The Microscope

Introduction: The word "microscope" may be broken into "***micro***" which refers to tiny; and "***scope***" which refers to viewing. Microscopes are tools used to enlarge images of small objects so they can be studied. The compound light microscope is an instrument containing two lenses, which magnifies and a variety of knobs to resolve (focus) the picture. Because it uses more than one lens, it is sometimes called the compound microscope in addition to being referred to as a light microscope. In this lab, not only will we learn about the proper use and handling of the microscope, but we will also learn how to make slides.

Instructional Objectives

- Demonstrate the proper procedures used in correctly using the compound light microscope.
- Prepare and use a wet mount.
- Determine the total magnification of the microscope.
- Explain how to properly handle the microscope.
- Describe changes in the field of view and available light when going from low to high power using the compound light microscope
- Explain why objects must be centered in the field of view before going from low to high power using the compound light microscope.
- Explain how to increase the amount of light when going from low to high power using the compound light microscope.
- Explain the proper procedure for focusing under low and high power using the compound light microscope.

Rules for Microscope Usage

Microscopes are very expensive to replace; therefore, be particularly careful when handling. Follow these simple rules and you can protect your microscope.

- Use both hands to carry the microscope.
- Always ***hold it upright*** so that the ocular lens does not slip out.
- Use only clean, dry lens paper to clean dust off of the glass lenses. Do ***not*** use wet paper, paper towels, or other materials that may scratch these lenses.
- The lowest power objective should be in place at both the beginning and end of use.
- Keep the stage clean and dry to prevent slides from sticking to the stage. When slides stick the mechanical stage will not be able to move the slide around during viewing. This could break the mechanism of the mechanical stage.
- Do ***not*** remove parts of the microscope unless directed.
- Always replace the microscope on the cart covered by its protective cloth.
- ***Report any malfunction immediately***. Do ***not*** simply trade the defective scope for a new one.
- Try ***not*** to get the lenses wet during microscope use. If they do get wet. Wipe them clean with a ***piece of lens tissue ONLY***.

Care of Slides

- Many slides and coverslips are glass. Be careful not to cut yourself when using them.
- Dispose of broken glass or organic materials as instructed.

Background: We will be preparing two (2) types of slides for this lab: a dry mount slide and a wet mount slide.

A dry mount slide is made by placing the specimen directly on a slide and then covering the specimen with a cover-slip. On the other hand, a wet mount slide is made by placing a fluid solution on a slide, suspending a specimen in the solution and then covering the specimen and solution with a cover-slip. A wet mount slide may also be made by first combining the specimen and fluid solution; placing this mixture on a slide and then covering the specimen/solution mixture with a cover-slip. In many cases, a stain such as ***Lugol's Iodine***, ***methylene blue***, or ***crystal violet*** may be added to specimens in order to increase contrast. The stain can be directly added to the specimen when first preparing the slide or it can be added later after viewing the specimen without the stain. **CAUTION**: these dyes will stain skin and clothing; they are also harmful if ingested. Remember that the only difference in the procedure of preparing dry mount and wet mount slides is that dry mount slides receive no fluid solution. You should prepare yourself for this lab by becoming familiar with the ***history of the microscope*** and the ***parts of the microscope***. In addition, be aware of the ***safety procedures*** used when performing any lab activities utilizing the microscope.

Materials:

pen/pencil	2 glass slides
2 cover slips	methylene blue stain
microscope	yellow onion

Procedure for dry mount slide:

1. Place a sliver of onion in the center of the slide
2. Carefully lower the cover-slip onto the slide - do not drop the cover-slip
3. Secure your slide to the stage (with the spring clips)
4. Focus on the onion cells

Procedure for wet mount slide:

1. Place a sliver of onion in the center of the slide
2. Add a small drop of methylene blue stain to the preparation and gently agitate
3. Hold the cover slip so that its edge touches one side of the fluid
4. Carefully lower the cover-slip onto the preparation - do not drop the cover-slip
5. Secure your slide to the stage (with the spring clips)
6. Focus on the onion cells

Data & Questions

Exercise 1

Using the provided FOV (field of view) drawing page; draw four (4) visuals of what you saw when conducting this lab activity.

Exercise 2

Biological study includes the microscopic examination of many organisms. In this lab you have learned the correct terminology and techniques needed for efficient utilization of the light microscope. In addition to giving you training in proper microscope usage, this lab has provided you with correct terminology in regards to parts of the microscope.

Directions: Fill out the following chart by describing the function of each given microscope part.

Microscope Part	Function
Coarse Adjustment Knob	
Fine Adjustment Knob	
Stage	
Diaphragm	
Ocular	
Objective Lens	
Condenser	
Nosepiece	
Light Source	
Arm	
Body Tube	
Base	

Exercise 3

Your microscope is capable of powers of magnification based on the different objective lenses found on your microscope. You may have objective lenses of 4X; 10X; 40X; and 100X. Your ocular lens has a magnification of 10X. In order to calculate the total magnification when viewing a specimen, you simply multiply the ocular lens magnification by the objective lens magnification. For example, when the shortest, or 4X objective is in place, you will be viewing the specimen at a magnification of 40X (10X * 4X.)

Calculate the power for each of the following objective lenses:

1. 5X = _____.

2. 10X = _____.

