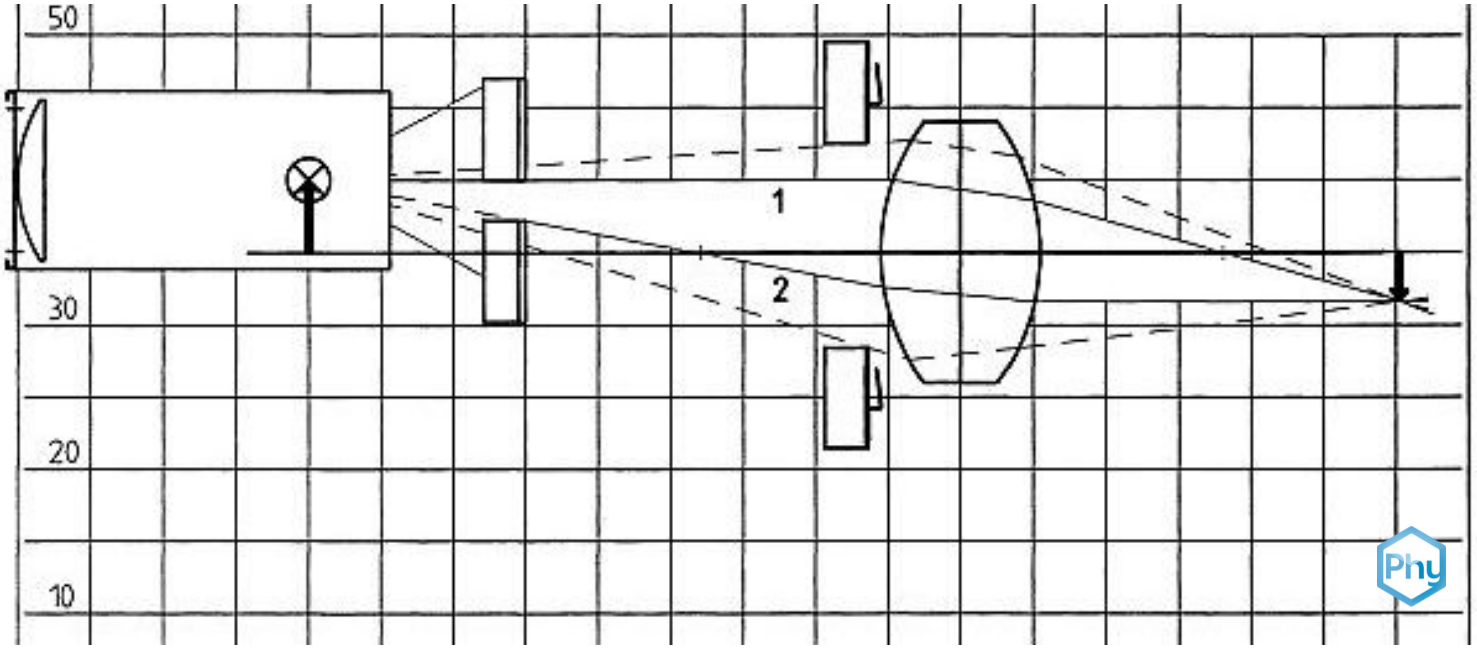
The camera



The camera

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/647251cbe1994e000281c7b9

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Teacher information

Application

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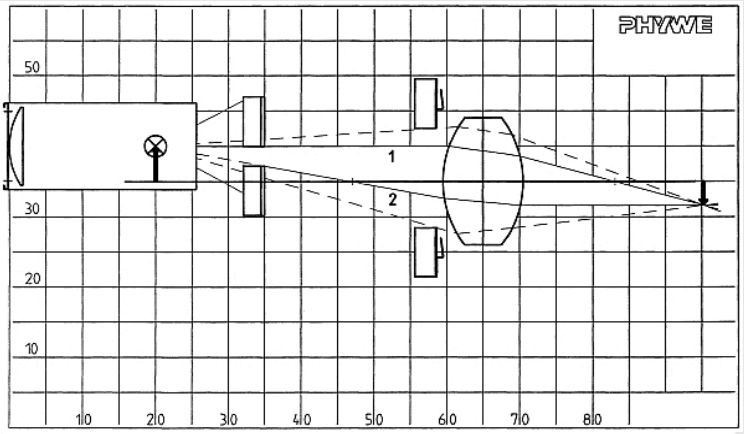

Experimental set-up:

Divergent light beam with apertures and biconvex lens

The experiment is to explain the function of a camera.

The way a camera works is that it uses the lens to create small inverted real images in the plane where the film is.

The photographed objects must be outside the double focal length of the lens.

The position of the file plane is just as decisive for the sharpness of the image as the aperture.

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Other teacher information (1/2)

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Prior knowledge

Students need prior knowledge of imaging optics, with collecting and diverging lenses and the spectral colours of light.

Principle

The basic construction and operation of the camera will be demonstrated.

Other teacher information (2/2)

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Learning objective

Students should understand the simple physical principles behind the function of a classic camera.

Tasks

The students should make observations and gather knowledge about the experimental set-up.

