

Investigating sound

Frequency and pitch

There are many ways of making sounds – banging, blowing, plucking – how many more can you think of? But all sound is made by something moving, which in turn causes vibrations which travel in waves through their air.

The vibrations are picked up by our ear and our brain translates them into sound.

The sounds that we hear vary in pitch – they may be high or low.

Do you have a high pitched voice? Listen to your friends and family. Who has the lowest pitched voice and who has the highest?

The difference in the pitch of sounds is caused by the speed at which an object vibrates – when we are speaking, the ‘object’ is our vocal cords.

Measuring sound

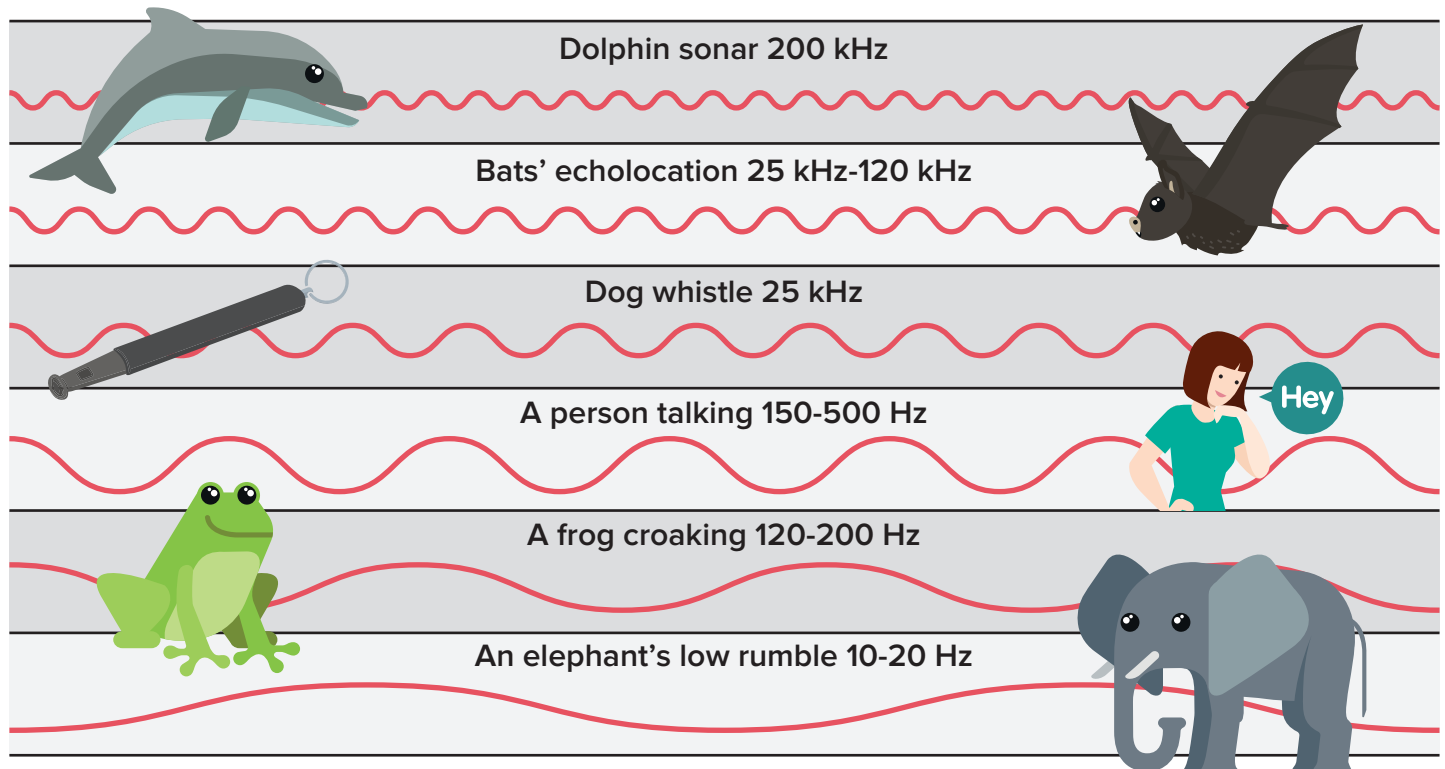
The number of times that sound vibrates per second is called its frequency. This is measured in Hertz, named after a 19th century German scientist. Very high-pitched sounds, like those produced by bats echolocation, are measured in kilohertz (kHz). One kHz is one thousand cycles per second.

