

## 9.4 Reactivity series

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 8 marks

**KEY WORDS** ions • calcium • potassium • displacement  
• displacement reaction

### Objective

Build the skills to answer exam questions on the **reactivity series** – the order, reactions with water/acid, **displacement**, and the special case of aluminium.

**You must be able to:**

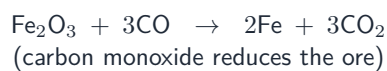
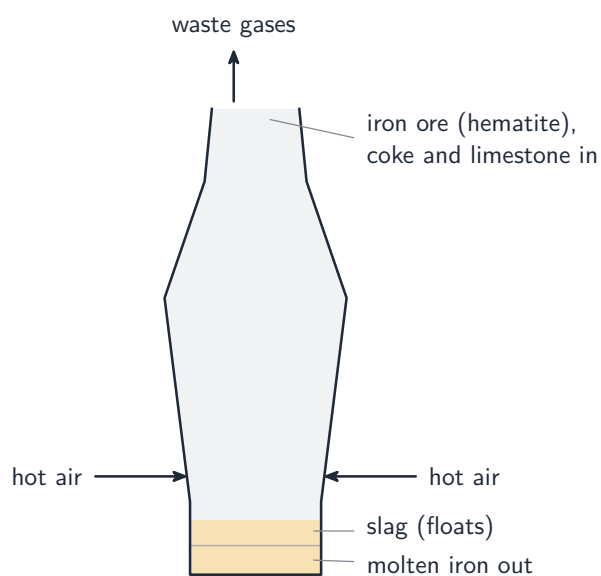
- recall the reactivity series and use it to predict reactions
- predict displacement reactions of metals
- explain why aluminium seems less reactive than expected

### 1 Key knowledge and worked examples

#### ■ Using the series

|                |       |                      |                                |
|----------------|-------|----------------------|--------------------------------|
| most reactive  |       |                      |                                |
| ↓              | K     | potassium            |                                |
|                | Na    | sodium               |                                |
|                | Ca    | calcium              |                                |
|                | Mg    | magnesium            | above carbon:                  |
|                | Al    | aluminium            | extract by <b>electrolysis</b> |
|                | C     | carbon (non-metal)   |                                |
|                | ----- |                      |                                |
|                | Zn    | zinc                 |                                |
|                | Fe    | iron                 |                                |
|                | H     | hydrogen (non-metal) | below carbon:                  |
|                | Cu    | copper               | extract by <b>reduction</b>    |
|                | Ag    | silver               | <b>with carbon</b>             |
|                | Au    | gold                 |                                |
| least reactive |       |                      |                                |

*A more reactive metal displaces a less reactive one from solution*



*Reactivity decides how a metal is extracted*

- 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.

## 2 Practice

2.1 State which is more reactive: zinc or copper.

[1]

2.2 Name a metal that reacts with cold water.

[1]

### 3 Exam-style questions

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**3.1** Four metals are added to separate samples of dilute sulfuric acid. Only one produces no bubbles at all. Which row is correct? [1]

☐

**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

**3.2** A piece of iron is placed in copper(II) sulfate solution.

(a) State what you would observe. [2]

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(b) Explain why this reaction happens. [1]

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**3.3** Aluminium is high in the reactivity series but appears unreactive. Explain why. [2]

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## Solutions

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Each answer shows the steps, then the **result**.

### 2.1

- zinc is **more reactive** than copper

### 2.2

- e.g. **potassium, sodium** or **calcium**

### 3.1 B

- silver is **below hydrogen**, so it produces **no bubbles**
- A has the wrong reason; C and D name metals that do react

### 3.2

(a)

- iron becomes coated with **pink/brown copper**
- the **blue solution fades**

(b)

- iron is **more reactive** than copper, so it **displaces** copper

### 3.3

- aluminium is covered by a thin, strong **oxide layer**
- this stops other substances reaching the metal, so it **seems unreactive**