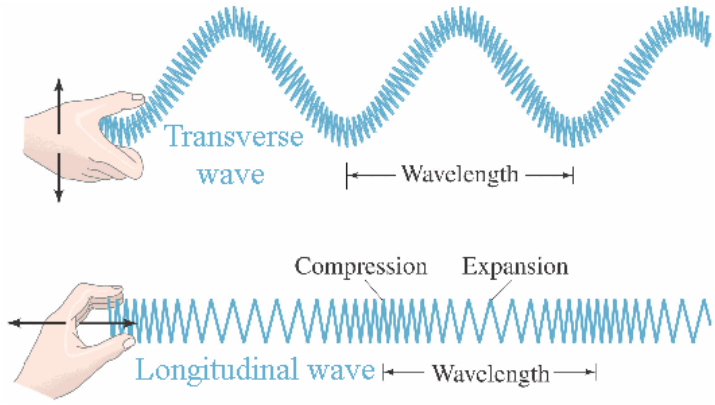
What is light?

Light is a form of energy that we can see and is given out by hot objects. It is made up of waves that travel outwards from a light source. Some of the waves reach our eyes, but most continue elsewhere.

Waves can be transverse or longitudinal

The two main types of waveform are transverse waves and longitudinal waves. All types of electromagnetic waves, including light, as well as water waves travel as transverse waves. Sound waves travel as longitudinal waves.

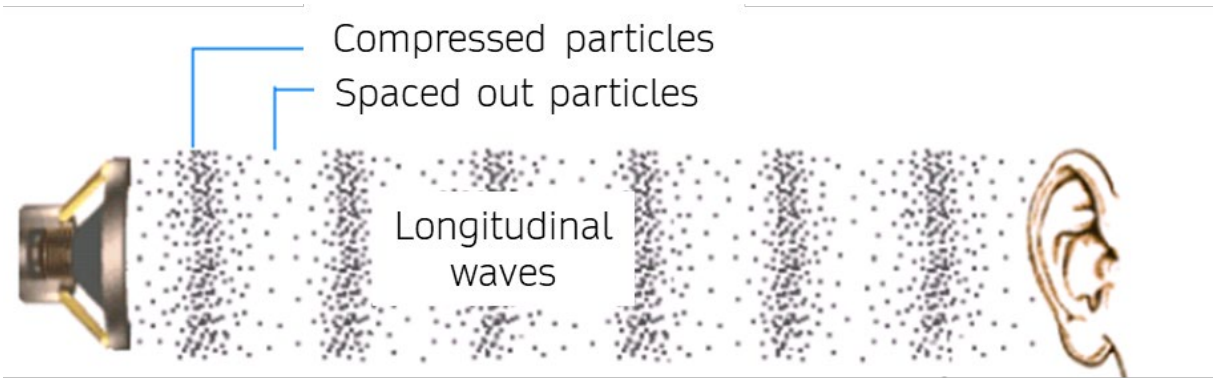


Transverse waves (**light**) are a moving wave where each part of the wave travels up and down in repeating motion as the wave moves forward. These do not need a medium to travel through and can travel through empty space.

Longitudinal waves (**sound**) are a compressing and expanding wave that needs a **medium** to travel in. A medium could be gas, solid or liquid.

Sound travels as a longitudinal wave

Sound waves are mechanical waves requiring particles. (a **medium** to travel through) Air particles vibrate back and forward creating repeating patterns of high (compressed particles) and low (spaced apart particles) pressure. One wave stretches from one compressed area of particles to the next. Waves of sound energy travel through air, water and solid substances.



