

Light sources and straight-line rays

Grade 6 science (Year 7 · Class 6) · Lesson

Quick answer: Light is a form of energy that travels in straight lines called rays. Luminous (primary) sources like the Sun and a lit lamp make their own light, while non-luminous objects only reflect it. Materials are transparent, translucent or opaque depending on how much light they let through. Light travels at about 3.0×10^8 m/s.

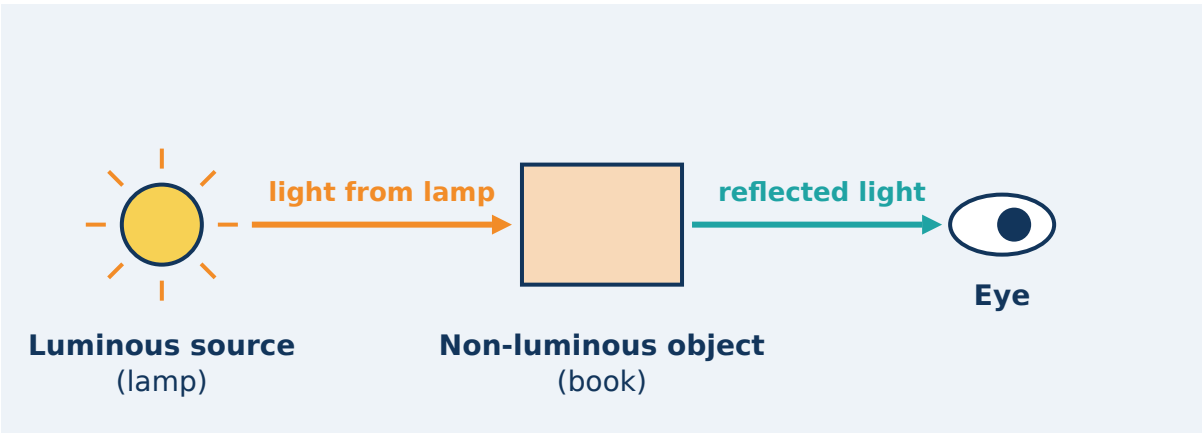
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What is a light source?

You can see a lit lamp, the Sun and a glowing phone screen because they make their own light. Most things around you, such as a chair or a tree, make no light at all. You still see them because light from somewhere else bounces off them and into your eyes.

Definition
A **luminous (primary) source** makes its own light, for example the Sun, a flame or a lit torch. A **non-luminous (secondary) object** only reflects light that falls on it, for example a book, a mirror or a planet.

Luminous (primary) sources	Non-luminous (secondary) objects
The Sun and other stars	A planet such as Venus
A candle flame	A bicycle reflector
A lit phone screen	A polished steel spoon
A firefly	A white wall



We see a book only because light from a source reflects off it and enters our eyes.

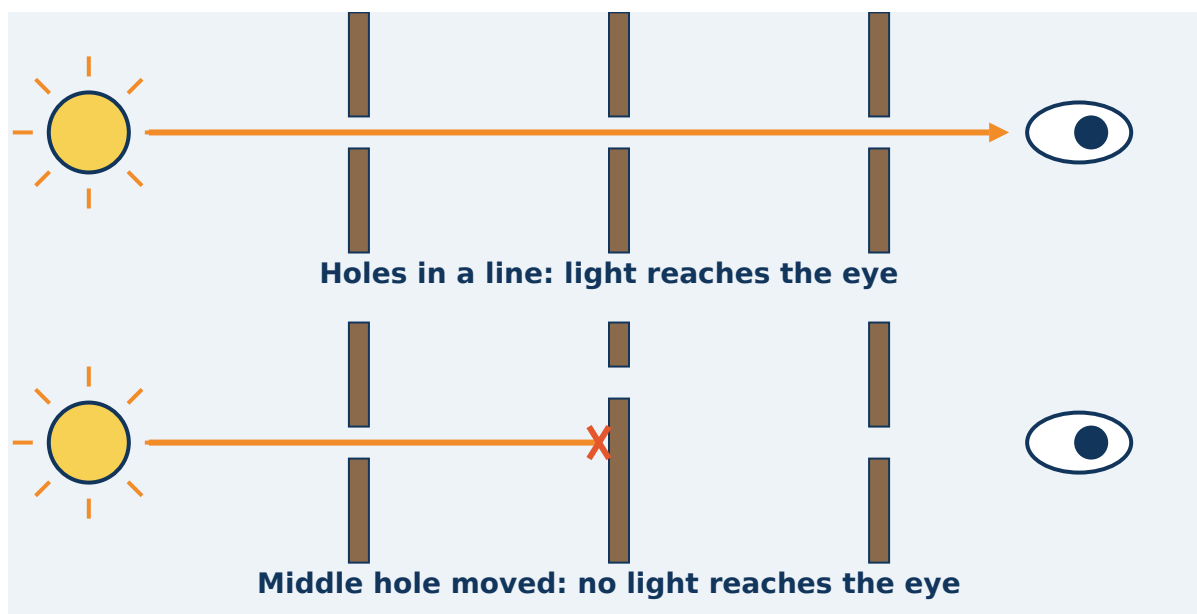
How does light travel?

Light travels in straight lines through air, water and glass. A thin, straight path of light is drawn as a **ray**, with an arrow showing the direction of travel. A beam is a bundle of many rays.

