Abdelhafid Boussouf University Center- Mila **Academic Year: 2023-2024**

Natural and Life Science Institute

Prepared by: Dr I. AMEUR

Practical work N° 2: Eye, Magnifying glass and Microscope

1. The Objective

This practical work aims to discover some optical instruments (eye, magnifying glass, and microscope) and achieve the following goals:

- ✓ Identifying the eye and representing it through a simplified model in the laboratory
- ✓ Knowledge a myopic eye is too convergent, that a hyperopic eye is not convergent enough, and that a presbyopic eye cannot accommodate.
- ✓ Learn about magnifying glass and microscope

2. Theoretical Aspects

2.1 The Eye

The human eye is the gateway to one of our five senses. The human eye is an organ that reacts with light. It allows light perception, color vision and depth perception. The eye comprises two components: **transparent media** (the cornea, the iris, the lens, the pupil, the vitreous cavity….) and the **retina.**

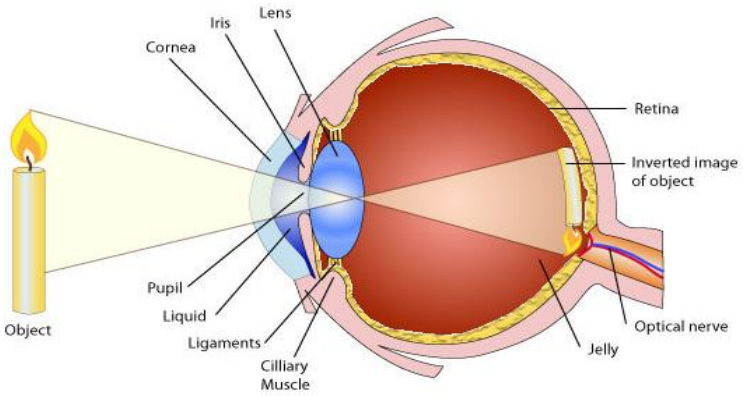


Figure 1: Real Eye

Vision Diagram: An image is formed on the retina with light rays converging most at the cornea and upon entering and exiting the lens. Rays from the top and bottom of the object are traced and produce an inverted real image on the retina.

- ✓ **Eye Model**

Real Eye	Transparent media	Retina
Eye model	Converging lens	Screen

- ✓ **The Normal Eye and its Defects**

An object is seen clearly by the eye when its image is formed exactly on the retina (normal eye), if otherwise, we say that there're vision defects. We have two types of defects:

Near Sighted Vision: Nearsightedness or **myopia** is a vision defect that occurs when the focus of the image is in front of the retina. This can be corrected by placing diverging lenses in front of the eye. This will cause the light rays to spread out before they enter the eye.

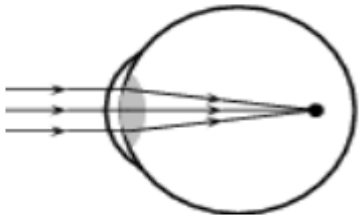


Figure 2: Near Sighted Vision: This occurs when the image is formed before the retina

Far Sighted Vision: Farsightedness or Hypermetropia is a vision defect that occurs when the focus of the image is behind the retina. This can be corrected by placing converging lenses in front of the eye. This will cause the light rays to slightly converge together before they enter the eye.

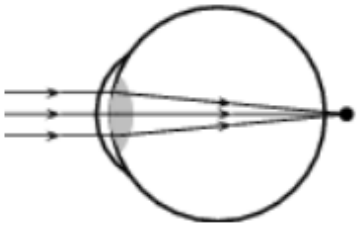


Figure 3: Far Sighted Vision: This occurs when the image is formed behind the retina

Far point R or Punctum Remotum PR: is defined as the object point farthest from the eye seen clearly and without accommodation (at rest).

Near point P or Punctum Proximum PP: is the object point least distant from the eye which is seen clearly with maximum accommodation.

Accommodation: is the work carried out by the ciliary muscles and which causes the change in the radius of curvature of the lens and consequently the variation in the power or vergence of the eye.

