PHYSICS YEAR 11 - MODULE 3 - LESSON 11

# Standing Waves in Pipes

Use this worksheet after reading the lesson to practise the key ideas and prove you can meet the success criteria.

Name _____

Date _____

Class _____

## 1. Key Ideas

Air columns can resonate just like strings, but the ends matter. Open pipes allow antinodes at both ends, while closed pipes force a node at the closed end and an antinode at the open end. That difference changes the harmonics the pipe can support.

- How standing waves form in open and closed pipes
- Why the end conditions change the allowed patterns

## 2. Success Criteria

By the end, you should be able to:

- How standing waves form in open and closed pipes
- The boundary conditions at open and closed ends
- That open pipes allow all harmonics

## 3. Key Terms

**Both ends**
displacement antinodes, so all harmonics are allowed: $n = 1, 2, 3,

**the pipe**
open at both ends, such as many flute-type models

**only odd modes**
allowed: $n = 1, 3, 5,

**one end**
closed, such as bottle or didgeridoo-style models

**pattern**
not allowed in a closed pipe

**Vectors and scalars**
just different ways of writing the same thing

## 4. Activity: Build the Lesson Map

Use the lesson to complete the table. Keep answers brief but specific.

| Prompt | Your answer |
| --- | --- |
| Main concept | |
| Important example | |
| Common mistake to avoid | |
| How this links to the next lesson | |

## 5. Short Answer Questions

**1. 7. Explain the difference in boundary conditions between an open pipe and a closed pipe.**

BAND 3 3 MARKS

**2. 8. An open pipe has length 0.75 m. Find the wavelength of the second harmonic.**

BAND 4 3 MARKS

**3. 9. A closed pipe has length 0.90 m. Find the wavelength of the fundamental and explain why even harmonics are absent.**

BAND 5 4 MARKS

## 6. Extend: Apply the Idea

BAND 5/6 5 MARKS

**A student gives a memorised answer about Standing Waves in Pipes but does not use evidence or reasoning.**

Improve the answer by writing a stronger response that uses accurate terminology, a relevant example and a clear explanation.

## 7. Multiple Choice

**1.** What is the best first step when answering a question about Standing Waves in Pipes?

☐ A. Identify the key concept being tested

☐ B. Write every fact from memory

☐ C. Ignore the command word

☐ D. Skip examples and evidence

**2.** Which answer would show stronger understanding of Standing Waves in Pipes?

☐ A. An answer with accurate terms and reasoning

☐ B. A copied definition only

☐ C. A single-word response

☐ D. An answer with no example

**3.** What should you do if a question asks you to explain?

☐ A. Link the idea to a reason or cause

☐ B. List unrelated facts

☐ C. Only draw a diagram

☐ D. Write the shortest possible answer

## 8. Success Criteria Proof

Finish with evidence that you can do each success criterion.

**SUCCESS CRITERION 1**

**Prove that you can: How standing waves form in open and closed pipes**

BAND 3 2 MARKS

**SUCCESS CRITERION 2**

**Prove that you can: The boundary conditions at open and closed ends**

BAND 4 3 MARKS

**SUCCESS CRITERION 3**

**Prove that you can: That open pipes allow all harmonics**

BAND 5 4 MARKS

**One thing I still need help with:**