



## Week 5: Acids and Metals

### Lesson 2: Metals and acids

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

##### Starter

Write word equations for the following three reactions:

- 1) Sodium reacting with water
- 2) Potassium reacting with water
- 3) Calcium reacting with water



##### Learning Outcomes

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

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

##### 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 1-7 - This involves watching selected videos, reading and highlighting your **Pupil Notes**, answering questions in your class jotter and completing Homework 25 (this will be self-assessed).

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

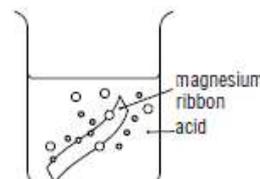
## Task 1: Watch video on Metals and Acids

Watch [this video](#) which demonstrates the different reactivity of metals with acid.

[This picture](#) shows a close-up of the reaction between Zinc and Hydrochloric Acid.

## Task 2: Read the following passage and answer the Questions under the heading Metals and Acid (in your class jotter)

Dawn and Robert investigated the effect of concentration on how quickly magnesium dissolved in acid. The concentration was changed by watering down the acid given to them.



The reaction rate was measured by timing how long it took for a short length of magnesium ribbon to dissolve in the acid.

To make it a fair test they changed the concentration of the acid but kept everything else the same for each experiment. Their results are given in the table below:

<i>Concentration (%)</i>	<i>Time taken for magnesium ribbon to dissolve (s)</i>
10	125
25	80
50	20
75	8
100	5

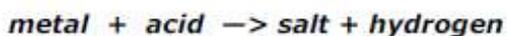
- 1) Name the other variables that Dawn and Robert have to keep constant in this experiment.
- 2) What is the effect of concentration on the rate of reaction?

## Task 3: Read and highlight notes on Metals and Acids (pg 48 and 49 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.

### Metals and acids

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



When magnesium is added to a test tube of acid the mixture fizzes- a gas is made in the reaction. The solution in the test tube gets warm-another sign that a chemical reaction is happening. The chemical energy in the magnesium and acid is being changed into heat energy. The gas produced burns with a pop. This means that it is hydrogen.

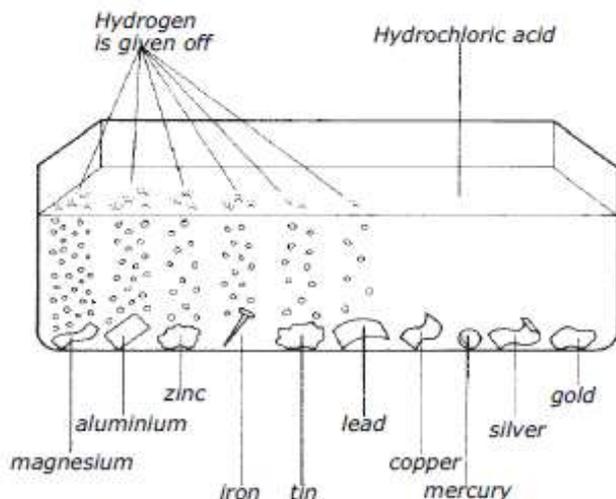
$H_2SO_4$

Sulfuric acid has the chemical formula  $H_2SO_4$ . This shows that it contains two atoms of hydrogen, 1 atom of sulphur and 4 atoms of oxygen.

### Another reactivity series

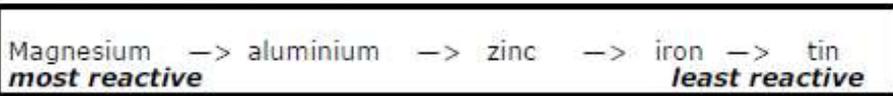
We can use the reaction between metals and acid to get more information about the reactivity series. Potassium, sodium, and calcium react violently with acid. When we put other metals into water we find the results below.

*Metals reacting with acid:*

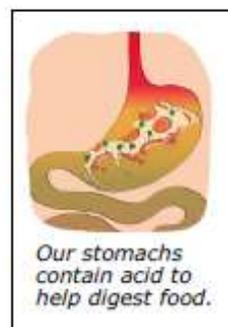


This shows that magnesium is more reactive than aluminium, which is more reactive than zinc.

