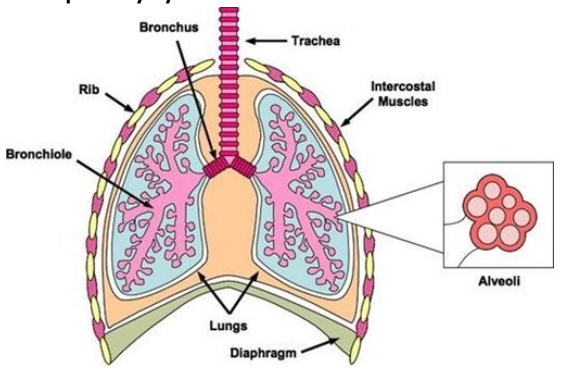
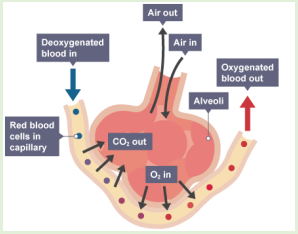
1. The Respiratory System



2. Adaptations of the Alveoli

Alveoli are the small air sacs in the lungs and are the site of gas exchange. There have several adaptations that make them suited to their function.

- **Large surface area** to allow for maximum gas exchange
- Walls **one cell thick** to minimise the diffusion distance.
- **Good blood supply** to ensure gases are transported quickly.
- **Moist walls** to allows gases to dissolve.



3. Ventilation

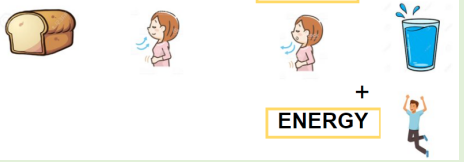
Ventilation is the scientific word for breathing. Breathing is a process that takes oxygen into the body and removes carbon dioxide. Breathing in is called i**nhalation** and breathing out is called **exhalation.**

	Inhaling	Exhaling
Diaphragm	Contracts and moves downwards	Relaxes and moves upwards
Intercostal muscles	Contract, moving the ribs upwards and outwards	Relax, letting the ribs move downwards and inwards
Volume of ribcage	Increases	Decreases
Pressure inside the chest	Decreases below atmospheric pressure	Increases above atmospheric pressure
Movement of air	Moves into the lungs	Moves out of the lungs

4. Aerobic Respiration

Respiration is a chemical reaction which releases energy, to keep up alive.. The energy is used to processes such as: growth, repair and movement. This process happens in the mitochondria of cells.

Glucose + Oxygen → Carbon dioxide + Water + ENERGY



5. Anaerobic Respiration

During intense exercise not enough oxygen can be supplied to our muscles. When this happens, our bodies carry out anaerobic respiration.

Glucose → Lactic acid + ENERGY

✓ Energy is quickly made

✗ Lactic acid is harmful to the body. It has to be removed from cells and broken down following the resumption of aerobic respiration (to repay the oxygen debt).

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Respiration

6. Respiration and Exercise

When our bodies undergo exercise our **breathing rate** and **heart rate increases.**

Breathing rate increases in order to draw more oxygen into our bodies which is needed for respiration. This also removes the carbon dioxide which is being produced quickly through respiration.

Our heart rate increases in order to pump oxygen around the body faster to the muscles.
We can measure our **heart rate** but finding our **pulse**.

7. Smoking

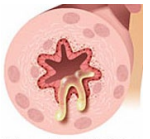
Smoking cigarettes cause damage in the lungs. Over time the alveoli become damaged and change shape. This reduces the surface area of the alveoli and reduces the amount of gas exchange that can take place. This causes symptoms like fatigue and shortness of breath.

Healthy alveolus

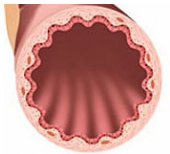
Alveolus damaged by pulmonary disease

8. Asthma

Asthma is a condition that affects the bronchioles in the lungs. The bronchioles become inflamed and produce mucus making it harder for air to enter and leave the lungs. This causes shortness of breath and tightness in the chest. Inhalers are used as a treatment for asthma. They cause the bronchioles to widen allowing air flow to return to normal.



