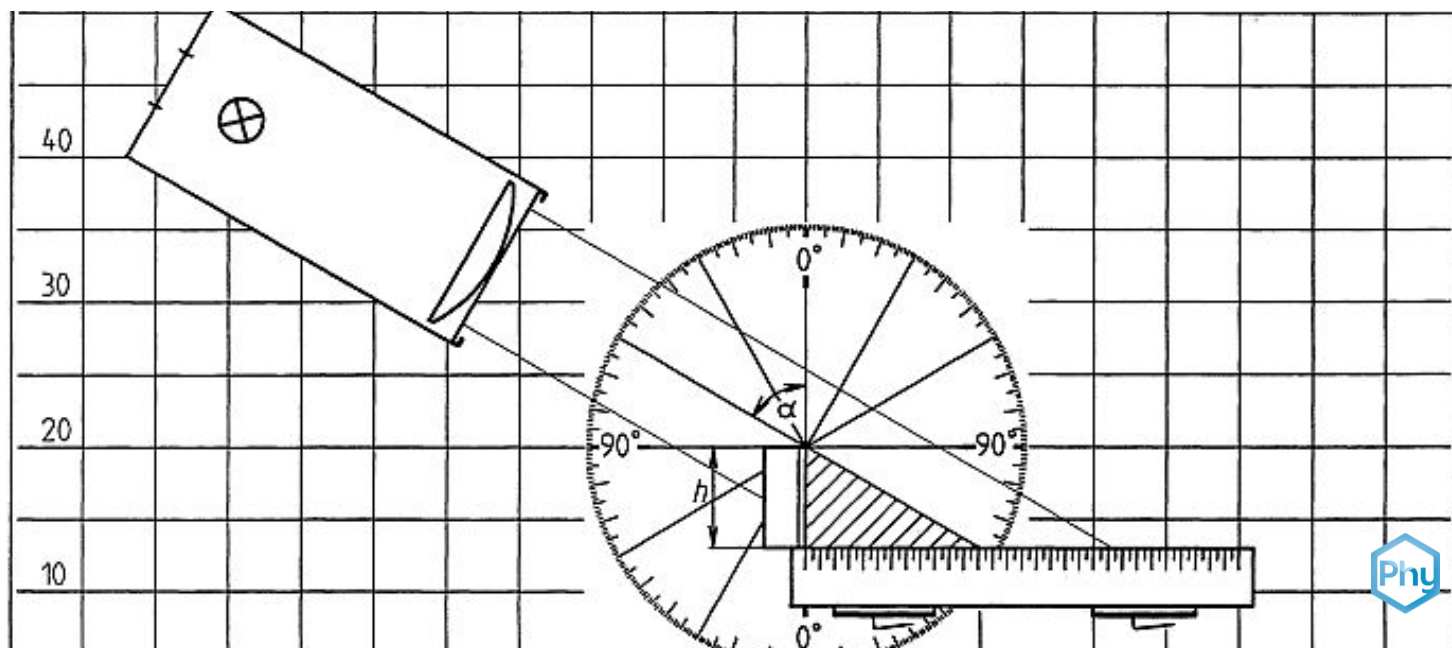


Length of shadows



Physics

Light & Optics

Dispersion of light



Difficulty level

easy



Group size

-



Preparation time

10 minutes



Execution time

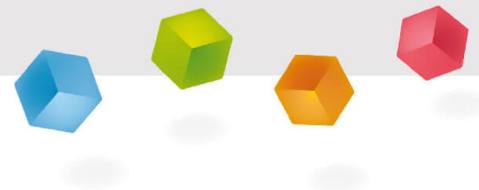
10 minutes

This content can also be found online at:



<http://localhost:1337/c/642818005e30a7000275e9f4>

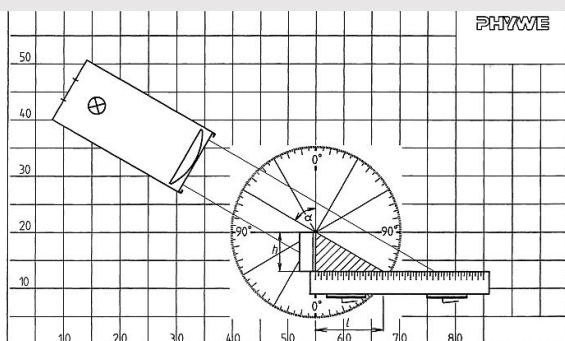
PHYWE



Teacher information

Application

PHYWE



Experimental set-up:

Adhesive luminaire with parallel light beam with object on optical disc

Light spreads out in a straight line. If a ray of light hits an opaque object, a shadow is created.

The shadow length is determined by the angle of entry of the light beam.

The shallower the angle of entry to the object, the longer the shadow.

As a naturally occurring example, the midday sun can be compared to the setting sun. At noon it shines vertically from above, only a small shadow is created. In the evening sun, the shadows stretch out.

Other teacher information (1/2)

PHYWE

Prior knowledge



The students need prior theoretical knowledge about the straight-line, ray-shaped propagation of light. They should also have prior knowledge about the formation of shadows.

Principle



It is to be shown that the length of the shadow behind an opaque body depends on the angle of incidence of the light.

Other teacher information (2/2)

PHYWE

Learning objective



Students should gain knowledge about the principles of shadowing.

Furthermore, they should recognise that a flat angle of entry leads to an increasing shadow length.

Tasks



The students should collect observations and findings on the length of shadows depending on the angle of entry of the light beam.

Additional teacher information

PHYWE

Note

In general, the semi-quantitative version of the experimental result is sufficient for teaching purposes.

