MICROSCOPE

A. INTRODUCTION

One of the most significant tools in science laboratory operations, particularly biology, is the microscope. A microscope is a device that enables us to examine extremely small objects (microscopic). This aided in the resolution of the human problem of small organisms. To understand the microscope, you must first understand its components, types of microscopes, and how to use and maintain them.

B. MATERIALS

1. Component of Microscope

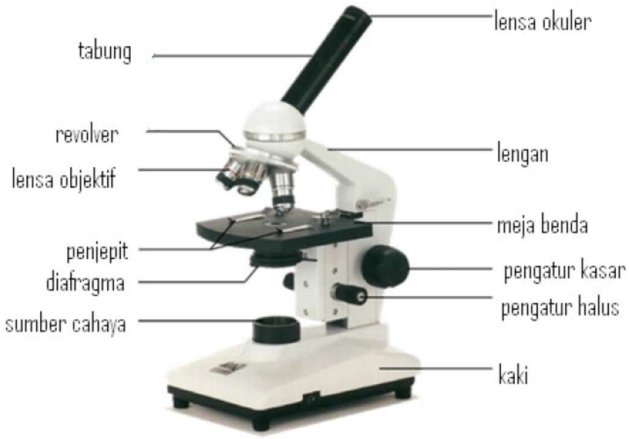


Figure 1. Components of Microscope

a. Base

The base supports and strengthens the position of the microscope. The base is attached to the arms by a kind of hinge, on a simple microscope (student model).

b. Arm

With the hinges between the base and arm, the arm can be up or down. The arm is also used to hold the microscope when moving the microscope.

c. Mirror

The mirror has two sides, the flat mirror side and the concave mirror side, serves to reflect light and the light source. The flat mirror is used when the light source is bright enough, and a concave mirror is used when the light source is low. The mirror can be removed and replaced with a light source from the lamp. In the new model microscope, the mirror is no longer installed, because there is already a light source mounted on the base.

d. Condensor
The condenser is composed of a combined lens that functions to collect light.

e. Diaphragm
The diaphragm functions to regulate the amount of incoming light by adjusting the opening of the iris. The location of the diaphragm is attached to the diaphragm at the base. In a simple microscope there is only a diaphragm without a condenser.

f. Stage
The stage is a place to put the object to be seen. The object is placed on the table by clamping it with tongs. In the center of the table is an arm for the light to pass through. In certain types of microscopes, the table position cannot be raised or lowered. On some microscopes, especially the newest models, the slide table can be moved up and down.

g. Tube
At the top of the tube is attached the eyepiece, with certain magnifications (15X, 10X, and 15X). At the bottom of the tube is a device called a revolver. The revolver has an objective lens.

h. Objective Lens
The objective lens works in the formation of the first image. This lens determines the structure and details that will be visible in the final image. An important feature of an objective lens is that it enlarges the image of an object with various magnifications according to the model and manufacturer, for example 10X, 40X, and 100X and has an aperture value. Aperture value is a measure of the refractive power of an objective lens which will determine the separation power of the specimen, so that it is able to show adjacent microscopic structures as two separate objects.

i. Ocular Lens
The microscope lens is located at the top end of the tube, close to the observer's eye. This lens serves to enlarge the image produced by the objective lens. Magnification of the formed image ranges from 4 - 25 times.

j. Coarse and Fine Focus
These components are located on the arm and at the base to determine the position of the goal against the object to be seen. In microscopes with straight/upright tubes, coarse and fine adjusters for raising and lowering the tube as well as the objective lens. In a microscope with an inclined tube, the coarse and fine adjusters are used to raise and lower the stage.

2. Types of Microscopes

There are two types of microscopes based on the appearance of the object being observed, namely a two-dimensional microscope (light microscope) and a three-dimensional microscope (stereo microscope). Meanwhile, based on the light source, microscopes are divided into light microscopes and electron microscopes.

a. Light Microscope

The light microscope has a maximum magnification of 1000 times. The microscope has heavy and sturdy base with the aim of being able to stand stably. The light microscope has three lens systems, namely an objective lens, an eyepiece, and a condenser. The objective lens and eyepiece are located at both ends of the microscope tube. The eyepiece lens on a microscope can be in the form of a single lens (monocular) or double (binocular). At the bottom end of the microscope there is an objective lens mount that can be attached to three or more lenses. Under the microscope tube there is a microscope table which is a place for preparations. The third lens system is the condenser. The condenser serves to illuminate objects and other microscope lenses.

