KS3 SCIENCE · PHYSICS

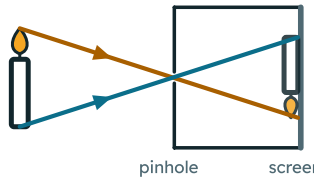
Light revision sheet

Name _____



1. How light travels

- Light is a **transverse wave**. It travels in **straight lines**, so we draw it as **rays**: straight lines with arrows.
- It needs no particles to carry it, so it can cross a **vacuum**. Sound cannot.
- In a vacuum light travels **300 000 km every second** (300 million m/s): about a million times faster than sound in air.
- Light does not bend round an object in its way, so the object casts a shadow.

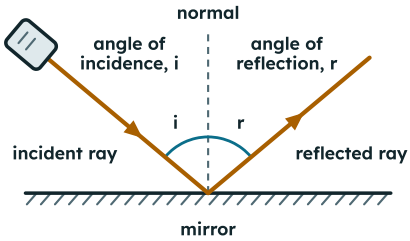


A pinhole camera: the image is upside down



2. Reflection

- **Reflection** is light bouncing off a surface. The **normal** is a line at 90° to the mirror, where the ray hits it.
- **The law of reflection:** angle of incidence = angle of reflection. Both are measured from the normal.
- Your **image in a flat mirror** is the right way up, the same size as you, and as far behind the mirror as you are in front. Left and right look swapped.

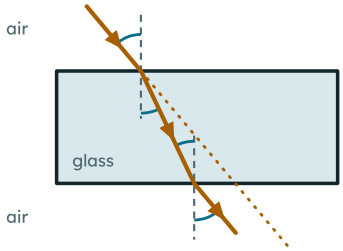


The ray diagram for a mirror



3. Refraction

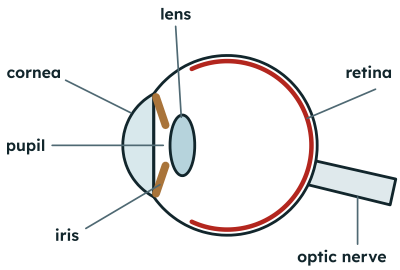
- **Refraction** is the change in direction of light when it crosses, at an angle, from one transparent material into another.
- **Into glass or water:** light slows down and bends **towards the normal**. **Out into air:** it speeds up and bends **away from the normal**. **Along the normal:** no bending.
- A pool looks **shallower** than it is: light from the bottom bends away from the normal as it leaves the water, so it seems to come from higher up.



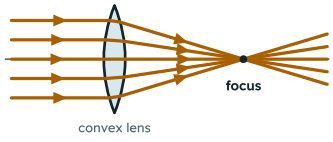
A ray leaves a glass block parallel to the way it went in

4. Lenses and the eye

- A **convex lens** is thicker in the middle. It brings parallel rays together at the **focus**.
- The **cornea** and the **lens** focus light on to the **retina**. The image there is upside down.
- Cells in the retina absorb the light and send electrical signals along the **optic nerve** to the brain. The sensor in a camera does the same job.
- The **iris** changes the size of the **pupil**, the hole that lets light in.



The eye

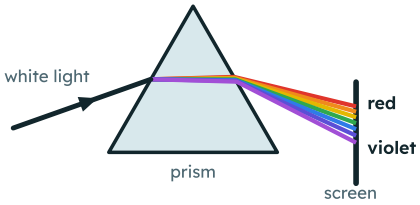


A convex lens



5. Colour and prisms

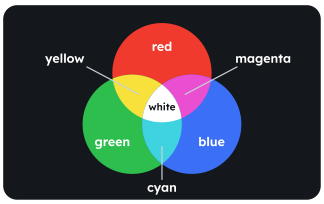
- **White light** is a mixture of colours. A prism splits it into a **spectrum**: red, orange, yellow, green, blue, indigo, violet.
- The prism refracts each colour by a different amount. **Red bends the least and violet the most.** This splitting is called **dispersion**.
- Each colour has its own **frequency**. Of the colours we can see, red has the lowest and violet the highest.



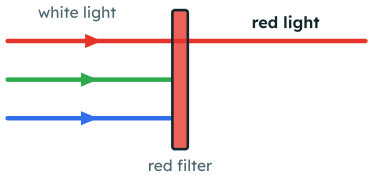
A prism splits white light into a spectrum

6. Coloured objects and filters

- Red, green and blue are the **primary colours of light**. Together they make white.
- Red + green = yellow. Red + blue = magenta. Green + blue = cyan.
- A **filter** transmits its own colour and absorbs the rest. A **coloured object** reflects its own colour and absorbs the rest.
- White things reflect every colour. Black things absorb every colour.



Adding coloured lights

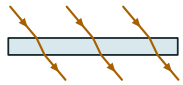


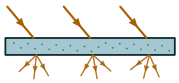
A red filter absorbs green and blue

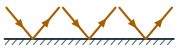
OBJECT	WHITE LIGHT	RED LIGHT	GREEN LIGHT
Red apple	Red	Red	Black
Green leaf	Green	Black	Green
White paper	White	Red	Green

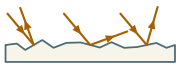
7. Light and materials

TRANSPARENT	TRANSLUCENT	OPAQUE
Lets light through. You can see clearly through it.	Lets some light through, but you cannot see clearly through it.	Lets no light through. It casts a dark shadow.
Clear glass, clean water, air	Frosted glass, tracing paper	Wood, brick, metal


Transmitted
clear glass


Scattered
frosted glass


Specular reflection
a mirror


Diffuse scattering
white paper


Absorbed
black card

- When light meets a material it can be **transmitted**, **absorbed** or **reflected**. Absorbed light transfers its energy to the material, which warms up. Black surfaces absorb nearly all the light that falls on them.
- A **mirror** is smooth: it reflects rays evenly, so you see an image. Most surfaces are rough and **scatter** light in all directions. That is how you see them, but they make no image.

Key words

Ray: a straight line with an arrow that shows the path of light
Reflected ray: the ray that leaves a surface after bouncing off it
Angle of reflection: the angle between the outgoing ray and the normal
Retina: the layer at the back of the eye that detects light
Filter: a coloured sheet that lets its own colour of light through
Transparent: lets light through, so you can see clearly through it
Reflection: when light bounces off a surface
Normal: a line at 90° to a surface, from which angles are measured
Refraction: a change in the direction of light as it enters a new material
Spectrum: the band of colours made when white light is split up
Absorption: when the energy of light is transferred to a material
Translucent: lets some light through, but not a clear view
Incident ray: the ray that travels towards a surface
Angle of incidence: the angle between the incoming ray and the normal
Convex lens: a lens, thicker in the middle, that bends rays towards each other
Dispersion: the splitting of white light into its colours
Scattering: when a surface or a material sends light off in all directions
Opaque: lets no light through

Pictures are illustrations made for this sheet, not real photographs.