GCSE Physics required practical activity 6: Light (physics only)

Student sheet

Required practical activity	Apparatus and techniques
Investigate the reflection of light by different types of surface and the refraction of light by different substances.	AT 4, AT 8

What happens to the direction of light after hitting the surface of different materials?

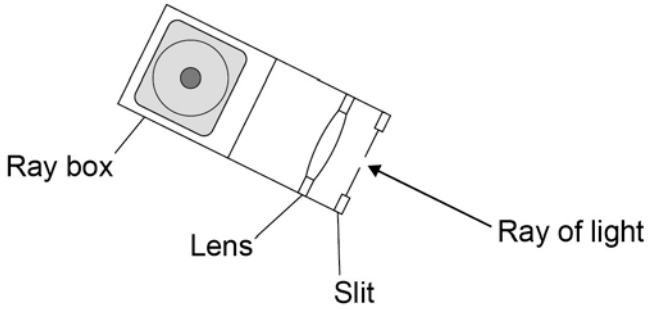
When light hits a surface it can be reflected, transmitted and absorbed. In this experiment, you will investigate what happens to light when it is reflected and transmitted using two different materials. You will use a ray box to direct a ray of light onto the surface of a transparent block. You will then mark the path of the ray that is reflected from the surface of the block and the ray that passes through the block. You will use the ray box to produce a narrow ray of light and perform the experiment in a darkened room, so that the paths of the rays can be marked precisely. You will then repeat the experiment using a different block and compare the results.

Learning outcomes
1 **2** **Teachers to add these with particular reference to working scientifically**

Method

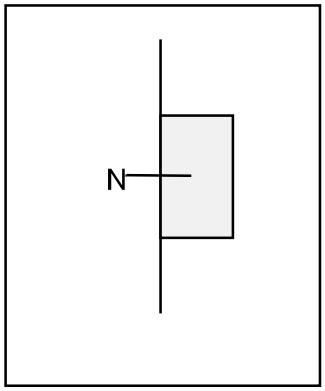
You are provided with the following:

- Ray box and suitable power supply
- a slit and lens that fit the ray box and can be used to make a narrow ray
- two rectangular transparent blocks of different materials eg glass, Perspex
- 30 cm ruler
- protractor
- sheets of plain A3 paper.

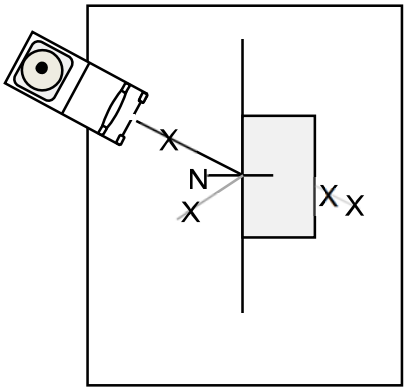


You should read these instructions carefully before you start work

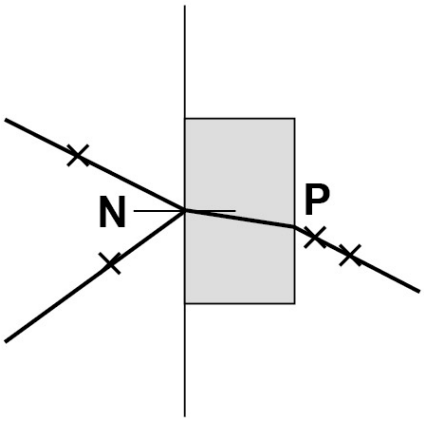
1. Before the room is darkened, set up the ray box, slit and lens so that a narrow ray of light is produced.
2. The ray box will get hot – be careful when you move it and switch it off when you don't need it.
3. Place the ruler near the middle of the A3 paper and draw a straight line parallel to its long side.
4. Use the protractor to draw a second line at right angles to this line. Label this line with an 'N' for 'normal'.



5. Place the longest side of the block against the first line, with the largest face of the block on the paper. The normal should be near the middle of the block.
6. Without moving the block, carefully draw around it.
7. Use the ray box to direct a ray of light at the point where the normal meets the block. This is called the incident ray.
8. The angle between the normal and the incident ray is called 'the angle of incidence'. Move the ray box or paper to change the angle of incidence until you see a clear ray reflected from the surface of the block and another clear ray leaving the opposite face of the block. You will probably have to do this with the room darkened.