In conventional microscopes, the light source still comes from sunlight reflected by a flat or concave mirror located under the condenser. This mirror will direct light from outside into the condenser. Modern microscopes are equipped with lights instead of the sun's light source.

b. Stereo Microscope

A stereo microscope is a type of microscope that can only be used for relatively large objects. Stereo microscopes have a magnification of 7 to 30 times. Objects observed with this microscope can be seen in three dimensions. The main components of a stereo microscope are almost the same as a light microscope. The lens consists of an eyepiece and an objective lens. Some of the differences with light microscopes are: (1) the sharpness of the stereo microscope lens is much higher than that of a light microscope so that we can see the three-dimensional shape of the object being observed, (2) the light source comes from above so that thick objects can be observed. The magnification of the ocular lens is usually 10 times, while the objective lens uses a zoom system with a magnification of between 0.7 and 3 times, so that the total magnification of the object is a maximum of 30 times. At the bottom of the microscope is a preparation table. In the area near the objective lens there is a lamp connected to a transformer. The object focus controller is located next to the microscope handle, while the magnification control is located above the focus control.

c. Electron Microscope

In this book, we provide a brief overview of the electron microscope. Electron microscopes employ electrons instead of light to magnify objects up to a million times. Scanning electron microscopes (SEM) and transmission electron microscopes (TEM) are the two types of electron microscopes (TEM). The SEM is used to examine the intricate architecture of the cell surface (or other microscopic

structures) in three dimensions. While TEM is used to examine the inside structure of cells in great detail.

3. The use of Microscope

Things to consider when using a microscope:

a. Always carry the microscope with two hands.
b. When using wet objects, the microscope tube is always upright and the stage is in flat position. This applies to microscopes with upright tubes, not to microscopes with inclined tubes
c. Wet objects should always be covered with a cover glass when viewed under a microscope
d. Always keep the microscope lenses clean, including mirrors.
e. If any part of the microscope is not working well/missing, immediately report it to the laboratory assistant.
f. It is not permissible to remove the microscope lenses from their holder.
g. When finished using the microscope, attach the objective lens with the lowest magnification straight down.

How can we observe an object with a microscope?

The steps to observe an object using a microscope:

a. Ensure that the stage is level and that the low-magnification objective lens is positioned in line with the axis of the eyepiece.
b. Look through the eyepiece with one eye (for a monocular microscope) and two eyes (for a binocular microscope). Adjust the mirror so that enough light is available or turn on the light and adjust the amount of light as needed. Adjust the aperture so that the light received by the eye is optimal (not too bright or dim).
c. Move the objective lens away from the stage by turning the coarse adjustment clockwise. Place the slide under the objective. Look from the side, adjust the low-magnification objective lens to a distance of approximately 1 cm from the slide. Look again through the eyepiece, and raise the slide with a coarse dial and then use the fine adjuster until the slide is clearly visible.
d. Look from the side once more, and carefully move the higher-magnification goal (say 45x) into position. Carefully avoid making contact with the lens, then look through the eyepiece again and focus on the slide by slowly rotating the fine dial counterclockwise. Make adjustments to the lighting.
e. Observe the object, if necessary, draw.
f. When the observation is complete, turn the revolver objective to low magnification, raise the tube or lower the table, then take the slide from the stage.

4. Maintenance of Microscope

a. The microscope should be stored in a cool, dry, dust-free, free from acid-base fumes. A suitable storage place is a microscope box equipped with silica gel, which is hygroscopic so that the microscope environment is not humid. In addition, it can also be in a lighted cupboard
b. Non-optical parts of the microscope can be cleaned with a flannel cloth. To clean the dust that has slipped, you can use a small brush or camera lens brush, as well as a spray tool or a soft brush.
c. Clean dirt, finger files, oil, etc. on the lens by using a lens cloth, tissue or soft cloth moistened with a small amount of alcohol-ether or isopropyl alcohol. Never clean the lens with a handkerchief or cloth.
d. Clean the microscope body and arm with a soft cloth with a small amount of detergent.
e. The remaining immersion oil on the objective lens can be cleaned with xylol (xylene). Be careful xylol can damage the plastic material.