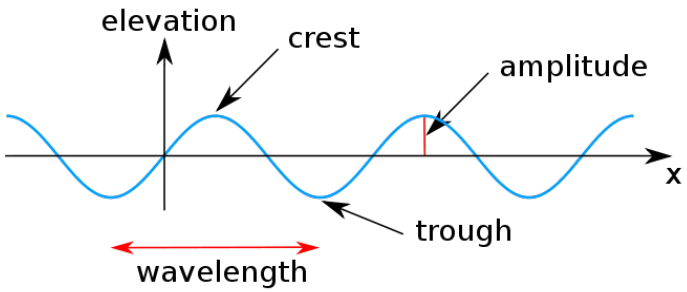
Waves transfer energy

Waves are a means of transferring energy from one place to another without also transferring matter. Some waves need a medium (matter) to travel through in order to transport their energy from one location to another and are known as **mechanical waves,** such as ocean waves, sound waves and earthquake waves.

Other waves can travel through the vacuum of space where there is little or no atoms. These are **electromagnetic waves**. Examples of those waves include light waves, microwaves and radio waves.

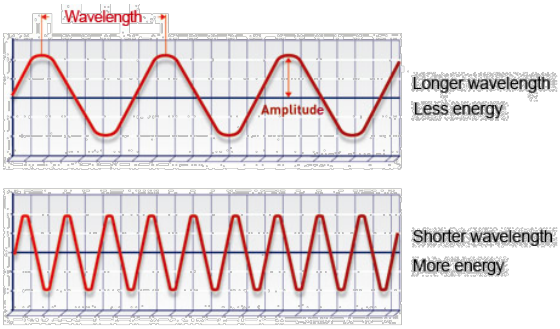
extra info

Features of a wave



Waves have **troughs**, the lowest point, and **crests**, the highest point. A **wavelength** is the distance between two closest crests. The **amplitude** of a wave is a measure of its height. The height is taken from a midpoint between a trough and a peak up to the top of a peak of a wave.

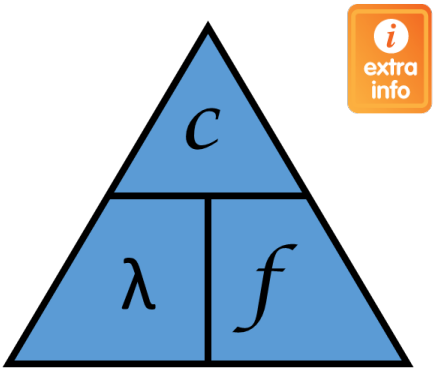
Frequency of a wave



The **frequency** of a wave is calculated by the number of waves that pass by a fixed point in a given amount of time. The frequency is measured in **hertz** (Hz). Because all electromagnetic radiation travels at the same speed then more waves of shorter wavelength will pass by a point over the same time as waves of longer wavelength.

wave speed = wavelength x frequency

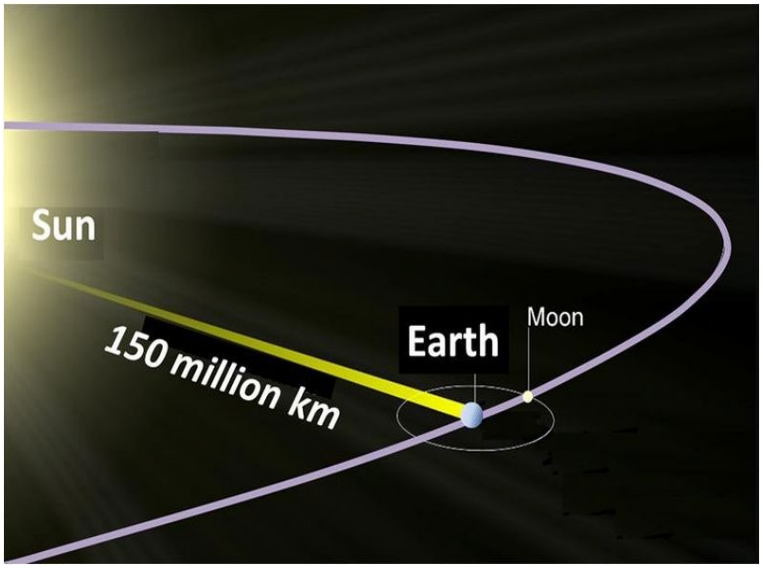
Waves always travel at the same speed. A scientific value that always remains the same is called a **constant**. The constant for the speed of light is c = $3x10^8$ m/sec or 300,000 kilometres per second.



