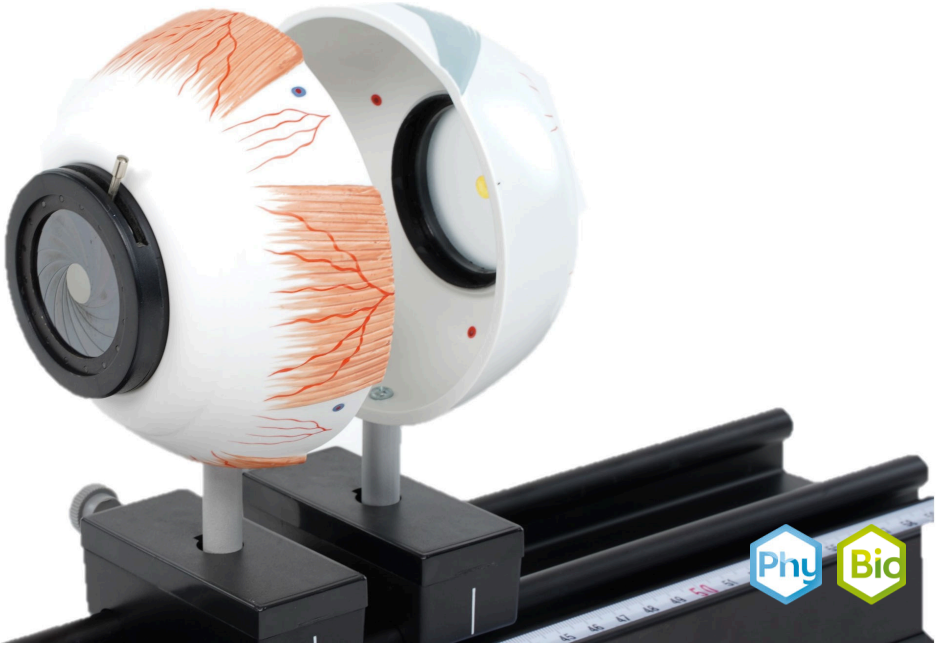
Accommodation of the eye with eye function model



Physics	Light & Optics	Dispersion of light
Biology	Human Physiology	Hearing & Seeing

Difficulty level	Group size	Preparation time	Execution time
easy	-	10 minutes	30 minutes

This content can also be found online at:

https://www.curriculab.de/c/671788a12787770002d59b41

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Teacher information

Application

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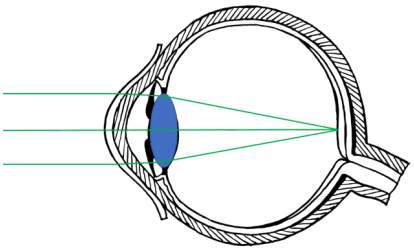
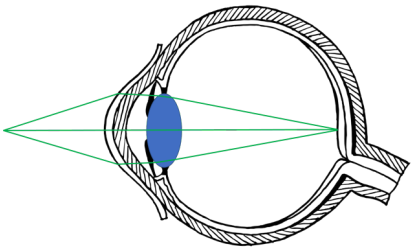
The ability of the eye to dynamically adjust the refractive power for near and far vision is known as accommodation. This is made possible by actively changing the curvature of the lens. The curvature of the lens is controlled by the ciliary muscle, which ultimately leads to a change in the refractive power of the lens.



Accommodation of the eye: distance vision



Accommodation of the eye: near vision

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Other teacher information (1/2)

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Prior knowledge

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

Principle

At rest, the eye with normal vision is set up to see into the distance. The parallel incident light is focussed on the retina by the lens of the eye. For objects in the near distance $(distance < 5\,\mathrm{m})$, the refraction of the lens must be increased by a stronger curvature of the crystalline lens.

Other teacher information (2/2)

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Learning objective

Pupils should develop an understanding of the accommodation of the eye.

Tasks

Investigate the influence of lens curvature on the image of the object on the retina.

