Phys CP3 Investigating refraction

Your teacher may watch to see if you can:

- measure angles accurately.

Aim

To investigate how light is affected when it travels from air into glass, or from glass into air.

Method

A Place a piece of plain paper on the desk. Set up the power supply, ray box and single slit so that you can shine a single ray of light across the paper on your desk.

B Place a rectangular glass block on the paper. Draw around the block.

C Shine a ray of light into your block. Use small crosses to mark where the rays of light go.

D Take the block off the paper. Use a ruler to join the crosses and show the path of the light. Then extend the line to meet the outline of the block. Join the points where the light entered and left the block to show where the light travelled inside the block.

E Measure the **angle of incidence** (*i*) and **angle of refraction** (*r*) where the light entered the block, and measure the angles where the light left the block.

F Repeat steps **C**–**E** with the ray entering the block at various different angles.

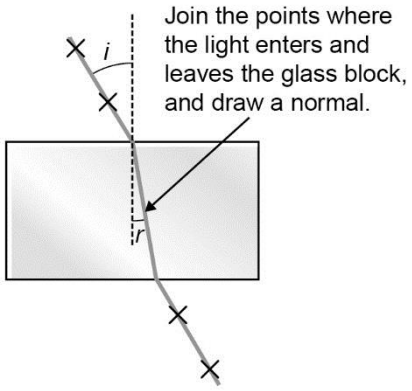
G Move the ray box so that the light ray reaches the **interface** at right angles. Note what happens to the light as it enters and leaves the block.

Apparatus

- ray box with single slit
- power supply
- rectangular glass block
- ruler
- protractor
- plain paper

⚠ Safety

The ray box may get hot enough to burn you, so take care.



Recording your results

1 Draw a table like this to record your results.

Air to glass (light entering the block)		Glass to air (light leaving the block)	
i	***r***	***i***	***r***

2 Draw a scatter graph to show your results. Put the angle of incidence (*i*) on the horizontal axis. Plot the air to glass points and draw a smooth curve of best fit. Repeat for the glass to air points on the same set of axes.

Considering your results/conclusions

3 Describe the results shown by your graph and your table of results.

4 How does the direction of the ray of light leaving the glass block compare with that of the ray entering the block?

5 Write a conclusion for your investigation.

Evaluation

6 How accurate were your measurements? Is there any way you could improve your measurements?

Phys CP3 Investigating total internal reflection

Your teacher may watch to see if you can:

- make careful measurements.

Introduction

Light leaving transparent materials at certain angles can be **reflected** within the material. The angle at which this starts to happen is called the **critical angle**.

Aim

To determine the critical angle for different materials.

Method

A Place one of the semi-circular blocks on the piece of paper and draw around it. Remove the block and measure the straight edge. Draw a line at right angles to the centre of the straight edge on the paper. This line is the **normal**.

B Put the block back on the paper and aim a ray of light through the curved edge of the block towards the centre of the straight edge, as shown in the diagram. You may need to use a lens with your ray box to obtain a narrow ray.

C Move the ray box around, still aiming at the same point, until the ray of light emerging from the straight edge lies along the edge. Mark two crosses along the path of the light ray going into the block.

D Remove the block and draw a line through your marked points to the centre of the straight edge. The angle between this line and the normal is the **angle of incidence** of the light within the block. When the ray of light emerging from the block lies along the straight edge, the angle of incidence is the **critical angle** for the material.

E Repeat steps **B** and **D** with the other blocks.

Apparatus

- ray box, lens and slit
- low voltage power supply
- protractor
- semi-circular blocks made of glass and other transparent materials
- plain paper
- ruler

⚠ Safety

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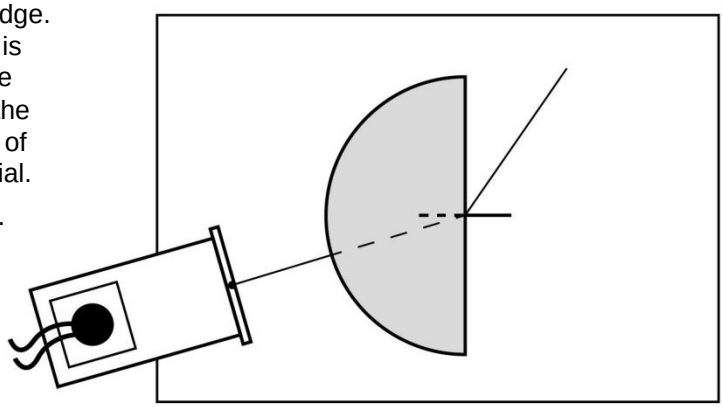

Recording your results

1 Record your results in a table, including the name of each material and its critical angle.

Evaluation

2 How accurate do you think your measured critical angles are? Explain your answer.

3 Explain why a semi-circular block is used in this investigation rather than a rectangular block. (*Hint:* think about the angle at which the ray of light goes into the block.)