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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

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Motivation

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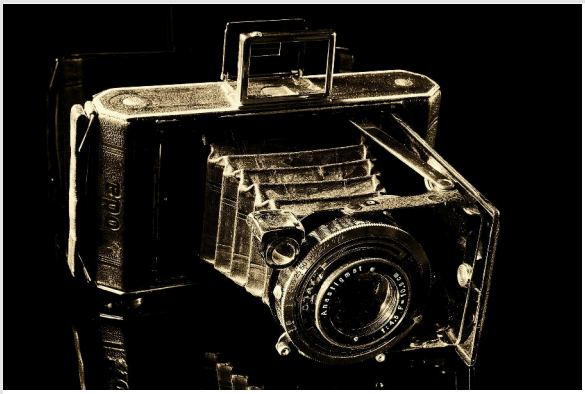

Camera

In this day and age, they are installed almost everywhere - cameras.

But before they found their way digitally into smartphones and tablets, they were technical devices in their own right.

The picture shows a classic camera.

Since you have learned a lot about imaging optics in the meantime, you will now get to know the interaction in a camera.

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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	Diaphragm w. holder, magnet held	08270-10	2
5	Plane mirror, magnet held	08270-13	2
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	02014-01	2

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Set-up and Procedure (1/3)

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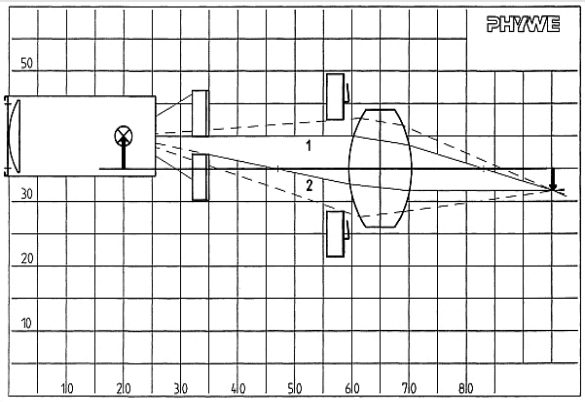
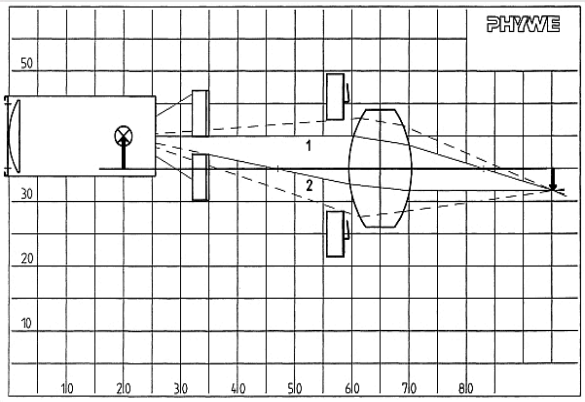


Divergent light with apertures and converging lens

- Place biconvex lens from plano-convex model bodies on the optical axis; lens centre 350 mm from the right edge of the panel.
- Draw a 50 mm high object arrow at a distance of 450 mm from the centre of the lens across the optical axis.
- Create a divergent light beam from the arrowhead with the adhesive luminaire.
- View beam path
- Place shutters in front of the lens so that the peripheral zones of the lens are no longer illuminated

Set-up and Procedure (2/3)

PHYWE



Divergent light with apertures and converging lens

- Pointing to the thereby increasing sharpness of the image point of the arrowhead
- Push the plane mirror, rear side facing the luminaire, into the light beam from above and below until the edge rays of the divergent light beam run parallel to the optical axis or through the focal point of the lens on the object side (180 mm from the centre of the lens) (rays 1 or 2).
- Complete the model of the camera (apertures as the aperture of the apparatus; converging lens as the objective; plane mirror with its back in the image width, perpendicular to the optical axis, as the film plane).

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Set-up and Procedure (3/3)

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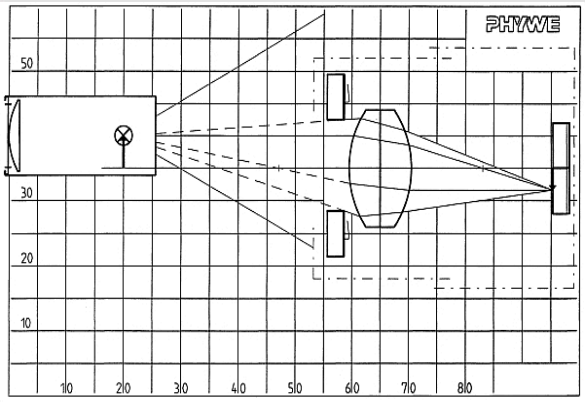

Divergent light with apertures and converging lens

- Trace the edge rays as far as possible; in particular, hold the image arrow on the "film plane".
- Draw a second object arrow of the same size, e.g. at a distance of 400 mm from the centre of the lens, and image the arrowhead in the same way.
- Follow how the image that initially appears blurred on the "film plane" can be brought into focus by changing (enlarging) the distance of the "lens" from the "film plane".
- Look at the current position of the "film level" and compare it with the previous one.

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Report

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Task 1

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Put the correct words into the gaps!

The _____ camera produces inverted, small, _____ images of objects in the _____ through a _____.
The photographed _____ are thereby outside the _____ focal length of the lens.

photographic
real
objects
film plane
collecting lens
double

Check

Task 2

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The converging lens of a camera is called a lens.

○ True ○ False

Review

The aperture can be reduced as required to achieve a greater depth of field.

○ True ○ False

Review

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Task 3

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The image is focused by

- shifting the focal length to the image plane and reducing the aperture.
- a button with the inscription "Zoom".
- moving the camera back and forth.

Slide	Score / Total
Slide 13: Camera	0/6
Slide 14: Multiple tasks	0/2
Slide 15: Focusing	0/3

Total 0 / 11

Solutions Repeat

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