

Exercise walk-through

9.3

Alloys and their properties

IGCSE Chemistry

Properties and uses

metals

good conductors; **malleable** & **ductile**; high melting points

non-metals

poor conductors; **brittle**; low melting points

Uses follow properties: **aluminium** is light (aircraft, cables); **copper** conducts & is ductile (wiring).



Aluminium is light and resists corrosion

The physical properties that decide a metal's use

electrical conductivity

metals: **good**. Non-metals: poor, **except** graphite

melting and boiling point

metals: usually **high**. Non-metals: usually low

malleability and ductility

metals can be hammered into shape and drawn into wires

copper

electrical wiring – good conductivity *and* ductility, so it can be drawn into wire

aluminium

aircraft and drinks cans – low density and corrosion-resistant

alloys

harder than the pure metal, because different-sized atoms stop the layers sliding

Give the property **and** the use it explains. “Copper conducts” is half a mark; “so it is drawn into wiring” completes it.

Why metals behave as they do

Conduction

Delocalised electrons move freely, giving high electrical and **thermal conductivity**.

Malleable

Layers of ions slide over each other without breaking the metallic bond – so metals bend rather than shatter.

With acids

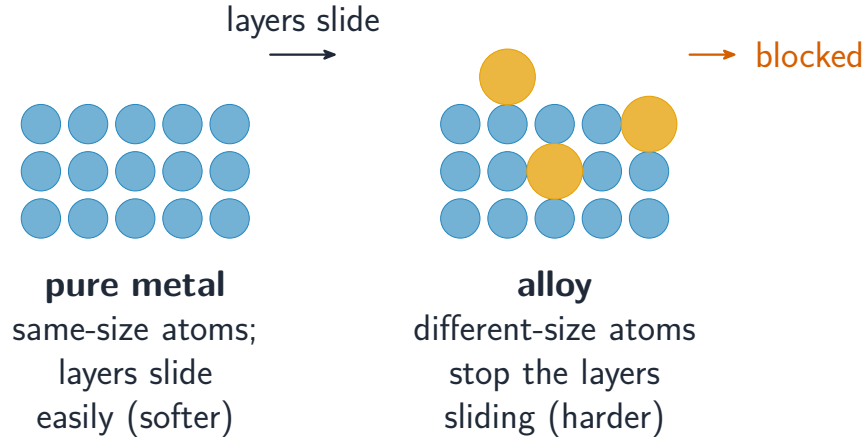
A reactive metal reacts with **acids** to give a **salt** and hydrogen – the fizz test.

A useful oxide

Calcium oxide (from limestone in the blast furnace) removes acidic impurities as slag.

Every metallic property traces back to one picture: positive ions in a sea of delocalised electrons.

Alloys



- **Brass** is a mixture of copper and **zinc**.
- **Stainless steel** is a mixture of **iron** with other elements such as **chromium**, **nickel** and **carbon**.

Exercises 2.1·2.2

2.1 Define an alloy.

[1]

2.2 Name the two metals in brass.

[2]

Exercises 2.1·2.2

2.1 Define an alloy.

[1]

2.1

- an alloy is a **mixture of a metal with one or more other elements**
-

2.2 Name the two metals in brass.

[2]

2.2

- brass is **copper** and **zinc**

Exercise 3.1

3.1 Alloys are usually harder than pure metals because the different-sized atoms: [1]

☐

A are more reactive

B stop the layers sliding over each other

C make the metal lighter

D conduct better

Exercise 3.1

3.1 Alloys are usually harder than pure metals because the different-sized atoms: [1]

☐

A are more reactive

B stop the layers sliding over each other

C make the metal lighter

D conduct better

3.1 B

- different-sized atoms **stop the layers sliding**
- A, C and D are not why alloys are harder

Exercise 3.2 (a)

3.2 Stainless steel is used for cutlery.

(a) Name two elements (other than iron) found in stainless steel.

[2]

Exercise 3.2 (a)

3.2 Stainless steel is used for cutlery.

(a) Name two elements (other than iron) found in stainless steel.

[2]

(a)

- **chromium** and **nickel** (or carbon)

Exercise 3.2 (b)

3.2 Stainless steel is used for cutlery.

(b) State two properties that make it suitable for cutlery.

[2]

Exercise 3.2 (b)

3.2 Stainless steel is used for cutlery.

(b) State two properties that make it suitable for cutlery.

[2]

(b)

- it is **hard** and **does not rust**

Exercise 3.3

3.3 Explain, using their structures, why an alloy is harder than the pure metal it is made from. [2]

Exercise 3.3

3.3 Explain, using their structures, why an alloy is harder than the pure metal it is made from. [2]

3.3

- in a pure metal the atoms are the same size, so layers **slide easily**
- in an alloy different-sized atoms **distort the layers** and stop them sliding