C. OBJECTS

1. Preparing a Non-Permanent Object

The following steps are taken to create non-permanent objects.

a. Make slices such as water hyacinth stems transversely or longitudinally. The slices made must be translucent (if using a light microscope). If you are going to use a stereo microscope, thick slices are not a problem.
b. Place the slice on the object glass, then drip the object with a drop of water using a pipette.
c. Cover with a cover glass. Make sure that there are no air bubbles in the medium. This can be done with the following steps: hold the cover glass at a 45º position against the slide, touch the bottom edge of the cover glass on the medium surface and slowly lower the cover glass (can be with the help of a needle as a cover glass support) so that the cover glass slowly rises to the top. object glass. If there are still air bubbles, repeat the work until there are no air bubbles. Observe the preparations you make under a microscope by first using a weak magnification (10x10), if you already know the object to be observed then use a strong magnification (10x20 or 10x40).

2. **Storage and Maintenance of Preserved Objects or Slides**

a. The objects or slides should be numbered in one corner of the label.
b. Maintenance: no need to touch the surface of the object with your fingers during the practicum.
c. To clean slides or slides with a dry brush, if a lot of adhesive interferes with viewing, xylol can be used.
d. Preserved species of microscopic plants and animals are stored in special wooden boxes equipped with mini shelves the size of an object glass.
e. Storage is arranged vertically parallel and stored in a dry place.
f. Collection and storage is carried out with care.

g. Each preserved species is stored with a label and arranged alphabetically for easy storage and retrieval.

WORKSHEET
MICROSCOPE

Objective

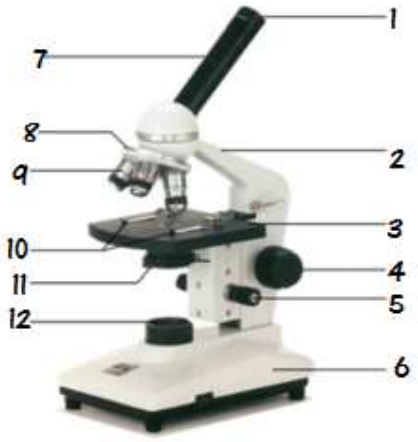
Introducing the monocular microscope, how to use it, and how to maintain it.

Tools and Materials

- Monocular microscope
- Object glass
- Glass cover
- Wipe flannel / soft tissue
- Cuts of lettered paper
- Scissor
- Drop pipette
- Cup
- mm scale ruler

Task

1. Complete the description of the microscope below!



1. ……..
2. ……..
3. ……..
4. ……..
5. ……..
6. ……..
7. ……..
8. ……..
9. ……..
10. ……..
11. ……..
12. ……..

2. The place of shadow ……. and…… is a mirror image.
3. A. If the object is shifted to the left, the image will shift to …….
   B. If the object is shifted to the right, the image will shift to …….
4. A. If the object is moved forward, the image will shift to …….
   B. If the object is moved backwards, the image will shift to …….
5. When the objective lens is replaced with a stronger one, the field of vision becomes more ……..
6. Replacing weak objects with strong objects …… changes the location of the image.
7. Image becomes more……. when compared to using a weak objective.

8. Ocular magnification 10x
   A. When a weak objective is used (5x), the magnification is =……
   B. When a weak objective is used (10x), the magnification is =……
   C. When a strong objective is used (40x), the magnification is =……
   D. When a weak objective is used (100x), the magnification is =……
9. The diameter of the field of view of the microscope with the objective is (10x) = …… mm
10. The diameter of the above sight =……. micron
11. Field of view microscope with strong objective (40x) = ……
12. The Actual letter height = …… mm
13. The Letter height in microns = …… micron
14. Differences:

With eyes	Using microscope
- Image : - Size : - Position : - Separation power :	

Yogyakarta,……

Practitioner,

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