9. Mark the path of the incident ray with a cross. If the ray is wide, make sure the centre of the cross is in the centre of the ray.
10. Mark the path of the reflected ray with another cross.
11. Mark the path of the ray that leaves the block (the transmitted ray) with two crosses, one near the block and the other further away.
12. Switch on the room lights, switch of the ray box and remove the block.
13. Draw in the incident ray by drawing a line through your first cross to the point where the normal meets the block.
14. Draw the reflected ray by drawing a line through your second cross to the point where the normal meets the block.
15. Draw the transmitted ray by drawing a line through the two crosses on the other side of the block to that side of the block. Label this point with a 'P'.
16. Draw a line that represents the path of the transmitted ray through the block. Do this by drawing a line from point P to the point where the normal meets the block.

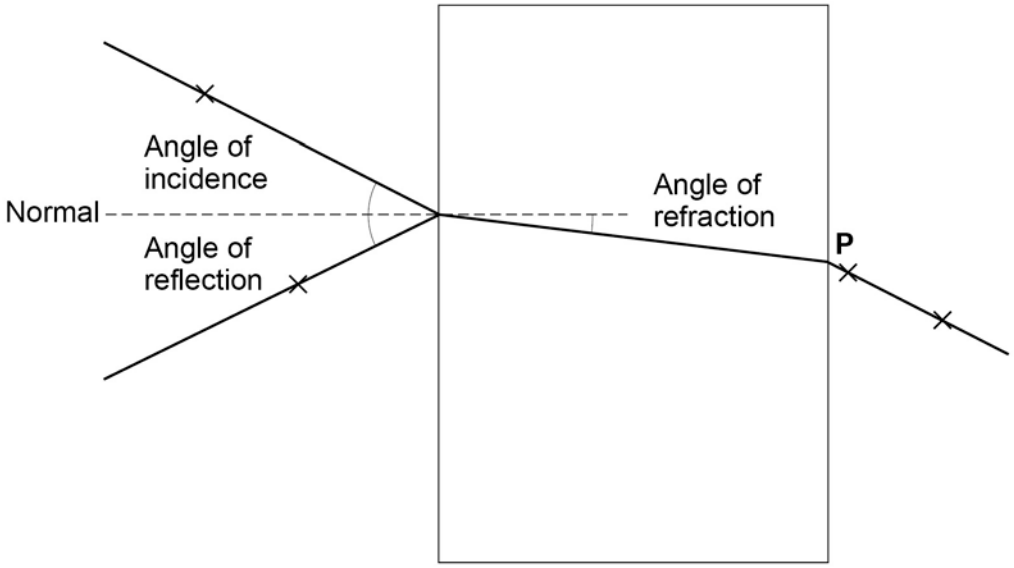


17. Use the protractor to measure:

    a. the angle between the incident ray and normal. This is the angle of incidence.

    b. the angle between the reflected ray and normal. This is the angle of reflection.

    c. the angle between the ray inside the block and the normal. This is the angle of refraction.



18. Record your measurements in a suitable table. You are going to need three rows and five columns.

angle of incidence in degrees	first block		second block	
	angle of reflection in degrees	angle of refraction in degrees	angle of reflection in degrees	angle of refraction in degrees

19. Now repeat this for the other block. Place the other block on the A3 paper.

20. Line up the long side of the block as before.

21. If the block is not the same size as the first one, carefully draw around it without moving it.

22. Use your ray box to send in an incident ray along the same line as before. Again you may have to work in a darkened room.

23. Look at the directions of the reflected and transmitted rays.

24. If they are not the same as before, mark their paths using crosses.
25. Remove the block, switch off the ray box, and switch on the room lights.
26. Draw in the reflected and refracted rays.
27. Measure the angle of reflection and the angle of refraction and record them in your table.
28. Physics theory suggests that the angles of reflection should be the same, but the angles of refraction should be different. How well do your results support this theory?