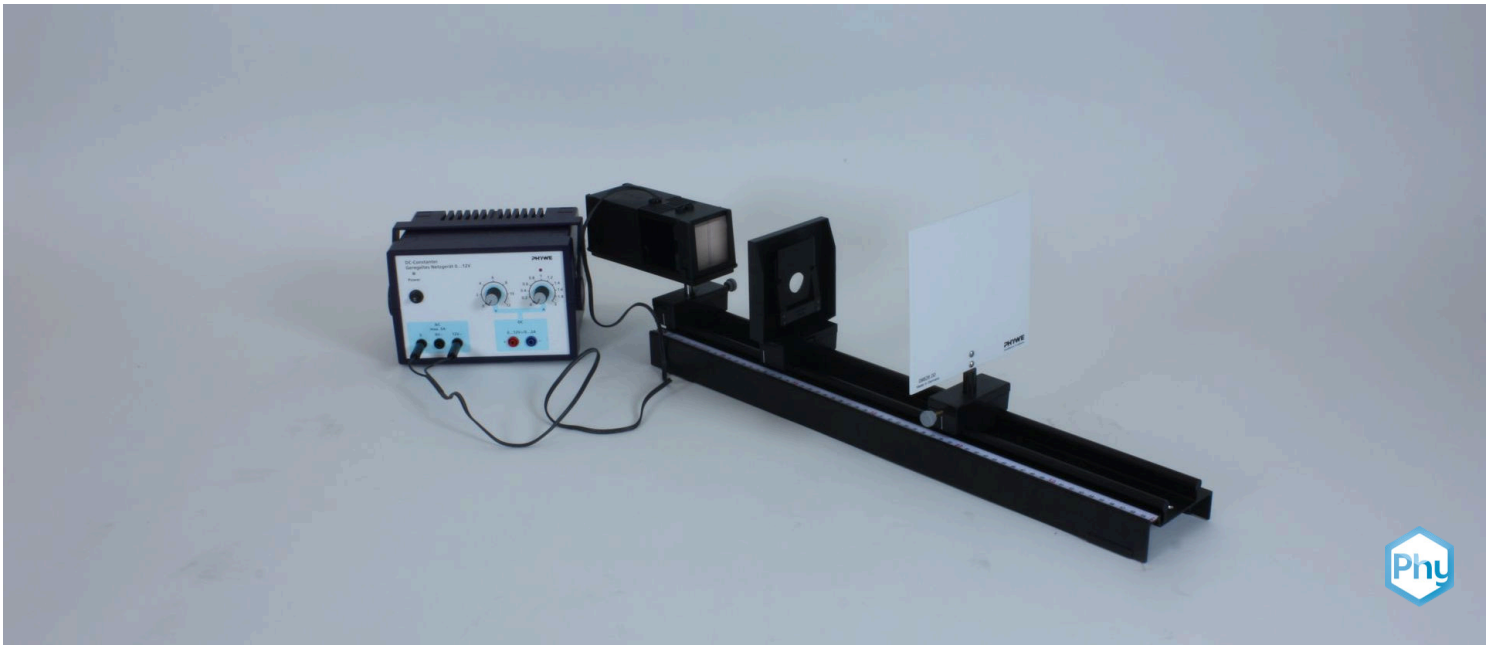
The slide projector



Physics > Light & Optics > Optical devices & lenses

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/62e17d8b8248420003226dd9

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Teacher information

Application

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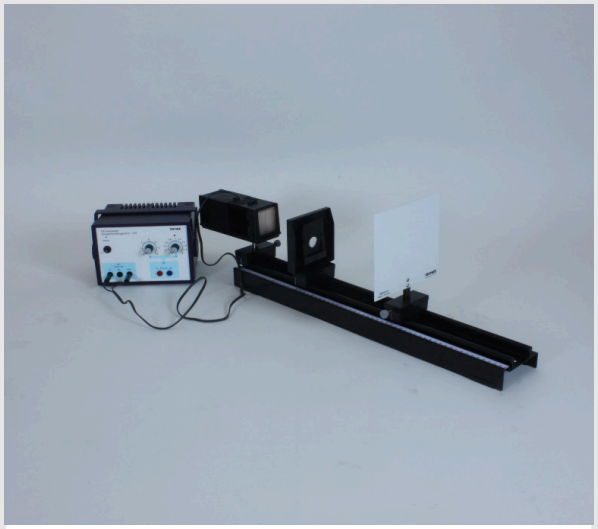

Experimental setup

A slide projector projects enlarged slides onto a wall using light. The enlargement takes place through a lens.

