Your notes

GCSE Physics: revision notes

Reflection and refraction

Contents

1. What can happen at a boundary
2. Reflection
3. Refraction
4. Total internal reflection (Edexcel, separate sciences)
5. Required practical: reflection and refraction of light
6. Key terms
7. Quick questions
8. What to do next

What can happen at a boundary

- When a wave meets a boundary between two different materials, it can be reflected, refracted (transmitted with a change of direction), transmitted without changing direction, or absorbed.
- What happens depends on the wavelength of the wave and the materials.

Reflection

- The **angle of incidence** equals the **angle of reflection**. Both are measured from the **normal**: a line at right angles to the surface.
- A smooth surface, such as a mirror, gives **specular reflection** in a single direction. A rough surface scatters light in many directions (**diffuse reflection**).

Refraction

- **Refraction** is the change in direction of a wave when it passes from one material into another at an angle, because its speed changes.
- When light enters a denser material such as glass, it slows down and bends towards the **normal**. When it leaves, it speeds up and bends away from the **normal**.
- A wave travelling along the **normal** (at 90° to the surface) changes speed but not direction.
- (Higher) On a wave front diagram, the part of the wave front that enters the new material first changes speed first, so the wave front turns.

Total internal reflection (Edexcel, separate sciences)

- When light travels from glass or water towards air, it speeds up and bends away from the **normal**.

- The **critical angle** is the **angle of incidence** at which the refracted ray just runs along the boundary (the **angle of refraction** is 90°). For glass it is about 42°.
- If the **angle of incidence** is bigger than the **critical angle**, all the light is reflected back inside: **total internal reflection**.
- Optical fibres and endoscopes use **total internal reflection** to carry light along the fibre, even round bends.

Your notes

Required practical: reflection and refraction of light

- Shine a ray of light from a ray box at a surface or a glass block on paper, and trace the rays with a pencil.
- Draw the **normal** at the point where the ray hits the surface and measure the angles of incidence, **reflection** and **refraction** with a protractor.
- Repeat for different angles and different materials. Carry this out in a darkened room with a narrow ray for accuracy.

Key terms

Reflection	When a wave bounces off a surface.
Refraction	The change in direction of a wave as it passes into a different material at an angle, caused by a change in speed.
Normal	A line at 90° to a surface at the point where a ray meets it.
Angle of incidence	The angle between the incoming ray and the normal.
Angle of reflection	The angle between the reflected ray and the normal.
Angle of refraction	The angle between the refracted ray and the normal.
Specular reflection	Reflection from a smooth surface in a single direction.
Diffuse reflection	Reflection from a rough surface that scatters light in many directions.
Critical angle	The angle of incidence at which light leaving a denser material travels along the boundary. (Edexcel, separate sciences)
Total internal reflection	When all the light is reflected back inside a material because it meets the boundary at more than the critical angle. (Edexcel, separate sciences)

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What does the law of reflection state?
2. What is the normal?
3. Why does light refract when it enters glass?
4. Which way does light bend when it enters glass at an angle?

5. What happens to a ray that hits a glass block along the normal?
6. What type of reflection happens from a rough surface?
7. A ray hits a mirror with an angle of incidence of 35°. What is the angle of reflection?
8. Which way does light bend when it leaves glass into air at an angle?

Answers

1. Angle of incidence = angle of reflection
2. A line at 90° to the surface where the ray hits
3. Its speed changes
4. Towards the normal
5. It passes straight through without changing direction
6. Diffuse reflection
7. 35°
8. Away from the normal

What to do next

Practise 12 questions on this topic

Try 6 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

Your notes