

Serie5 The Eye**Exercise 1****-----

An observer's eye sees clearly between **10 cm** and **1.40 m**.

1. What is its defect?
2. State the nature and convergence of the lens which, placed **1 cm** from its vertex **S**, allows it to see very distant objects without accommodation.
3. What happens to its **PP**? Deduce its new field of vision.

Exercise 2**-----

The **PR** and **PP** of a myopic eye are located, respectively, **120 cm** and **40 cm** from its vertex **S**.

1. What is the **L₁** lens (nature and convergence) that, placed **2 cm** from its vertex **S**, allows it to see very distant objects clearly without accommodation.
2. A half-lens **L₂** (with the same optical axis as **L₁**) is attached to the part below **L₁**, which would allow it to reduce its **PP** to **20 cm**. What should the convergence of **L₂** be?

Exercise 3**-----

The visual acuity of an emmetropic eye (with a distance of **20 cm**) and that of a myopic eye seeing from **12 cm** to **50 cm** are equal and equal to $\epsilon = 5 \cdot 10^{-4}$ rad.

1. What is the length of the smallest object that the emmetropic eye can distinguish?
2. What is the length of the smallest object that the myopic eye can distinguish?

Serie6 Magnifying Glass**Exercise 1****-----

The visual acuity and minimum distance of distinct vision of an emmetropic eye are, respectively, **1'** and **25 cm**. This eye is placed in the focal plane of a magnifying glass of intrinsic power **50 δ**, so that the vertex **S** of the eye coincides with the image focus.

1. Determine the length **AB** of the smallest object seen distinctly by this eye through the magnifying glass.
2. The object **AB** is perpendicular to the optical axis of the magnifying glass. Determine the apparent diameters α of the object and α' of its image through the magnifying glass.
3. Deduce the magnification of this magnifying glass.

Exercise 2**-----

Consider a magnifying glass with a focal length of **2 cm**.

1. Determine its intrinsic power and its commercial magnification.
2. A myopic eye, with a minimum distance of $d_m = 12$ cm, is placed at the image focus of this magnifying glass. It distinguishes, by accommodating as much as possible, the image of a small object. Determine:
 - 2.1. The power of the magnifying glass.
 - 2.2. The magnification of the magnifying glass.
3. The previous magnifying glass is used by a normal eye, which sees clearly between **20 cm** and infinity, and is placed at the image focus. What is the position of the object **AB** relative to the magnifying glass:
 - 3.1. When the eye does not accommodate.
 - 3.2. When the eye accommodates as much as possible.
 - 3.3. What is the depth of field of this magnifying glass?

Serie7 The Microscope

Exercise 1**-----

An object **AB**, **1 μm** long, is placed **4.1 mm** from the objective **L₁** (focal length **f₁ = 4 mm**) of a microscope. The object **AB** is perpendicular to the optical axis of the microscope.

1. Find the position, nature, and magnitude of the image **A₁B₁** of **AB** through **L₁**.
2. The eyepiece **L₂** of the microscope, with focal length **f₂ = 20 mm**, is located **184 mm** from **L₁**.
 - 2.1. What is the position of **A₁B₁** relative to **L₂**?
 - 2.2. Where is the image **A₂B₂** of **A₁B₁** located through **L₂**?
 - 2.3. Calculate the power **P** and commercial magnification **G_c** of the microscope.
 - 2.4. At what angle **α'** does an observer with normal vision, positioned behind **L₂**, see the image **A₂B₂**?
 - 2.5. Trace the path of a light beam coming from **B** and crossing the microscope.

Exercise 2-----

The objective of a microscope consists of a compound magnifying glass **L** with a focal length **f = 5 mm**. Its eyepiece consists of another compound magnifying glass equivalent to a lens **L'** with a **50 δ** convergence. The elements (**L** and **L'**) of this microscope are **20 cm** apart.

1. An observer with normal vision and **d_m = 25 cm**, placed at the image focus of **L'**, examines, without accommodating, a small object **A**. Determine:
 - 1.1. The position of object **A** relative to **L**.
 - 1.2. The power and magnification of the microscope.
2. The observer's eye examines another object **A'** while accommodating to the maximum. Determine:
 - 2.1. The position of object **A'** relative to **L**.
 - 2.2. The focusing latitude "**a**".
 - 2.3. Check the result of **2.2** using the formula expressing "**a**" as a function of the power (or magnification) and dioptric amplitude of the observer's eye.

Exercise 3**-----

The convergences of the reduced elements of a microscope are **100 δ** for the objective and **20 δ** for the eyepiece. The distance separating these elements is **16 cm**.

1. A normal-sighted observer uses this microscope to observe, without accommodation, a red blood cell, **22 μm** in diameter.

- 1.1. What is the commercial magnification of this microscope?
- 1.2. At what angle does the observer see the image of the red blood cell through the microscope?

2. Using a draw tube, the eyepiece can be moved closer or further from the objective. The eyepiece attached to the eyepiece keeps the eye at the image focus of the eyepiece.

A myopic observer, whose PR is **50 cm**, follows the previous observer to view the red blood cell. The eyecup, fixed to the eyepiece, keeps the eye at the image focus of the eyepiece.

- 2.1. By how much and in which direction must the eyepiece be moved to view the red blood cell without accommodation?
- 2.2. What is the new commercial magnification of the microscope?
- 2.3. From the position in question **2.1**, the focus is refocused to infinity by moving the slide containing the red blood cells relative to the objective. By how much and in which direction must this slide be moved?