

# Sound

Sound is a form of **energy**, which is caused by **vibrations**.  
Vibrations are a type of **kinetic** energy.

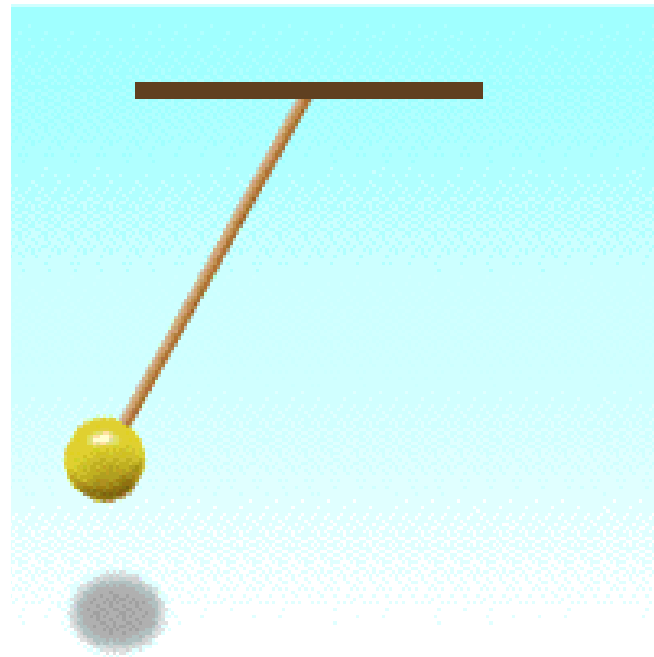


Sound moves in **waves**, spreading out from its source.

## Experiment - Ping Pong Ball and Speaker

To show that sound is a form of energy





## How does sound move?

Sound moves as a wave but needs something to move through, e.g. solid, liquid or gas.

We say that sound needs a **medium** to move through.

Example -



In air, sound moves by pushing against air particles which causes them to move. This causes other particles to move and so the sound spreads out as a wave till it hits our eardrums.

## What does sound travel through?

Sound **travels 15 times quicker in solids than air.**

Sound travels through **solids** the quickest as the particles are close together.

e.g. Elephants can communicate for kms through the ground using ultra low-frequency sounds that we cannot hear.



**Sound travels 4.5 times faster in liquids than in air.**

e.g. It allows whales to communicate over great distances.



Sound travels through **air** the **slowest** as the particles are spread out.

## Speed of Sound

The speed of sound is **340 m/s**.

The speed of light is 300,000,000 m/s

**This why we see lightening before we hear it.**



## What happens when you go faster than sound?

Fighter planes go faster than sound and produce a Sonic Boom.  
This is where the air waves get so squashed that they form a big wall of sound.

**We can see the air as a cone here**



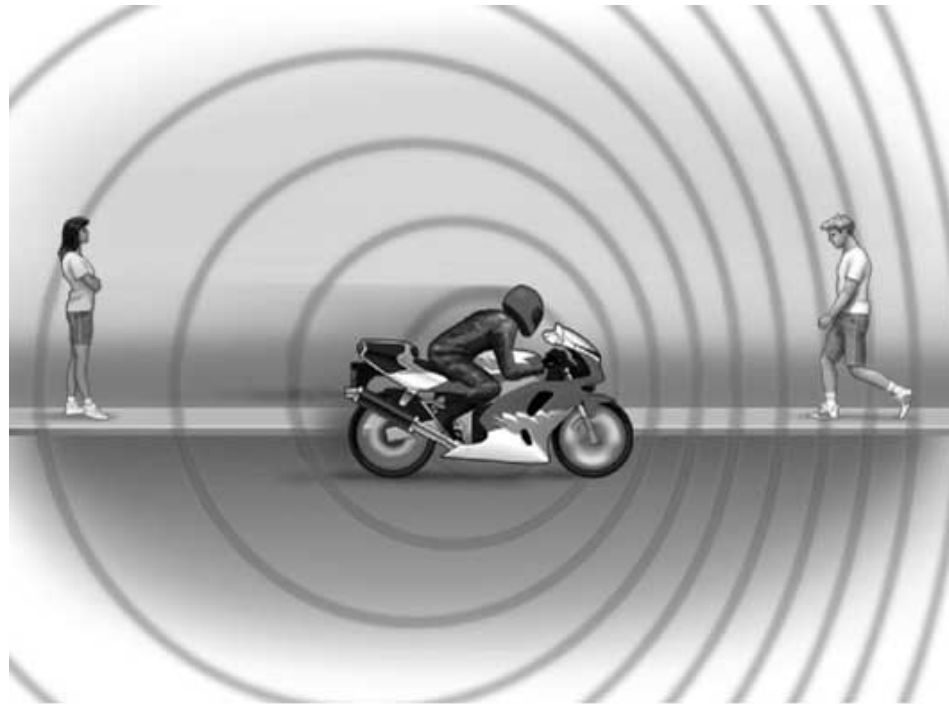
**Here's what it sounds like...**





## The Doppler Effect

The **Doppler Effect** can be heard when a fast-moving object comes towards you. As it comes **closer** the sound waves are squashed and the **pitch goes up**. Once it has gone **away** the waves are spreading out and the **pitch drops**.



Precision Graphics



# Echoes

**Echoes are sounds that are reflected from a surface.**

## Disadvantages of Echoes

Echoes in a music hall or cinema can ruin the sound.  
The sounds can get mixed up and clash with each other.  
Soft padded walls and different shapes can be used to stop echoes.

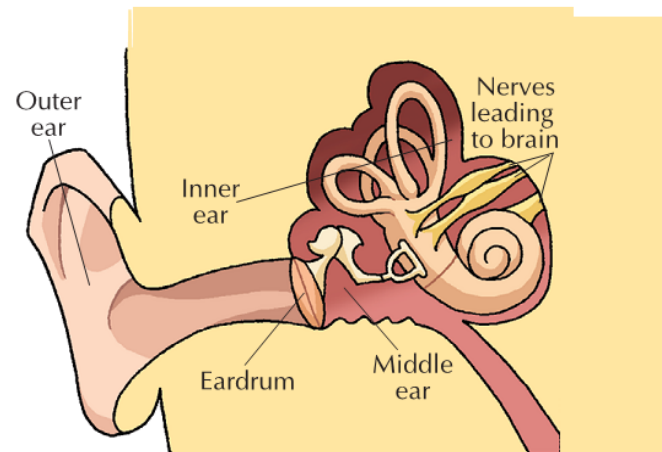
## Advantages of Echoes

Echoes can be useful.  
Ships use echo-sounding to find the depth of the sea.  
Bats use echoes to catch food.  
Ultrasound is used to scan babies.



## Sound Detection in the Ear

1. Our outer ear is shaped to collect sound.  
It directs the air particles into the inner ear.
2. The eardrum is like a thin sheet of skin that vibrates with the sound.
3. This vibration is turned into an electrical message in the ear.
4. The message is carried along an auditory nerve into the brain.



## Noise Levels

Sound is measured in **Decibels** (dB).  
The quietest sounds we hear are at 0dB  
and go up to 190dB.

Disco speakers are around 120dB,  
Pain is caused at 130dB and eardrums burst at 150dB.

Constant noise over 85dB can damage your hearing  
permanently.

Hearing protection must be worn at levels over 90dB.

