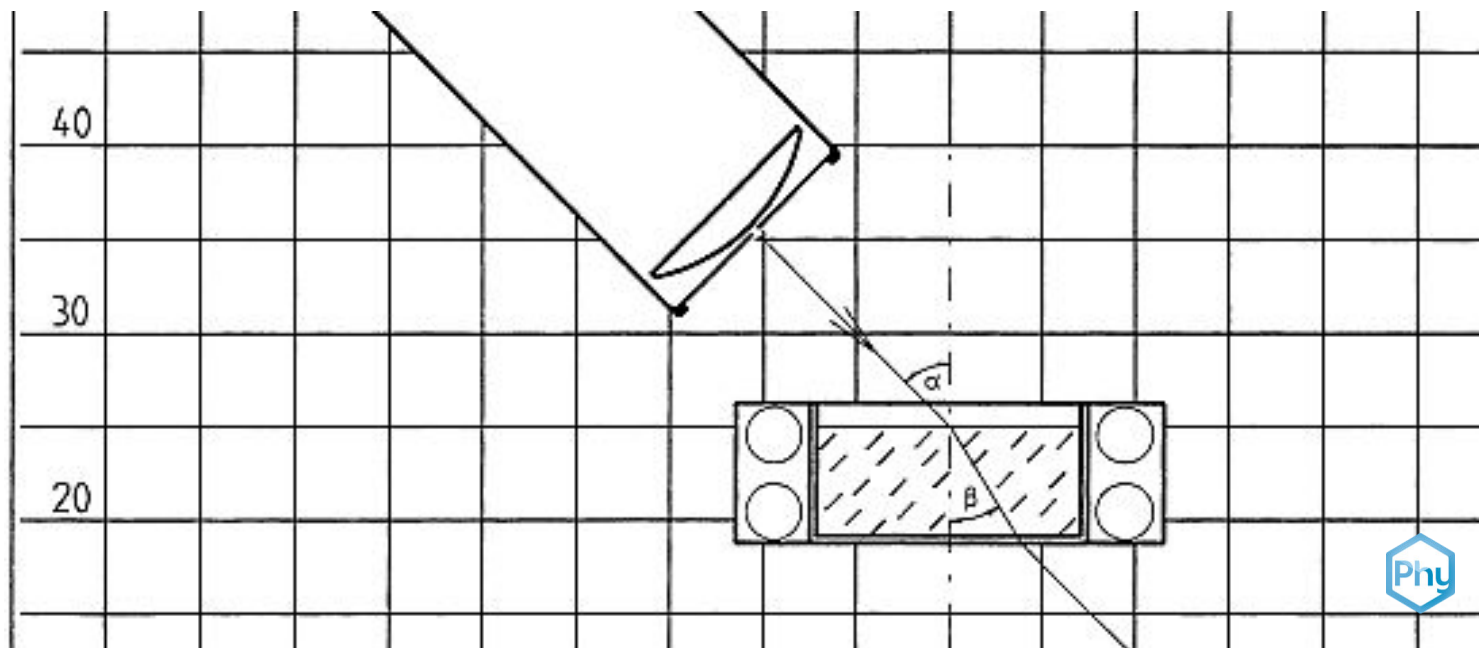


Refraction of light at the air-water boundary



Physics

Light & Optics

Reflection & refraction of light



Difficulty level

easy



Group size

-



Preparation time

10 minutes



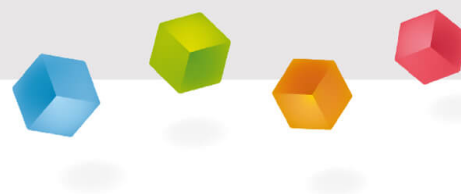
Execution time

10 minutes

This content can also be found online at:

<http://localhost:1337/c/64286c5c5e30a7000275eaea>

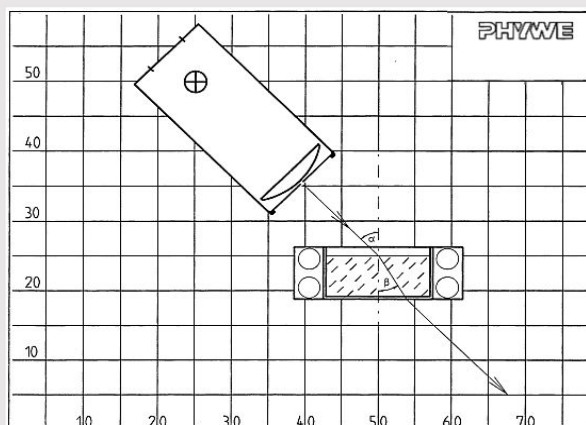
PHYWE



Teacher information

Application

PHYWE



Experimental set-up:
Refraction of light in water

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.

