Heading

Title

**Introduction**

**Purpose**

To become familiar with the microscope, its uses and to learn the parts of the compound, or light microscope.

**Discussion**

The compound microscope has two separate lens systems, providing a two-stage magnification: an ocular (eyepiece) and objectives. Depending on the lenses in these systems, the compound microscope provides magnification from 50X to as much as 1,500X or 2,000 times. The most common magnifications are 100X, 400X or 430X and possibly 1000X. Magnification is determined by multiplying the magnification of the ocular times the objective used. If the ocular is 10X and the low power objective is 10X then, the magnification is 10X x 10X = 100X.

This microscope is referred to as a light microscope because light passes through the materials to be examined and through the lens systems to the observer’s eye. Since light is transmitted through the materials to be examined, subjects viewed must be thin enough or small enough to allow light to pass through them or around them. Some parts of the material will absorb more light than other parts, thus making it possible to distinguish form and structure in the magnified image that reaches the eye. For this reason, materials for study are mounted on a rectangular glass slide. Normally a thin square “cover glass” or plastic “cover slip” is placed over the material being observed on the slide. A frequently used preparation is called the WET-MOUNT slide. Other slides are stained and prepared by laboratories.

**Hypothesis**

If one studies the anatomy of the microscope, then one can identify parts and functions of the compound microscope and determine magnification.

**Materials** VirtualStandard Compound Microscope: <https://virtuallabs.nmsu.edu/micro.php> OR <http://somup.com/c3nQodZNSz> (6:49)

# Procedures

1. Go to the website and complete the virtual “Using the Microscope” virtual lesson (hit “Continue”). If the site does not work, use the video provided.

2. Microscopes equipped for use in high school are referred to as student microscopes. Some have a single ocular, or eyepiece, and is, therefore, called a monocular microscope. Monocular microscopes require one to view materials with only one eye, which sacrifices depth-perception.

3. In real life, students obtain a compound microscope BY HOLDING THE “ARM” OF THE MICROSCOPE IN ONE HAND AND PLACING YOUR OTHER HAND UNDERNEATH THE BASE OF THE MICROSCOPE.

4. In the Calculations and Data Section LABEL each part named below on the drawing of the microscope. You will be responsible for knowing the function of each part as well.

A. Eyepiece or Ocular The removable cylinder in the top of the microscope. The ocular contains one set of lenses which magnify the number of times indicated on the top of the eyepiece (e.g. 5X, 7.5X, 10X). RECORD the magnification marked on your eyepiece.

B. Tube The hollow cylinder which forms the body of the microscope. The upper portion of the tube contains the ocular or eyepiece.

C. Nosepiece Fastened to the base of the tube is the circular nosepiece. The lower part of the nosepiece which is movable is called the revolving nosepiece.

D. Objectives The revolving nosepiece contains two or more small cylinders having magnifying lenses called objectives.

1. Low-Power Objective The shorter of the objectives, containing a series of lenses which magnify the amount indicated on the side of the lens. A 10X objective is widely and commonly used.

2. High-Power Objective The longer of the objectives, containing stronger lenses and yielding greater magnification. A 43X objective is found on many microscopes.

3. Calculating Magnification The total enlargement or magnification you see when looking into the ocular is determined by multiplying the magnification of the eyepiece by the magnification of the objective used. DETERMINE the low-power magnification and the high-power magnification of your microscope and record this in the Calculations and Data section of this lab.

E. Coarse Adjustment The microscope is focused by turning one of two adjustment knobs located on the tube of the microscope. The coarse adjustment consists of large knobs or wheels on the sides of the tube which, when turned, raise and lower the body tube visibly. Be careful when using the coarse adjustment … many slides have been broken!

F. Fine Adjustment The sharp focus on the microscope is used AFTER the object has been brought into view using the coarse adjustment knobs. The knobs or wheels for the fine adjustment are usually smaller than the coarse adjustment and located below them. The fine adjustment does not bring large items into focus, so DO NOT adjust them more than one half turn in either direction.

