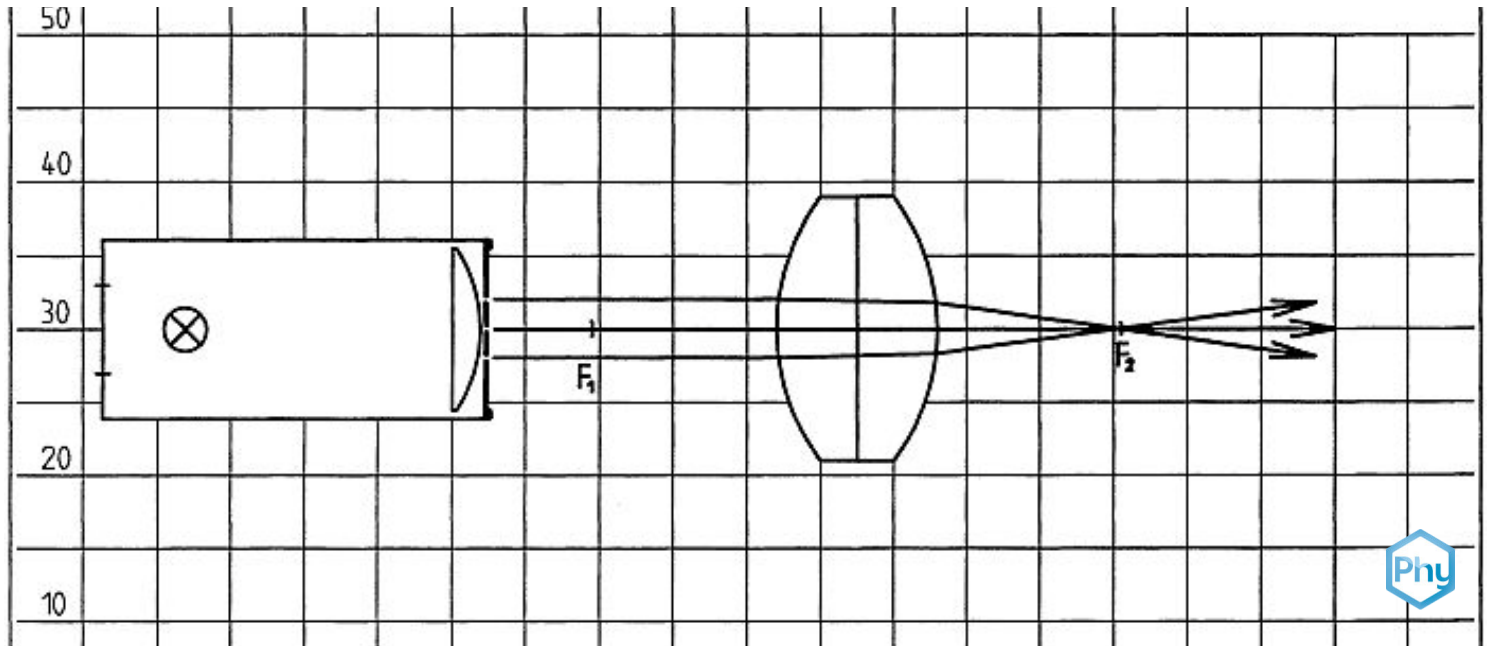


Properties of a convergent lens



The properties of a converging lens are to be determined; for this purpose, essential terms are to be introduced and the courses of light rays, which are particularly suitable for image constructions, are to be demonstrated.

