

14 Interference, standing waves, and diffraction – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)		
Constructive interference	相长干涉	_____	_____	_____
Destructive interference	相消干涉	_____	_____	_____
standing wave	驻波	_____	_____	_____
nodes	波节	_____	_____	_____
antinodes	波腹	_____	_____	_____
Diffraction	衍射	_____	_____	_____

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

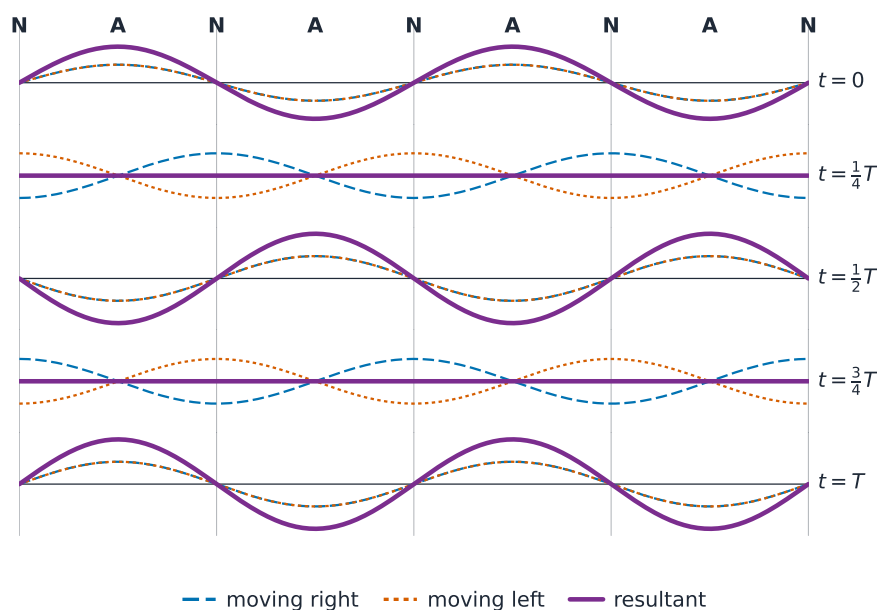
■ 1 Adding waves (superposition)

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

- **Constructive interference** 相长干涉 – crest meets crest – makes a bigger wave.
- **Destructive interference** 相消干涉 – crest meets trough – cancels out.

■ 2 Standing waves

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

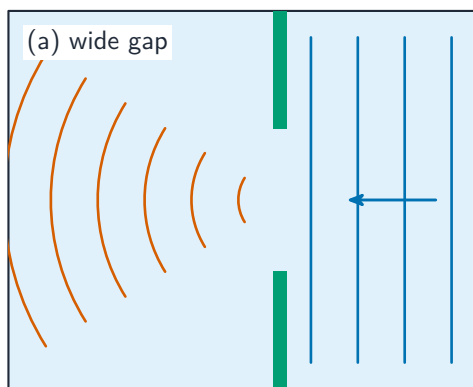


Worked example. A string 0.65 m long, fixed at both ends, fits half a wavelength in its simplest note, so $\lambda = 2L = 1.30$ m. If waves travel at 260 m/s, the note is

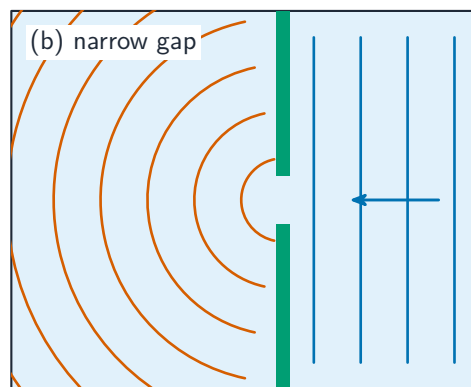
$$f = \frac{v}{\lambda} = \frac{260}{1.30} = 200 \text{ Hz.}$$

■ 3 Diffraction

Diffraction 衍射 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.



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]

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]