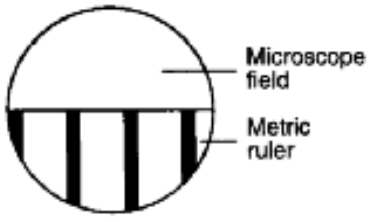
3. 40X = _____.

4. 50X = _____.

5. 100X = _____.

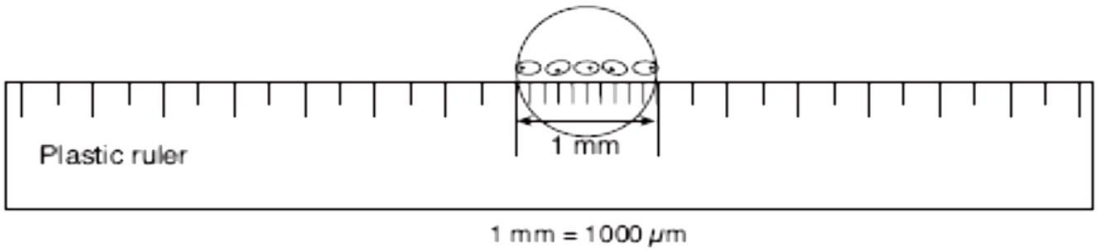
Exercise 4

Microscopic Measurement: In order to calculate the field of view on low or high power of a microscope, you would place a clear plastic ruler with mm markings on top of the stage. Then, by looking through the lowest power objective, you would focus your image. Next, you would count how many divisions of the ruler fit across the diameter of the FOV (field of view.) You would then multiply the number of divisions by 1000 to obtain the field of view in micrometers (µm) and then finally recording your answer in µm (*Note: 1mm = 1000 µm.)

Finding the Size of a Microscope Field of View	
	In the pictured field of view at the left, it can be observed that there are approximately 3 1/2 divisions equal to a length of 3.5 mm. Therefore this field of view is equal to 3.5 mm or 3,500 µm.

6. Review the diagram below. A clear plastic ruler is placed across the middle of the field of view of a compound light microscope. A row of cells can be seen under low-power magnification (100X.) What is the average length of a single cell in micrometers (μm?)

A) 10 μm B) 200 μm C) 100 μm D) 2000 μm



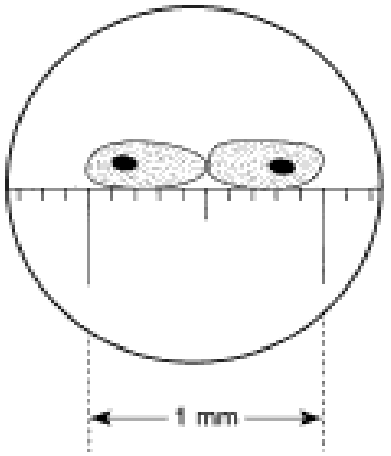
7. Indicate the ***approximate size of an individual cell in Field of View Figure A below*** in micrometers. Be able to justify your answer using written descriptions and calculations. The field of view in this question is 2 mm.

_____

_____

_____

Use the diagram on the right to answer questions 8 - 11.



8. What is the size of the field of view in **millimeters**? _____

9. What is the size of the field of view in **micrometers**? _____

10. What is the size of a cell in **micrometers**? _____

11. What is the size of a nucleus in **micrometers**? _____

Exercise 5

Looking through the microscope during this lab, you were able to get a close look at very small objects. If you woke up one morning and discovered that you had been shrunken to microscopic size, what would you do? Write a short story about how you got that way; where you would go; what you would eat; and other challenges you would face.

Exercise 6

Directions: Read the following passage. Fill in the blanks with words that make sense. Remember to use context clues that come before and after the blanks.

It happened over 300 years __12__ in Holland. Anton van Leeuwenhoek (AN-tun van LAY-vun-hook) had a new microscope that he had __13__. One day he __14__ through it at a drop of lake water. What he saw surprised him. The water was alive with what Leeuwenhoek called "wee beasties." The microscope made tiny organisms look 200X __15__ than their actual life size. Leeuwenhoek was one of the first scientists to see living things that were that __16__. His work was a giant __17__ for science. Today, microscopes are much stronger. An electron microscope can make tiny organisms look 200,000 times their actual __18__ size. A few electron microscopes can see individual atoms. Pictures can be made to show the objects or organisms much bigger. The pictures add greatly to what we know about tiny objects and __19__. Microscopes have come a long way in 300 years!

12.	a.	since	b.	ago	c.	before	d. after
13.	a.	made	b.	lost	c.	previewed	d. delivered
14.	a.	fell	b.	broke	c.	looked	d. went
15.	a.	farther	b.	smaller	c.	darker	d. larger
16.	a.	life	b.	small	c.	darker	d. larger
17.	a.	turtle	b.	gorilla	c.	step	d. tower
18.	a.	small	b.	over	c.	under	d. life
19.	a.	organisms	b.	gravity	c.	electricity	d. microscopes

Exercise 7

Directions: Answer the following questions.

20. What is a microscope and how does it work?

21. How do you obtain an optimal image with a microscope? What limits what you can see with the microscope?

22. Explain the differences between magnification, resolution and contrast. How do they each contribute to the image that you see with the microscope?

23. How are slides (wet mounts and dry mounts) prepared?

24. Why stain cells?

******When doing the lab report write-up, be sure to follow the guidelines.******