Magnification of the microscope

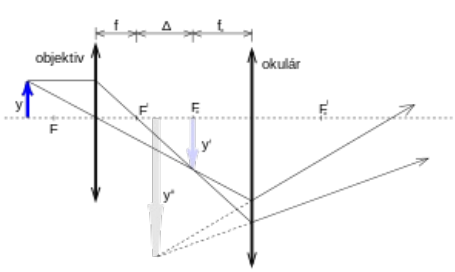
The magnification of the microscope can be found on the eyepiece and objective of the microscope . Knowing these data, the total magnification of the microscope can be calculated.

Light microscope overall magnification

The total magnification of the microscope corresponds to the product of the transverse magnification of the objective (Z ob) and the angular magnification of the eyepiece (β ok). Therefore, the relation applies to its calculation

$$\Gamma = Z_{ob} \cdot \beta_{ok} = \frac{\Delta}{f_{ob}} \cdot \frac{250}{f_{ok}}$$

while it is true that



Representation of focal lengths and optical interval on a diagram of an optical microscope.

- $Z_{ob} = \frac{\Delta}{f_{ob}}$ is the transverse magnification of the lens;
- β_{ok} is the angular magnification of the eyepiece;
- f_{ob} and f_{ok} are the focal lengths (https://cs.wikipedia.org/wiki/Ohniskov%C3%A1_vzd%C3%A1lenost) of the objective and the eyepiece (in mm);
- Δ is the optical interval of the microscope (in mm). Expresses the focal distance of the objective and the eyepiece;
- *250* is the conventional visual distance of the human eye expressed in mm.

The relationship for microscope magnification can also be derived from the laws of geometric optics (https://cs.wikipedia.org/wiki/Geometrick%C3%A1_optika), as far as it is possible in practice to calculate it as the product of the individual magnifications indicated on the eyepiece and objective .

Zoom effects

The desired result of the magnification obtained by the eyepiece and objective is the observation of the object being examined with the possibility of observing more details. In the case of inappropriate eyepiece and lens combinations, however, magnifications may occur that do not show us more details. More details on this topic can be found in the article on Abbe's theory , in which these relationships are described in more detail.

From a practical point of view, it is optimal for the observer to achieve a **useful overall magnification** that leads to the observation of new details.

On the contrary, if we do not observe any new details with the enlargement, but only an enlarged image, this is an **empty enlargement.**

Links

Related Articles

- Optical microscope
- The principle of imaging with an optical microscope
- Microscope depth of field
- Abbe's theory

References

JAROMÍR, Plášek. *DML-CZ - Czech Digital Mathematics Library: New methods of optical microscopy*. Prague, 1996, 25 pp. Also available from:https://dml.cz/bitstream/handle/10338.dmlcz/139719/PokrokyMFA_41-1996-1_1.pdf. Unity of Czech mathematicians and physicists.