hydrogen, because of this they are known as the alkali metals.

The further down the group the more reactive the metals are with water. Lithium, at the top of the group fizzes quietly in water, the reaction is:



Potassium in the middle burns brightly in water, whilst caesium at the bottom of the group explodes on contact with water.

Li lithium
Na sodium
K potassium
Rb rubidium
Cs caesium
Fr francium

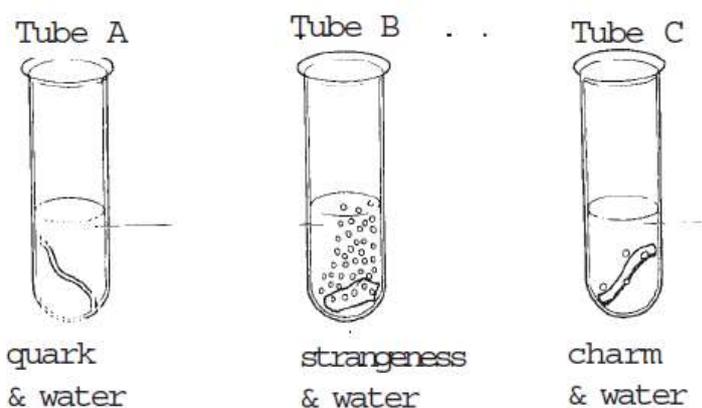


Titanium is the metal used to make military jets as it is stronger than aluminium.

## Task 4: Questions to try

### Self Check 11

- 1) Comparing the metals copper, sodium, magnesium, calcium.
  - a) Which does not react with water?
  - b) Which reacts most quickly with water?
  - c) Which has the slowest reaction with water?
- 2) A scientist discovers 3 new metals called quark, strangeness and charm. She puts the 3 metals in water and this is what she sees:



- a) Which metal gives the fastest reaction?
  - b) Which metal gives the slowest reaction?
  - c) Which metal does not react with water?
  - d) What gas are the bubbles in tubes (b) + (c) made of?
- 3) Write word equations for the following reactions.
    - a) Sodium reacting with water
    - b) Lithium reacting with water
    - c) Potassium reacting with water
    - d) Calcium reacting with water

**Self Check 11 Answers will be published on S2  
Chemistry Team on Wednesday 17<sup>th</sup> February.**

**Task 5: Complete Homework 24 Metals and Water**  
**Homework Deadline of Friday 19<sup>th</sup> February 1pm for completing Homework 24.**

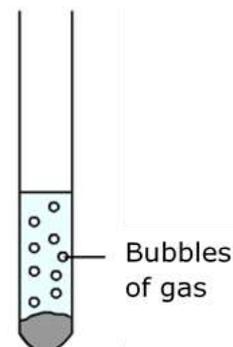
Photos of your work should be submitted to your class teacher through your class Team or normal method of communication.

**Metals and water**

**24**

1) When a piece of sodium is put into water it reacts to make sodium hydroxide and hydrogen.

- Write a word equation for the reaction.
- How would you show that hydrogen is made in the reaction?

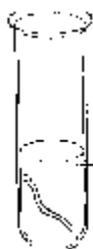


2) Write word equations for the following reactions.

- Sodium reacting with water
- Lithium reacting with water
- Potassium reacting with water

3) Look at the diagram below which shows three metals, X, Y and Z in water.

**Metal X**



**Metal Y**



**Metal Z**



- Which metal gives the fastest reaction?
- Which metal gives the slowest reaction?
- Which metal does not react with water?
- Put the metals in order of reactivity, starting with the most reactive.

4) Hardness is the ability of an object to resist scratching. Scientists have arranged minerals in order of hardness in Mohs' scale. On this scale talc is the softest mineral with a hardness of 1. Diamond is the hardest at 10. Glass is in the middle of the scale at 5 whilst quartz has a hardness of 7.

Present this information in a table.

**Hint:** Look back at Skills from Week 3 for advice on presenting data in a table.



## Task 6: Correct today's starter

### Starter answers

1. Carbon dioxide, sulphur dioxide and nitrogen dioxide
2. Burning of fossil fuels and sparking of air in car engines
3. 2 of: Corrosion of buildings, corrosion of metal structures, soil and sea acidification, plant growth affected, loss of aquatic life

### Extension activities

Once completed all your Chemistry work, here are some links to look further into the Acids and Metals topic:

- Watch [this video](#)
  - Watch this short video simulation showing the reactions of five different metals with water.
  - After watching, write out word equations for the metals that manage to react with water.
  - Note which metals (if any) do not react with water and from this and the results of the experiments construct a mini reactivity series. Compare this to the reactivity series within your notes to see if yours is correct.