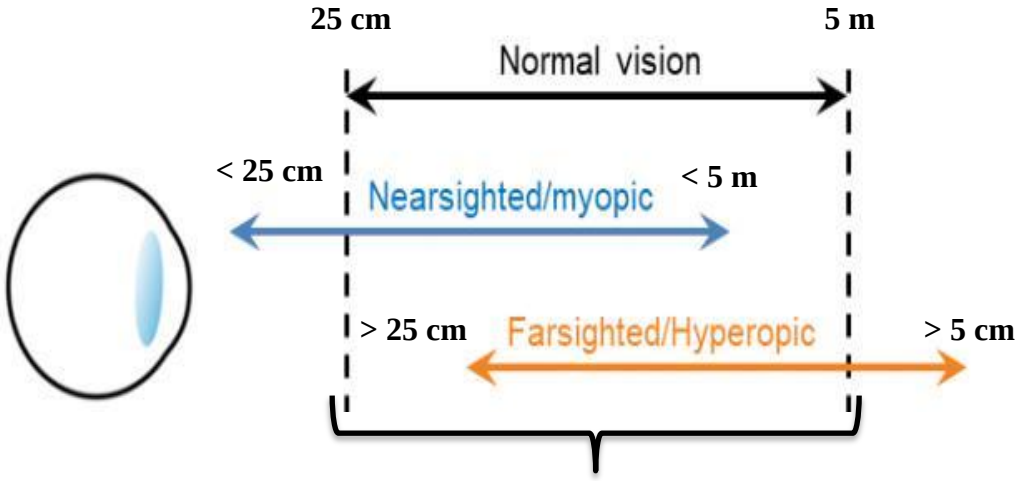


Figure 4: Field of vision of the normal, myopic and hyperopic eye

2.2 Magnifying Glass

A magnifying glass is an optical system made up of a **"converging lens"** allowing you to obtain an **enlarged virtual image** of an object. The object must be located between the main focus of the object and the center of the lens, so the image will be behind the object and enlarged.

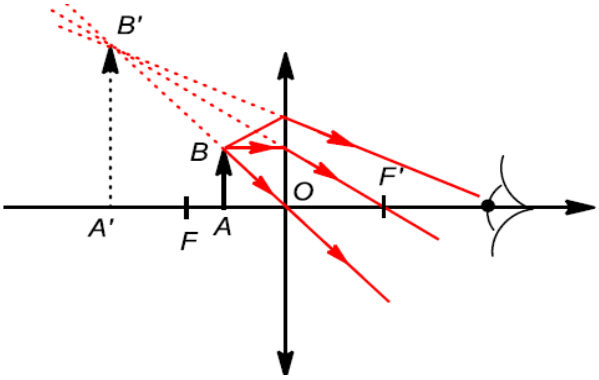


Figure 5: Construction for an object between O and F

The power P of a magnifying glass is

$$\mathbf{P = \frac{\alpha'}{AB} = \frac{1}{f'} = vergence}$$

The dimension of power is m^{-1}, called a diopter. It is symbolized by δ

2.3 Microscope

The basic optical microscope is an optical system with two lenses which allows you to obtain an enlarged image of an object. However, it is characterized by a greater magnification than that of the magnifying glass. The microscope is made up of two parts:

The objective and the eyepiece: the objective is the first element of the optical instrument which receives the light rays coming from the object. The eyepiece (ocular) is in fact a magnifying glass that provides an enlarged image of the intermediate image formed by the objective, the objective and the eyepiece in the microscope are converging lenses. The eyepiece is placed so that the final image is reflected to infinity so that the observer's eye does not have to adjust and does not get tired.

