Name…….. Period……..

Student Laboratory Packet

Using a Compound Light Microscope

A Laboratory Activity for the Living Environment

Background

The microscope is an important scientific tool. It enables a person to observe things too small to be seen with the unaided eye. In many of the activities in this lab manual you will use a *compound microscope,* a microscope having two lenses. In this type of microscope, light passes through the specimen, or object being viewed. One lens, the *objective,* causes the light rays coming from the specimen to spread apart, forming an enlarged image of the object. The second lens, the *ocular,* focuses and further enlarges the image.

Working with a compound microscope, you may use specimens that have been prepared in one of two ways. A prepared slide is made to be permanent and can be purchased from a supply house. A wet-mount slide is made for temporary use and can be made and used during a lab period.

Objectives

In this activity you will:

1. Learn the parts and operation of a compound microscope.
2. Learn to prepare and observe a wet mount.

Materials

microscope	slide	cover slip	magazine page
pipette	water	hairs	

Procedures and Observations

PART I. LEARNING ABOUT THE MICROSCOPE _____

1. Obtain your microscope from your teacher. Always carry the microscope in an upright position with one hand holding the arm and the other supporting the base, as shown in Figure 1. Set it down away from the edge of the table. **Note:** *The microscope is an expensive, precision instrument. Handle it carefully.*
2. Compare your microscope with Figure 2 on the next page. Identify each part on your microscope.

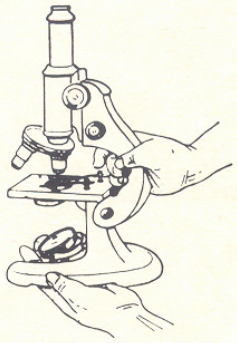


Figure 1

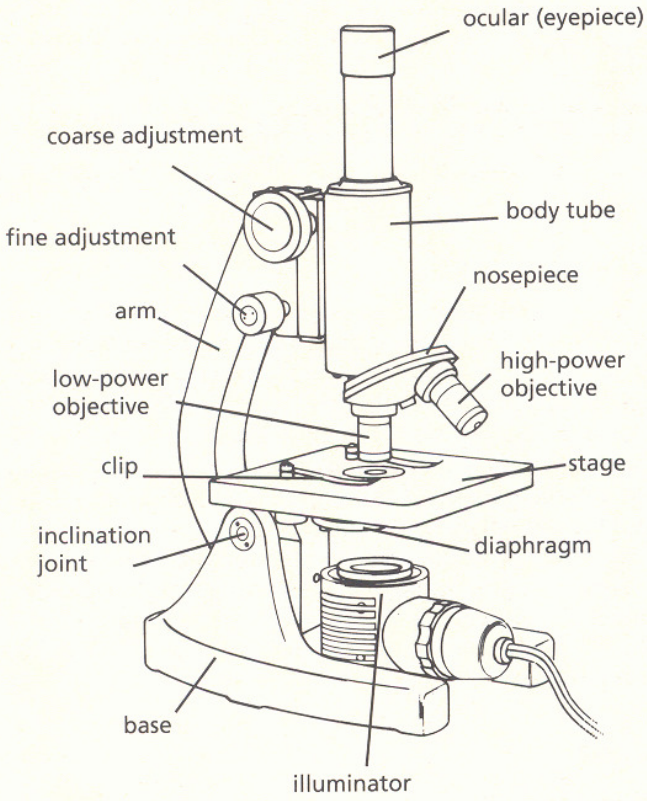


Figure 2

3. Some microscopes have a built-in electric light, or illuminator. Others have a mirror to reflect light onto the specimen. If you have a mirror, note that its angle is adjustable. Practice directing the reflected light upward through the microscope by slanting the face of the mirror. Look through the ocular as you adjust the mirror to obtain the maximum amount of light. **CAUTION**: *Never use direct sunlight as a light source. It can damage your eyes.*
4. Examine the diaphragm. Adjust it to the largest opening so that the most light enters the microscope. You can tell this by looking through the ocular.
5. While looking at your microscope from the side, slowly turn the coarse adjustment one-half turn toward you.

   a. *In which direction does the objective move?*

_____

_____

6. Continue to turn the coarse adjustment until the low power objective is about 3 cm from the stage. The low power objective is the shorter, or the shortest, objective.
7. Look at the number followed by an "X" on the side of each objective. This number is the objective's magnifying power. The "X" stands for "times." Thus the number tells how many times an object is magnified by this lens.

b. *What is the magnifying power of the low-power objective?*

_____

8. Locate the high-power objective.

c. *What is its magnifying power?*

_____

9. If the lenses look dirty or smudged, carefully wipe them with lens paper. Use only lens paper because other kinds of paper can damage the lenses.

The ocular lens also has a magnifying power. The total magnifying power of the microscope is easy to calculate. Simply multiply the magnifying power of the ocular by the magnifying power of the objective. For example, if the ocular is 5X and the objective is 10X, the total magnification of the object being viewed is 5X x 10X = 50X.

10. Examine the ocular lens.

d. *What is its magnifying power?*

_____

e. *What is the total magnification produced when the low-power objective is used? Show your calculations.*

_____

f. *What is the total magnification produced when the high-power objective is used? Show your calculations.*

_____

PART II. PREPARING AND EXAMINING A WET MOUNT _____

1. Tear out the square with the letter "e" → e

2. Place the square in the middle of a clean slide. With a pipette, put 1 drop of water on the square. Drop the water from about 1 cm above the slide. Do not touch the pipette to the paper or the paper will stick to the pipette.