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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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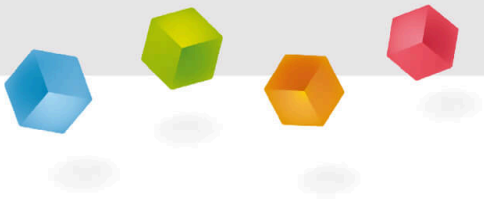

Student information

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Motivation

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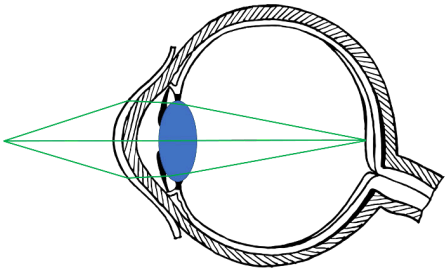
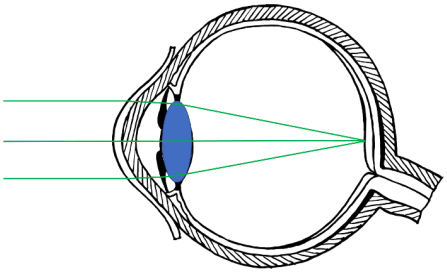
The eye has the ability to see objects sharply at different distances. To achieve this, the refractive power of the lens of the eye is altered by actively changing the curvature of the lens.



Accommodation of the eye: near vision



Accommodation of the eye: distance vision

Tasks

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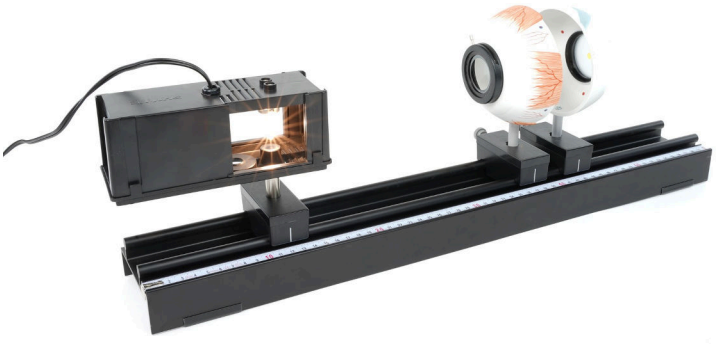
- Examine the curvature of the lens used to view close objects $(distance\ < 5\,\mathrm{m})$ sharply on the retina (frosted glass disc).
- Examine the curvature of the lens used to focus objects in the distance on the retina (frosted glass disc).



Experimental setup

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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

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Set-up (1/3)

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Experimental setup

- 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 $2.5\ \mathrm{cm}$.

Set-up (2/3)

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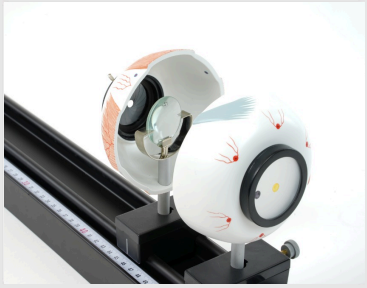

- Place the lens $S1\ (f\ = 65\ \mathrm{mm})$ in the lens holder inside the eye shell.
- Place the base with handle under the light box.

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Set-up (3/3)

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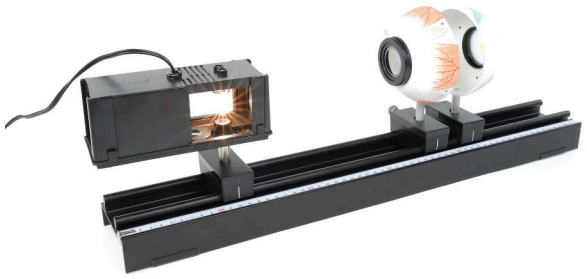
- Place the light box at a distance of approx. $27\ \mathrm{cm}$ to the eye lens on the optical bench.
- Pay attention to the orientation of the light box.