Inflamed bronchial tube of an asthmatic

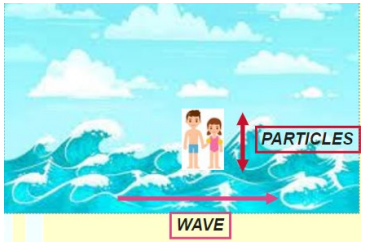


Normal bronchial tube

1. Waves

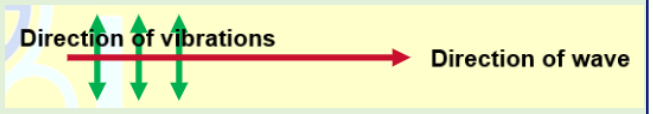
Waves are a **transfer of energy**. They do **not** transfer particles.

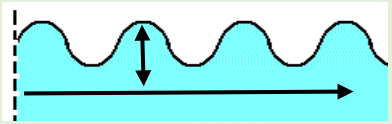
For example, when in the sea, the wave moves past you and you bob up and down. You are the particle in this example



2. Water waves

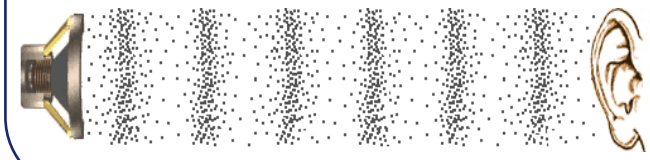
The particles in water waves move at a right angle to the direction of the wave. Water waves are an example of **transverse waves.**





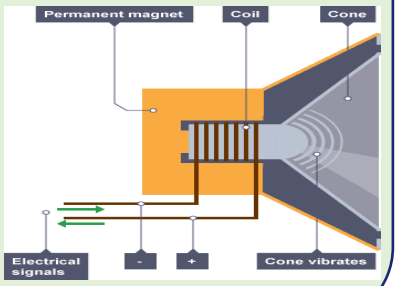
3. Sound waves

Sound waves are **longitudinal waves** - the vibrations are in the same direction as the direction of travel.



4. Loudspeakers

Sound waves are produced by all vibrating objects. Loudspeakers work by converting electrical energy into kinetic energy. This moves the cone which creates the sound waves.



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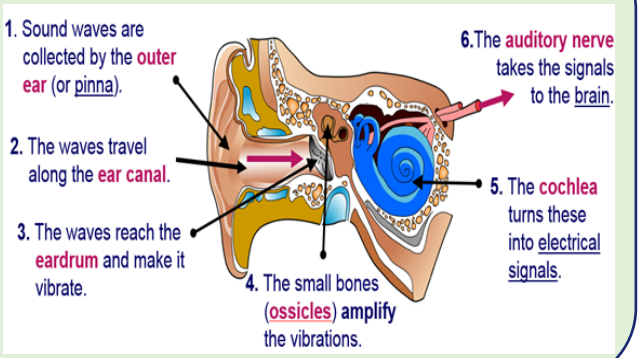
Waves 1: Sound

5. Detecting sounds



6. Microphones

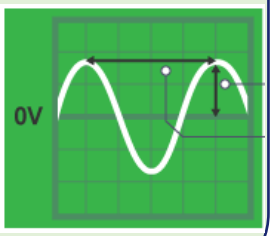
Mobile phones and telephones contain microphones. These devices contain a diaphragm, which does a similar job to an ear drum. The vibrations in air make the diaphragm vibrate, and these vibrations are changed to electrical impulses. In the lab, the electrical impulses can be sent to an oscilloscope, which represents them as a graph on a screen

7. Oscilloscope traces

Amplitude is the height of the wave from its resting position – the greater the amplitude, the louder the sound

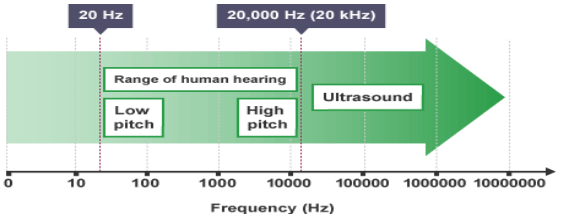
Wavelength is the distance between the crests (tops) of two waves

Frequency is the number of waves per second – the higher the frequency, the closer together the waves are and the higher the pitch



8. Human Hearing range

The frequency of sound waves is measured in hertz, which has the symbol Hz. The bigger the number, the greater the frequency and the higher the pitch of the sound. Human beings can generally hear sounds as low as 20 Hz and as high as 20,000 Hz (20 kHz).