These distractions are technically exploited, e.g. to correct a visual impairment with the help of glasses.

Other teacher information (1/2)

PHYWE

Prior knowledge



The students need theoretical knowledge about the straight-line, ray-shaped propagation of light and that objects reflect light rays.

Principle



To demonstrate how a beam of light travels when it passes from air into water and vice versa.

Other teacher information (2/2)

PHYWE

Learning objective



Students should gain knowledge about the principles of light refraction.

Tasks



The students should observe how a beam of light is refracted in the transition between two media.

Additional teacher information (1/2)

PHYWE

Note



It is recommended to colour the water in the cuvette, e.g. with Paten Blue-V (48376-04).

Then the course of the light beam in the water is even more clearly visible.

If this experiment is also to demonstrate the reversibility of the light path during refraction, then it is advisable to additionally use the light box so that its light beam runs in the opposite direction to the light beam of the adhesive luminaire, and to operate both luminaires alternately.

Additional teacher information (2/2)

PHYWE

Note



If you want to work out the different refraction at the air-glass and air-water transitions, then the angle of refraction is determined for the same angle of incidence (e.g. 45°) by marking the refracted beam.

Transition air-water: $\alpha = 45^\circ$; $\beta = 32^\circ$

Transition air-glass: $\alpha = 45^\circ$; $\beta = 28^\circ$

Therefore, it is realised that light is refracted more strongly at the air-glass transition than at the air-water transition.

Safety instructions

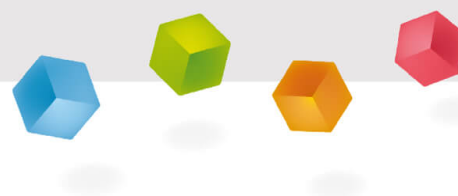
PHYWE



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

PHYWE

Student information



Motivation

PHYWE



Straw in water glass

Some of you may have noticed that a straw in a glass of water seems to deform below the water surface.

Of course, the straw doesn't really deform, it just looks that way because the water refracts the light rays differently than the air.

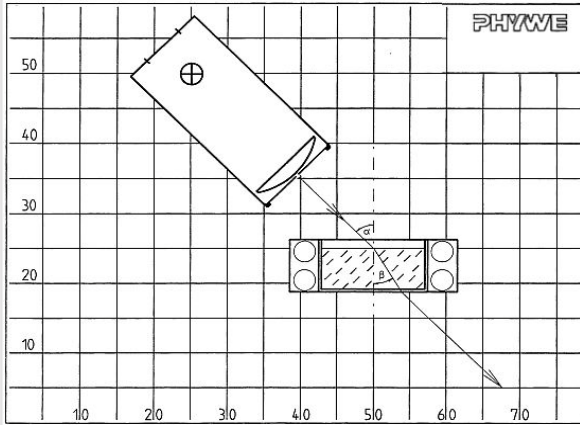
The present experiment aims to explain how this "kink in the optic" occurs.

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	Cuvette, magnet held, 230x75 mm	08270-08	1
4	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
5	G-clamp	02014-00	2

Set-up and Procedure

PHYWE

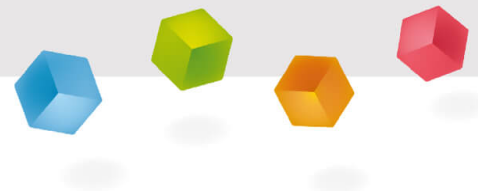


1-slit orifice with water-filled cuvette

- Draw a horizontal line to mark the interface approximately in the middle of the lower half of the adhesive board; erect incidence plumb bob
- Place the cuvette filled with water in such a way that the water surface is level with the marking of the interface.
- Position the luminaire with the 1-slit aperture so that the beam runs in the direction of the incident plumb bob and does not experience any refraction ($\alpha = \beta = 0^\circ$); readjust the cuvette if necessary.
- Vary the angle of incidence while observing the course of the light beam

PHYWE

Report



Task 1

PHYWE



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

Task 2

PHYWE



Fill in the blanks!

When the light beam passes [] from air into [], it changes its []; it is refracted. The [] is always greater than the angle of refraction; the ray is refracted towards the [].

angle of incidence

plumb bob

direction

water

at an angle

✓ Check

Task 3

PHYWE



Fill in the blanks!

When the light beam passes obliquely from the water into , it is refracted by the perpendicular. Incident ray, refracted ray and perpendicular lie in plane. If the angle of incidence is 0° , then the light beam is refracted.

Slide

Score/Total

Slide 14: Refraction

0/5

Slide 15: Angle of incidence

0/4

Total

 ★