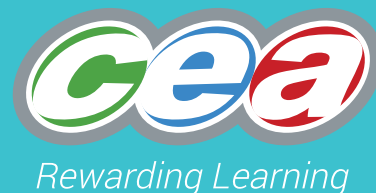


GCSE



CCEA GCSE TEACHER GUIDANCE  
**Double Award Science**  
**Practical Manual**

Unit 7: Practical Skills

P5: Investigating Refraction  
of Light

For first teaching from September 2017



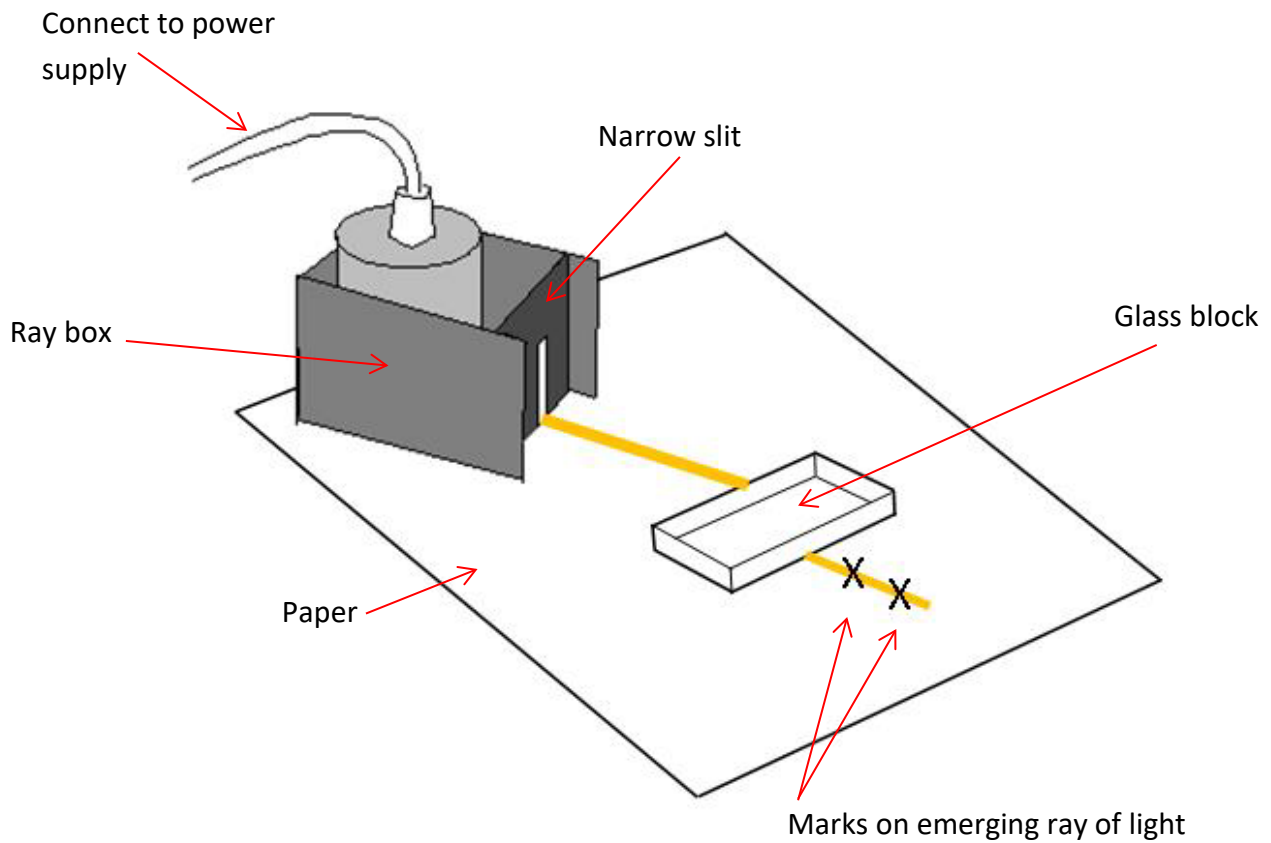


## **Investigating Refraction of Light**

Use ray tracing to measure the angles of incidence and refraction when light is refracted by a glass block, demonstrate knowledge that the angles of incidence and refraction are measured from a line at right angles to the normal and use the measurements taken to plot a graph of angle of incidence against angle of refraction to show that they are related but not proportional.  
(Prescribed Practical P5)

Use ray tracings to measure the angles of incidence and refraction when light is refracted by a glass block.

