

**Home learning activities**

Subject
Science
Year Group
Year 8
Unit of work / Knowledge organiser
Reactivity
Activities
<ul style="list-style-type: none"><li>• Complete the 'Knowledge Check' by clicking on the link below (Mr Tobi has also emailed this link out to you): <a href="https://forms.office.com/Pages/ResponsePage.aspx?id=tWqUKrjGMEuM3bZvypd0-1JR5WsjulFPvbjl4VXu0Y1UNTAwnNVRHNjVYRDRQWFNPODdKRURZVVpFRC4u">https://forms.office.com/Pages/ResponsePage.aspx?id=tWqUKrjGMEuM3bZvypd0-1JR5WsjulFPvbjl4VXu0Y1UNTAwnNVRHNjVYRDRQWFNPODdKRURZVVpFRC4u</a></li><li>• Read through Sections 1-5 of the 'Knowledge Organiser' on 'Reactivity'.</li><li>• Make careful and details notes on Sections 1-5 of the 'Knowledge Organiser' on 'Reactivity', including writing out the 'Key Terms' from Sections 1 and the 'Reactivity Series' in Section 2.</li><li>• Describe, in your own words, what is meant by a 'displacement reaction', without looking at your earlier notes from Section 1.</li><li>• Read the 'Key Revision Facts' on 'Metals and Acids' sheet carefully.</li><li>• Without looking at the 'Key Revision Facts' sheet, give two examples each of 'reactive' and 'unreactive' metals.</li><li>• Complete the 'Reactivity Series' Tasks 1-3 using the 'Knowledge Organiser' and 'Key Revision Facts' sheets to help you; the answers are provided at the end, but do not look at these until you have tried to complete the work yourself (<b>be strict with yourself here</b>).</li></ul>
Where do you complete the work?
In Study Books.

What to do if you finish the work? (Extension activity)

- Complete the exam question on 'Acids and Metals Reactions' using the 'Knowledge Organiser' and 'Key Revision Facts' sheets to help you. Use the mark scheme (**once you have tried the question**) to mark your answers carefully.

These websites might help:

- BBC Bitesize -> Secondary -> KS3 -> Science -> Chemistry -> Chemical Reactions and Tests -> Types of Reaction

If you are struggling with your work or if you have finished.

**Please email your classroom teacher directly using the email list found in the Home Learning section of the website.**

### Section 1: Key Terms

1 Metal oxide	Metals react with oxides to produce metal oxides. This is an oxidation reaction.
2 Displacement reaction	A <b>more reactive metal</b> can <b>displace</b> a <b>less reactive metal</b> from a <b>compound</b> .
3 Oxidation	Two definitions: Chemicals are oxidised if they <b>gain oxygen</b> in a reaction. Chemicals are oxidised if they <b>lose electrons</b> in a reaction. (HT)
4 Reduction	Two definitions: Chemicals are reduced if they <b>lose oxygen</b> in a reaction. Chemicals are reduced if they <b>gain electrons</b> in a reaction. (HT)
5 Acid	A chemical that <b>dissolves in water</b> to produce <b>H<sup>+</sup> ions</b> .
6 Base	A chemical that <b>reacts with acids</b> and <b>neutralise</b> them. E.g. <b>metal oxides, metal hydroxides, metal carbonate</b>
7 Alkali	A <b>base</b> that <b>dissolves in water</b> . It produces <b>OH<sup>-</sup> ions</b> in solution.
8 Neutralisation	When a <b>neutral solution</b> is formed from reacting an <b>acid</b> and <b>alkali</b> . General equation: <b>H<sup>+</sup> + OH<sup>-</sup> → H<sub>2</sub>O</b>
9 pH	A scale to <b>measure acidity/ alkalinity</b> . A <b>decrease of one pH</b> unit causes a <b>10x increase in H<sup>+</sup> ions</b> . (HT)
10 Strong acid (HT)	A strong acid is <b>completely ionised</b> in solution. E.g. <b>hydrochloric, nitric</b> and <b>sulfuric</b> acids.
11 Weak acid (HT)	A weak acid is <b>only partially ionised</b> in solution. E.g. <b>ethanoic, citric</b> and <b>carbonic</b> acids.

