KS3 SCIENCE · PHYSICS

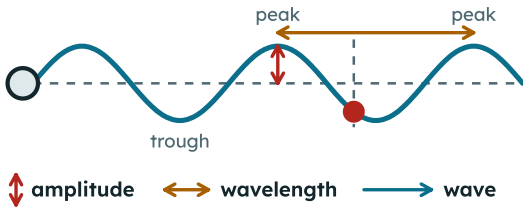
Sound revision sheet

Name _____

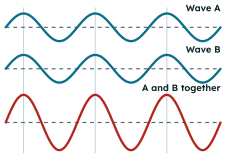


1. Waves

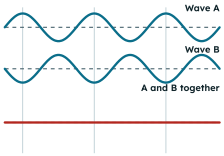
- A **wave** carries energy from place to place. The matter it travels through does not go with it.
- In a **transverse wave** the vibration is at right angles to the way the wave travels. Ripples on water and waves on a rope are transverse.
- Waves bounce off a barrier. This is **reflection**.
- When two waves meet they add together. This is **superposition**. Sound waves do it too.



A transverse wave on a rope



In step: they add

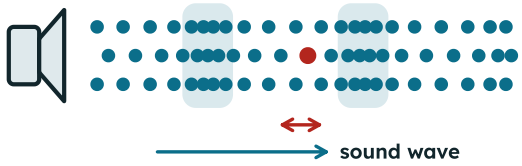


Out of step: cancel



2. Making sound

- Every sound starts with a **vibration**: a back and forth movement that repeats.
- The vibrating object pushes on the air particles next to it. They pass the vibration on, all the way to your ear.
- Sound is a **longitudinal wave**: the particles move back and forth along the same line as the wave travels.



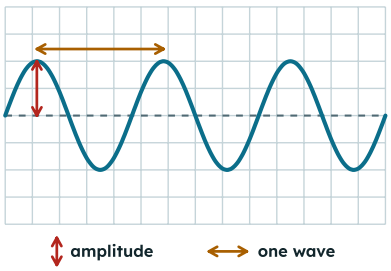
The squashed-up bands travel on. Each particle only moves back and forth.



3. The speed of sound

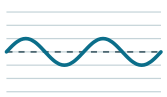
- Sound needs particles to carry it. It cannot cross a **vacuum**, because a vacuum has no particles in it.
- Sound is usually fastest in solids. Their particles are closest together, so they pass the vibration on most quickly.
- Typical speeds: about **330 m/s in air**, 1500 m/s in water and 5000 m/s in steel.
- Light is about a million times faster than sound, so you see lightning before you hear the thunder.

4. Loudness and pitch

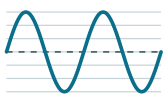


An oscilloscope screen showing one hundredth of a second: this sound is 300 Hz

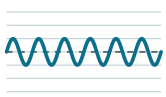
- **Amplitude** is the height of the wave, from its middle line to a peak. A bigger amplitude means a **louder** sound. How loud a sound is can be measured in decibels (dB).
- **Frequency** is the number of waves each second, in hertz (Hz). A higher frequency means a **higher pitch**.
- **Wavelength** is the distance from one peak to the next (section 1). In the same material, a higher frequency gives a shorter wavelength.



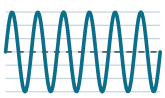
Quiet and low



Loud and low



Quiet and high



Loud and high



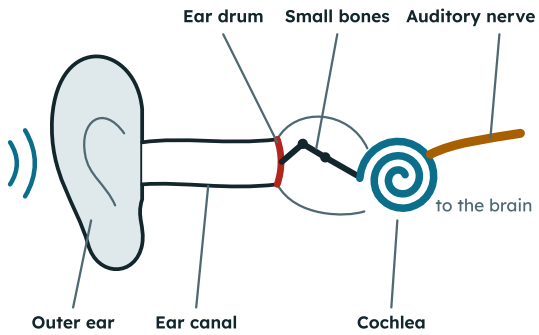
5. Echoes

- An **echo** is a sound that has been reflected from a surface.
- Hard surfaces, such as cliffs, walls and tiles, reflect sound. Soft surfaces, such as carpets and curtains, **absorb** it: its energy is transferred to the material. That makes a room quieter.

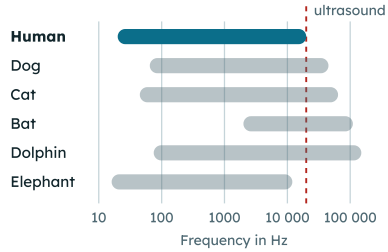
distance = speed × time · then halve it, because the sound goes there and back

An echo comes back from a cliff after 2 s. Sound travels at 330 m/s. 330 × 2 = 660 m, so the cliff is 660 ÷ 2 = 330 m away.

6. Hearing



The ear, drawn as a simple section



Hearing ranges: each step is ten times higher

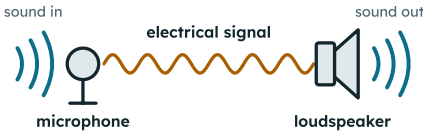
- Very loud sounds can damage your ears.
- Some animals can turn their outer ears to point at a sound.

- The **outer ear** collects sound waves. They travel along the **ear canal** and make the **ear drum** vibrate.
- Three **small bones** pass the vibrations on to the **cochlea**, which turns them into electrical signals. The **auditory nerve** carries the signals to the brain.
- Your **hearing range** is from about 20 Hz to 20 000 Hz. Dogs, cats, bats and dolphins can hear much higher sounds.



7. Using sound

- **Ultrasound** is sound with a frequency too high for humans to hear: above 20 000 Hz.
- An ultrasound scan builds a picture from echoes inside the body. Sonar times an echo from the sea bed to find the depth of the sea. Ultrasound in a bath of liquid cleans jewellery and glasses.
- A **microphone** turns a sound wave into an electrical signal. A **loudspeaker** turns the signal back into sound.
- Sound waves carry energy and information.



From sound to an electrical signal, and back to sound

Key words

Wave: a vibration that carries energy from place to place, but not matter

Vibration: a back and forth movement that repeats

Wavelength: the distance from one peak of a wave to the next

Volume: how loud or quiet a sound is, in decibels (dB)

Absorption: when the energy of a sound is transferred to a material

Ultrasound: sound with a frequency too high for humans to hear

Transverse wave: its vibration is at right angles to the way the wave travels

Vacuum: a space with no particles in it

Frequency: the number of waves each second, in hertz (Hz)

Oscilloscope: shows a sound as a wave on a screen

Ear drum: a thin skin in the ear that vibrates when sound reaches it

Microphone: turns a sound wave into an electrical signal

Longitudinal wave: its vibration is along the same line as the wave travels

Amplitude: the height of a wave, from its middle line to a peak

Pitch: how high or low a sound is

Echo: a sound reflected back from a surface

Hearing range: the lowest and highest frequencies an animal can hear

Loudspeaker: turns an electrical signal into a sound wave

Pictures are illustrations made for this sheet, not real photographs.