Because we know the speed of light, if we know either the wavelength (λ) in metres or the frequency (f) in hertz then we can calculate the other.

Wavelength = speed of light / frequency
Frequency = speed of light / wavelength

Light energy can travel as rays



Light travels **fast** and in **straight lines**.

At the speed of light, which is 300,000 kilometers per second, light from the sun takes about 8 minutes to travel 149 million kilometers to earth. Light can go around the earth 7 times in one second. Light travels straight, until something bends it. The straight paths of light are called **light rays.**

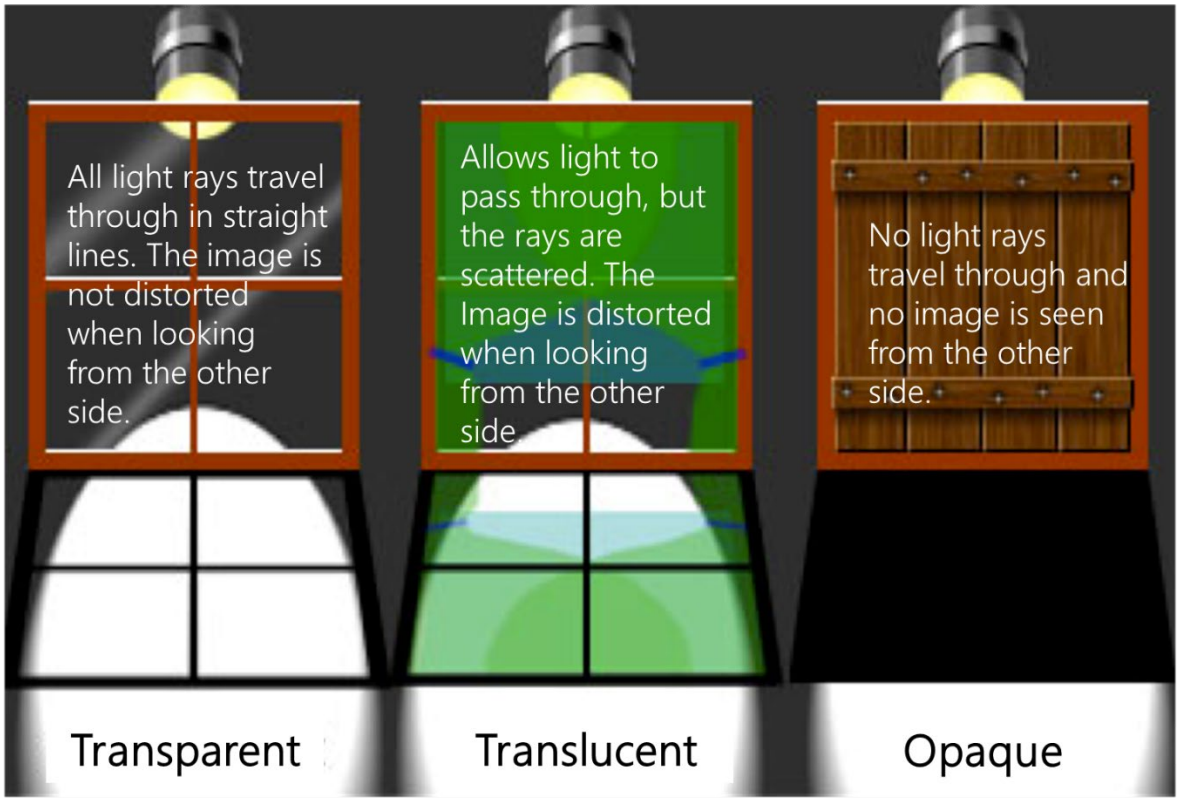
Light energy can be reflected, refracted or dispersed

Light **travels** in a straight line until it strikes an object or a force. Light can be:

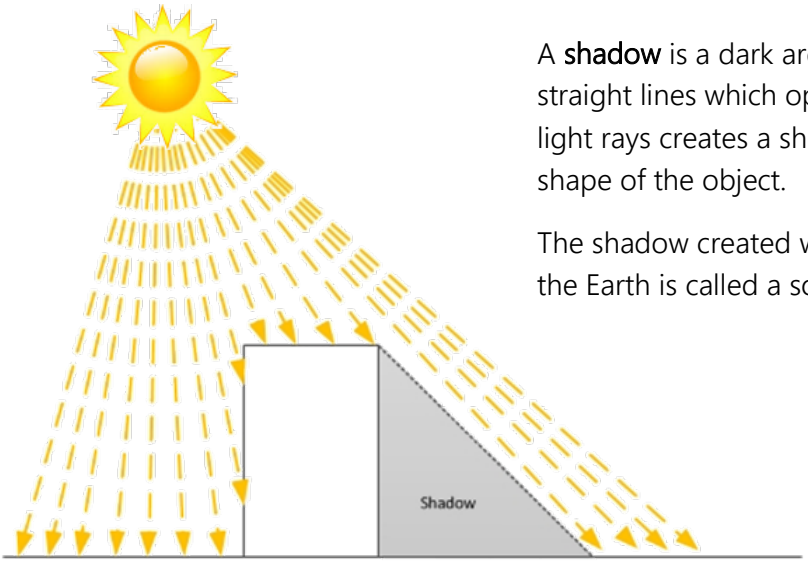
1. Reflected by a mirror
2. Refracted by a lens
3. Absorbed by the object

Light interacts with matter by **transmission** (including refraction) which is travelling through it, **absorption** where it enters but doesn't leave again, or **scattering** (including reflection) where it bounces off. To see an object, light from that object— emitted by or scattered from it—must enter the eye.

Transparent, Translucent and Opaque



Shadows are created when light rays are stopped



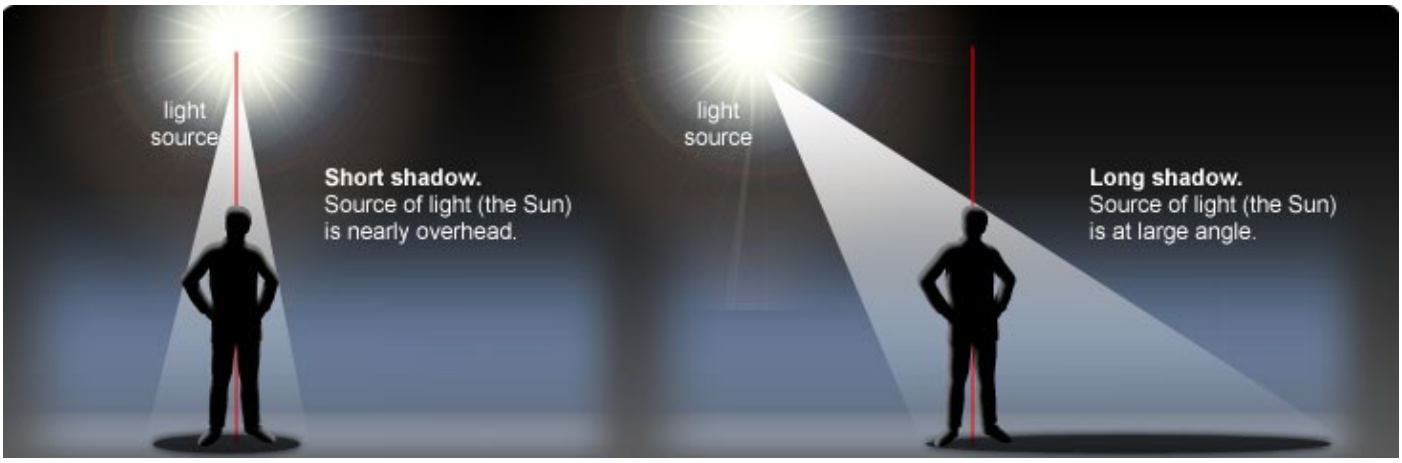
A **shadow** is a dark area that is formed due to light travelling in straight lines which opaque objects block. An object that stops direct light rays creates a shadow. The shape of the shadow resembles the shape of the object.