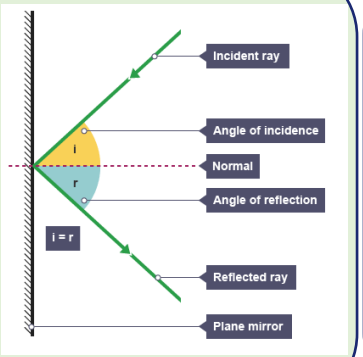
1. Sound and Light

Light travels at 300,000,000 m/s, much faster than sound, which travels at 343 m/s. This is why you see lightning before you hear it.

	Light waves	Sound waves
Type of wave	Transverse	Longitudinal
Can they travel through matter (solids, liquids and gases)?	Yes (if transparent or translucent)	Yes
Can they travel through a vacuum?	Yes	No
How are they detected?	Eyes, cameras	Ears, microphones
Can they be reflected?	Yes	Yes
Can they be refracted?	Yes	Yes

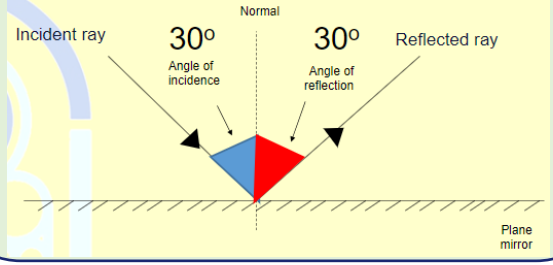
2. Reflection

When light reaches a mirror, it reflects off the surface of the mirror:
the **incident ray** is the light going towards the mirror
the **reflected ray** is the light coming away from the mirror



3. The law of reflection

The **law of reflection** states that the angle of incidence equals the angle of reflection, i = r.
For example, if the angle of reflection is 30° then the angle of incidence is 30°.



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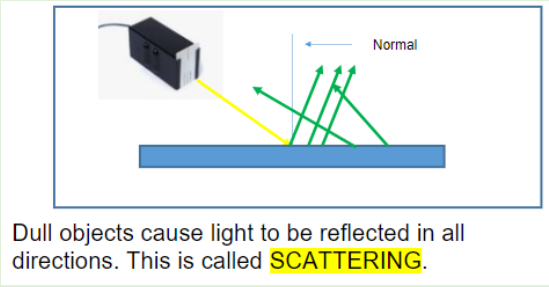
Waves 2: Light

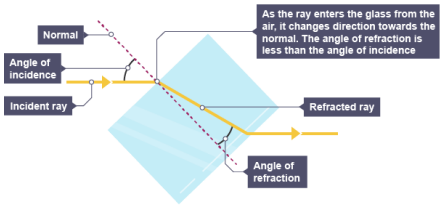
4. Scattering

The reason a reflection is not seen in dull objects is because of scattering.



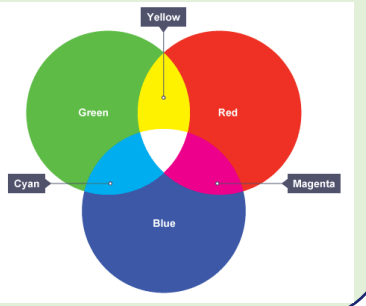
5. Refraction

Light waves change speed when they pass across the boundary between two substances with a different **density**, such as air and glass. This causes them to change direction, an effect called **refraction**.



6. Coloured light

There are three primary colours in light: red, green and blue. Light in these colours can be added together to make the secondary colours magenta, cyan and yellow.
All three primary colours add together make white light.



7. Seeing in colour

Any coloured object reflects the colour that it is, and absorbs the rest. A leaf looks green because it has absorbed all colours except for green.
Black objects absorb all colours
White objects absorb no colours and reflect all the light