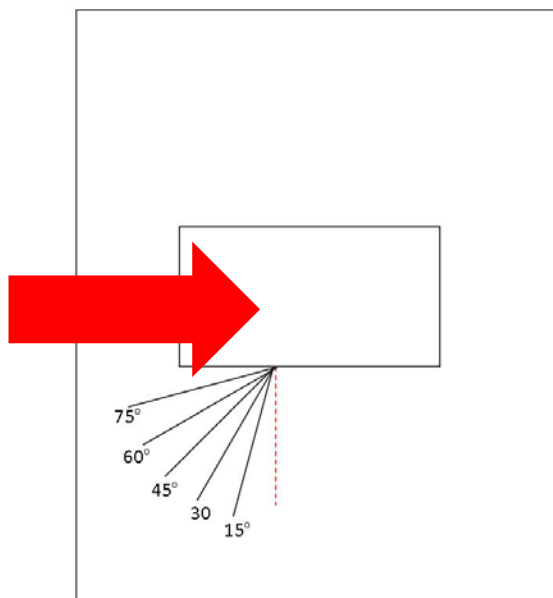
### Diagram of apparatus



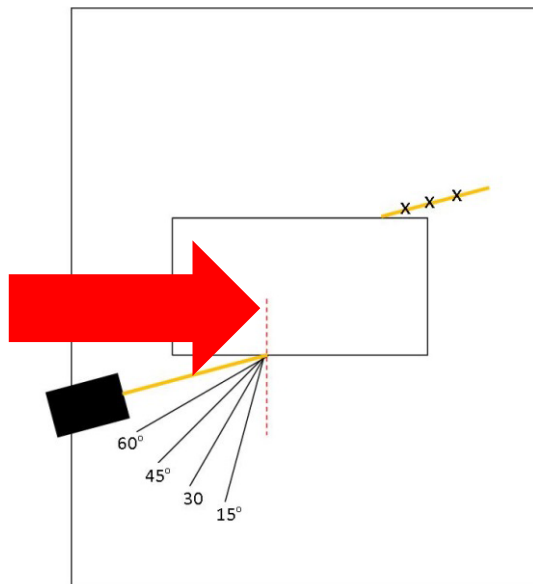
### Apparatus List

- Power supply
- Ray box
- Narrow slit
- A4 paper
- Glass block
- Protractor

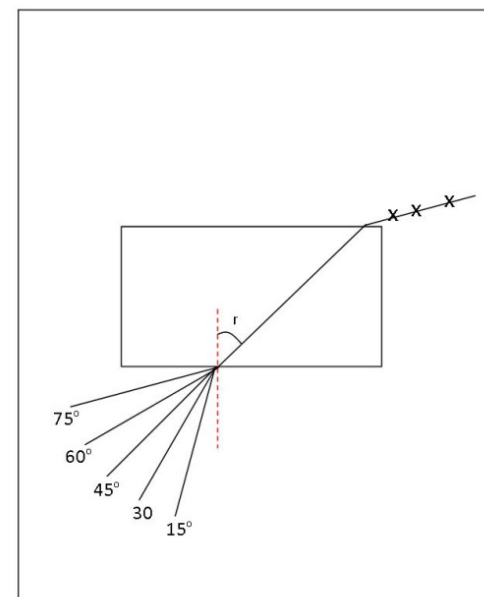
## Method



- 1) Place a glass block on a sheet of paper and draw around it.
- 2) Draw on a normal (line at  $90^\circ$  to the surface of the block) using a protractor.
- 3) Measure angles of incidence from this normal at the following angle  $15^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and  $75^\circ$ .



