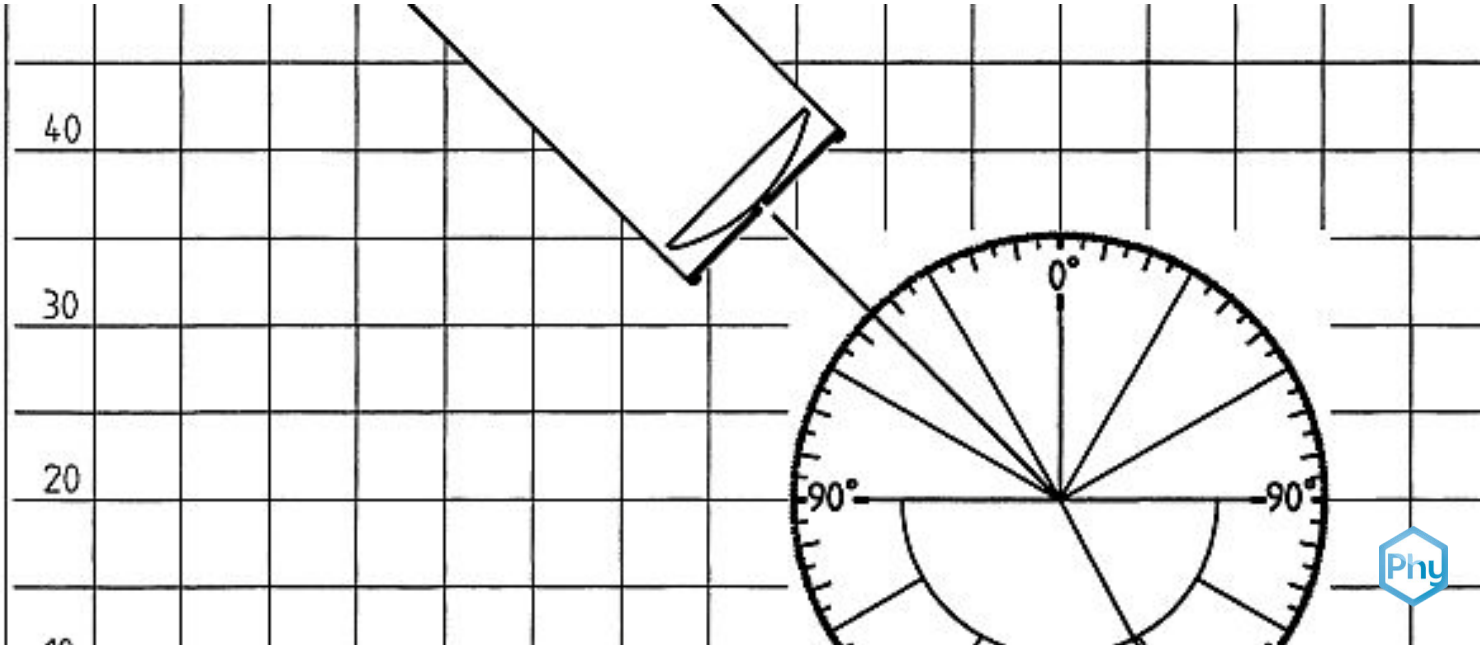
The law of refraction (quantitative)



Physics > Light & Optics > Reflection & refraction of light

Difficulty level	Group size	Preparation time	Execution time
easy	-	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/64286ebb5e30a7000275eaf4

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Teacher information

Application

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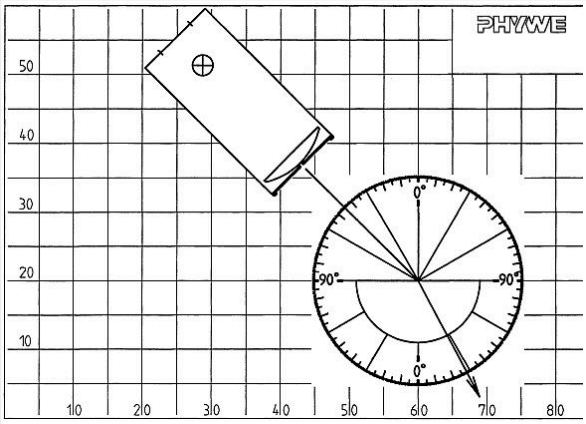

Experimental set-up:

Law of refraction

Light rays not only reflect, they are refracted in the transition between different media.

With each new transition between two media (air / glass) or (air / water) the light beam is slightly deflected.

This experiment is designed to work out the law of refraction with the help of Plexiglas.

The air/plexiglass transition has a refractive index n=1.5.

The refractive index describes the ratio of the angles before the transition to after the transition.

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Other teacher information (1/2)

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Prior knowledge

The students need theoretical knowledge about the straight-line, ray-shaped propagation of light. Furthermore, they should have gained experience of reflection and refraction.

Principle

The law of refraction is to be derived using a semicircular model body made of Plexiglas.