Physics

Light & Optics

Optical devices & lenses



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/64720e45e1994e000281c751>

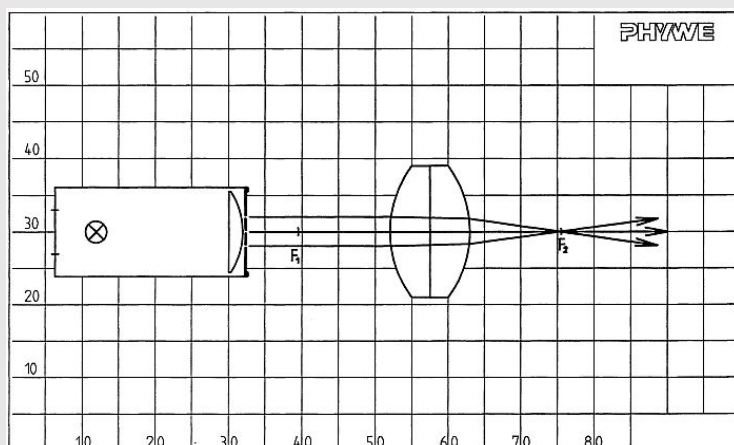
PHYWE



Teacher information

Application

PHYWE



Experimental set-up:

Beam path with a converging lens

The experiment below is designed to introduce students to the functions of a converging lens.

The converging lens refracts both divergent and parallel light to a common collection point. This is calculated according to the radius and the material used.

Other teacher information (1/2)

PHYWE

Prior knowledge



Students need prior theoretical knowledge about the straight-line, ray-shaped propagation of light. They should have gained experience about light refraction and refractive indices.

Principle



The properties of a converging lens are to be determined; for this purpose, essential terms are to be introduced and the courses of light rays, which are particularly suitable for image constructions, are to be demonstrated.

Other teacher information (2/2)

PHYWE

Learning objective



Students should develop a sound knowledge of image construction.

Tasks



The students should observe the experiment and learn which concepts and properties are of high importance for the construction of the image.

Additional teacher information

PHYWE

Note



Because of the thickness of the lens, rays far from the axis intersect at a slightly smaller distance from the lens than rays close to the axis.

The rays with which the characteristic course is shown should therefore have no greater distance than 4 mm from the optical axis when they hit the lens.

The smaller the angle between the centre rays and the optical axis, the smaller the parallel shift.

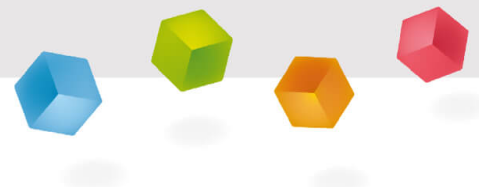
Safety instructions

PHYWE



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

PHYWE



Student information

Motivation

PHYWE



Detective with magnifying glass

A reading magnifier is an object that only becomes interesting and important for most people when they reach retirement age.

And yet magnifying glasses are built into many technical devices.

You can even use them to start a fire. They are able to focus the incident light so strongly that a fire can be created through the accompanying heat.

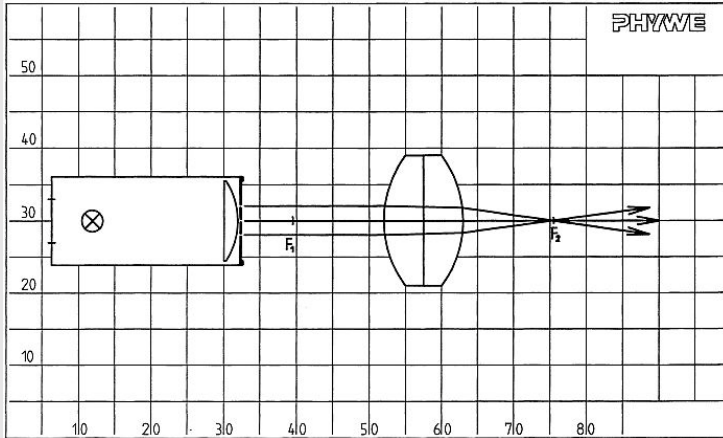
This experiment is intended to explain how a magnifying glass, or rather a converging lens, works.