### Section 2: Reactivity

Element	Reaction	Reactivity
1 Potassium	When potassium is added to <b>water</b> , the metal <b>melts</b> and floats. It moves around very quickly. The metal is also <b>set on fire</b> , with sparks and a <b>lilac flame</b> .	
2 Sodium	When sodium is added to <b>water</b> , it <b>melts</b> to form a ball that moves around on the surface. It <b>fizzes rapidly</b> .	
3 Lithium	When lithium is added to <b>water</b> , it floats. It <b>fizzes steadily</b> and becomes smaller.	
4 Calcium	<b>Fizzes quickly</b> with dilute <b>acid</b> .	
5 Magnesium	<b>Fizzes quickly</b> with dilute <b>acid</b> .	
6(Carbon)		
7 Zinc	<b>Bubbles slowly</b> with dilute <b>acid</b> .	
8 Iron	<b>Very slow reaction</b> with dilute <b>acid</b> .	
9(Hydrogen)		
10 Copper	<b>No reaction</b> with dilute <b>acid</b> .	

Acids produce hydrogen ions (H<sup>+</sup>) in aqueous solutions. Aqueous solutions of alkalis contain hydroxide ions (OH<sup>-</sup>).

### Section 3: Extracting Metals

22 Very unreactive metals	Found <b>naturally</b> in the ground. <b>Don't need extracting</b> .
23 Metals less reactive than carbon	Extracted by <b>reduction with carbon</b> .
24 Metals more reactive than carbon	Extracted by <b>electrolysis</b> .

### Section 4: Reactions of Acids

25 With metal	Acid + Metal → Salt + Hydrogen
26 With alkali	Acid + Metal Hydroxide → Salt + Water (Neutralisation reaction)
27 With metal oxide	Acid + Metal Oxide → Salt + Water (Neutralisation reaction)
28 With carbonate	Acid + Metal Carbonate → Salt + Water + Carbon Dioxide (Neutralisation reaction)

### Section 5: Making a Soluble Salt

29	<b>Add solid</b> metal, metal carbonate, metal oxide or metal hydroxide <b>to an acid</b> .
30	Add solid <b>until no more reacts</b> .
31	<b>Filter</b> off excess solid.
32	<b>Evaporate</b> to remove some of the water.
33	Leave to <b>crystallise</b> .
34	Remove all water in a <b>desiccator/ oven</b> .

### Displacement Reactions

A **more reactive** will **displace** a **less reactive** metal from its compound.



### pH scale



Test solutions using an indicator solution or a pH probe

# Metals and Acids

## Key Revision Facts

- To test for hydrogen gas- place a lighted spill near the gas and hear a 'squeaky pop'.
- Potassium, sodium and magnesium are all examples of reactive metals.
- Copper, lead and gold are all examples of unreactive metals.
- When reactive metals are placed in acids they will react violently with lots of gas given off. Unreactive metals do not react with the acid.
- The equation for the reaction between a metal and an acid is:  
metal + acid  $\rightarrow$  salt + hydrogen  
 $\text{Zn} + \text{HCl} \rightarrow \text{sZnCl} + \text{H}$
- State symbols  
Solid (s)  
Liquid (l)  
Gas (g)  
Aqueous - a substance dissolved in water (aq)
- Magnesium and iron filings react vigorously with air
- Group 1 metals react with water to produce hydroxides and hydrogen.
- sodium + water  $\rightarrow$  sodium hydroxide + hydrogen
- Some metals like magnesium react slowly with cold water but will react quickly with steam.
- The reactivity series lists in order, how reactive metals are:

K	Potassium	Most reactive
Na	Sodium	↑ Increasingly reactive ↓
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	
Fe	Ferum	
Sn	Tin	
Pb	Lead	
Cu	Copper	
Hg	Mercury	
Ag	Silver	Least reactive
Au	Gold	

- A more reactive metal will displace a less reactive metal from its compound for example
- Magnesium + copper sulphate  $\longrightarrow$  Magnesium sulphate + copper
- Metals below carbon in the reactivity series can be extracted from its ore by heating it with carbon
- Ceramic materials are compounds for example silicates and metal oxides
- Polymers are long chain molecules.
- Wool is an example of a natural polymer.
- Polyethene is an example of a synthetic polymer.
- A composite material is a mixture of different materials.



