14 Interference, standing waves, and diffraction – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
Constructive interference			
Destructive interference			
standing wave			
nodes			
antinodes			
Diffraction			

Recall

In Part A you described single waves. Now see what happens when **two** waves meet:

- Two sets of ripples cross and make a criss-cross pattern.
- A guitar string vibrates in a fixed shape and sounds a clear note.
- Waves bend around a corner so you hear sound from another room.

Each idea has a worked example before the Practice.

New ideas

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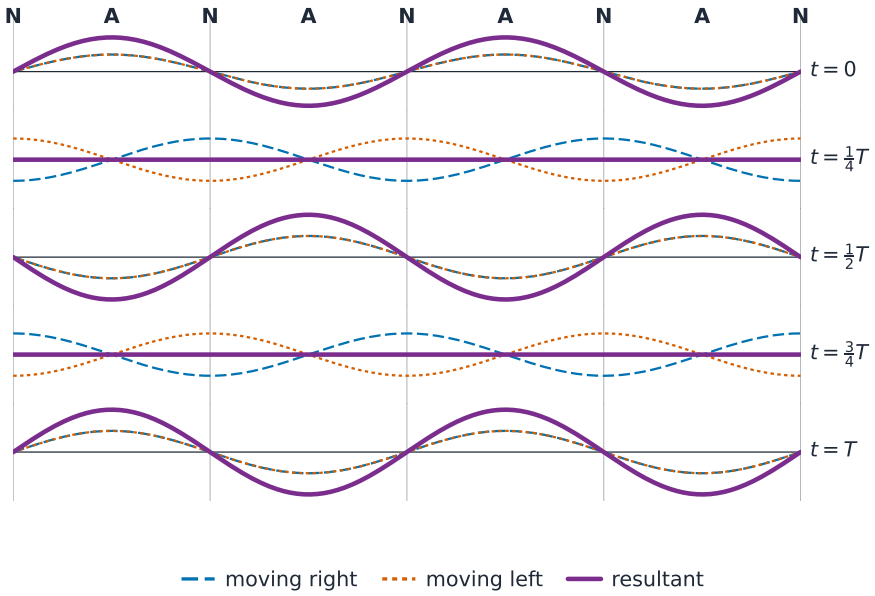
1 Adding waves (superposition)

When two waves overlap they simply **add**:

- **Constructive interference** – crest meets crest – makes a bigger wave.
- **Destructive interference** – crest meets trough – cancels out.

2 Standing waves

Two waves travelling in opposite directions in a fixed space form a **standing wave**, with **nodes** (points that never move) and **antinodes** (points that move the most). This is how a guitar string or a pipe makes a note.

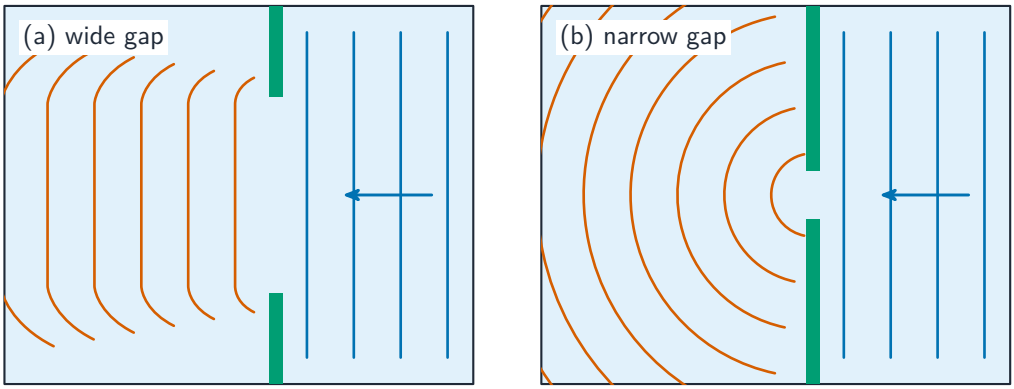


Worked example. A string 0.65 m long, fixed at both ends, fits half a wavelength in its simplest note, so $\lambda = 2L = 1.30$ m. If waves travel at 260 m/s, the note is $f = \dfrac{v}{\lambda} = \dfrac{260}{1.30} = 200$ Hz.

3 Diffraction

Diffraction is the bending and spreading of waves around edges or through gaps. It is largest when the gap is about the same size as the wavelength.

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gap $\gg \lambda$: little spreading

gap $\approx \lambda$: strong spreading

4 The double slit

Light passing through two close slits makes a pattern of bright and dark **fringes**, where the waves interfere. Bright fringes appear where the two paths differ by a whole number of wavelengths.

Watch out: diffraction is only obvious when the gap is close to the wavelength. Sound (long wavelength) bends around a doorway easily; light (tiny wavelength) needs a very narrow slit to spread noticeably.

Practice

Try these in order. The methods are all above.

2.1 State what happens when a crest of one wave meets (a) a crest of another, (b) a trough of another. [2]

2.2 On a standing wave, state what a node is and what an antinode is. [2]

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2.3 A string 0.50 m long, fixed at both ends, has $\lambda = 2L$ in its simplest note. Waves travel at 300 m/s. Find the frequency of the note. [3]

2.4 Explain why you can hear sound coming from around a corner, but cannot see around it. [2]

2.5 State what you would see on a screen when light passes through two closely spaced slits. [1]

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