

Exercise walk-through

Introduction for Reactions ■ 4.1

eXercise

You must be able to

- spot evidence of a **chemical change** 化学变化 (gas, precipitate, color, temperature, light)
- distinguish a chemical change from a physical one
- link the evidence to new substances forming

Method — Signs of a chemical reaction

A chemical reaction makes **new substances**. Common evidence:

- a **gas** is produced (bubbles);
- an insoluble **precipitate** 沉淀 forms;
- a **color change**;
- a **temperature change** (heat released or absorbed);
- light or a flame.

Method — One sign is a clue, not proof

A single sign (like bubbles) suggests a reaction, but could be physical (boiling makes bubbles too). Look for new substances with different properties.

Method — A worked judgement

Mixing two clear solutions that turn cloudy → a **precipitate** formed → a chemical reaction. Ice melting to water → same substance, only a **physical** change.

Method — Energy as evidence

A reaction that gets hot (or cold) is exchanging energy as bonds break and form — evidence of a chemical change.

Practice 2.1 ■ 2 marks

List two signs that a chemical reaction has occurred.

Solution 2.1

Method: Signs of a chemical reaction

Worked steps

Any two: gas produced, precipitate, color change, temperature change, light
B1 **B1**.

Practice 2.2 ■ 1 mark

Cloudiness forms when two solutions mix. What has formed?

Solution 2.2

Method: A worked judgement

Worked steps

A precipitate (an insoluble solid) **B1**.

Practice 2.3 ■ 2 marks

Is dissolving sugar in water a chemical change? Give a reason.

Solution 2.3

Method: A worked judgement

Worked steps

No — it is physical; the sugar keeps its identity and can be recovered by evaporation

M1 A1.

Exam-style 3.1 ■ 1 mark

Which is the best evidence of a **chemical** reaction?

- A water evaporating
- B a precipitate forming from two clear solutions
- C ice melting
- D sugar dissolving

Solution 3.1

- A water evaporating
- B a precipitate forming from two clear solutions** 
- C ice melting
- D sugar dissolving

Worked steps

B — a precipitate forming is a new substance, evidence of a chemical reaction.

Exam-style 3.2 ■ 2 marks

A student adds a metal to acid and observes bubbling and warming.

- (a) State the two signs of a chemical reaction.
- (b) Explain why bubbling alone is not conclusive.

Solution 3.2

Method: Signs of a chemical reaction

Worked steps

(a) Bubbling (gas produced) and warming (temperature change) **B1** **B1**. (b) Bubbling can also be physical (e.g. boiling), so it is not conclusive on its own **B1**.

Exam-style 3.3 ■ 3 marks

Classify each as physical or chemical: (a) iron rusting, (b) crushing a can, (c) a firework exploding.

Solution 3.3

Method: A worked judgement

Worked steps

(a) chemical; (b) physical; (c) chemical **B1** **B1** **B1**.