AP PHYSICS 2 • EXERCISE SHEET

14.6 Wave Interference and Standing Waves

Name: _____ Class: _____ Date: _____ **Total: 8 marks**

KEY WORDS standing wave 驻波 • destructive 相消 • constructive 相长 • nodes 波节 • principle of superposition 叠加原理

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]

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

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

3 Exam-style questions

3.1 Two waves meeting in phase interfere [1]

- **A** destructively
- **B** constructively
- **C** not at all
- **D** randomly

3.2 A point of zero displacement on a standing wave is a [1]

- **A** antinode
- **B** node
- **C** crest
- **D** trough

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]

Solutions

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.