The shadow created when the Moon blocks the light from the Sun to the Earth is called a solar eclipse.

The length of the shadow depends on the angle of the light source

The length of the shadow formed on the ground depends on the angle that the light rays hit the object blocking the light. If the light rays hit the object straight on, then this will create the smallest possible shadow. The greater the angle the light rays hit the longer the resulting shadow.

The changing of length of shadow can be seen as the Sun moves across the sky. In the morning and afternoon, the shadows created are the longest as the Sun is at the greatest angle. The shortest shadows are formed at midday when the sun is directly over-head (in Summer).

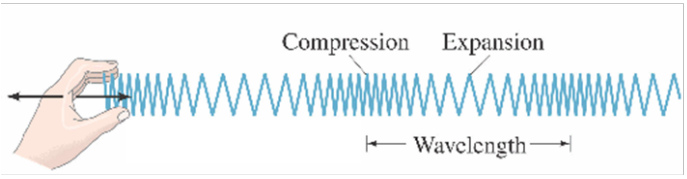


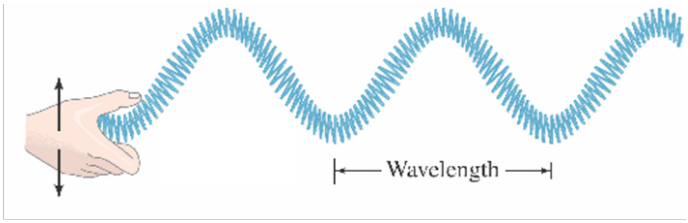
Sources of light and reflectors of light

Light is a form of energy. The Sun is our most important source of light, which is produced along with heat energy, that is transformed from matter during a nuclear reaction. Other sources of light energy such as electrical lighting, fire and the glow from bioluminescent animals are produced during energy transformations as well. Light sources need energy to be transformed to produce light. These are also called illuminators.

Objects that appear to produce light such as the Moon or shiny objects but do not use energy are reflectors of light. Light rays must originally come from a light source, such as the Sun's light reflecting off the moon.

