Light

Printable revision sheet — Galaxscia

LEVEL 1

Light travels in straight lines

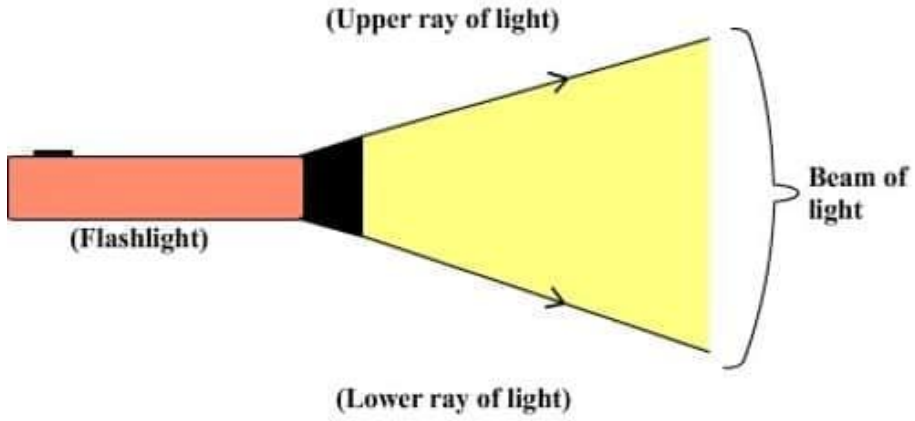
Light travels in a straight line. You can see this, for example, when a sunbeam crosses a dusty room: a straight, sharp path stands out.

The light ray model

To model light, we use the **light ray** model:

Light is drawn as a straight line with an arrow showing the direction it travels in.

Several rays make up a **beam of light**. Only the outermost rays are drawn to keep diagrams simple, but there is in fact an infinite number of rays between those two.



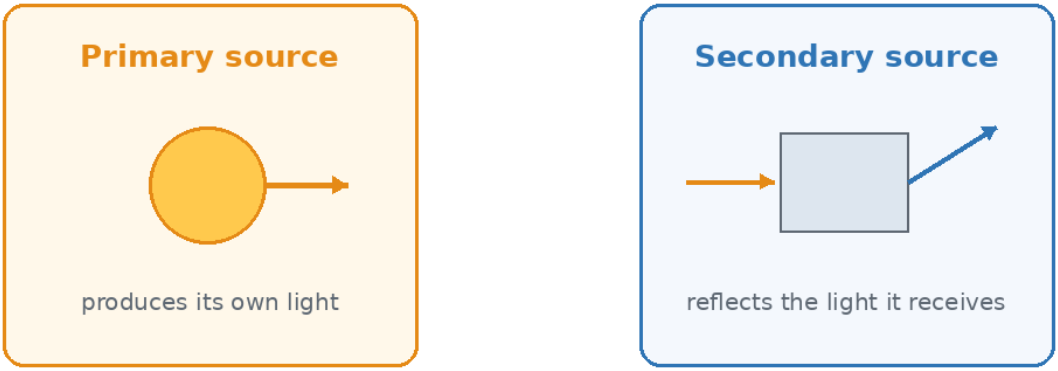
Types of light source

There are 2 types of light source:

Primary sources, which make their own light (such as the Sun, a lamp, a candle, a screen or a firefly).

Secondary sources, which do not make light but send back the light they receive (such as the Moon, walls, books, faces, or any other object).

Light sources



Key points — revision questions

In which direction does light travel?

How is a light ray drawn on a diagram?

What is the difference between a primary source and a secondary source?

Give two examples of each type of source.

