

Wave Properties	Types of Wave	Echoes and Absorption	Ultrasound	Refraction	The Eye	Lenses and Correcting Vision	Colour Filters
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Key Words

Key Word	Definition
Oscillation	Repeating back-and-forth movement.
Transverse wave	When the oscillations of the wave are perpendicular (90°) to the direction of its energy transfer.
Longitudinal wave	When the oscillations of the wave are parallel to the direction of its energy transfer.
Reflection	When a wave bounces off a boundary.
Refraction	When a wave changes direction when passing from one medium to another.
Absorption	When a material takes in the energy of a wave.
Transmission	When a wave passes through a material.
Echo	The reflection of a sound wave.
Ultrasound	Sound with frequencies higher than the range of human hearing (20 Hz to 20,000 Hz).

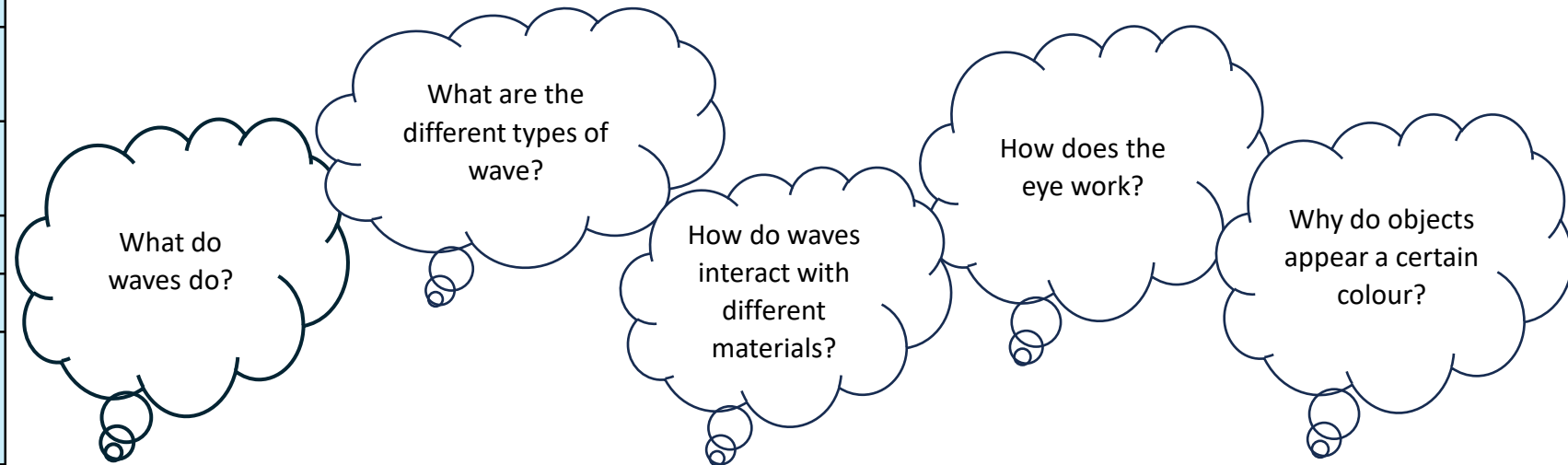
Misconceptions

Saying that transverse waves are perpendicular.
Say instead that the oscillations and energy transfer are perpendicular.

The primary colours of light are NOT Red, Green, Yellow.
The primary colours of light are Red, Green, Blue.

Refraction does not happen inside materials.
Refraction happens at the boundary between two materials of different density.