Ultrasound

Sounds above 20kHz are called ultrasonic because most people cannot hear them.

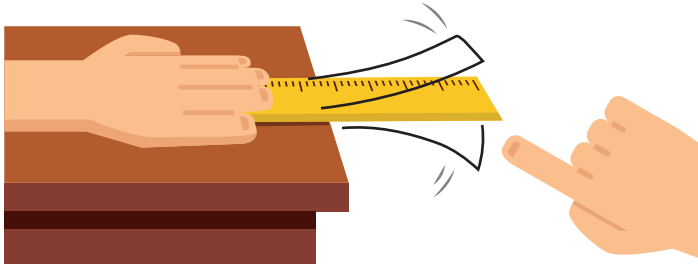
Sound waves

Sound moves through the air in waves. Higher frequency sound has shorter wavelengths than lower frequency sound. The diagram compares some different sound.



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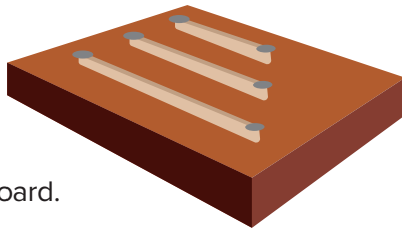
Test changes in pitch. Place a ruler over the end of a table. Hold it firmly.



Pull it down then let it go. Listen to the sound it makes. Vary the length of the ruler overlapping the table edge. Pluck it each time and listen to the sound change. When the length of the ruler vibrating is shorter, is the note higher or lower?

Make a 'voice box'

Stretch elastic bands (of the same size) across drawing pins or nails on a wooden board.



Pluck the bands. How do the sounds change when they are stretched more tightly?

Which has the highest pitch?

Most bat calls are very high-pitched.

Experiment with sound

Do big ears improve your hearing?

Like us, bats listen with their ears. The larger your external ears, (the part of the ear you can see), the better sounds can be heard. Cup your hands behind your ears. Use stiff paper to cut out a band with big ears. Design a test to find out which helps you hear better. Test ears of different shapes and sizes.



Ear trumpets

Cut cones out of paper to make ear trumpets. Change their shape and position to see how they help pick up sound from a distance.



Can you echolocate?

Slowly walk blindfolded towards a wall, clapping your hands or clicking your tongue, listening carefully before you take each step. Your partner stays close as a 'guardian'. Can you tell when you are near the wall? Try this in a large room like the school hall and outdoors.

Recognising sounds

Blindfold your partner and tap a wooden stick three times on different objects – such as the floor or a wooden box. Ask your friend to say what you are tapping. Change over. How many objects can you recognise by their sound? Put a small object (cotton reel, pins, rice etc) in a tin. Can others guess what's inside by shaking it?



Loud and soft sounds

How loud are the sounds made by bats?

The echoes of long-eared bats are as quiet as a computer keyboard.

The sounds made by pipistrelle bats are as loud as a smoke detector.

The noctule bats have the loudest call amongst bats, carrying up to 500 metres, and can be as loud as a jet engine.

...but most of us can't hear any of them!

The loudness of sounds is measured in Decibels (dB) after Alexander Graham Bell. He studied sound in great detail, and invented the telephone in 1876.

Some decibel levels

- 10 dB – the rustling of dry leaves
- 30 dB – bird song
- 70 dB – loud talking
- 80 dB – a speeding train
- 100 dB – a chainsaw
- 110 dB – a pneumatic drill
- 120 dB – dangerously loud music
- 140 dB – a jet plane