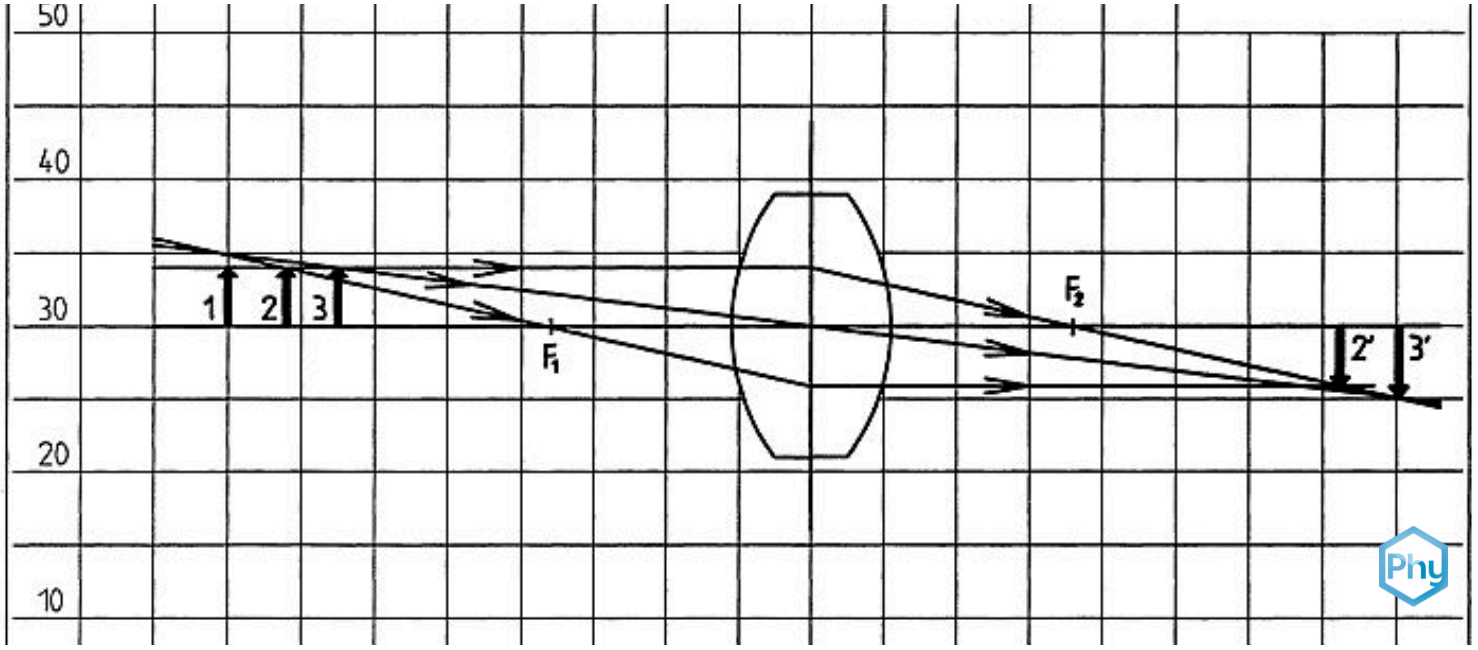
Real images with a convergent lens



Real images on a converging lens

Physics > Light & Optics > Optical devices & lenses

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/6472110de1994e000281c75d

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Teacher information

Application

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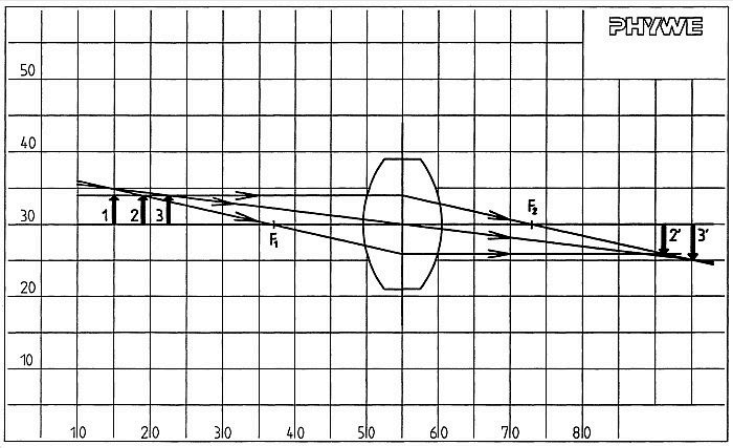

Experimental set-up:

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.

This experiment is intended to provide an introductory explanation of the imaging of converging lenses, for which objects from different distances are reproduced as an image.

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Other teacher information (1/2)

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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

With the help of parallel rays and centre or focal point rays, the formation of real images through a converging lens is to be demonstrated; at the same time, the properties of the images are to be shown.