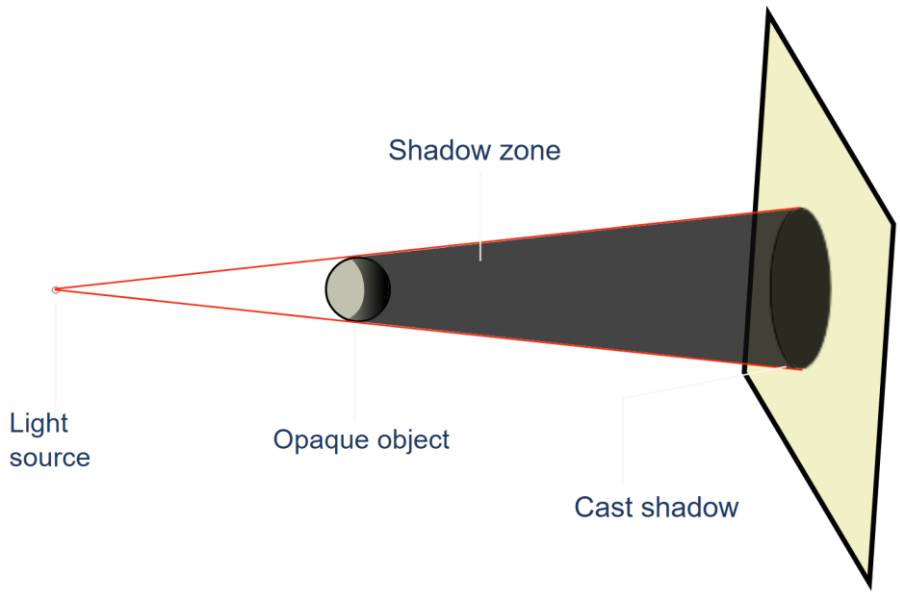
LEVEL 2

How shadows form

An opaque object placed in front of a light source blocks some of the rays, creating areas without light. Several areas can be distinguished:

The shadow on the object itself: the unlit part of the space behind the object.

The cast shadow: the shadow projected onto a surface behind the object.



What is needed to see an object

Whether or not we can see an object (with our eyes or with a camera) depends on two conditions:

The object to be seen is lit. Light must therefore be present.

The light sent back from the object reaches the observer's eyes (or the camera lens).

Three optical phenomena

Light interacts differently with the matter it meets. It is generally either scattered, reflected or transmitted. In some cases it is absorbed.

Scattering Light sent back **in all directions** by the surface. *Examples: a white wall, paper, a cloud*

Reflection Light sent back in **a single direction**. *Examples: a mirror, the still surface of water*

Transmission Light **passes through** the object and carries on travelling. *Examples: a window pane, clear water, glass*

Key points — revision questions

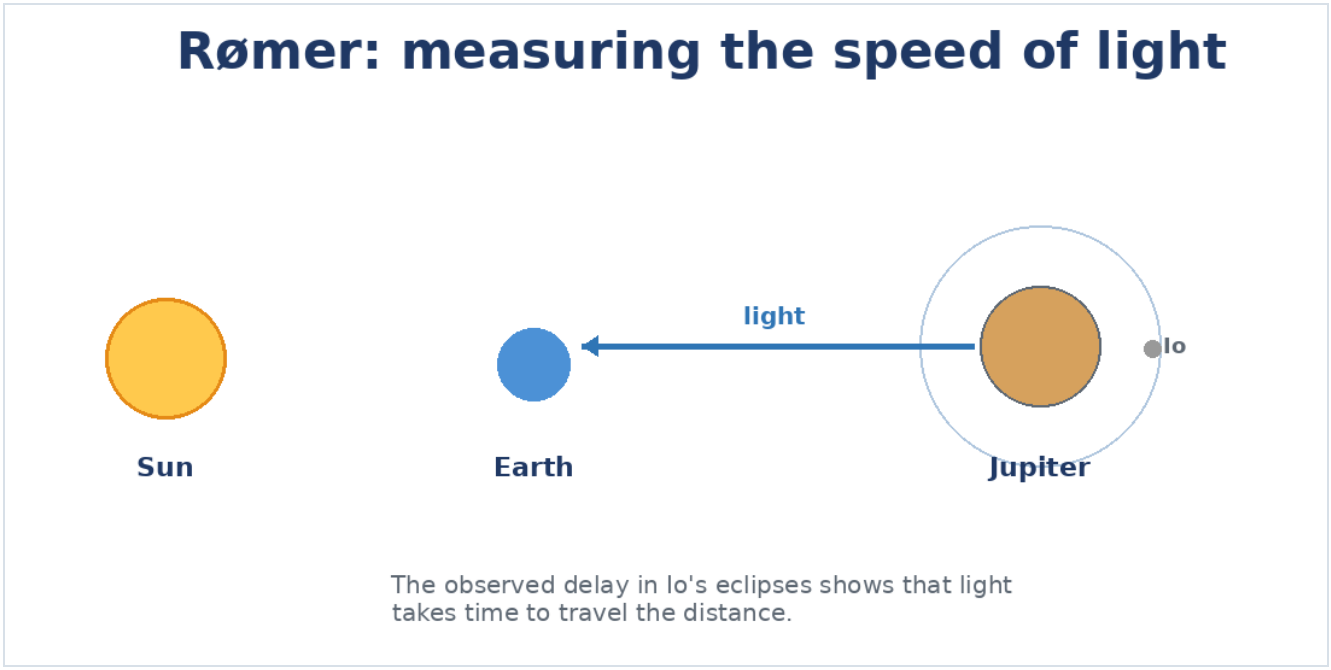
What are the two parts of a shadow?