Experimental setup - normal eye

Procedure (1/4)

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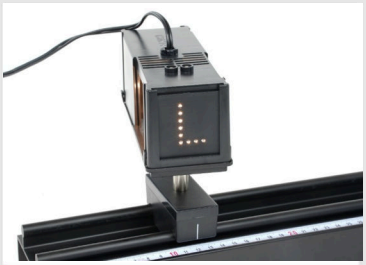

- Connect the light box to the power supply unit $(\sim 12\ \mathrm{V})$ and switch it on.
- Position the object in the slot of the light box.

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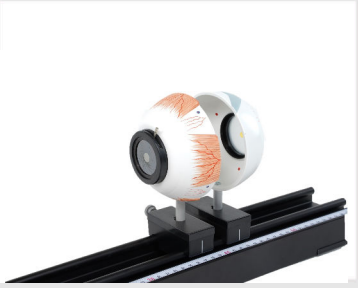
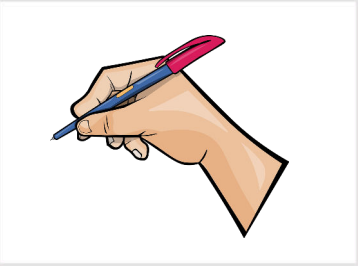
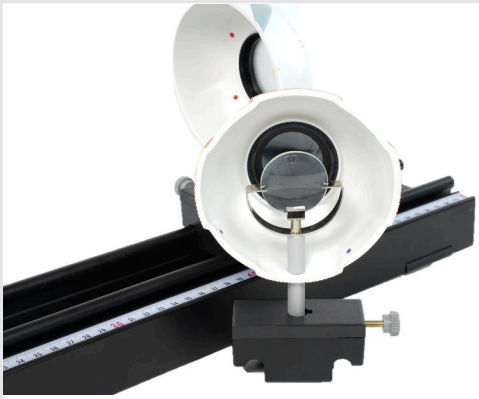
Procedure (2/4)





- Change the distance to the object and the aperture of the diaphragm until the object is focused on the retina.
- Remove the eye lens $S1$ and look at the curvature of the lens.
- Take notes of your observations.

Procedure (3/4)



Eye half shell with lens $S2$

- Now clamp the lens $S2$ $(f = 80\,\mathrm{mm})$ into the lens holder of the eye shell.
- Place the eye half shells at the end of the optical bench at a distance of $2.5\,\mathrm{cm}$.
- Find an object in approx. $30 - 40\,\mathrm{m}$ distance (house, tree) and aim at it.

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Procedure (4/4)

- Adjust the aperture until the object is focused on the retina (frosted glass disc).
- Remove the lens $S2$ and look at the curvature.
- Compare this curvature with the curvature of the lens $S1$.
- Take notes of your observations.

Report

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Task 1

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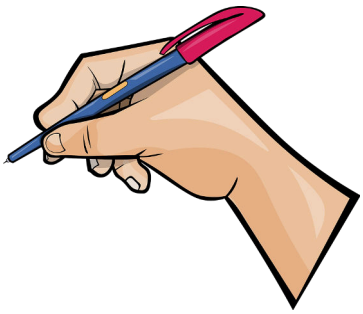

Fill in the blanks based on your observations.

For _____ vision, for example when reading, the lens of the eye is _____ curved. If distant objects, for example houses or trees, are viewed at a distance of $30 - 40\,\mathrm{m}$(_____), the lens of the eye is _____ curved.

strongly | close-up | weakly | far vision

Check

Task 2

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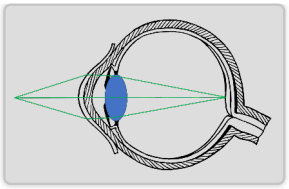
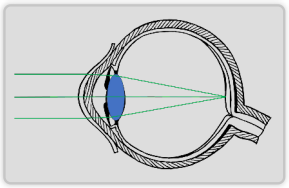
Assign the ray paths accordingly:

Close-up view





Long-distance view

Check

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Task 3

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Is the following statement true?

The resting position of an eye with normal vision enables vision in the distance.

○ True ○ False

Check

Slide	Score / Total
Slide 18: Accommodation of the eye lens	0/4
Slide 19: Assign the ray paths accordingly:	0/2
Slide 20: The normal-sighted eye	0/1

Total amount 0 / 7

Solutions Repeat

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