

9.4 Reactivity series

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS ions 离子 • magnesium 镁 • calcium 钙 • reactivity series 金属活动性顺序 • displacement 置换

Objective

Build the skills to answer exam questions on the **reactivity series** 金属活动性顺序 — the order, reactions with water/acid, **displacement** 置换, 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 Worked examples

■ Using the series

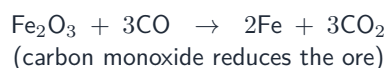
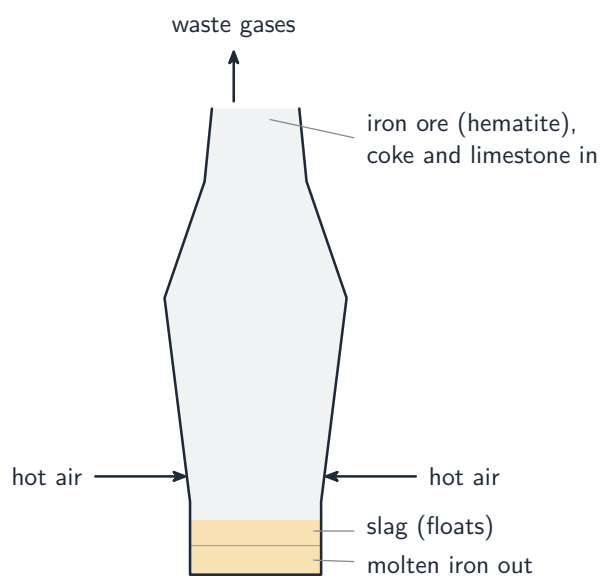
most reactive		
↓	K	potassium
	Na	sodium
	Ca	calcium
	Mg	magnesium
	Al	aluminium
	C	carbon (non-metal)

	Zn	zinc
	Fe	iron
	H	hydrogen (non-metal)
	Cu	copper
	Ag	silver
	Au	gold
least reactive		

above carbon:
extract by **electrolysis**

below carbon:
extract by **reduction
with carbon**

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

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]

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

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

Solutions

2.1 zinc.

2.2 potassium, sodium or calcium.

3.1 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.

3.2 (a) the iron becomes coated with (pink/brown) copper; the blue solution fades.
(b) iron is more reactive than copper, so it displaces copper from the solution.

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