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	Opt. block, planoconvex, magn.held	08270-02	2
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	02014-01	2

Set-up and Procedure (1/3)

PHYWE

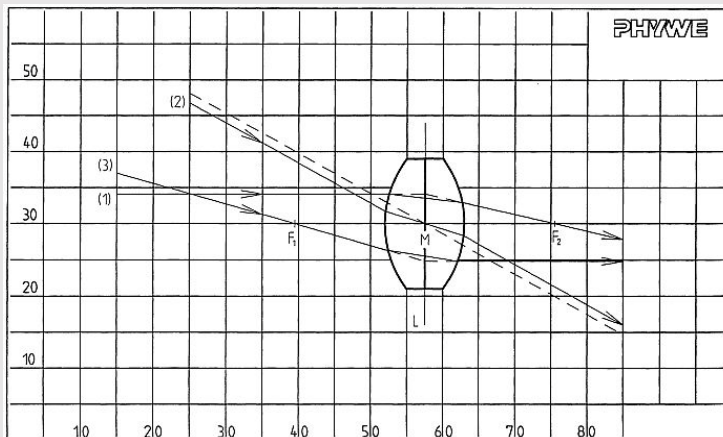


3-slit diaphragm on converging lens

- Draw optical axis on the adhesive board
- Attach biconvex lens from both model bodies
- Place the adhesive luminaire with 3-slit aperture on the optical axis, with the middle beam running in the optical axis
- Mark the intersection of the refracted rays with F_2 ; at the same distance in front of the lens, mark F_1 on the optical axis.

Set-up and Procedure (2/3)

PHYWE

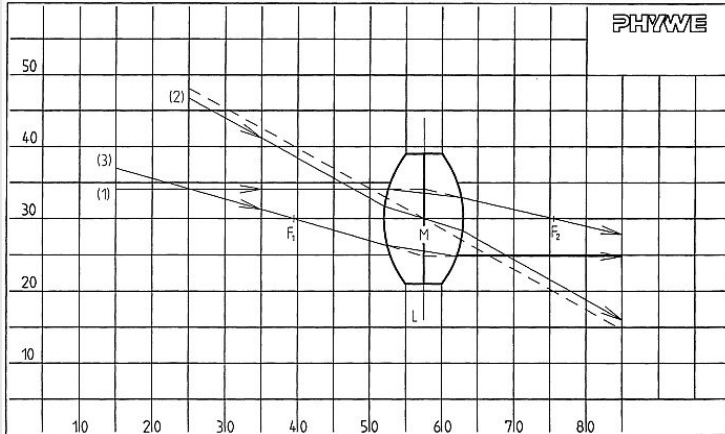


1 slit diaphragm on converging lens

- Replace 3-slit aperture with 1-slit aperture
- Let the light beam enter through the centre of the lens - at an angle to the optical axis
- Allow light beam to enter through F_1
- Observe radiation patterns
- Trace rays as far as possible

Set-up and Procedure (3/3)

PHYWE

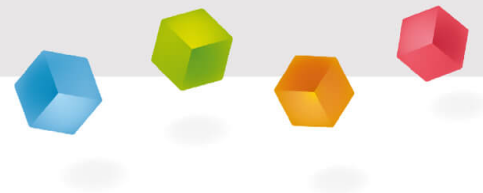


1 slit diaphragm on converging lens

- Sketch outlines of the lens body on the board
- Remove luminaire and lens body and complete beam paths
- Draw centre line (main plane); mark lens centre point M
- Draw ray paths in a simplified way

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Report



Task 1

PHYWE

Draw the correct words into the gaps!

Rays incident parallel to the axis pass through a beyond the converging lens.

Rays passing through the continue beyond the lens in direction, but .

☒ Check

Task 2

PHYWE

Due to the symmetry of the lens with respect to F_2 located point F_1 rays are axis-parallel beyond the lens.

☐ True☐ False☒ Check

Rays are refracted twice by the lens; only the ray that runs along the optical axis is always refracted.

☐ True☐ False☒ Check

Task 3

PHYWE



To the 1st structure, parallel beams...

...are not refracted at all, only divergent rays.

...run beyond the lens through the focal point F2.

...run parallel through the lens.

Slide

Score/Total

Slide 14: Beam path

0/5

Slide 15: Multiple tasks

0/2

Slide 16: Parallel beams

0/3

Total

0/10

Solutions

Repeat

10/10