

# 14.6 Wave Interference and Standing Waves

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 8 marks

## Objective

Build the skills to answer exam questions on **wave interference and standing waves**.

You must be able to:

- apply the **principle of superposition** 叠加原理 to combine overlapping waves
- distinguish **constructive** 相长 from **destructive** 相消 interference
- describe **standing waves** 驻波 with nodes and antinodes

## 1 Worked examples

Study these first. Each one shows the method for a question type used later.

### ■ Superposition

Where waves overlap, their displacements **add**.

### ■ Constructive and destructive

- **In phase** → crests meet crests → **constructive** (larger amplitude).
- **Out of phase** → crest meets trough → **destructive** (cancellation).

### ■ Standing waves

Two waves travelling in opposite directions form a standing wave with fixed **nodes** (no motion) and **antinodes** (maximum motion) —as on a guitar string or in a pipe.

## 2 Practice

2.1 State the principle of superposition. [1]

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2.2 State the condition for two waves to interfere destructively. [1]

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**2.3** Define a node on a standing wave. [1]

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### 3 Exam-style questions

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**3.1** Two waves meeting in phase interfere [1]

- **A** destructively
  - **B** constructively
  - **C** not at all
  - **D** randomly
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**3.2** A point of zero displacement on a standing wave is a [1]

- **A** antinode
  - **B** node
  - **C** crest
  - **D** trough
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**3.3** Two identical waves overlap.

(a) State the result when they meet in phase. [1]

(b) State the result when they meet exactly out of phase. [1]

(c) Name the general principle used. [1]

### 4 Go further

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- work through the **14.6 Wave Interference and Standing Waves** lesson on the **Learn** page;
- read the **Waves and Sound** section of the AP Physics 2 handout on the **Know** page.

## Solutions

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**2.1** where waves overlap, the total displacement is the sum of the individual displacements.

**2.2** they must be exactly out of phase (crest meets trough).

**2.3** a point on a standing wave that stays at rest (zero displacement).

**3.1** B.

**3.2** B.

**3.3** (a) a larger wave (constructive interference). (b) they cancel (destructive interference). (c) the principle of superposition.