Other teacher information (2/2)

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Learning objective

Students should understand the law of refraction.

Tasks

Students should observe the measurement of light rays and understand that light refraction depends on the transition media.

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Additional teacher information

Note

The table contains some measured values for related angles

α	β	$sin\alpha$	$sin\beta$	$\frac{sin\alpha}{sin\beta}$
15°	10°	0,26	0,17	1,49
30°	20°	0,5	0,34	1,46
45°	28°	0,71	0,5	1,51
60°	35°	0,87	0,57	1,51
75°	40°	0,97	0,64	1,50

Safety instructions

- The general instructions for safe experimentation in science lessons apply to this experiment.

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Student information

Motivation

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This is the first small conclusion of a series of experiments. In the last experiments you learned a lot about the behaviour of light.

In a nutshell:

- Light occurs in the form of rays
- When light hits an opaque body, a shadow is created.
- Surfaces reflect light rays depending on their colour and texture
- Oblique incident light rays are refracted at the transition between two media

The underlying experiment is to work out the law of refraction.

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Demo Physics board with stand	02150-00	1
2	Halogen lamp for experiments, 12V/50W, with magnetic base	08270-20	1
3	Optical block, semicircular, magnet held	08270-01	1
4	Optical disk, magnet held	08270-09	1
5	PHYWE Multitap transformer DC: 2/4/6/8/10/12 V, 5 A / AC: 2/4/6/8/10/12/14 V, 5 A	13533-93	1
6	G-clamp	02014-00	2

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Set-up and Procedure (1/2)

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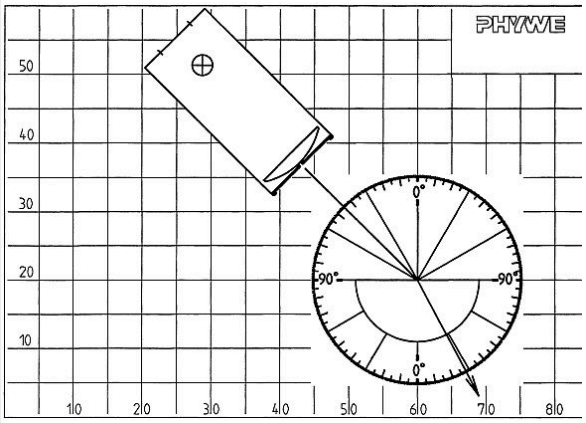

1 slit diaphragm directed towards optical disc

- Place optical disc on adhesive board
- Place the semicircle model body so that its flat surface is level with the horizontal diameter of the optical disc and its centre of curvature is at the centre of the optical disc.
- First place the luminaire with the 1-slit aperture so that the light beam (at any angle of incidence) does not hit the centre of curvature of the semi-circular body, thus making the two-fold refraction of the light clear

Set-up and Procedure (2/2)

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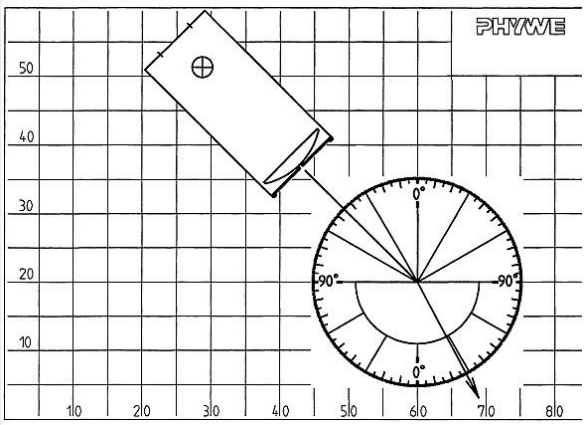

1 slit diaphragm directed towards optical disc

- Change the beam path so that the light beam impinges on the centre of the optical disc, so that refraction only occurs at the air-glass transition
- Vary the angle of incidence and read off and tabulate the angle of incidence and refraction.

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Report

Task 1

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Write down your observations on the refractive behaviour of the light beam.

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Task 2

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Tabulate your measurements for the angle β associated with the set angle α

α	β
15°	
30°	
45°	
60°	
75°	

Task 3

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Answer the questions

When the light beam hits the centre of curvature of the semicircular Plexiglas body, it always runs in the direction of a radius after refraction and is not refracted again when it passes into air because...

- the light is only refracted when passing from air into a medium.
- light can only be refracted a maximum of once
- the radius is perpendicular to the circle.

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Task 4

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Notice!

If light enters at an angle from an optically thinner medium into an optically denser one, it is refracted. The following applies:

$\frac{sin\alpha}{sin\beta} = konstant$

$\frac{sin\alpha}{sin\beta} = n(Brechzahl)$

For a = 0°, β = 0°.

Incident beam, refracted beam and incident perpendicular lie in the same plane.

The measurements show: When light passes from air into Plexiglas, n = 1.49

Slide	Score / Total
Slide 15: Law of refraction	**0/3**

Total **0 / 3**

Solutions | Repeat | Export text

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