Key law

In a uniform material, light travels in **straight lines**. It travels away from the source in all directions, and the rays can only enter your eye if there is a clear straight path.

You can test this idea. Place three cards with holes between a lamp and your eye. You see the lamp only when the three holes lie on one straight line. Move the middle card a little and the light disappears.



Light only gets through when the holes lie on a straight line, so it travels in straight lines.

How fast does light travel?

Light is the fastest thing we know. In a vacuum and in air it travels at about **3.0×10^8 m/s**, which is 300 000 km/s. Light takes so little time to cross a room that it seems instant, but across space the travel times become noticeable.

Formula

$t = d \div v$, where t is the time in seconds (s), d is the distance in metres (m) and v is the speed of light, 3.0×10^8 m/s.

Worked example 1

The Sun is 1.5×10^{11} m from Earth. How long does its light take to reach us?

$$t = d \div v = 1.5 \times 10^{11} \div 3.0 \times 10^8 = 500 \text{ s.}$$

$500 \div 60 = \mathbf{8.3 \text{ minutes}}$. We always see the Sun as it was about 8 minutes ago.

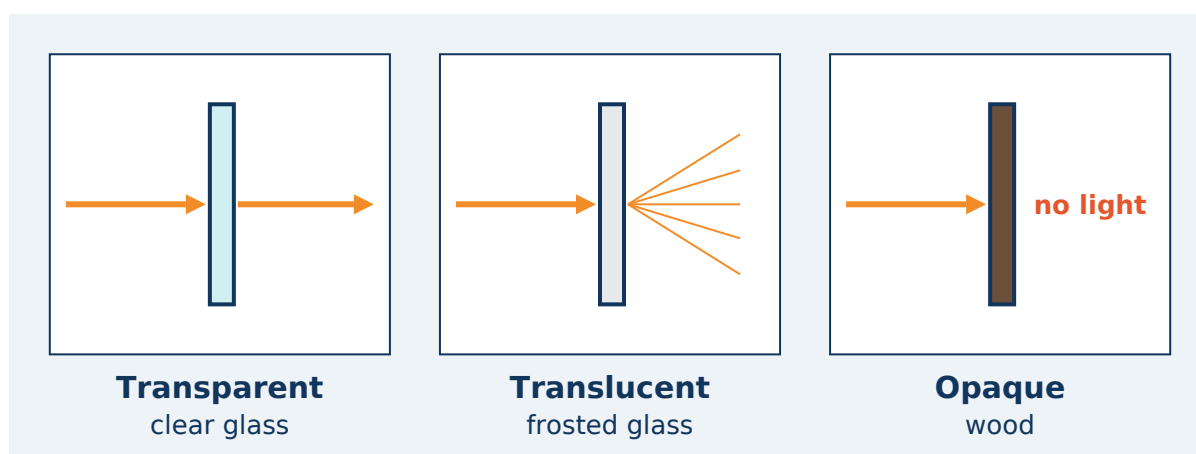
Worked example 2

A weather satellite is 3.6×10^7 m above Zainab's house in Kano. How long does a light signal take to reach it?

$$t = 3.6 \times 10^7 \div 3.0 \times 10^8 = \mathbf{0.12 \text{ s.}}$$

What are transparent, translucent and opaque materials?

Materials are sorted by what they do to light. **Transparent** materials such as clear glass let light pass so you can see clearly through them. **Translucent** materials such as tracing paper let some light through but scatter it, so you cannot see a clear picture. **Opaque** materials such as wood or metal let no light through.



Transparent materials pass light, translucent materials scatter it, opaque materials block it.

Common mistake

Translucent does not mean transparent. You can see light through frosted glass, but not a clear image of what is behind it. Also, an opaque object is not always dark: it can reflect a great deal of light.

Lina's tip

To decide on a material, ask two questions: does light get through, and can I see a clear picture? Yes and yes means transparent; yes and no means translucent; no light at all means opaque.

Why does a pinhole camera show an upside-down picture?

Light from the top of an object passes through a tiny hole and travels on in a straight line, ending up at the bottom of the screen. Light from the bottom ends up at the top. Because the rays cross at the hole, the image is upside down. This is good evidence that light travels in straight lines.

Key points to remember

- Luminous (primary) sources make light; non-luminous (secondary) objects reflect it.
- Light travels in straight lines, drawn as rays with arrows.

- Speed of light $\approx 3.0 \times 10^8$ m/s, so $t = d \div v$.
- Transparent, translucent and opaque describe how much light passes through.
- We see an object when light from it enters our eyes.

Light sources and straight-line rays: frequently asked questions

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

A primary (luminous) source makes its own light, like the Sun or a candle flame. A secondary (non-luminous) object only reflects light from a primary source, like a book or a planet.

How do we know that light travels in straight lines?

Light only passes through three cards with holes when the holes are exactly in line. A pinhole camera also forms an upside-down image because the rays cross in straight lines at the hole.

How fast does light travel?

Light travels at about 3.0×10^8 m/s, or 300 000 km/s, in air and in a vacuum. It takes about 8.3 minutes for sunlight to reach Earth.

What does translucent mean?

A translucent material lets some light through but scatters it. You can tell light is passing, for example through frosted glass, but you cannot see a clear image through it.

Why can we not see in a completely dark room?

Seeing needs light to enter the eye. In a room with no light source, there is no light for objects to reflect, so no light reaches your eyes.