# Reactivity Series

The reactivity series for some common metals is shown below.

Carbon and hydrogen are non-metals but these elements can be used to extract metals, so it is helpful for you to learn where they fit into the reactivity series.

## Task 1

Create a mnemonic (silly sentence) to help you learn the reactivity series of metals.

Once you are confident that you have learnt the reactivity series, test yourself with the questions - but no peeking!

	most reactive	
potassium		p _____
sodium		s _____
lithium		l _____
calcium		c _____
magnesium		m _____
aluminium		a _____
carbon		c _____
zinc		z _____
iron		i _____
hydrogen		h _____
copper		c _____
gold	least reactive	g _____

**Task 2**

Match up the key words to their definitions. Draw one line from each key word.

ore	A chemical reaction in which a metal loses oxygen. This method is used to extract metals less reactive than carbon.
reduction	The breakdown of a compound using electricity. This method is used to extract metals more reactive than carbon.
electrolysis	A naturally-occurring rock from which a metal can be extracted.

**Task 3**

Answer the questions about the reactivity series and extraction of metals.

1. Which of these metals is the most reactive?

Tick **one** box.

sodium

zinc

copper

2. Which of these metals is the least reactive?

Tick **one** box.

potassium

magnesium

gold

3. Only metals that are less reactive than carbon can be extracted by reduction with carbon.

Name two metals that can be extracted this way.

1. \_\_\_\_\_

2. \_\_\_\_\_

4. A displacement reaction takes place when a more reactive metal displaces (takes the place of) a less reactive metal in a compound.

e.g. magnesium + copper sulfate  $\longrightarrow$  magnesium sulfate + copper

Predict the products of the displacement reactions below.

a) calcium + zinc sulfate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_

b) sodium + magnesium chloride  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_

c) magnesium + copper nitrate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_



# Reactivity Series Answers

The reactivity series for some common metals is shown below.

Carbon and hydrogen are non-metals but these elements can be used to extract metals, so it is helpful for you to learn where they fit into the reactivity series.

## Task 1

Create a mnemonic (silly sentence) to help you learn the reactivity series of metals.

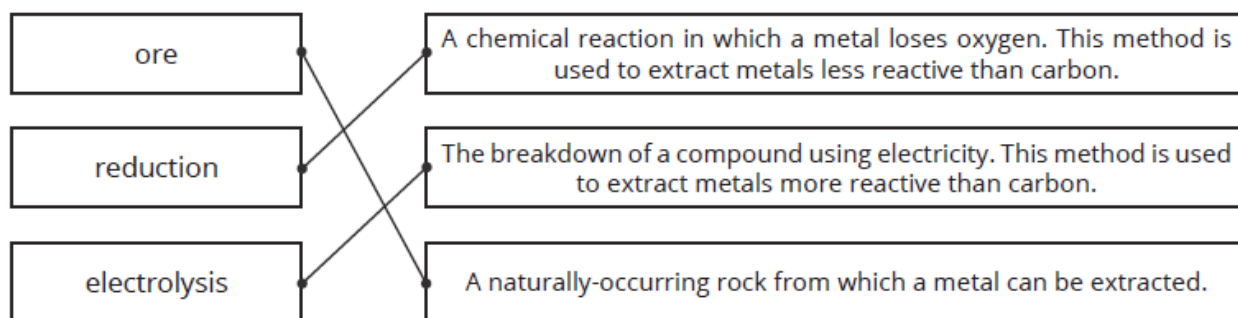
**Students can make up any silly sentence that helps them remember the reactivity series but an example is shown below.**

	most reactive	
potassium		please
sodium		stop
lithium		leaving
calcium		cute
magnesium		monkeys
aluminium		and
carbon		chunky
zinc		zebras
iron		in
hydrogen		hot
copper		cramped
gold		groups
		least reactive



**Task 2**

Match up the key words to their definitions. Draw one line from each key word.


**Task 3**

Answer the questions about the reactivity series and extraction of metals.