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Other teacher information (1/3)

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Principle

The slide is exposed with an illumination system consisting of a lamp and condenser lenses. The condenser lenses have the task of capturing the largest possible area of light. The resulting image is magnified and displayed on the wall with a lens.

Learning objective

The students should build a simple slide projector and learn about the functions of the individual components.

Other teacher information (2/3)

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Task

The students are asked to build a model of a slide projector and give you knowledge about the main components of this device as well as their function.

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Other teacher information (3/3)

All pupils are familiar with the slide projector. Quite a few will be interested in how it is constructed and how it works. This motivates them for the experiment in general.

Hint: As a model experiment, the proposed experiment is only suitable in principle for investigating the physical principles for a slide projector.

Safety instructions

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

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Student information

Motivation

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Slide projector

A slide projector projects slides onto a wall with light. This makes it possible to view analogue images enlarged.

How does a slide projector work?

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Tasks

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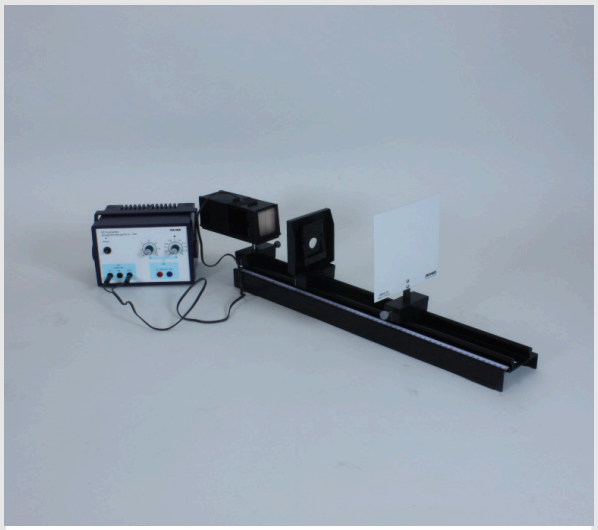

Experimental setup

Build a model of a slide projector according to the following instructions and get to know the main components of this device as well as their function.

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Equipment

Position	Material	Item No.	Quantity
1	Optical profile-bench for student experiments, l = 600 mm	08376-00	1
2	Light box, halogen 12V/20 W	09801-00	1
3	Bottom with stem for light box	09802-20	1
4	Lens on slide mount, f=+50mm	09820-01	1
5	Lens on slide mount, f=+100mm	09820-02	1
6	Slide mount for optical bench	09822-00	1
7	Mount with scale on slide mount	09823-00	1
8	Screen, white, 150x150 mm	09826-00	1
9	Diaphragm holder, attachable	11604-09	1
10	Slide -Emperor Maximilian-	82140-00	1
11	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Set-up (1/4)

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- Assemble the optical bench from the two tripod rods and the variable tripod base.

Set-up (2/4)

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- Place the base with the stem under the light box and clamp it into the left part of the tripod base so that the lens side faces away from the optical bench.

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Set-up (3/4)

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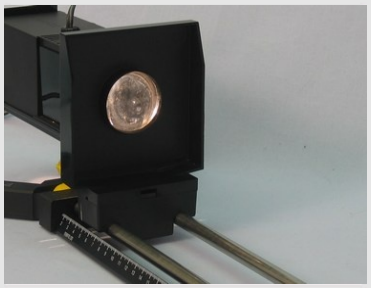

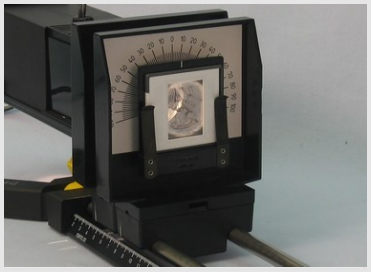

- Slide an opaque shade in front of the luminaire lens.
- Set the lens with $f = +50\,\mathrm{mm}$ directly in front of the luminaire and right next to it the socket with the shade holder.
- Put the slide in the aperture holder. Make sure that the distance between the lens and the slide is as small as possible.

