Investigating Refraction

PRACTICAL

Hurrah — it's time to whip out your ray box and get some refraction going on.

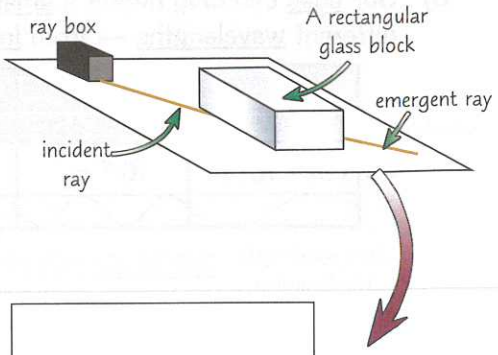
You Need to Do This Experiment in a Dim Room

1) This experiment uses a ray of light, so it's best to do it in a dim room so you can clearly see the ray.
2) The ray of light must be thin, so you can easily see the middle of the ray when tracing it and measuring angles from it.
3) To do this, you can use a ray box — an enclosed box that contains a light bulb. A thin slit is cut into one of the sides — allowing a thin ray of light out of the box that you can use for your experiment.

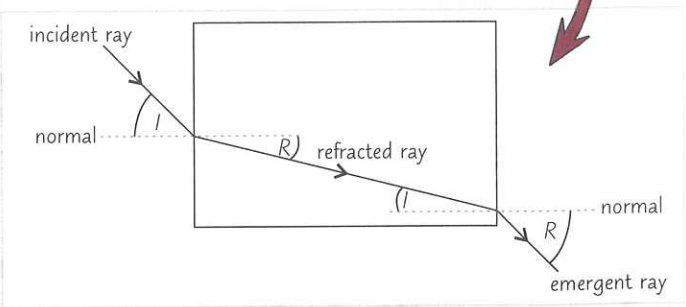
You Can Use a Glass Block to Investigate Refraction

Light is refracted at the boundary between air and glass. You can investigate this by looking at how much light is refracted when it passes through a glass block.

1) Place a rectangular glass block on a piece of paper and trace around it. Use a ray box to shine a ray of light at the middle of one side of the block.
2) Trace the incident ray and the emergent ray on the other side of the block. Remove the block and, with a straight line, join up the incident ray and the emergent ray to show the path of the refracted ray through the block.
3) Draw the normal at the point where the light ray entered the block. Use a protractor to measure the angle between the incident ray and the normal (the angle of incidence, *I*) and the angle between the refracted ray and the normal (the angle of refraction, *R*).
4) Do the same for the point where the ray emerges from the block.
5) Repeat this three times, keeping the angle of incidence as the ray enters the block the same.
6) Calculate an average for each of the angles.



You should draw...



Head over to page 166 for a reminder about refraction.

- You should see that the ray of light bends towards the normal as it enters the block (so the angle of refraction is less than the angle of incidence). This is because air has one of the lowest optical densities that there is (p.34) so the light ray will almost always slow down when it enters the block.
- You should then see the ray of light bends away from the normal as it leaves the block. This is because the light ray speeds up as it leaves the block and travels through the air.
- It's important to remember that all electromagnetic waves can be refracted — this experiment uses visible light so that you can actually see the ray being refracted as it travels through the block.

Bonus tip: glass also slows down pesky bugs.

Lights, camera, refraction...

This experiment isn't the trickiest, but you still have to be able to describe how to do it and what it shows.

Q1 a) Describe an experiment you could do to measure how much light is refracted when it enters a glass block. [3 marks]

b) Explain why a thin beam of light should be used. [1 mark]

Investigating Refraction

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1 A student is investigating refraction through different materials. The student uses a ray box to shine a ray of light into blocks of materials at a fixed angle of incidence, *I*. He traces the path of the ray entering and leaving the block on a sheet of paper.

Grade 6-7

a) Explain why a ray box was used for this experiment.

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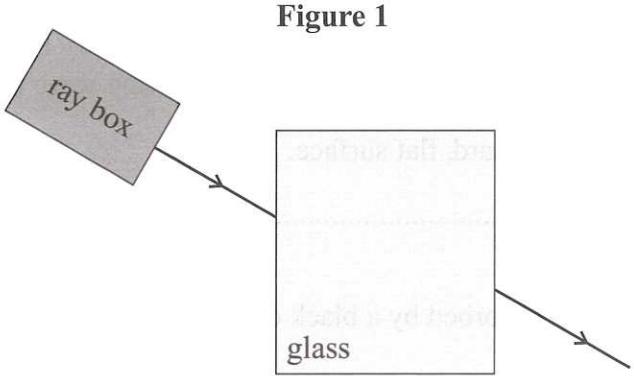
[1]

Figure 1



b) **Figure 1** shows the student's investigation for light refracted through a glass block. Complete the diagram by drawing the light ray as it passes through the glass block.

[1]

c) The student measures the angle of refraction, *R*, of the light ray as it enters the block. **Figure 2** shows the results for a range of materials. Complete **Figure 2** by measuring the angle of refraction for the glass block shown in **Figure 1**.

Figure 2

Material	*I*	*R*
Cooking Oil	30°	20°
Water	30°	22°
Plastic	30°	20°
Glass	30°	.....

[1]

d) State and explain which of the materials shown in **Figure 2** changes the speed of the light ray the least.

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[3]

[Total 6 marks]