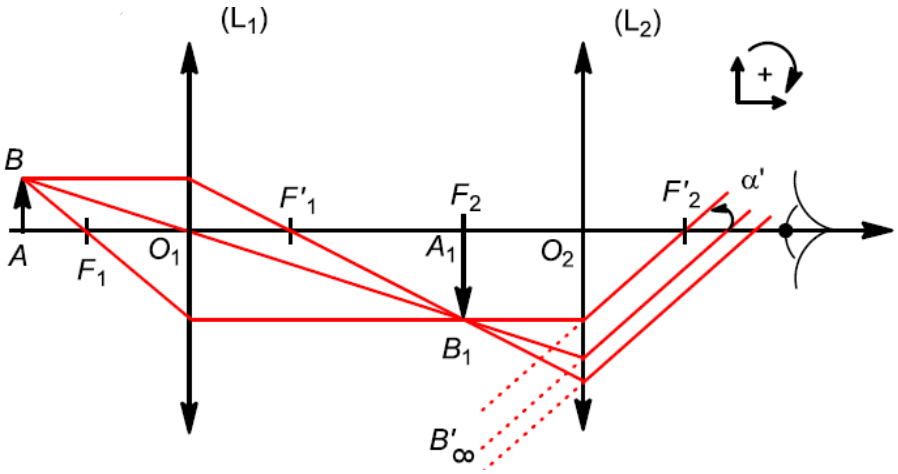


Figure 6: Microscope operation diagram

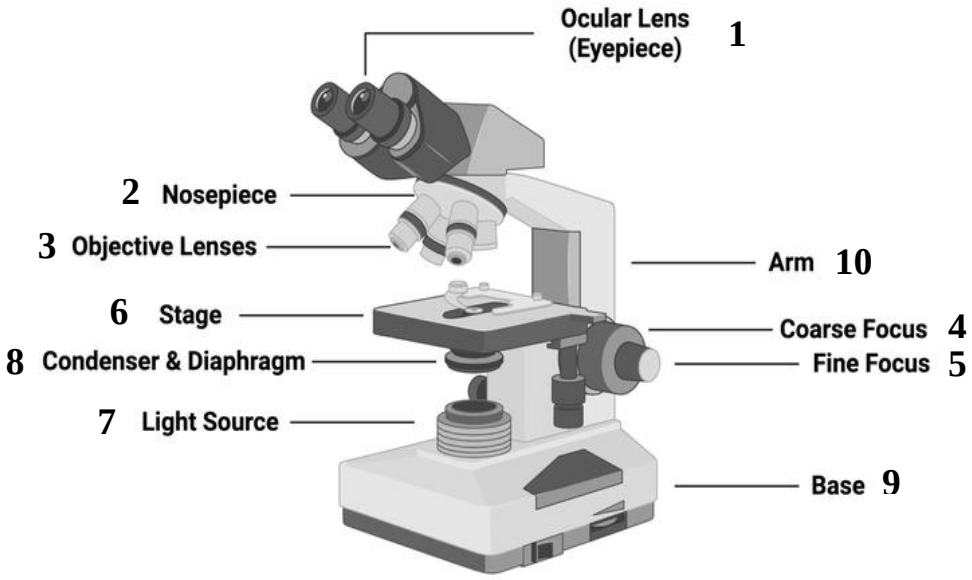


Figure 8: Components of a real microscope

1) Eyepiece (ocular lens)

2) Objective turret, revolver, or revolving nose piece (to hold multiple objective lenses)

3) Objective lenses

4) Coarse adjustment

5) Fine adjustment

6) Stage (to hold the specimen)

7) Light source (a light or a mirror)

8) Diaphragm and condenser

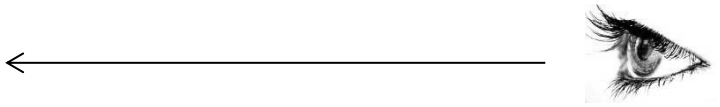
9) Base

3. Required Questions

1. Build a reduced eye using a lens f = + 100 mm and a screen
2. Determine the PP and PR of one eye of one of your classmates by measuring the:

   Eye distance PR: OR = …….cm

   Eye distance PP: OP = …….….cm
3. Position in the figure bellow the points PR and PP approximately to determine the net field of vision of this eye on the OX axis



4. A patient's PP is 10 cm and his PR is 2 m.

   What type of defect does this patient have?

   What correction (glasses should be placed to correct the vision of this eye)?

   Calculate the vergence?
5. Calculate the powers of two magnifying glasses with focal lengths 30 mm and 200 mm, respectively

   Compare the results of the two magnifiers then give a conclusion