What conditions are needed in order to see an object?

Explain the difference between scattering, reflection and transmission.

LEVEL 3

A bit of history



For a long time, light was thought to be *instantaneous*. In the 17th century, Galileo tried to measure its speed without success. In 1676, **Ole Rømer** used observations of Jupiter's moon Io to prove that light does have a speed, and therefore takes time to travel.

The value used today

Today we know that c = 299,792,458 m/s (about **300,000 km/s**). Light can go around the Earth about 7.5 times in one second.

Applications

Knowing the value of the speed of light, distances can be worked out by measuring the time between light being sent out and received. You simply apply the speed formula. This principle is used in:

A laser rangefinder: measuring a distance by timing the round trip of a beam.

The light-year: the distance light travels in one year (≈ 9.46×10^{12} km). It is used to measure the distances between the stars of the Milky Way.

Key points — revision questions

Who first measured the speed of light, and how?

What is the value of the speed of light?

Is a light-year a time or a distance?

How does a laser rangefinder work?

LEVEL 4

Limits of the light ray model

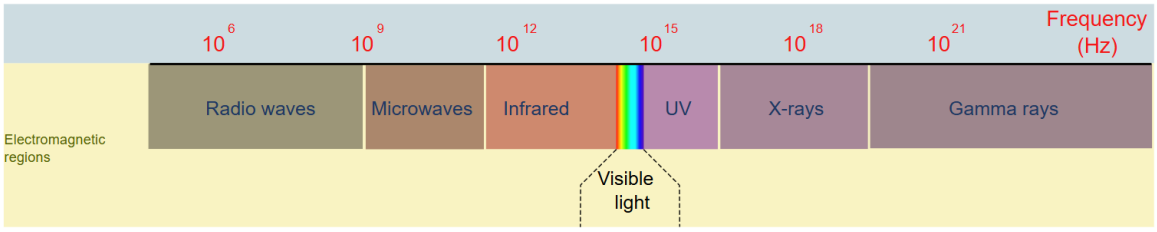
The light ray model helps us understand many phenomena involving light. However, it cannot explain colours, interference, or the deeper nature of light. That is why a new model replaced it.

The wave model

Light is an **electromagnetic wave** able to travel through a vacuum. It still travels in a straight line (as the light ray does), but it now has the properties of a wave.

The electromagnetic spectrum

The **electromagnetic spectrum** brings together all electromagnetic waves ordered by frequency. Different regions are described within it:



Advantages of the wave model

Thanks to this model we can explain:

Colours: each frequency corresponds to a different colour.

Travel through a vacuum.

Phenomena such as rainbows and interference.

Key points — revision questions

What are the limits of the light ray model?

What distinguishes the different types of electromagnetic wave?

Name electromagnetic waves other than visible light.