The experiment also allows a quantitative version of the result. The following applies (cf. Fig. 2): $\tan \alpha = l/h$

with h = Height of the body casting the shadow

and l = Shadow length

$$l = h \cdot \tan \alpha$$

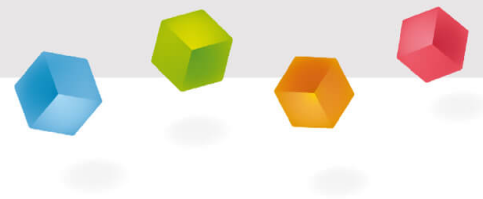
Safety instructions

PHYWE



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

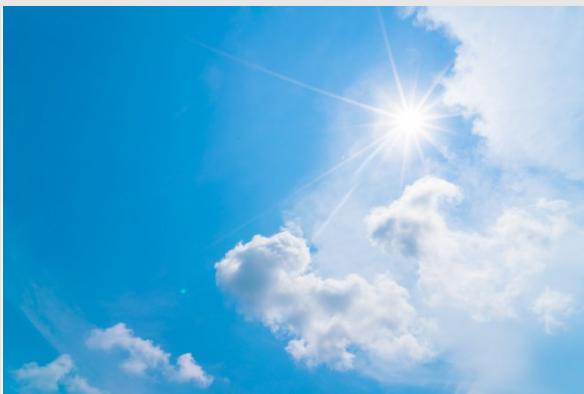
PHYWE



Student information

Motivation

PHYWE



Slightly cloudy midday sun

When the sun shines, our bodies and objects in our surroundings cast a shadow.

Everyone has noticed it before: Our shadow changes its length during the day!

While at midday it forms a small round spot around us, in the late evening sun it stretches several metres away from our feet.

This experiment will show how the shadows are of different lengths and what the midday and evening sun are all about.

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 disk, magnet held	08270-09	1
4	Diaphragm w. holder, magnet held	08270-10	2
5	Plane mirror, magnet held	08270-13	1
6	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
7	G-clamp	02014-00	2

Set-up and Procedure (1/2)

PHYWE

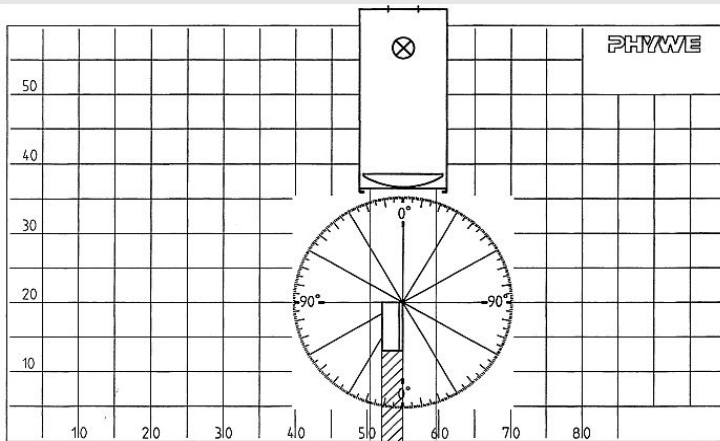


Fig.1:

Vertically aligned luminaire

- Place optical disc in the middle of the lower half of the adhesive panel
- Place the plane mirror intended for casting shadows in such a way that its upper right edge rests in the centre of the optical disc.
- Position the luminaire so that the parallel light beam is incident from above (angle of incidence = 0°) (Fig. 1).

Set-up and Procedure (2/2)

PHYWE

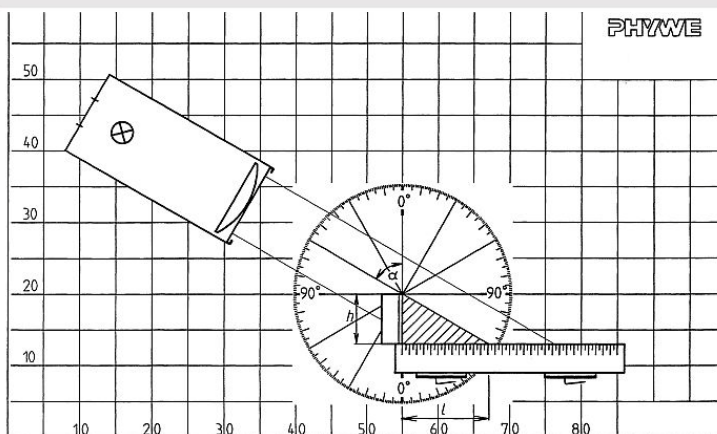


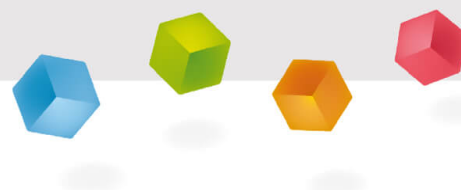
Fig.2:

Adhesive luminaire with different angles of incidence. Angle of incidence aligned

- Attach the ruler to the lower end of the shadow body with the help of the two covers with holder (Fig. 2).
- Different angles of incidence with the adhesive luminaire α of the light beam; in doing so, set the respective angles of incidence as well as the associated shadow lengths l read off and tabulate (Fig. 2)

PHYWE

Report



Task 1

PHYWE

As the angle of incidence increases, the shadow becomes longer.

Add the measured values for α and l in the table.



l in cm	l in cm
0°	
15°	
30°	
45°	
60°	
75°	

Task 2

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If light hits an opaque body at an angle, then a shadow is created behind the body, which is larger the smaller the angle of incidence of the light.

☐ True☐ False Check

If an opaque body is illuminated by an extended light source, a sharp shadow is created behind the body.

☐ True☐ False Check

Slide

Score/Total

Slide 14: Multiple tasks

0/2

Total

  0/2 Solutions Repeat Export text