

1 Introduction to the Microscope

How do you use a microscope?

Materials:

microscope	slide
cover slip	water
eyedropper	lens paper
newspaper	colored sewing thread (2)
ruler	

Introduction:

In almost every type of biological research, the microscope plays a fundamental role. Scientists in each field rely on it to study the fine structures of cells and tissues--things too small to see with the unaided eye. Were it not for the microscope, our understanding of life would be far different from what it is today.

In this lab, you will learn how to use a compound light microscope to observe structures too small to see with the unaided eye. In future labs, you will observe microscopic organisms using the techniques you learned in this lab.

Prelab Preparation:

It is essential that you learn how to use and care for your microscope properly. Study the diagram of the microscope and learn the names of all its parts.

LABEL the parts on your microscope picture.

Your microscope is expensive and fragile. It is important for you to use it correctly to avoid damaging it and to avoid breaking slides or destroying specimens. When you are using your microscope, it should rest securely on your table or bench, away from the edge. **When you carry your microscope**, always use two hands.

Always use an appropriate light source. Adjust the mirror to get a good amount of light through the eyepiece (ONLY FOR NON-ELECTRIC MICROSCOPES). CAUTION: Never use direct sunlight as your light source. Make sure the diaphragm is sufficiently open so enough light can get through. (This will be especially important if you look through the eyepiece and see nothing).

Always keep both eyes open as you look into the eyepiece. This is important because it reduces eyestrain. If you find this difficult, cover your other eye with your hand. This may feel awkward at first but it will become easier with practice. Keep the lenses on your microscope clean. Never touch them with your fingers. If the eyepiece or objective lenses get dirty, clean them with a piece of lens paper moistened with alcohol. Wipe the lens in a light circular motion and change the lens paper as it picks up the dirt. Make certain that you leave no streaks on the lens. **NOTE:** Cleaning the lens with anything other than lens paper, or wiping too hard, will scratch the lens.

The purpose of the microscope is to magnify your specimen. Microscopes use two lenses--the eyepiece and an objective--to magnify the image. The magnification is the number of times the size of an object appears increased. If the magnification of an object is 10x, it will appear 10 times larger than it really is. The total magnification of your microscope is equal to the product of the separate magnifications of the eyepiece and the objective. (The magnification of each lens is written on the lens case. **It is a whole number!! no decimals**) If the eyepiece is 10x and the low power objective is 10x, then the magnification under low power is 100x. In equation form, this is written:

$$\text{(Eyepiece magnification)} \times \text{(Objective magnification)} = \text{Total magnification}$$

1. If the magnification of the eyepiece is 10x and the magnification of the high power objective is 40x, what is the total magnification under high power?
2. How many times larger than life will a specimen appear under **this** magnification?

If you have a scanning power (4x objective), note that it gives a very low magnification. This is useful for locating a specimen on the slide, but in many cases it is not appropriate for observation. The other two objectives are called low power and high power.

scanning objective: smallest

low power objective: middle sized

high power objective: biggest

Procedure:

Part I: Using your microscope. (Focusing on a letter "R")

- A. Place your microscope on your table, away from the edge. Make certain that you are familiar with all of its parts and that it is functioning properly.
3. What are the total magnifications of your microscope under scanning, low, and high power?
- B. Prepare a wet mount of an R by first cutting a capital R out of a newspaper. This R should come out of the regular printing. Place one drop of water on the slide. Add the R to the drop. Place one edge of a cover slip on the slide, in the water, next to the R. Lower the cover slip onto the R. Do not tap on the top of the cover slip (if this were a living thing you would crush it!!).
- C. Adjust the diaphragm and mirror to obtain the appropriate light for viewing.
- D. Become familiar with the high and low power magnifications of your microscope. Put your wet mount on the microscope's stage. Turn the nosepiece so that it is on scanning power. **Focus under scanning power:** The coarse adjustment knob should be turned so the scanning power objective is as low as possible, focus with the coarse adjustment and then with the fine adjustment knob.
- E. **STOP!! Get teacher help here. To use the high power objective:** first focus with scanning power, then focus with low power, turn it to the high power objective while watching from the side, focus with the fine adjustment knob only!! Move the slide around and focus to see small irregularities in the R.

NOTE: slides are easily broken by using the coarse focus with high power.
USE ONLY FINE FOCUS ON HIGH POWER!

4. **Draw** the R as you saw it on scanning power. Which magnification, low or high, is more appropriate for looking at the R?
5. How does the R appear to be positioned compared to the way it looked before you put it under the microscope?
6. Move your slide to the left. Which way does the image of the R appear to move?
7. Move your slide toward you. Which way does the image of the R appear to move?
8. What can you conclude about the way the image moves as compared to the way you are actually moving the slide?
9. Do you see more or less of the R on high power than on low power?
- F. Depth perception: Move the slide to the edge of the cover slip and change to low power. Now adjust the coarse adjustment back and forth. By doing this you change the depth of what you see.
10. When you look at a focused object in the microscope are you seeing 3 dimensions or 2 dimensions?
- G. On high power, move the diaphragm.
11. What differences did you observe as you moved the diaphragm settings?

Part II: Microscopic measurement.

- H. Put a clear plastic ruler on the microscope stage so that you can see the millimeter scale under scanning power. Place one millimeter marking of your ruler at the far left hand side of the scanning power field of view. Count how many whole millimeters you can see. Now, estimate how much of the next millimeter you can see. It might help you if you slide the ruler to see how far it is into the next millimeter. (sample answer might be: 2.3 mm)
12. What is the diameter in millimeters of your scanning power field of view? Your answer should be to the nearest 0.1 mm.

Putting away the microscope:

1. Put the microscope on scanning power
2. Move the coarse adjustment all the way down
3. Cover the microscope.

It is now ready to place back on the counter!!!

13. Divide the high power magnification of your microscope by the scanning power magnification. This will give you how many times larger your scanning power field is than your high power field.

high power magnification ÷ scanning power magnification = answer 13

14. Now determine the diameter of your high power field by dividing the diameter of your microscope's scanning power field by the answer in question 13.

scanning power diameter in mm (#12 answer) ÷ #13. answer = answer 14

Microscopic measurements are often expressed in microns because many of the things that you will be looking at are smaller than one millimeter.

1 millimeter=1000 microns

15. What are the diameters of your scanning and high power fields in microns? (Remember you have the diameters as answers to questions 12 and 14!!)

Postlab Analysis:

16. What range of specimen size is appropriate for observing under your microscope?
(Remember, you figured out the diameters of your scanning and high power objectives)
17. Why is it necessary to make your drawings as accurate as you can?
18. What is the purpose of indicating the magnification on your drawing?
19. How are observations made with a microscope usually communicated?