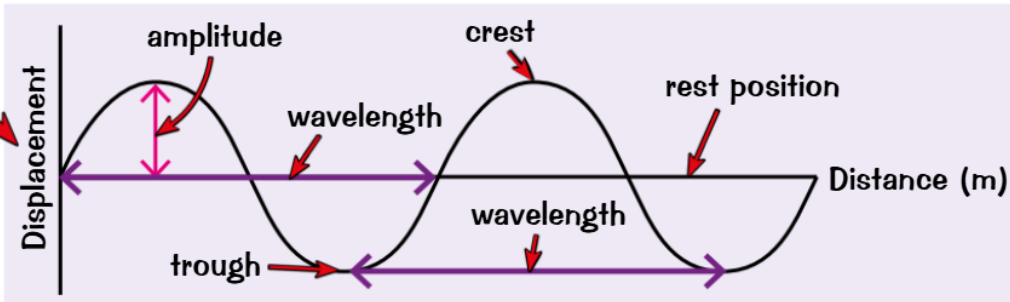
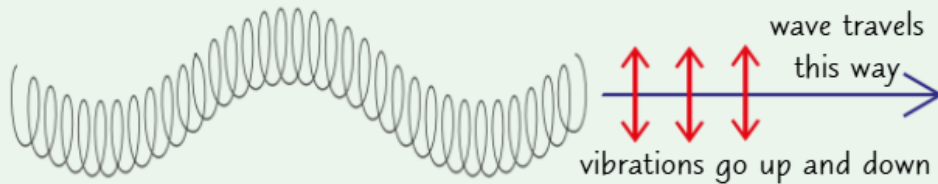
Key questions



Transverse Waves

Transverse waves oscillate (vibrate) perpendicular to the direction of energy transfer.
Examples include rope waves, water waves, and any electromagnetic wave like light.

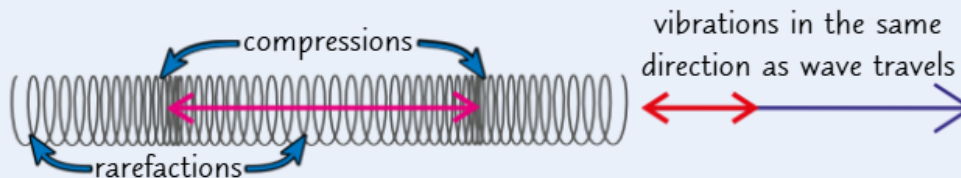
A spring wiggled **up and down** gives a **transverse** wave.



Longitudinal Waves

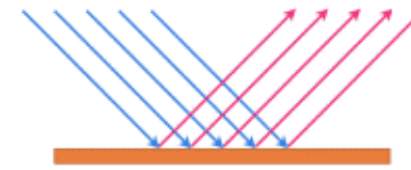
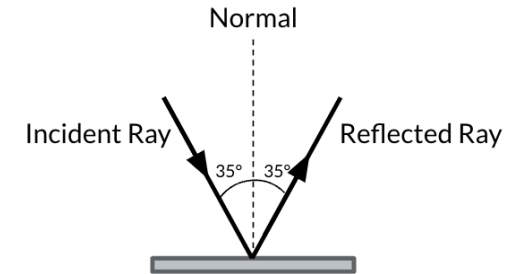
Longitudinal waves oscillate (vibrate) parallel to the direction of energy transfer.
Examples include pushing and pulling a slinky, sound, and ultrasound

If you **push** the end of a spring you get a **longitudinal** wave.

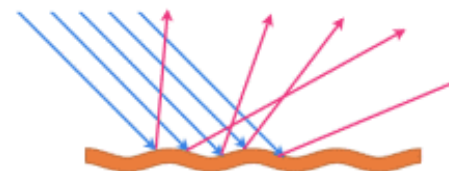


Reflection

When waves reflect, the angle of incidence equals the angle of reflection. This is called the law of reflection.
All angles are measured from a 'normal' line which is perpendicular to the surface.



Specular reflection



Diffuse reflection

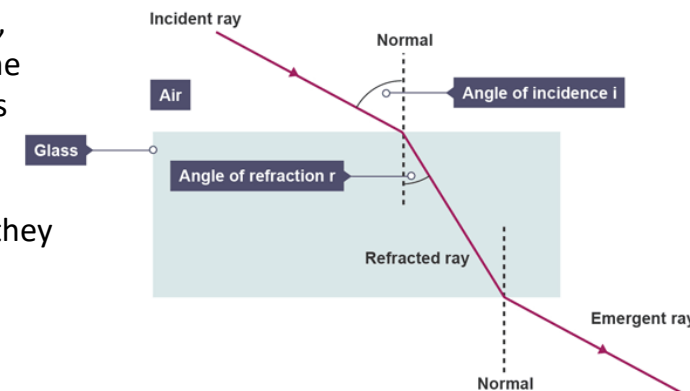
When considering many incident rays we have two types of reflection; specular and diffuse.

