

7 Waves – Part 1

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)		
wave	波	_____	_____	_____
amplitude	振幅	_____	_____	_____
wavelength	波长	_____	_____	_____
frequency	频率	_____	_____	_____
period	周期	_____	_____	_____
transverse wave	横波	_____	_____	_____
longitudinal wave	纵波	_____	_____	_____
progressive wave	行波	_____	_____	_____
electromagnetic spectrum	电磁波谱	_____	_____	_____
Polarisation	偏振	_____	_____	_____

Recall

At IGCSE you studied waves. Bring this with you:

- A **wave** 波 carries energy from place to place without moving matter along with it.
- You used wavelength and frequency, and the wave equation $v = f\lambda$.

At AS we define the wave quantities carefully and meet a new idea: polarisation.

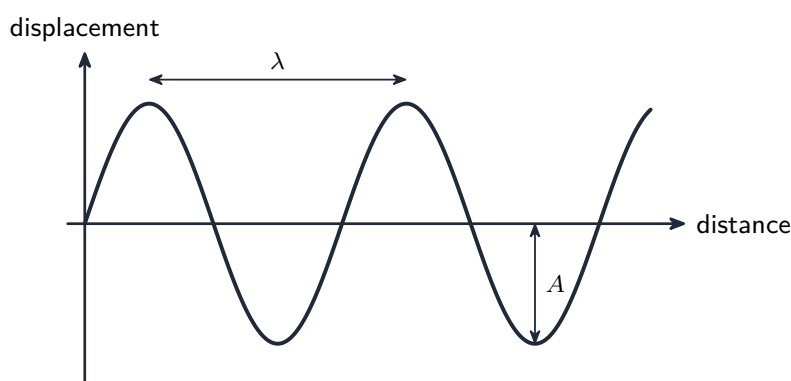
New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

■ 1 Describing a wave

- **amplitude** 振幅: the largest distance a point moves from its rest position.
- **wavelength** 波长 λ : the length of one complete wave.
- **frequency** 频率 f : the number of waves passing each second, in hertz (Hz).
- **period** 周期 T : the time for one complete wave, with $T = \frac{1}{f}$.

These link through the wave equation $v = f\lambda$.

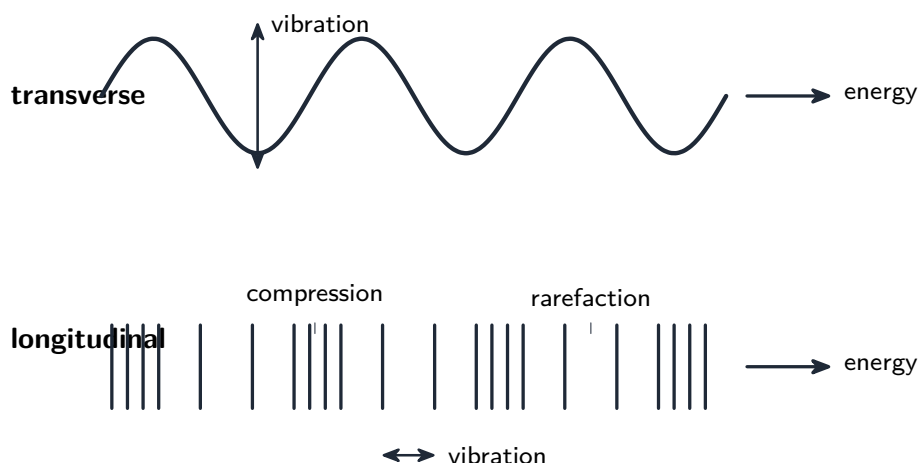


Worked example. A wave has $f = 50$ Hz and $\lambda = 6.0$ m: $v = f\lambda = 50 \times 6.0 = 300 \text{ m s}^{-1}$, and $T = \frac{1}{50} = 0.020$ s.

Watch out: in $v = f\lambda$ keep the units matched — f in Hz and λ in metres give v in m s^{-1} .

■ 2 Transverse and longitudinal waves

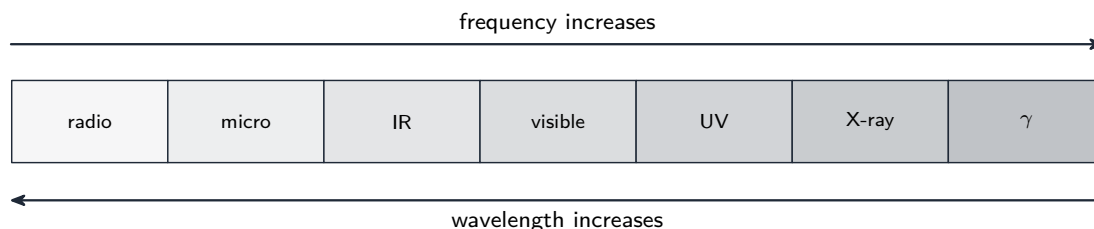
- In a **transverse wave** 横波 the points move at right angles to the wave's travel (light, water waves).
- In a **longitudinal wave** 纵波 the points move along the travel direction (sound).
- A **progressive wave** 行波 is one that travels and carries energy.



Worked example. Shaking a rope up and down sends a transverse wave (the rope moves across the travel); pushing a slinky back and forth sends a longitudinal wave (the coils move along the travel).

■ 3 The electromagnetic spectrum and polarisation

All electromagnetic waves (radio, micro, infrared, visible, ultraviolet, X-rays, gamma) travel at $3.0 \times 10^8 \text{ m s}^{-1}$ in a vacuum; arranged by wavelength they form the **electromagnetic spectrum** 电磁波谱.



Only transverse waves can be polarised. **Polarisation** 偏振 makes all the oscillations lie in a single plane; a polarising filter lets through only that plane and blocks the rest.

Worked example. Two polarising filters at right angles block almost all light: the first passes one plane, and the second (crossed) blocks that plane.

Practice

7.1 A sound wave has frequency 200 Hz and wavelength 1.7 m. Find its speed. [2]

7.2 A wave has frequency 25 Hz. Find its period. [1]

7.3 Light travels at $3.0 \times 10^8 \text{ m s}^{-1}$. Find the wavelength of light with frequency $5.0 \times 10^{14} \text{ Hz}$. [2]

7.4 State whether each is transverse or longitudinal: (a) sound, (b) light. [2]

7.5 Light can be polarised but sound cannot. Explain why. [2]

7.6 All colours of light travel at the same speed in a vacuum but have different wavelengths. Explain how this fits the wave equation. [2]

7.7 Challenge. Two polarising filters are first lined up so light passes through. Describe and explain what happens to the brightness as the second filter is slowly rotated by 90° . [2]
