

Presbyopia with eye function model



Physics

Light & Optics

Dispersion of light

Biology

Human Physiology

Hearing & Seeing



Difficulty level

easy



Group size

-



Preparation time

10 minutes



Execution time

30 minutes

This content can also be found online at:



<https://www.curriculab.de/c/671789215a9eff000237aad8>

PHYWE



Teacher information

Application

PHYWE

From the age of 40 to 45, the accommodative ability of the lens of the eye deteriorates. This leads to age-related long-sightedness. The lens of the eye loses its elasticity and can no longer optimally adjust its refractive power. Near objects can no longer be visualised sharply.



Picture of an elderly man with glasses

Other teacher information (1/2)

PHYWE

Prior knowledge



The structure of a human eye should be discussed in class beforehand.

Principle



To correct presbyopia, a converging lens (biconvex lens) is placed in front of the eye (spectacles).

Other teacher information (2/2)

PHYWE

Learning objective



Pupils should develop an understanding of the visual defect of presbyopia.

Tasks



Examine the visual defect of presbyopia and correct it using a converging lens.

Safety instructions

PHYWE



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

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Student information



Motivation

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From the age of 40 to 45, the adaptability of the lens of the eye deteriorates. This leads to age-related long-sightedness. The lens loses its elasticity and is unable to optimally adjust its refractive power. Near objects can no longer be seen clearly.

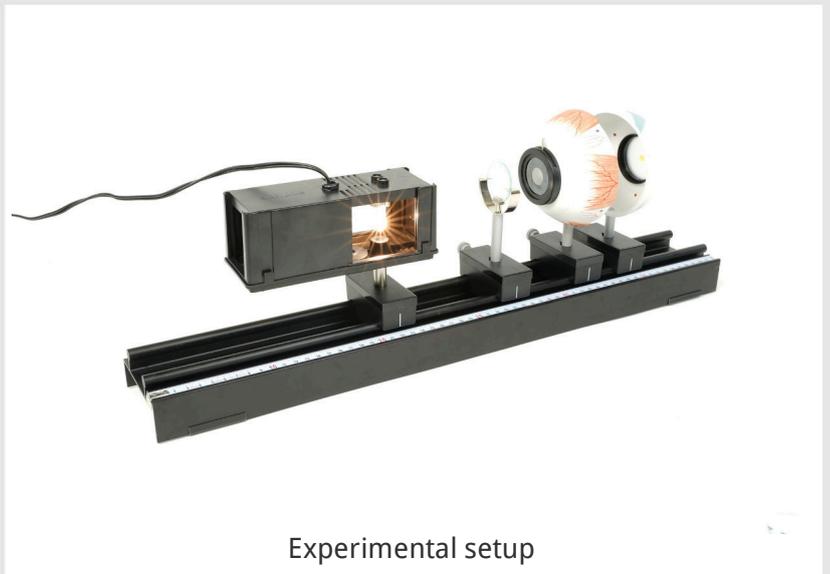


Picture of reading glasses

Tasks

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- Examine the image of the object on the retina of a presbyopic eye.
- Position a biconvex spectacle lens in front of the eye and observe the image of the object.



Experimental setup

Material

Position	Equipment	Item no.	Quantity
1	Optical profile bench for student experiments, l = 600 mm	08376-00	1
2	Rider for optical profile bench	09822-00	3
3	Light box, halogen 12 V/20 W	09801-00	1
4	Lenses made of glass for eye function model, set consisting of 4 lenses	64955-00	1
5	Base with stem for light box for optical profile bench	09802-20	1
6	Perl L , mapping object	11609-00	1
7	PHYWE power supply unit, RiSU 2023 DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
8	Eye function model, consisting of two eye half shells	64960-00	1
9	Lens holder for eye function model	64957-00	1

Set-up (1/3)

PHYWE



Experimental setup - normal eye

- Set up the experiment as shown on the left.
- The rods of the two eye half shells are each inserted into a rider and placed at the end of the optical profile bench at a distance of 2.5 cm (normal eye).

Set-up (2/3)

PHYWE



- Place the lens $S1$ ($f = 65 \text{ mm}$) in the lens holder inside the eye shell.



- Place the base with handle under the light box

Set-up (3/3)

PHYWE

- Place the light box at a distance of approx. 27 cm to the eye lens on the optical bench.
- Pay attention to the orientation of the light box.



Experimental setup

Procedure (1/3)

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- Connect the light box to the power supply unit ($\sim 12\text{ V}$) and switch it on.
- Position the object in the slot of the light box.

Procedure (2/3)

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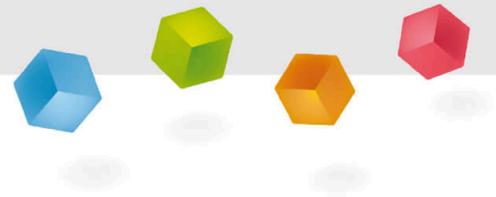
- Examine the image of the object on the retina.
- We assume that the object is at the near point of the eye. The lens of the eye is not able to adapt any further. The lens of the eye cannot focus on an object that is closer to the eye than the light box containing the object.
- Slowly move the light box towards the eye model to a distance of approx. 18 cm.
- Observe the image on the retina (frosted glass disc).
- Take notes of your observations.

Procedure (3/3)

PHYWE

- Now clamp the biconvex spectacle lens $B2$ ($f = 300 \text{ mm}$) into the lens holder and place it approx. 4 cm in front of the eye lens on the optical bench.
- Examine the image on the retina (frosted glass disc).
- Take notes of your observations.

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Report

Task 1

PHYWE

Fill in the blanks based on your observations.

In older people, the [] of the eye lens deteriorates. The elasticity of the eye lens decreases and the focal point of the light rays lies behind the [], resulting in a blurred image. This visual defect is called []. This visual defect can be corrected with the help of a [] lens ([]) in the form of spectacles.

adaptability

retina

convex

convex lens

presbyopia

 Check

Task 2

PHYWE

How can presbyopia be corrected?

- With a converging lens in front of the eye lens.
- With a diverging lens in front of the eye lens.
- With a convex lens in front of the eye lens.

✓ Check



Picture of an elderly man with glasses

Task 3

PHYWE

Is the following statement true?

People with presbyopia usually use a magnifying glass or reading glasses. These bring objects closer to the eye. The image on the retina is displayed larger and is therefore easier to recognise.

True

False

✓ Check



Picture of a magnifying glass

Slide	Score / Total
Slide 17: Myopia of the eye	0/5
Slide 18: Presbyopia correction	0/2
Slide 19: The short-sighted eye	0/1

Total amount  0/8

 Solutions

 Repeat