Specular reflection occurs on smooth surfaces where the reflected rays are parallel.
You can see clear images with specular reflection.

Diffuse reflection occurs on rough surfaces where the reflected rays are not parallel. You cannot see clear images with diffuse reflection.

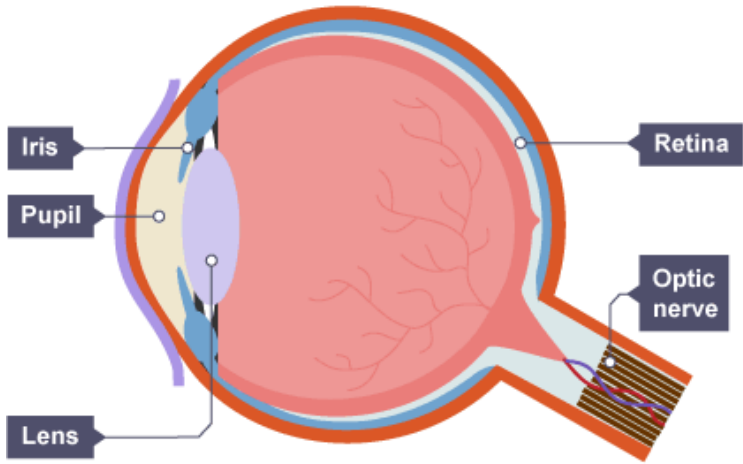
Refraction

When waves enter a denser medium, they slow down and bend towards the normal. The angle of refraction is less than the angle of incidence.



When waves exit a denser medium, they speed up and bend away from the normal. The angle of refraction is greater than the angle of incidence

The Eye



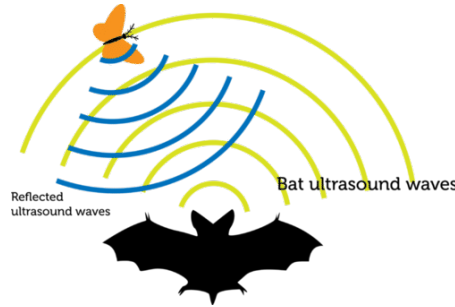
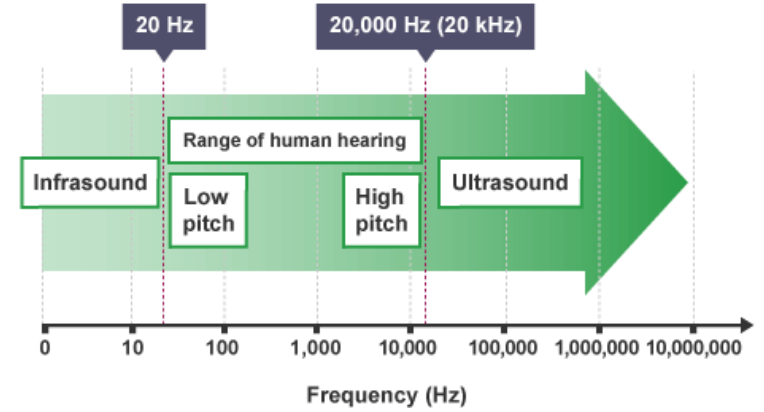
Component of Eye	Description
Pupil	The black part of the eye. This is an opening that lets light in.
Iris	The coloured circle around the pupil. It controls the size of the pupil.
Lens	Focuses light onto the retina
Optic Nerve	Carries messages from the retina to the brain. The brain turns these into an image of what we are looking at.
Retina	The Light-sensitive layer at the back of the eye.

Ultrasound

Humans have a hearing range of about 20Hz to 20,000Hz.

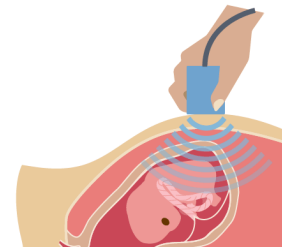
This varies slightly between people, particularly those of different ages.

Any sounds above this range of hearing, i.e. above 20,000Hz, are called ultrasound.



Bats used ultrasound for echolocation. This is when emitted ultrasound from the bat reflects off other objects. Bats can detect how long it takes for the ultrasound to return in order to sense how far away the object is.