3. Now cover the mount with a clean cover slip. One way to do this is shown in Figure 3-a. Hold the cover slip at about a 45° angle to the slide and move it toward the drop. As the water touches the cover slip, it will spread along the edge. Gently lower the cover slip into place. Another way to put the cover slip into place is to support the cover slip with a dissecting needle, as shown in Figure 3-b. Slowly lower the supported edge and watch as the water fills the space. Use whichever method is easier for you and gives you a good wet mount. Do not press on the cover slip—it should rest on the top of the water. A good wet mount is free of bubbles. If your mount has too many bubbles, take off the cover slip and absorb the water with a paper towel. Then repeat Steps 2 and 3.

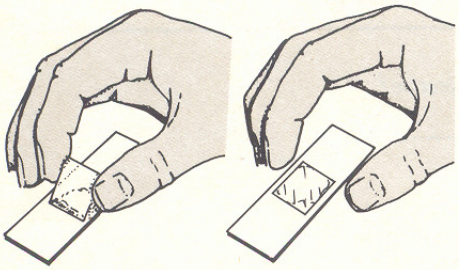


Figure 3-a

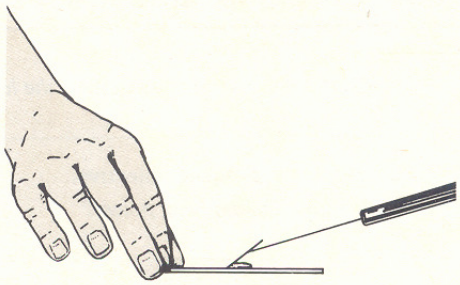


Figure 3-b

4. Click the low-power objective into place. Make sure you have a good light source and that the diaphragm is at the largest opening. Look through the microscope and adjust the mirror or illuminator to give the brightest light. Remember to never use direct sunlight as a light source.
5. Check to be sure the bottom of the slide is dry before placing it on the stage of the microscope. Set it on the stage so that the "e" is in reading position and over the hole in the stage. Fasten the slide with stage clips.
6. Look at the microscope from the side. Use the coarse adjustment knob to lower the body tube until the objective is about 1/2 to 1 cm above the slide, or until you feel an automatic stop.
7. Look through the ocular, keeping both eyes open. Keeping both eyes open is difficult at first, but it helps to prevent eyestrain. It will become easier with practice. **Note:** *Always look at the microscope from the side while you lower the low-power objective. If you look through the eyepiece you could run the objective into the slide, breaking the slide and damaging the microscope.*
8. Slowly raise the objective by turning the coarse adjustment until the letters come into focus. Use the fine adjustment to sharpen the focus. Observe the letter "e."

   a. *In the space at the left, draw the letter "e" the same size and in exactly the same position as you see it through the microscope.*

9. Move the slide to the left.

   b. *Which way does the image move?*

_____

10. Move the slide to the right.

    c. *Which way does the image move?*

_____

_____

11. Move the slide backward and forward.

    d. *Which ways does the image move?*

_____

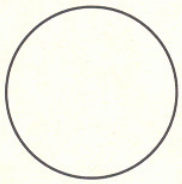
_____

12. Observe the wet mount as you change the diaphragm to each of its settings. Adjust it to give good contrast and illumination without glare.

e. *What does the diaphragm control?*

Before using high power, the specimen must be in sharp focus in the center of the low-power field of view. **Note:** *All focusing under high power is done with the fine adjustment knobs.* There is no automatic stop for the high-power objective.

13. Watching from the side, carefully switch to the high-power objective. Make sure that the objective does not hit the slide, but expect it to be very close.
14. Focus on the letter "e." Only a slight turn of the fine adjustment knob will be needed to do this.



f. *In the space at the right, draw the letter "e" exactly as you see it under high power.*

g. *Is the field of view larger under high power or low power?*

h. *Compare the brightness of the field under high power and low power.*

PART III. RESOLVING POWER AND DEPTH OF FIELD

1. Make a wet mount using a 1-cm square of a colored newspaper cartoon or a colored picture from a magazine printed on thin paper. Choose a square that has both light and dark tones, but not black.

a. *Record the colors of the square.*

Resolving power is the ability to distinguish between two separate points that are very close together. Microscopes have a resolving power greater than that of the human eye.

2. Observe the slide under low power. Then switch to high power. Examine the light and dark areas of the square.

b. *How is the color distributed?*

c. What colors do you see?

The *depth of field* is the distance above the slide in which the object is in good focus.

3. Prepare another wet mount, this time using two hairs of different colors. Cross them on the slide, then add a drop of water and the cover slip.
4. View the slide under low power. Focus directly on the point where the hairs cross.

   d. *Are both hairs in focus under low power?*

_____

5. Switch to high power and observe the hairs.

   e. *Are both hairs in focus under high power? Explain.*

_____

_____

6. Prepare some wet mounts of other things, such as pieces of cloth, skin, a fly's wing, or anything that is thin enough for light to pass through it.

   f. *Sketch the things that you observe under the microscope. Label each drawing with its name and the magnification used.*

Analysis and Interpretations

1. Quiz yourself by briefly describing the function of each of the microscope parts listed below.

Part	Function
ocular	
coarse adjustment	
nosepiece	
objectives	
stage	
stage clips	
diaphragm	
mirror or illuminator	
fine adjustment	

2. Why should a wet mount have no bubbles?

3. What did the microscope do to the image of the letter "e"?

4. Why must you center and focus the object in the field of view under low power before switching to high power?

5. Why is only the fine adjustment used for high power?

6. Explain why the color of the magazine picture looked different when you looked at it under the microscope.

7. By using the idea of depth of field, how can you tell which hair was above the other?

8. If you were scanning a slide to find a particular area, which objective would be better to use? Why?