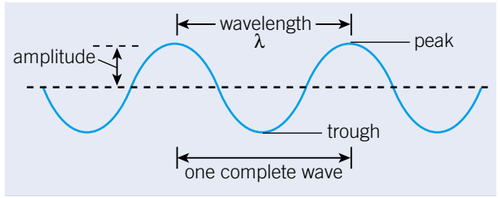
P1 Chapter 2: Sound

Knowledge organiser

Properties of waves

A wave is an **oscillation** or **vibration** that transfers energy. Matter is not transferred. Waves can be longitudinal or transverse.



Amplitude – distance from the middle to the top or bottom of the wave

Wavelength – distance between a point on the wave to the same point on the next wave

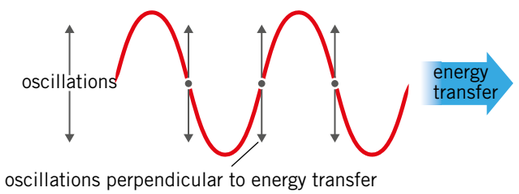
Trough – bottom of the wave **Peak** – top of the wave

Frequency – how many waves go past a particular point in a second, measured in **hertz** (Hz) or kHz

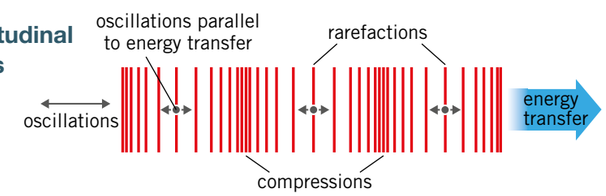
If waves meet they **superpose**. This means they add up or cancel out, depending on if they are in time with each other or not.

Transverse and longitudinal waves

Transverse waves



Longitudinal waves



Sound waves

Sound is produced by vibrations, which make air molecules oscillate.

Sound is a longitudinal wave.

speed of sound ↑

fastest – in solids (e.g., steel ≈ 5000 m/s)

in liquids (e.g., water ≈ 1500 m/s)

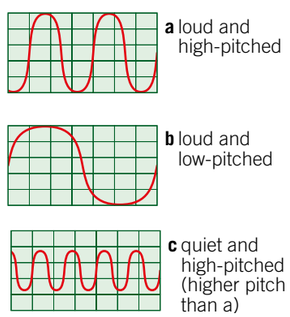
slowest – in gases (e.g., air ≈ 340 m/s)

Waves can be **reflected** from a surface. The wave hitting the surface is the **incident wave**, and the wave bouncing off is the **reflected wave**.

A reflected sound wave is heard as an echo. The time delay of an echo can be used to work out the distance to an object.

Ultrasound (waves >20 kHz) is used to make images of unborn babies, in medical scans, and for underwater (sonar) searches.

Measuring sound



Oscilloscopes are instruments that give a visual representation of a sound wave. The taller the waves, the more energy that is in the wave and higher the volume. The more waves there are in the screen, the higher the frequency and the pitch is higher.

Humans can hear frequencies 20 Hz to 20 kHz. Above this is ultrasound. Below this is **infrasound**.

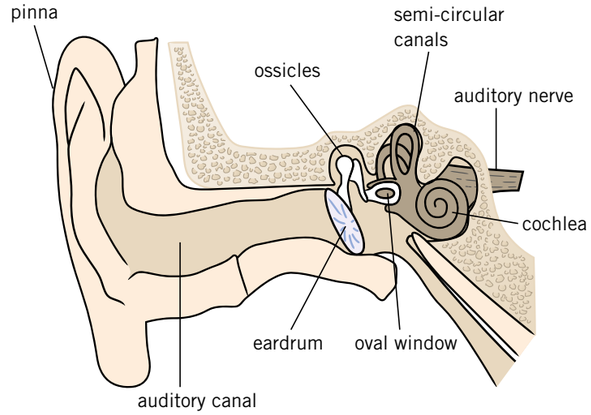
Sound volume is measured in **decibels** (dB). The decibel scale is not linear – a 10dB increase is 10 times the volume.

Recording and playing sounds

In a microphone sound waves hit a **diaphragm** making it vibrate. This produces an electrical signal by moving a coil of wire over a magnet. Speakers are the opposite to microphones – an electrical signal is turned into sound by moving a cone backwards and forwards.

Hearing

Your ear is made of many specially adapted structures that detect and transmit sound waves, allowing you to hear noises.



Part of ear	Structure	Function
outer ear	**pinna**	directs sound into auditory canal
	auditory canal	sound travels through it to reach the eardrum
	eardrum	vibrates and passes vibrations to the ossicles
middle ear	**ossicles**	tiny bones that **amplify** sound
inner ear	**cochlea**	contains fluid and hair that produce an electrical signal
	semi-circular canals	helps you keep your balance

Hearing damage be caused by a number of factors, for example:

- a hole in the ear drum (grows back naturally)
- canal blocked with wax (curable)
- loud sounds or injury, causing damage to the hairs in the cochlea (permanent).

Key words

Make sure you can write a definition for these key terms.

amplify *amplitude* *auditory canal* *auditory nerve* *cochlea* *compression* *decibel* *diaphragm* *eardrum* *frequency* *hertz* *incident wave* *infrasound* *longitudinal* *oscillation* *oscilloscope* *ossicle* *oval window* *peak* *pinna* *pitch* *rarefaction* *reflected* *semi-circular canal* *superpose* *transverse* *trough* *ultrasound* *vibration* *wavelength*