G. Arm The arm of the microscope is the curved part of the frame below the focusing adjustments. When carrying the microscope ALWAYS grasp the microscope FIRMLY by the arm, supporting the bottom of the microscope with the opposite hand. Carry the microscope upright at all times to avoid losing the eyepiece, clips or other parts of the scope.

H. Stage The platform upon which material is placed for observation. An opening in the center of the stage permits light to pass from below the stage through the object being studied so it becomes visible through the eyepiece.

I. Spring Clips A pair of spring clips, mounted on the stage, hold materials securely in place on the stage.

J. Diaphragm Beneath the stage, the diaphragm regulates the amount of light which passes through the lenses to the observer’s eye. Some diaphragms are disks with holes of different sizes. Others have a series of sliding leaves which vary the size of the opening and therefore, the light passing through.

K. Base The heavy, U-shaped anchor used to hold the microscope in place on a table or counter. Always use one hand underneath the base when carrying the microscope to support it properly.

L. Mirror The mirror is fastened to the base of the movable arm and is used to direct light through the lenses. If the mirror has two faces, one flat and one concave, the concave mirror should be used under ordinary conditions. Most microscopes today come equipped with a sub-stage light in place of the mirror(s).

M. Inclination Joint Sometimes, the microscope frame is fastened to the base by a movable hinge called the inclination joint. This allows the microscope to be tilted for a comfortable viewing position. However, DO NOT tilt the microscope unless specifically instructed to do so. NEVER prop your microscope on books or other objects in order to tilt it because it may fall over. A standard compound microscope costs ~$500 to replace!

## Calculations and Data

1. The first part of this lab is to complete a satisfactory lab report. Begin by placing a proper heading at the top of page 1 of this document:

# *Name (upper left) Biology (upper right)*

*Date Teacher, Section*

2. Place the title of the lab at the top center below your heading: “*The Compound Microscope*”.

3. Label the compound microscope on the next page using the procedure section.

Compound Light Microscope



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4. Answer the following questions about the compound microscope using the website or video: <https://virtuallabs.nmsu.edu/micro.php> OR <http://somup.com/c3nQodZNSz> (6:49)

a) What is the magnification of the ocular, eyepiece, of the compound microscope?

b) Why is the low-power objective (~10X) used widely and commonly when locating objects in a microscopic field?

c) What is the low-power magnification of your microscope (SHOW WORK)?

d) What is the high-power magnification of the microscope (SHOW WORK)?

e) Why should one be very careful when using the coarse adjustment on your microscope?

f) Why would one NOT turn the find adjustment of your microscope more than one half turn in either direction when focusing?

g) When would be an obvious time one would NOT want to tilt the microscope using the inclination joint?

h) Which high power objective used for oil immersion? What does it actually improve?

**Conclusions**

**Address Hypothesis** (*Was the hypothesis confirmed or incorrect? Give evidence*.)

**Analysis** (*Repeat content from the discussion with evidence from the lab*.)

**Questions** (*Use complete sentences that convey a complete thought to answer each question*.)

1. Why are most student microscopes called “light microscopes”?

2. Using the standard student microscope, is it possible to magnify an object by only 10 times? Why or why not?

3. If one viewed an object using a 10X ocular and a 10X objective, what is the magnification of the object? SHOW WORK.

4. If one viewed an object using a 10X ocular and a 40X objective, would you be using low-power or high-power objectives? SHOW WORK and explain.

**Errors**

This lab does not really have experimental error since it is virtual and used to identify parts and functions of a microscope. The error section can also afford the learner opportunity to offer any ideas for relevant further study/research of this topic or scientific principle (this is optional).

**Resources/Bibliography**

The Compound Microscope. *Lab Worksheet*. Biology Course Site, Week 1. Learning CTR Online, n.d. Web. 9 Sept. 2022. <[www.learningctronline.com](http://www.learningctronline.com)/biology-course-site-s1>.

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