

3 Light and sound – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	Write it 3 times (English)		
Light	_____	_____	_____
sound	_____	_____	_____
electromagnetic	_____	_____	_____
normal	_____	_____	_____
angle of incidence	_____	_____	_____
angle of reflection	_____	_____	_____
total internal re- flection	_____	_____	_____
optical fibres	_____	_____	_____
electromagnetic waves	_____	_____	_____
medium	_____	_____	_____

Recall

From Part 1 you can describe a wave. **Light** and **sound** are waves too. Here we look at how light reflects and bends, and at the family of **electromagnetic** waves.

- Light reflects off mirrors and bends through glass.
- Light is one member of a big family of waves.

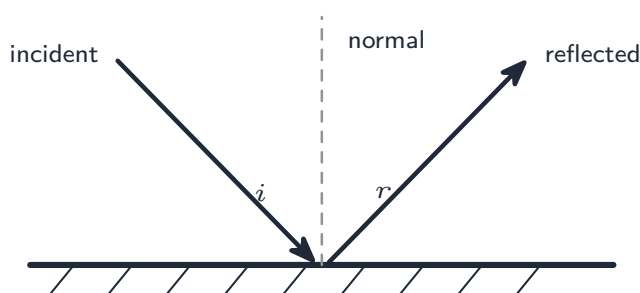
Nothing here is hard — it just adds the rules.

New ideas

Read these first, then do the Practice.

■ 1 Reflection

Angles are measured from the **normal** (a line at 90° to the surface). The **law of reflection**: the **angle of incidence** equals the **angle of reflection**.



■ 2 Refraction

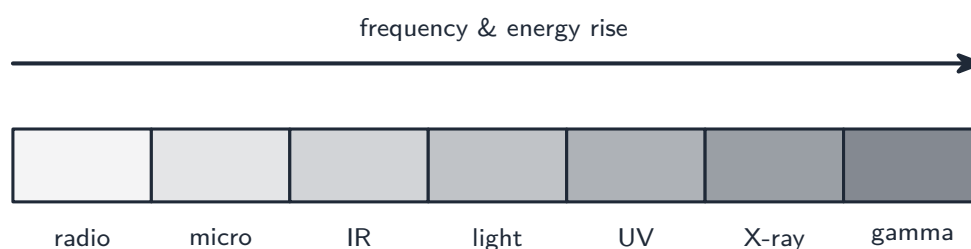
When light passes into a new material it changes **speed** and **bends**. Going from air **into** glass it slows down and bends **towards** the normal. The **refractive index** is

$$n = \frac{\sin i}{\sin r}.$$

When light tries to leave glass at too steep an angle, it cannot get out and reflects completely — **total internal reflection**. This is how **optical fibres** carry light signals.

■ 3 The electromagnetic spectrum

All **electromagnetic waves** travel at the same speed in a vacuum (3.0×10^8 m/s). In order of rising frequency:



From radio waves to gamma rays, the **wavelength falls** while the **frequency and energy rise**.

■ 4 Sound

Sound is a **longitudinal wave** made by a vibrating object. It needs a **medium**, so it cannot travel through a vacuum.

Watch out: angles are always measured from the **normal** (the 90° line), not from the surface. All electromagnetic waves travel at the **same** speed in a vacuum — what changes across the spectrum is the wavelength and frequency.

Practice

Try these in order.

3.1 State the law of reflection. [1]

3.2 From which line are angles of incidence and reflection measured? [1]

3.3 Going from air into glass, does light bend towards or away from the normal? [1]

3.4 Name the effect used in optical fibres to keep light inside. [1]

3.5 List, in order of **rising frequency**: infrared, radio waves, X-rays, visible light. [2]

3.6 Why can sound not travel through a vacuum? [1]

3.7 Challenge. Light hits a mirror with an angle of incidence of 35° . State (a) the angle of reflection and (b) the angle between the incident and reflected rays. [2]