1. Identify the diagrams as either transverse or longitudinal waves



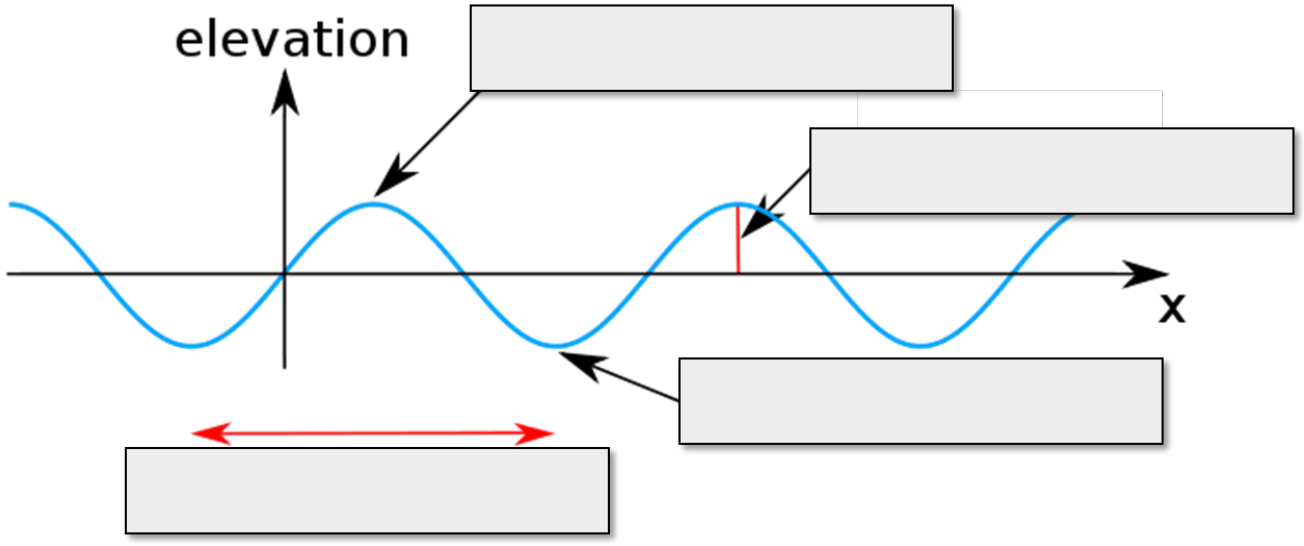


2. Complete the table below showing a list of examples of transverse and longitudinal waves

Ripples on water sound light 'Mexican' wave pressure waves (P) in an earthquake vibrations in a guitar string radio waves squashing and releasing slinky

3. identify parts of the wave

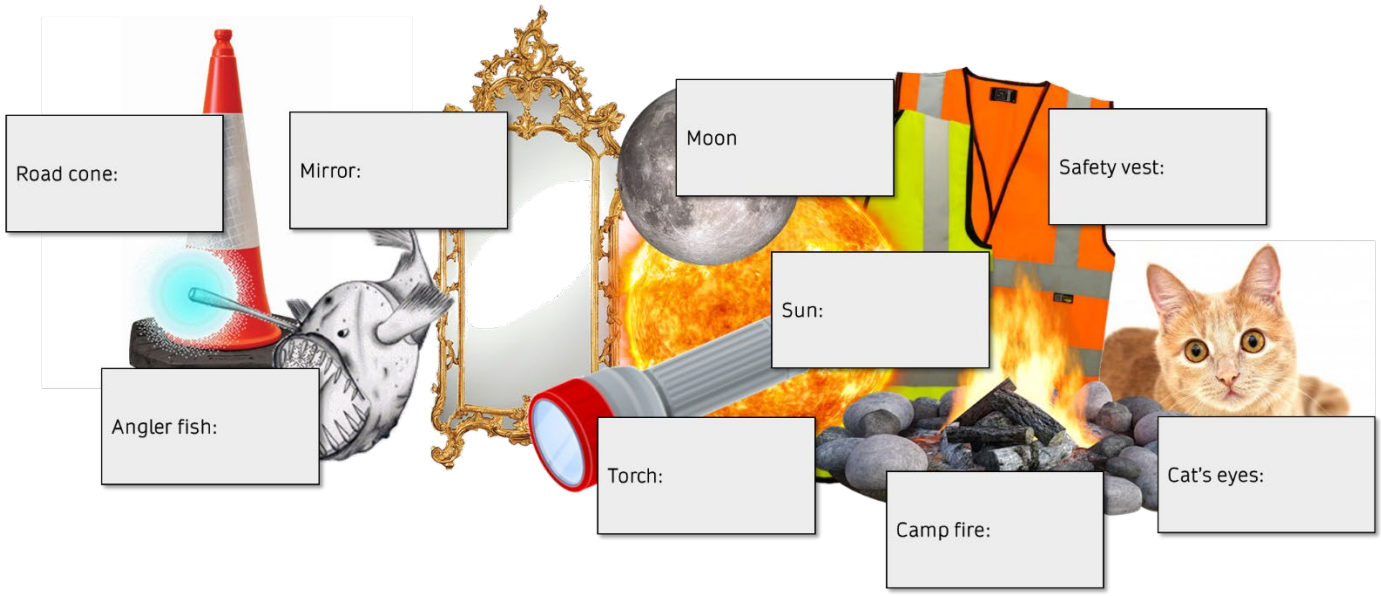
trough crest amplitude wavelength



4. Identify the following cups below as either translucent, transparent or opaque, then list at least 3 examples for each

Example	glass cup 	plastic cup 	ceramic cup 
description			
More examples			

5. Identify as either a light source (S) or light reflector (R)



6. Draw the light rays from the light source, and show the shadow formed by the object on the floor and wall of the diagram