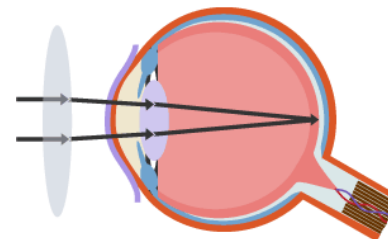
Other uses include prenatal scans, SONAR, and even for cleaning jewellery.



Correcting Vision

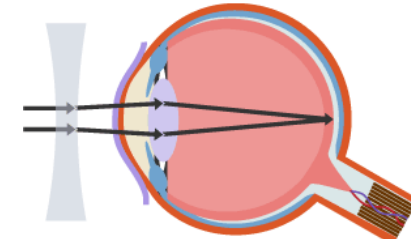
Concave lenses refract rays inwards. As such, they are often called converging lenses.

These can be used to correct for long-sightedness.

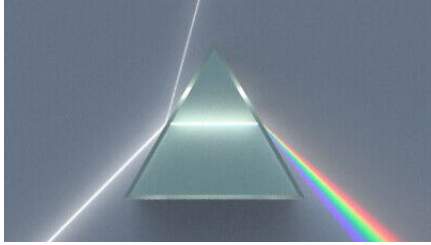


Convex lenses refract rays outwards. As such, they are often called diverging lenses.

These can be used to correct for short-sightedness.



Separating Light

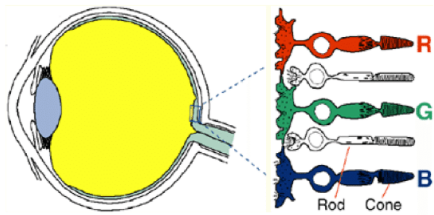


White light is a mixture of all of the colours of light.

A glass prism can be used to separate these colours as they all refract at different angles.

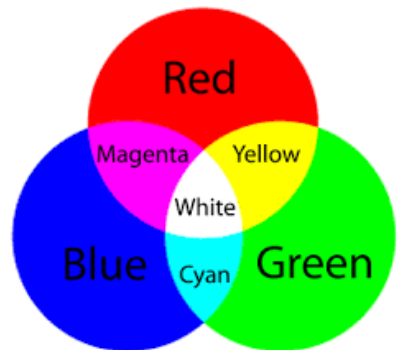
Colours

Since our retina is most sensitive to red, green, and blue colours our brain can make up any other colour using a mixture of these.

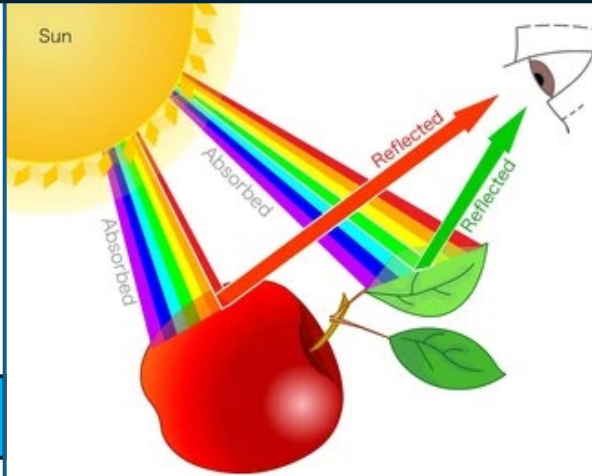


The primary colours of light are therefore Red (R), Green (G), Blue (B).

You can mix two primary colours of light to create the secondary colour; magenta, yellow, and cyan.



Seeing objects

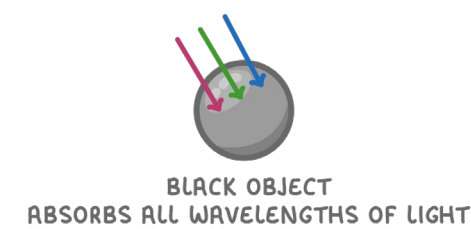


We see objects certain colours because that colour of light is reflected into our eyes and the other colours are absorbed.

To simplify this, we can just use the primary colours.

White light, made up of red, green and blue, is shone onto different objects.

Some colours get absorbed and some reflected.



Filters

Colour filters only allow certain colours to transmit through. The rest are absorbed.

Filters can therefore be used to change the apparent colour of an object.

