Reflexion and Refraction

Optical phenomena play an outstanding role in our everyday experience and in technology (e.g. fibre optics).

Goal You investigate the behaviour of light rays when they strike the interface between two transparent materials.

Experiment 1

Devices
- Sheet of paper, pins, protractor
- Rectangular glass block

Procedure

A Place the glass block on the sheet of paper and mark its exact position. Put a pen next to the block, forming an angle of some 45° with it.

B Look at the pen through the glass block and place a second pen exactly along the direction of the first pen's image. Mark the path of the light rays with some pins and draw it on the paper.

C Repeat this procedure for a total of at least five different angles.
Hint: You can omit the pens and use the pins only.

D Measure the angles of incidence, refraction and exit, as well as the parallel translation for each ray.

Analysis

1. Compile the angles of incidence and refraction in a table. Add columns for the sine of the angles. Draw a diagram proving Snell's law.
2. Using an appropriate fit to your data determine the index of refraction of the glass used in your experiment.
3. Derive a formal expression for the parallel translation of the light rays as a function of the angle of incidence, the width of the block and the index of refraction. Calculate the parallel translations for the light rays in your experiment. Check if the deviations from the measured values are within the error range.

Experiment 2

Devices
- Optics set
- Worksheets

Procedure

E Discuss the expected path of the light rays in the first figure with your partner. Draw it (qualitatively) on the worksheet in a first colour. Try also to predict where total internal reflexion could occur.

F Check the path of the light rays using the lamp with an appropriate slit diaphragm and draw the correct path in a second colour.

G Repeat these steps for all figures on the worksheets.

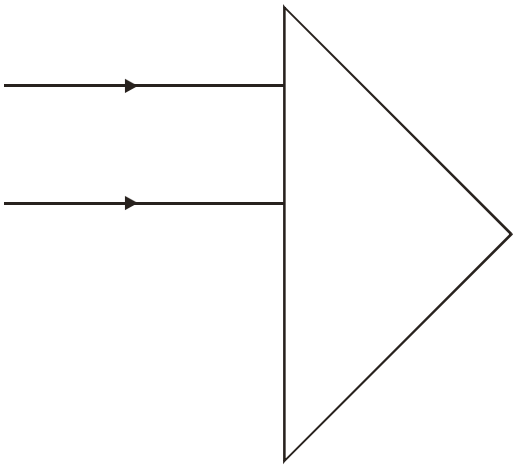
Analysis

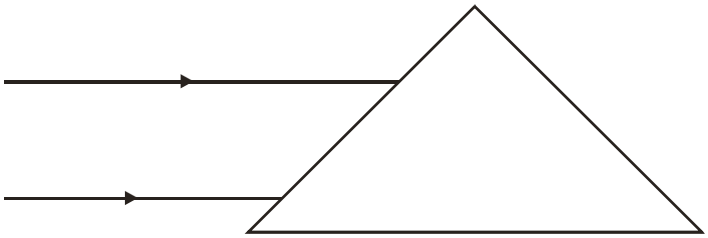
4. Using an appropriate figure determine the refractive index of acrylic glass (Plexiglas). Calculate the corresponding critical angle for total internal reflexion.
5. Quantitatively compare the measured to the calculated angles for one of the examples with total internal reflexion.

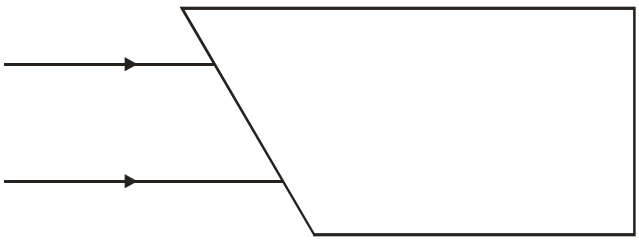
Requirements If you write a short report on this experiment, work at least on steps 1, 2 and 4 of the analysis. The complete interpretation is required for a full report.

Hand in your report and the lab journal by Tuesday, 19 April 2011.

Prisms







Lenses