We get the following reactivity series:

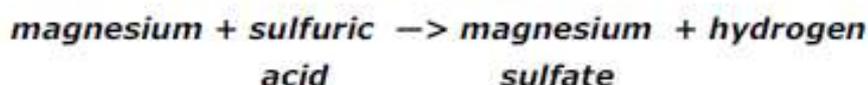
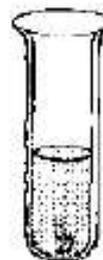


The metals copper, mercury, silver and gold **do not** react with acid.

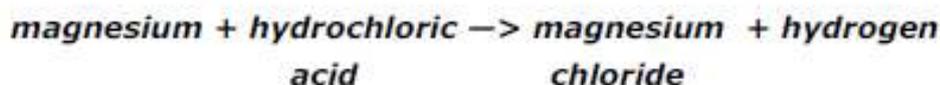


## Metals and acids- reaction

We know that when magnesium is added to a test tube of sulfuric acid the mixture fizzes- a gas is made in the reaction. The gas produced burns with a pop. This means that it is hydrogen. The solution left behind can be evaporated to produce a salt - magnesium sulfate. The word equation for the reaction is:



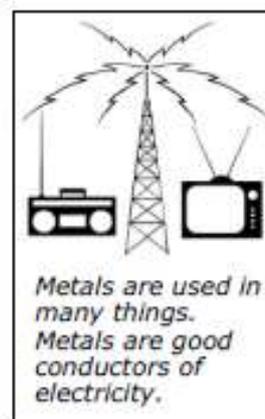
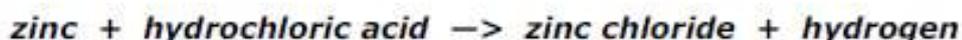
If magnesium is added to hydrochloric acid a similar reaction occurs- this time the salt produced is magnesium chloride. The word equation for the reaction is :



Similarly, if zinc is reacted with sulfuric acid then zinc sulfate and hydrogen are produced.



Zinc also reacts with hydrochloric acid, again hydrogen gas is made. The salt made in this reaction is zinc chloride



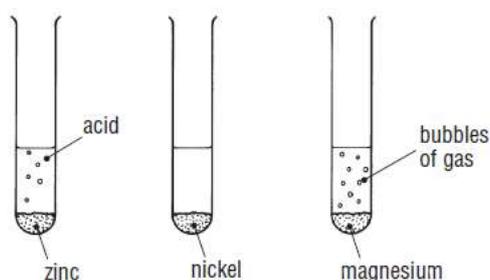
*Modern water pipes are made from copper*

## Lead in Water

Ancient water pipes were made from the element lead. This was not a good idea as some of the lead from the pipes dissolved in the water. This may seem odd as lead does not react with water. In fact water is naturally slightly acidic. The lead reacted with the acid in the water. Lead is a poisonous chemical. Modern water pipes are made from copper which is much safer.

**Task 4: Complete the following Questions under the heading Metals and Acid (in your class jotter)**

- 1) Look at the 3 test-tubes in the diagram below. They show what happens when you add acid to the metals zinc, nickel and magnesium.



- a) Put the 3 metals in order of reactivity (put the **most** reactive **first**).
- b) Iron is more reactive than nickel but less reactive than zinc. Draw a test-tube showing what happens when acid is added to iron.
- 2) The metals can be put into a Reactivity Series, this tells us the relative reactivity of metals and also tells us what metals reacts with acid. You are told that copper does not react with water.
- a) Predict the products formed, if any, when copper is added to sulphuric acid.
- b) Write a word equation for the reaction of magnesium with sulphuric acid.