1. Which of these metals is the most reactive?

 Tick **one** box.

 sodium 

 zinc 

 copper 

2. Which of these metals is the least reactive?

 Tick **one** box.

 potassium 

 magnesium 

 gold 

3. Only metals that are less reactive than carbon can be extracted by reduction with carbon.

Name two metals that can be extracted this way.

**Any two from:**

- zinc
- iron
- copper

4. A displacement reaction takes place when a more reactive metal displaces (takes the place of) a less reactive metal in a compound.

 e.g. magnesium + copper sulfate  $\longrightarrow$  magnesium sulfate + copper

Predict the products of the displacement reactions below.

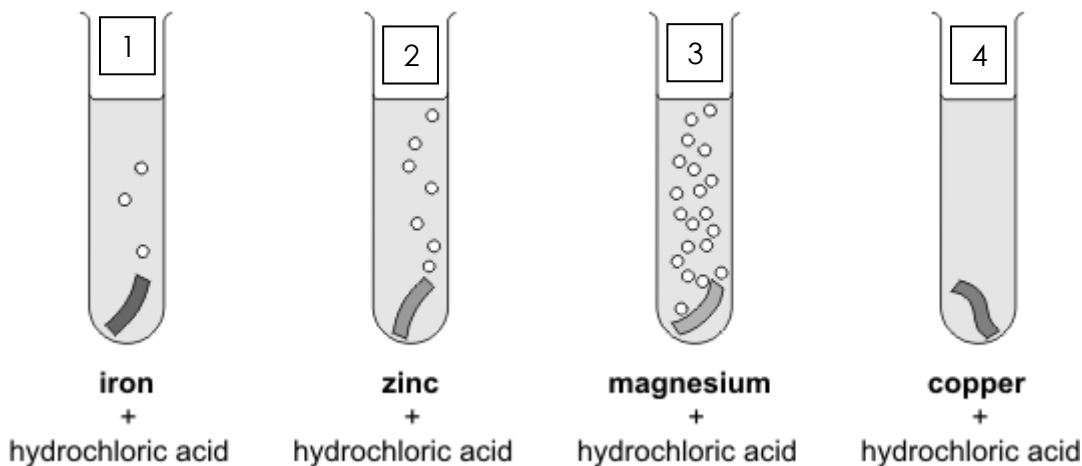
- a) calcium + zinc sulfate  $\longrightarrow$  **calcium sulfate + zinc**
- b) sodium + magnesium chloride  $\longrightarrow$  **sodium chloride + magnesium**
- c) magnesium + copper nitrate  $\longrightarrow$  **magnesium nitrate + copper**

# Exam Question - Acids and Metals Reactions

Acid + metal → salt + hydrogen

**Q1.** (a) Ruth put a piece of a different metal in each of four test tubes.

She poured 10 cm<sup>3</sup> of hydrochloric acid onto each metal.



(i) How do these show if a metal reacts with the acid?

.....

1 mark

(ii) **On the lines below**, put the **four** metals in the order of how strongly they react with the acid.

**most reactive** .....

.....

.....

**least reactive** .....

1 mark

(b) Choose the name of a metal from the box below to answer each question.

copper	iron	magnesium	zinc
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(i) Which metal from the box is used for electrical wires?

.....

1 mark

(ii) Which metal from the box goes rusty?

.....

1 mark  
maximum 4 marks

# Exam Question - Acids and Metals Reactions

## Answers

- M1.** (a) (i) any **one** from
- bubbles
  - fizzing  
accept 'effervescence'
  - gas is given off  
*'metal goes into solution **or** turns into a salt' and 'there would be a rise in temperature' are insufficient answers as they are **not** shown in the drawings*
- 1 (L3)**
- (ii)
- magnesium  
accept 'Mg'
  - zinc  
accept 'Zn'
  - iron  
accept 'Fe'
  - copper  
accept 'Cu'  
*answers must be in the correct order*  
**all four** answers are required for the mark
- 1 (L4)**
- (b) (i)
- copper  
accept 'Cu'
- 1 (L3)**
- (ii)
- iron  
accept 'Fe'
- 1 (L4)**

**[4]**