Experiment – Total Internal Reflection

Aim – This experiment is concerned with investigating total internal reflection.

Apparatus – Ray box, slit, a white sheet of paper, a pencil, a ruler, a semi-circular glass block, a prism and a protractor.

Method

Part 1:
1. On a sheet of paper, draw round the semi-circular block using a pencil, and accurately draw the normal at the mid-point of the straight side.
2. Direct a ray of light through the glass block towards the normal.
3. Move the ray-box until the refracted ray can be seen to graze just along the surface of the straight side of the glass block. At this point the angle of refraction is $90^\circ$ and the angle of incidence is now the critical angle.
4. Mark the direction of the incident ray and the reflected ray with pencil crosses.
5. Remove the glass block and draw in the rays.
6. Measure the angles with a protractor and mark them in your diagram.

Part 2:
1. Set the apparatus as part 1.
2. Move the ray-box until total internal reflection takes place.
3. Mark the direction of the incident ray and the reflected ray with pencil crosses.
4. Remove the glass block and draw in the rays.
5. Measure the angles with a protractor and mark them in your diagram.

Part 3:
1. On a sheet of paper, draw round the 45° – 45° – 90° prism using a pencil.
2. Direct a narrow beam of light towards the prism so that the light is turned through 90°.
3. Mark the direction of the incident ray and the reflected ray with pencil crosses.
4. Remove the prism and draw in the rays.
5. Repeat part 3 in order to turn the light rays through 180°.

Results
See diagrams attached.

Precautions

Discussion
1. How come the light ray did not bend when it entered the semi-circular block?
2. What happened to the ray of light when the angle of incidence was:
   a) Smaller than the critical angle?
   b) Larger than the critical angle?
3. What are the two conditions that should be observed for total internal reflection to occur?
4. Research: Explain how a mirage occurs. Remember to refer to the principle, Total Internal Reflection.

Conclusion