

Exercise walk-through

2.1

Elements, compounds and mixtures

IGCSE Chemistry

What we will cover

- 1 Elements, compounds & mixtures
- 2 Inside the atom
- 3 Electron shells & isotopes
- 4 Ionic bonding
- 5 Covalent & giant structures
- 6 Metallic bonding

Element, compound, mixture

the building blocks

all substances are made from about 100 elements

an element

only one type of **atom** – and it cannot be broken into anything simpler by a chemical reaction

a compound

two or more elements **chemically joined**, in a fixed ratio, with new properties

a mixture

substances **just mixed**, not joined – the parts keep their own properties and can be separated physically

the atomic number

the number of protons – it is what makes an atom that element

telling them apart

a compound has a fixed formula and a sharp melting point; a mixture has neither

Air is a mixture, water is a compound, and both are colourless liquids or gases. The distinction is about **bonding**, not appearance.

Dot-and-cross diagrams, and what the bonding explains

a dot-and-cross diagram

draw each atom's **outer-shell** electrons – dots for one element, crosses for the other – and show where they end up

ionic

electrons are **transferred**; show the ion charges and use square brackets

covalent

electrons are **shared**; show the overlapping outer shells

electrostatic attraction

the strong force between oppositely charged ions – so ionic compounds have high melting points

electrical conductivity

an **ionic compound** conducts only when molten or dissolved, because the ions must be **free to move**

metals

delocalised electrons give conductivity, **ductility**, and malleability

Draw **only the outer shell** unless asked otherwise, and label which atom the dots came from. Both are marked.

Exercises 2.1·2.2

2.1 Define a compound.

[1]

2.2 State how a mixture can be separated.

[1]

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2.1 Define a compound.

[1]

2.1

- a compound is **two or more elements chemically joined** in a **fixed ratio**
-

2.2 State how a mixture can be separated.

[1]

2.2

- a mixture is separated by **physical methods** (filtering, distillation)

Exercise 3.1

3.1 Which is a compound?

[1]

☐

A oxygen, O_2

B water, H_2O

C air

D copper

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A oxygen, O_2

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C air

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3.1 B

- water is two elements chemically bonded – a **compound**
- A is an element molecule; C is a mixture; D is an element

Exercise 3.2 (a)

3.2 A particle diagram shows two different atoms always joined together in pairs.

(a) State whether this represents an element, a compound or a mixture.

[1]

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3.2 A particle diagram shows two different atoms always joined together in pairs.

(a) State whether this represents an element, a compound or a mixture. [1]

(a)

- two different atoms always joined in pairs
- a **compound**

Exercise 3.2 (b)

3.2 A particle diagram shows two different atoms always joined together in pairs.

(b) Explain your answer.

[2]

Exercise 3.2 (b)

3.2 A particle diagram shows two different atoms always joined together in pairs.

(b) Explain your answer.

[2]

(b)

- two different atoms are present, **chemically bonded** in a **fixed ratio**

Exercise 3.3

3.3 State the main difference between a compound and a mixture of the same elements.[2]

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3.3

- compound: elements **chemically bonded**; need a **chemical reaction** to separate
- mixture: **not bonded**; separated by **physical means**

Exercise 3.4 (a)

3.4 Four substances are examined: **W** is made of one kind of atom only; **X** contains two kinds of atom chemically joined in a fixed ratio; **Y** contains two kinds of atom that can be separated by filtering; **Z** is a shiny grey solid that conducts electricity and cannot be broken down.

(a) Classify **W**, **X**, **Y** and **Z** as element, compound or mixture, giving a reason for each.[4]

Exercise 3.4 (a)

3.4 Four substances are examined: **W** is made of one kind of atom only; **X** contains two kinds of atom chemically joined in a fixed ratio; **Y** contains two kinds of atom that can be separated by filtering; **Z** is a shiny grey solid that conducts electricity and cannot be broken down.

(a) Classify **W**, **X**, **Y** and **Z** as element, compound or mixture, giving a reason for each.[4]

(a)

- **W: element** – only one type of atom
- **X: compound** – different atoms bonded in a fixed ratio
- **Y: mixture** – parts not chemically joined, so filtering works
- **Z: element** – cannot be broken down into anything simpler

Exercise 3.4 (b)

3.4 Four substances are examined: **W** is made of one kind of atom only; **X** contains two kinds of atom chemically joined in a fixed ratio; **Y** contains two kinds of atom that can be separated by filtering; **Z** is a shiny grey solid that conducts electricity and cannot be broken down.

(b) Explain the difference between a compound and a mixture in terms of how the substances are joined and how they can be separated. [4]

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(b) Explain the difference between a compound and a mixture in terms of how the substances are joined and how they can be separated. [4]

(b)

- compound: atoms held by **chemical bonds** in a **fixed ratio**
- mixture: substances simply mixed, **any proportion**
- compound separated only by a **chemical reaction**
- mixture separated by **physical means** (filter, distil, magnet)

Exercise 3.4 (c)

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(c) Iron filings and sulfur powder are mixed, then heated strongly to form iron sulfide. Describe how you could show that a chemical change has taken place. [3]

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(c) Iron filings and sulfur powder are mixed, then heated strongly to form iron sulfide. Describe how you could show that a chemical change has taken place. [3]

(c)

- appearance changes: grey-and-yellow mix → a single **black solid**
- heat is given out and the reaction continues without further heating
- the product has **different properties**, and the change cannot be reversed easily

Exercise 3.4 (d)

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(d) Name a method that would separate the iron from the **mixture** but not from the **compound**, and explain why. [2]

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(d) Name a method that would separate the iron from the **mixture** but not from the **compound**, and explain why. [2]

(d)

- a **magnet**
- in the mixture the iron is still iron and is attracted; in iron sulfide the iron is **bonded**, so the compound is **not magnetic**