- 4) Connect the ray box to the Power Supply and set the voltage to about 10V.
- 5) Place a slit in front of the bulb to produce a narrow beam of light.
- 6) Shine ray of light along the  $75^\circ$  angle of incidence.
- 7) Mark on ray of light which emerges from the block by putting X's along the beam.

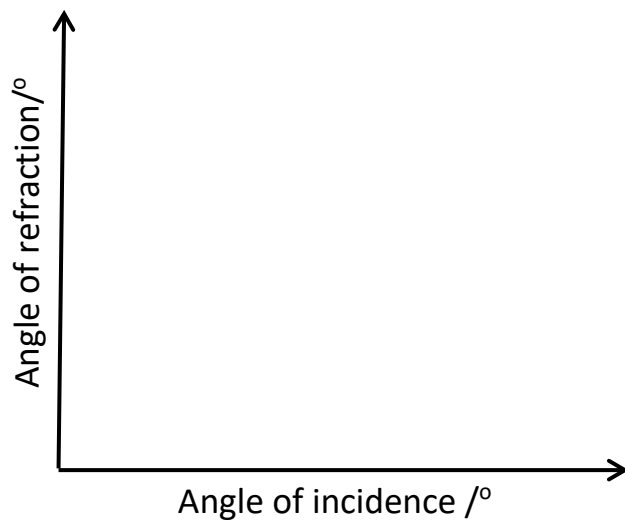


- 8) Turn off power supply.
- 9) Remove the block and, using a ruler, draw a line to link the incident ray to the corresponding refracted ray.
- 10) Measure the angle of refraction ( $r$ ) in the glass block and record in results table.
- 11) Repeat steps 4-9 for other angles of incidence.

## Results

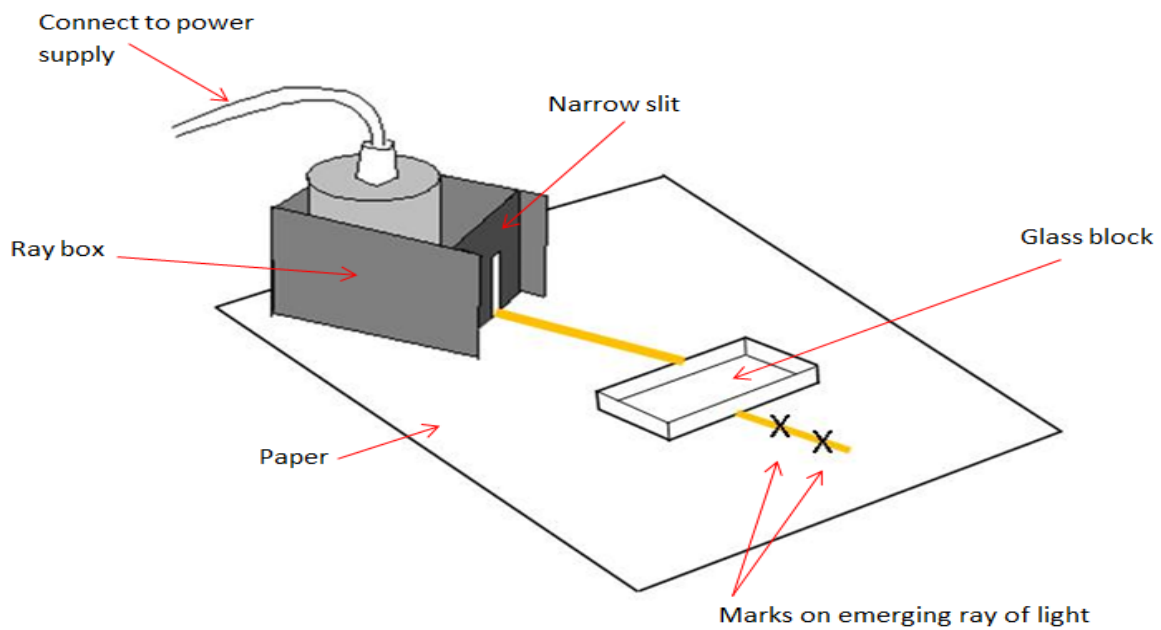
Angle of Incidence/ $^{\circ}$	Angle of Refraction/ $^{\circ}$
15	
30	
45	
60	
75	

