

4.4 Physical Changes versus Chemical Changes

Name: _____ Class: _____ Date: _____ **Total: 11 marks****KEY WORDS** chemical 化学变化 • physical 物理变化 • precipitate 沉淀

Objective

Build the skills to answer exam questions on **physical versus chemical changes**.**You must be able to:**

- classify a change as **physical** 物理变化 or **chemical** 化学变化
- justify with whether **new substances** form
- recognise state changes as physical

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ The key test

A **chemical change** makes **new substances** with new properties (and is usually hard to reverse). A **physical change** keeps the same substance, only its form or state changing.

■ Physical changes

Melting, boiling, dissolving, crushing, and mixing (without reacting) are physical — the substance's identity is unchanged and often easily reversed.

■ Chemical changes

Burning, rusting, digestion, and reactions producing a gas or precipitate are chemical — new substances form and bonds are rearranged.

■ A worked judgement

Boiling water: liquid → gas, still H_2O → **physical**. Burning wood: makes CO_2 , ash, water → new substances → **chemical**.

2 Practice

Now apply the methods above.

2.1 Classify melting ice as physical or chemical. [1]**2.2** Classify iron rusting, with a reason. [2]**2.3** What is the single best test for a chemical change? [1]

3 Exam-style questions

3.1 Which is a **chemical** change? [1]

- **A** boiling water
- **B** dissolving salt
- **C** burning paper
- **D** breaking glass

3.2 A student heats sugar until it turns black and gives off a smell.

(a) State whether this is physical or chemical. [1]

(b) Justify your answer. [2]

3.3 Classify each and give a one-word reason: (a) evaporating alcohol, (b) a battery discharging, (c) tearing paper. [3]

Solutions

2.1 Physical.

2.2 Chemical — a new substance (iron oxide) forms.

2.3 Whether new substances (with new properties) form.

3.1 C — burning paper forms new substances.

3.2 (a) Chemical. (b) New substances form (the black solid and the smell are different materials), so it is a chemical change.

3.3 (a) physical (state change); (b) chemical (reaction); (c) physical (shape).