

Law of imagery and magnification of a convergent lens



Physics

Light & Optics

Optical devices & lenses



Difficulty level

easy



Group size

1



Preparation time

10 minutes



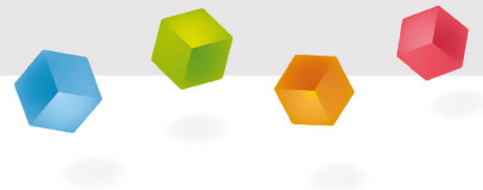
Execution time

10 minutes

This content can also be found online at:

<http://localhost:1337/c/5ef9f90a46e83e000319c1b9>

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General Information

Application

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Image with a photographic lens

In everyday life we encounter optical lenses in various applications. They are part of every smartphone. They can be found in tablets and notebooks to enable photos and videos.

But how does it work?

The basics for understanding this question will be developed in this and further experiments.

Other information (1/2)

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Prior knowledge



Students should have a basic knowledge of the linear propagation of light and be proficient in mathematical equations.

Principle



With the adhesive lamp the ray path of a light bundle through a convergent lens is demonstrated and the law of imaging is confirmed.

Other information (2/2)

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Learning objective



It shall be shown that the equations $1/f = 1/g + 1/b$ and $B/G = b/g$ apply to the converging lens.

Tasks



1. Draw the beam courses
2. Measure all distances and sizes

Material

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

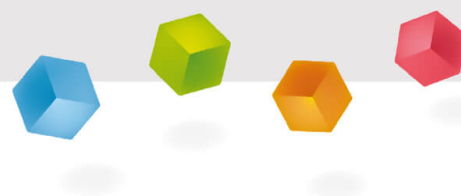
Material

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Position	Material	Quantity
1	Ruler	1
2	water-soluble foil stick	1

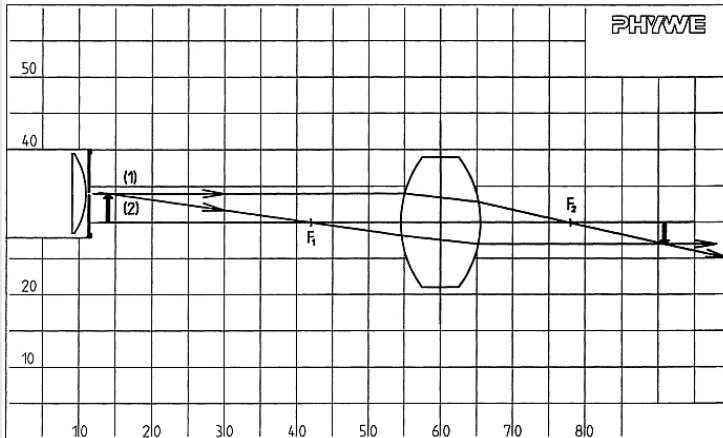
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Set-up and Procedure



Set-up

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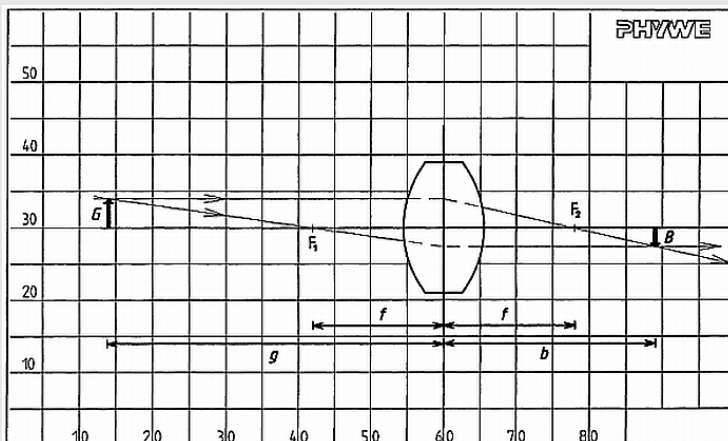


Test setup on the adhesive board

- Set the optical axis in the center of the adhesive board
- Mark lens plane at $x = 60$ cm; enter F1 and F2 ($f = 180$ mm)
- Attach a biconvex lens composed of both model bodies

Procedure

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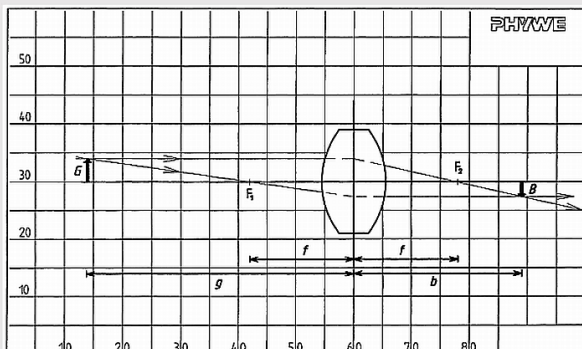


Marking of the beam courses on the adhesive board

- Draw object arrow ($G = 40$ mm, $g = 410$ mm)
- Using a luminaire with 1-slit aperture, run a parallel beam and a focal beam through the tip of the arrow
- Trace beams as far as possible
- Remove lamp and lens
- Completing beam paths; drawing an arrow
- enter g , b , f , G and B
- measure g , b , f , G and B

Tasks

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Determination of distances and sizes
on the blackboard

The measured distances are:

Object width $g =$

Screen width $b =$

Focal length $f =$

The measured quantities are:

Object size $G =$

Image size $B =$

Report

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Determine the values for $1/g$, $1/b$ and $1/f$

$1/g =$ \

$1/b =$ \

$1/f =$ \

It is therefore valid:

Determine the quotients B/G and b/g .

$B/G =$

$b/g =$

It is therefore valid:



Show solutions



Repeat



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