Plot a graph of angle of incidence (x-axis) against angle of refraction (y-axis).



## Conclusion

## Technician/Teacher Notes



### Apparatus per group/pupil

Mains DC power supply ~ 12V but not critical

Ray box ~ 12V bulb with connecting leads fitted with 4mm plugs

Narrow slit ~ 1mm

Perspex / Glass block ~ 10cm x 6.5cm x 1.8 cm but not critical

A4 paper

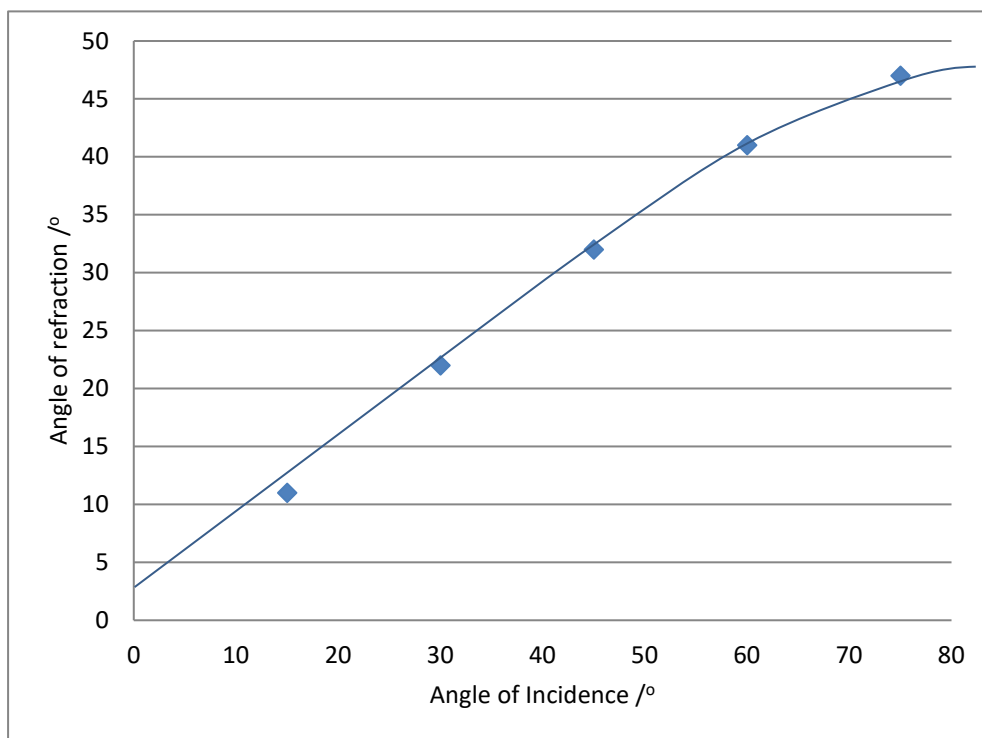
Protractor to read to 1°.

### Safety

Warn pupils bulb may get hot, turn off when not in use.

## Sample Results

Angle of Incidence/ $^{\circ}$	Angle of Refraction/ $^{\circ}$
15	11
30	22
45	32
60	41
75	47



## Conclusion

The graph shows that there is a relationship between the angle of incidence and the angle of refraction. The graph is not a straight line, therefore the angle of incidence and the angle of refraction are **not proportional**.