

Summary

- Light is reflected from a surface.
- The angle of incidence equals the angle of reflection.
- The image in a mirror is back to front (laterally inverted).
- The image in a mirror is the same size and colour as the object.
- Smooth surfaces reflect more regularly than rougher surfaces.
- A periscope will reflect light and let you see round corners.

Questions

1 Copy and complete the following sentences.
 The image in a mirror does not exist. It is _____ . The image in a mirror is the same shape, size and _____ as the object. The angle of _____ equals the angle of _____. A line drawn at 90° to a mirror is called a _____. A rough surfaces gives _____ reflection. [Total 3]

2 Ben is towing a caravan and finds that he cannot see the road behind him. Draw a way to help him using mirrors. He cannot use mirrors any bigger than his wing mirrors. [Total 4]

3 A beam of white light shines onto a sheet of white paper. An identical beam of light shines onto a mirror. Describe how the scattering by paper and the reflection by a mirror are different from each other. [Total 4]

4 a) Work out the angle of reflection shown in Figure 2.6. [1]
 b) What is the total angle turned by the light. [1]
 [Total 2]

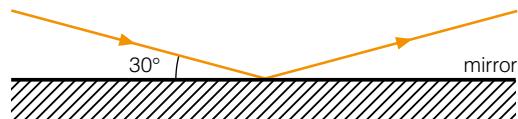


Figure 2.6

5 a) Sam sits in an optician's chair and looks at the chart in a mirror in front of him. He needs to be able to read the letters. They are all capital letters and Sam is seeing them in a mirror. Why will some letters look incorrect? [2]
 b) Write down two capital letters which will not be affected. [2]
 [Total 4]

6 The driveway at Dina's house leads out onto a blind corner. She needs some help to see cars on the road when she leaves the driveway in her car. Using one or two mirrors draw a plan of what she can do. [Total 3]

2.3 Refraction

Why does a swimming pool never look as deep as it is? Why does a straw in a glass of water always look bent? What makes a diamond sparkle? Light changes direction as it goes from air into glass or water. This principle has many applications.

Light travels in air at a speed of 300 000 000 m/s but if the light goes into a substance or **medium** which is optically denser than air it slows down. The light seems to bend. This is called **refraction**.

The ray of light hitting the glass is the incident ray. The angle between the normal and the incident ray forms the angle of incidence. The light entering the glass is the **refracted ray**. The angle of incidence is larger than the angle of refraction as the ray of light bends towards the normal. The light is slowing down because glass is optically denser than air. When the light leaves the glass the angle of incidence is now smaller than the angle of refraction as the ray of light bends away from the normal. The light is speeding up because air is optically less dense than glass.

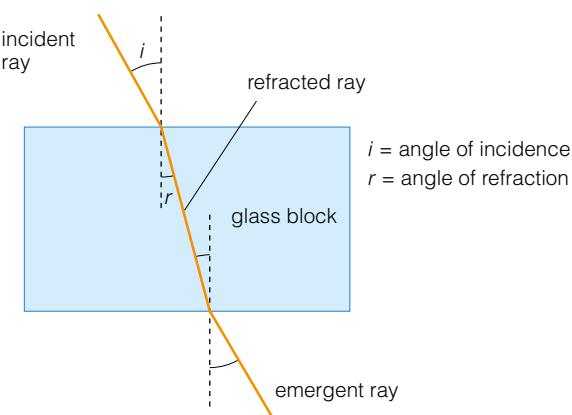


Figure 3.1 How light bends as it travels from air to glass.

When light travels from a less to a more optically dense medium it refracts *towards* the normal.
When light travels from a more to a less dense medium it refracts *away* from the normal.

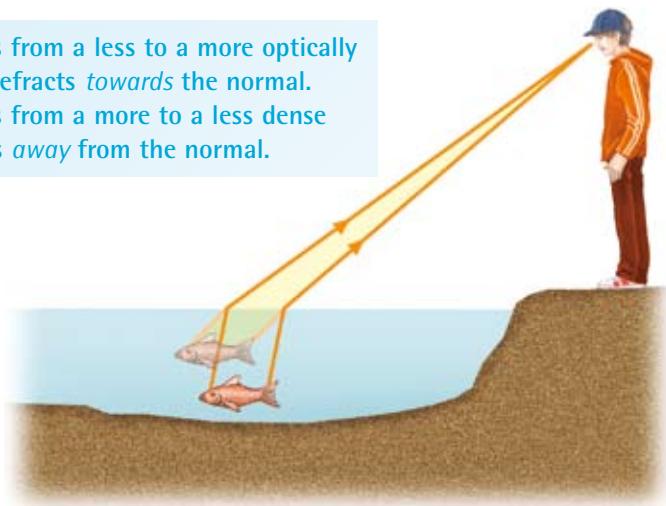


Figure 3.2 The fish is not really where the person sees it because the water refracts the light.



1 Explain why angle r is smaller than angle i in Figure 3.1. [Total 2]



Can you explain why this ruler appears to bend in the water? What trick is being played on our eyes?