# Exercise walk-through

## Reactivity series ▪ 9.4

eXercise

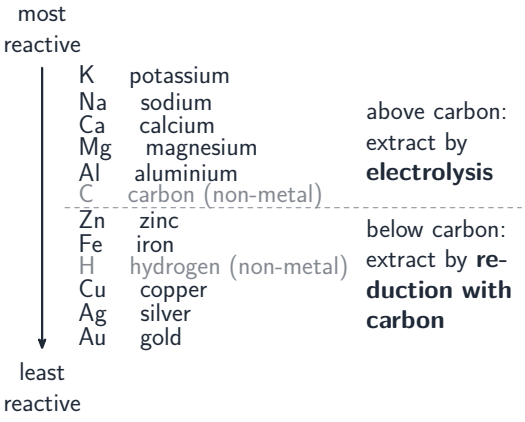
# You must be able to

- recall the reactivity series and use it to predict reactions
- predict displacement reactions of metals
- explain why aluminium seems less reactive than expected

## Method — Using the series

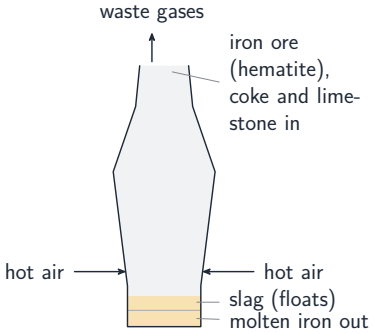
- K, Na, Ca react with cold water; Mg with steam; Mg/Zn/Fe with dilute acid; Cu/Ag/Au do not.
- **displacement:** zinc displaces copper from copper(II) sulfate (zinc is more reactive).
- **aluminium:** a strong oxide layer makes it seem less reactive.

# Method — Using the series




*The reactivity series from potassium to gold*

# Method — Using the series




$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(carbon monoxide reduces the ore)

*Reactivity decides how a metal is extracted*

## Practice 2.1 ▪ 1 mark

State which is more reactive: zinc or copper.

# Solution 2.1

Method: Using the series

**Worked steps**

zinc B1.

## Practice 2.2 ▪ 1 mark

Name a metal that reacts with cold water.

# Solution 2.2

Method: Using the series

**Worked steps**

potassium, sodium or calcium B1.

# Exam-style 3.1 ▪ 1 mark

Four metals are added to separate samples of dilute sulfuric acid. Only one produces no bubbles at all. Which row is correct?

**A** silver produces no bubbles, because it is above hydrogen in the reactivity series

**B** silver produces no bubbles, because it is below hydrogen in the reactivity series

**C** calcium produces no bubbles, because it is below hydrogen in the reactivity series

**D** tin produces no bubbles, because it is above hydrogen in the reactivity series

# Solution 3.1

Method: Using the series

**A** silver produces no bubbles, because it is above hydrogen in the reactivity series

**B** silver produces no bubbles, because it is below hydrogen in the reactivity series ✓

**C** calcium produces no bubbles, because it is below hydrogen in the reactivity series

**D** tin produces no bubbles, because it is above hydrogen in the reactivity series

## Worked steps

**B**. A metal displaces hydrogen from an acid only if it is above hydrogen in the reactivity series; silver is below it, so no bubbles form. A gives the right metal with the wrong reason, C names a very reactive metal that fizzes strongly, and D names a metal that is above hydrogen and does react.

## Exam-style 3.2 ▪ 2 marks

A piece of iron is placed in copper(II) sulfate solution.
(a) State what you would observe.
(b) Explain why this reaction happens.

# Solution 3.2

Method: Using the series

**Worked steps**

(a) the iron becomes coated with (pink/brown) copper M1; the blue solution fades A1.

(b) iron is more reactive than copper, so it displaces copper from the solution B1.

## Exam-style 3.3 ▪ 2 marks

Aluminium is high in the reactivity series but appears unreactive. Explain why.

# Solution 3.3

Method: Using the series

**Worked steps**

aluminium is covered by a thin, strong oxide layer **M1**; this stops other substances reaching the metal underneath, so it seems unreactive **A1**.