Set-up (4/4)

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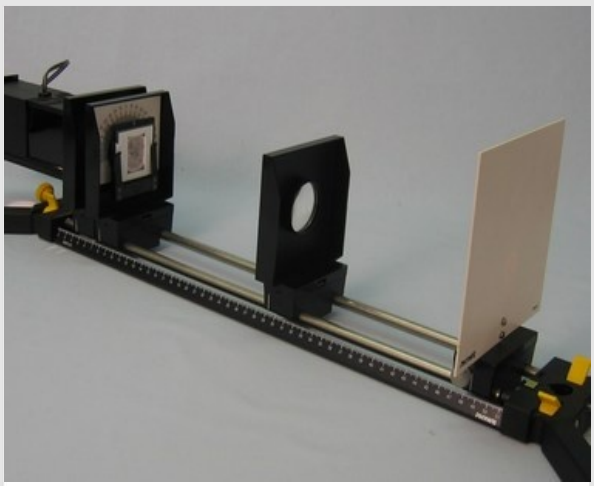

Experimental setup

- Set the lens with $f = +100\,\mathrm{mm}$ approximately to the centre and the screen to the end of the optical bench.

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Procedure (1/2)

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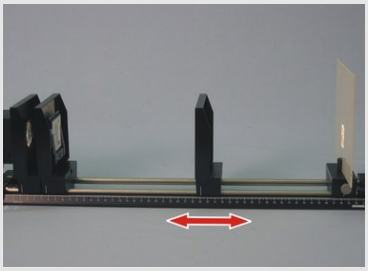

- Connect the lamp to the power supply unit (12 V~) and switch it on.
- Move the lens ($f = +100\,\mathrm{mm}$) which is called an objective lens because of its function, until the image on the screen is as sharp as possible. If necessary, adjust by moving the slide slightly in the holder so that it is evenly illuminated.
- You can also place the screen to the right of the optical bench and create a larger image, perhaps even on a bright wall about 2 m away.

Procedure (2/2)

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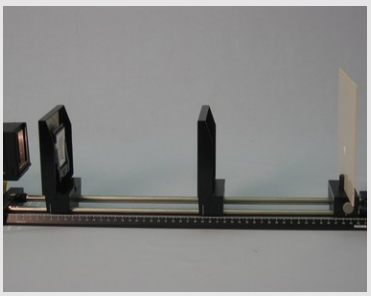

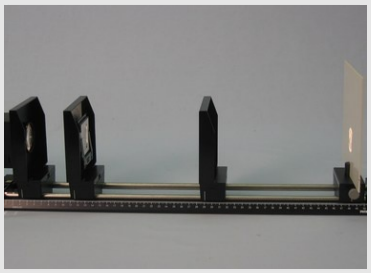

- After you have completed the basic construction of a slide projector, think about the task that the lens with the $f = +50\,\mathrm{mm}$, which in this function is called a condenser lens. Remove the lens and look at the image. Try to improve the now worse image. What do you notice? Write down your observations.
- Reset the lens and restore the initial situation: the image is sharp again.
- Now remove the slide slightly from the condenser lens and try to get a good quality image. Make a note of your observations.
- Switch off the power supply unit.

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Report

Task 1

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What is the image quality like with a large distance between the slide and the condenser lens?

- ☐ The picture quality is lower.
- ☐ The slide is better illuminated than at close distance.
- ☐ The slide is no longer illuminated as well.

Check

What do you observe about the image quality without a condenser lens?

- ○ The image from the slide is better than with a condenser lens.
- ○ The image from the slide is very poor and unevenly bright.

Check

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Task 2

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What are the main components of a slide projector?

- [ ] Holder for the slides
- [ ] Lens
- [ ] CMOS sensor
- [ ] Condenser
- [ ] (Point) light source

Check

Task 3

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Fill in the missing words.

The condenser lens (the condenser) has the task of illuminating the _____ evenly.

The objective lens (the lens) has the task of _____ imaging the slide.

Check

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Task 4

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The image of a mountain is projected onto a wall with a slide projector. On the slide the mountain is 2 cm high, the distance of the slide from the object (object distance) is 10 cm and the projection screen is 4 m away.

How big is the image that the slide projector produces of the mountain?

- 4 cm
- 80 cm
- 60 cm

Slide	Score / Total
Slide 18: Multiple tasks	0/3
Slide 19: Main components	0/4
Slide 20: Function of the lenses	0/2
Slide 21: Calculation of the image size	0/1

Total 0 / 10

Solutions Repeat

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