Other teacher information (2/2)

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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.

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Additional teacher information

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Note

Because of the necessarily large dimensions of the lens bodies and the relatively large focal length, there is little room for manoeuvre for the object widths if all the images are still to be created on the adhesive board.

For space reasons, the holding lamp must therefore be placed halfway on the edge of the board, or the smaller light box (09804-00) can be used instead.

Safety instructions

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

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Student information

Motivation

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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.

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Demo Physics board with stand	02150-00	1
2	Opt. block,planoconvex, magn.held	08270-02	2
3	Halogen lamp for experiments, 12V/50W, with magnetic base	08270-20	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	02014-01	2

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Set-up and Procedure (1/2)

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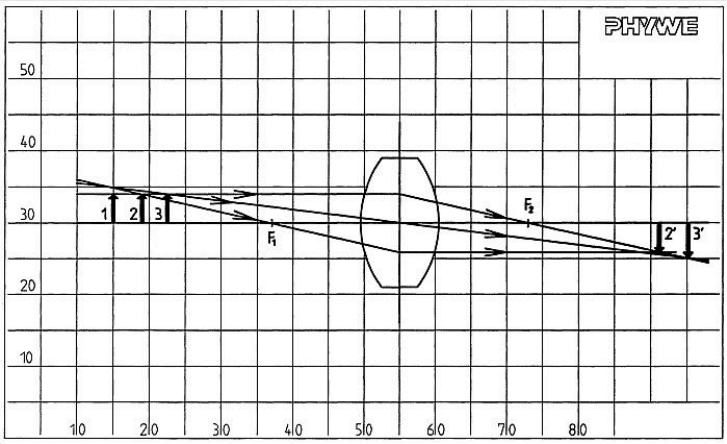

3 object arrows with different spacing and 1-gap aperture

- Draw optical axis halfway up the adhesive board
- Draw the lens plane in the centre of the board (at x = 55 cm), mark F1 and F2 (f = 180 mm)
- Set up both model bodies as a biconvex lens
- 40 mm high object arrows with g= draw in 400 mm, 360 mm and 325 mm
- Using a luminaire with a 1-slit diaphragm, create a parallel beam running through the arrowheads.

Set-up and Procedure (2/2)

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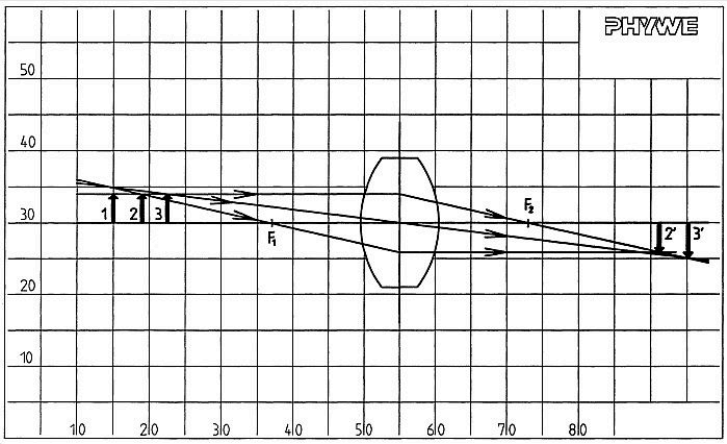

3 object arrows with different spacing and 1-gap aperture

- Then run the centre or focal point beam through each of the arrowheads in turn by moving the luminaire.
- Observe ray trajectories and trace each as far as possible
- Remove luminaire and lens
- Complete the ray trajectories and enter the arrows. (In the illustration, the rays are only shown for two cases for reasons of clarity.)

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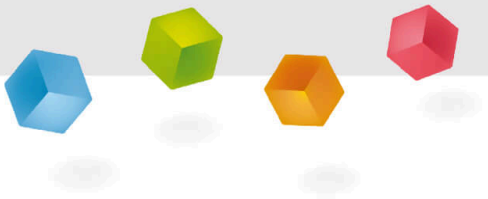

Report

Task 1

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Put the correct words into the gaps!

From objects located outside the double _____ length, the converging lens produces inverted, _____ images between the _____ and double focal lengths.

From objects located in the _____ focal length, the lens in the double focal length produces _____ images of the same size.

double
focal
single
inverted
reduced

Check

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Task 2

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Images created behind the lens as seen from the object are virtual!

○ True ○ False

Check

Virtual images are always twice as large as real images!

○ True ○ False

Check

Task 3

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From objects between the single and double focal length

...the lens creates a focal point.

...the lens produces mirrored magnified images.

...the lens produces reversed images of the same size outside the double focal length.

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Slide	Score / Total
Slide 13: Focal length	0/5
Slide 14: Multiple tasks	0/2
Slide 15: Between focal lengths	0/1

Total 0 / 8

Solutions Repeat

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