## Task 5: Questions to try

### Self Check 12

- 1) Many metals react with acids to make hydrogen gas.
  - a) Name one metal which does not react with the acids which you used.
  - b) How could you prove that the gas produced was hydrogen?
- 2) Copy and complete the following sentences -
  - a) Hydrogen is made when some ----- are added to acids or -----.
  - b) Both ----- and ----- contain Hydrogen.
  - c) Metals usually react quicker with-----than they do with -----.
- 3) Give word equations for the following reactions
  - a) Magnesium and hydrochloric acid
  - b) Calcium and sulphuric acid
  - c) Zinc and nitric acid
  - d) Aluminium and nitric acid
  - e) Magnesium and sulphuric acid
  - f) Zinc and hydrochloric acid

**Self Check 12 Answers will be published on S2 Chemistry Team along with a teacher explaining the answers to Homework 25 in a video on Wednesday 17<sup>th</sup> February.**

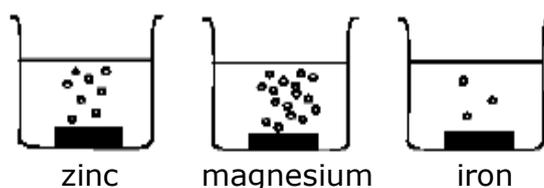
## Task 6: Complete Homework 25 Metals and Acids (you will self-assess this)

### Metals and acids

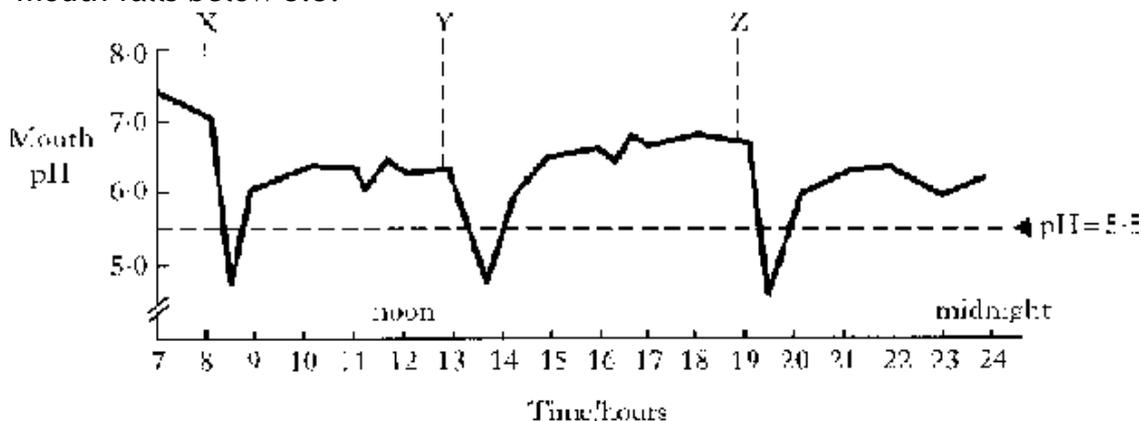
**25**

1) Lesley was given three metals: **A, B, & C.**

She did an experiment to investigate **how reactive** these metals were with acid. To compare the reactivity of these metals she set up 3 beakers containing dilute sulphuric acid. She added the 3 metals as shown in the diagram.



- a) Name, and give the test for the gas made in the experiment.
  - b) Use the results of the experiment to put the three metals in order of reactivity, most reactive first.
  - c) Name a metal which will not react with sulphuric acid.
- 2) Give word equations for the following reactions
- a) Magnesium and hydrochloric acid
  - b) Calcium and sulphuric acid
  - c) Zinc and nitric acid
- 3) Kirsty eats three meals a day. The graph shows how her mouth's pH changes during the day. X, Y, and Z are meal times. Tooth decay occurs if the pH of the mouth falls below 5.5.



- a) What happens to the pH of the mouth after meals?
- b) Why are most toothpastes alkaline?



## Task 7: Correct today's starter

### Starter answers

- 1) Sodium + Water  $\rightarrow$  Sodium Hydroxide + Hydrogen
- 2) Potassium + Water  $\rightarrow$  Potassium Hydroxide + Hydrogen
- 3) Calcium + Water  $\rightarrow$  Calcium Hydroxide + Hydrogen

## Extension activities

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

- S-cool website - [Reactions of metals](#)
  - Read through the notes on the webpage and take down 4 bullet points on each of the reactions covered this week: the reactions of metals with acid and metals with water
- BBC Bitesize website - [Reactions of metals revision guide](#)
  - Read through page 1 of the revision guide and take note of the two word equations within the notes. (There is one for the reaction with water and another for the reaction with acid)
  - Notice what product is produced in both reactions and explain in your jotter how you would test for the presence of this substance in the lab.