

# INVESTIGATION 1: The Microscope

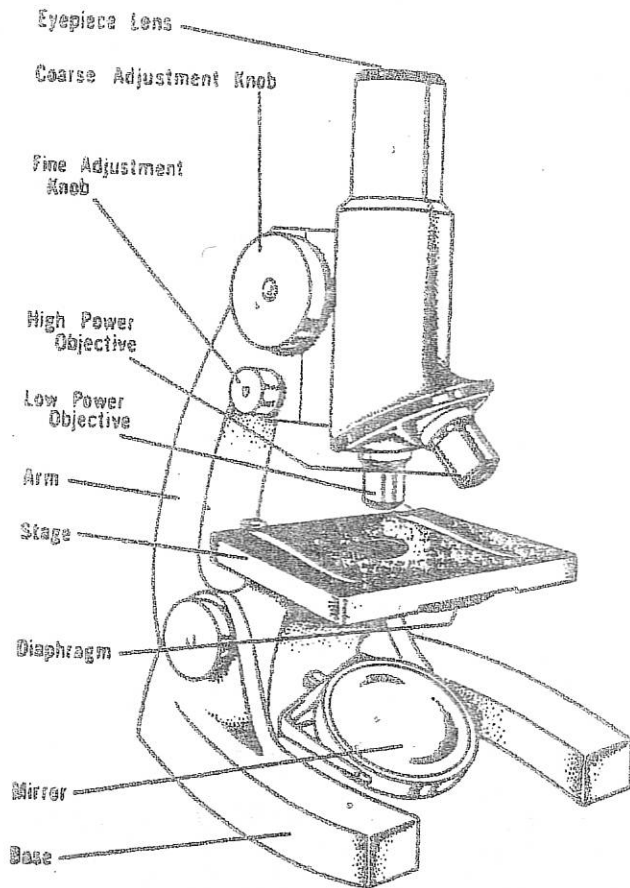
**INTRODUCTION:** The first step in scientific investigation is observation. Many kinds of instruments are available for scientists to use in making observations of physical and biological phenomena. In biology, many of the objects to be observed are very minute. In order to observe these objects, scientists use instruments which give magnified images of the things being viewed. The purpose of this investigation is for you to learn how to use the microscope. In all investigations, the microscope will be used as a tool for making observations.

With Leeuwenhoek's invention of the microscope, a new world of small objects was opened for study. At first, microscopes were scarce, because Leeuwenhoek was reluctant to share with his instruments, but today there are many microscopes available for use in classrooms as well as in laboratories. These instruments range from simple hand lenses that magnify three times to electron microscopes that magnify 1,000,000 times. The instrument that is most widely used in biology classrooms is the compound microscope. It is called a compound microscope because it has two or more lenses.

**PROBLEM TO BE INVESTIGATED:** What procedures should be followed in using the microscope?

**MATERIALS:** microscope, cover glass, black and blond hairs or fine black and white threads, microscope slide, medicine dropper, small piece of newspaper

**SUGGESTED PROCEDURES:** Before attempting to use the microscope, study the diagram below and become familiar with the names of the microscope parts. Read the accompanying general instructions. Always follow these instructions because the microscope is a sensitive and expensive instrument that should be handled and used with care.



1. Always pick up and carry the microscope with two hands. Grasp the arm of the microscope with one hand and place the other hand beneath the base. (Refer to the diagram to identify the parts of the microscope.)

2. When placing the instrument on the table, do it gently and keep it away from the edge. The top of the table should be clear of other objects.

3. Use only the special lens paper, supplied by your teacher, to clean the lenses of the microscope. Never use a handkerchief, clothing, or any other material. Keep your fingers off the lenses; fingertips and eyelashes leave an oil film which should be removed with lens paper.

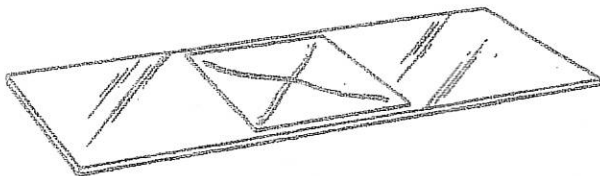
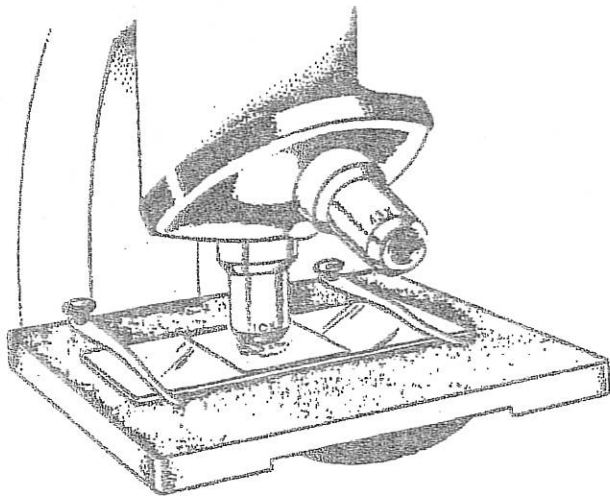
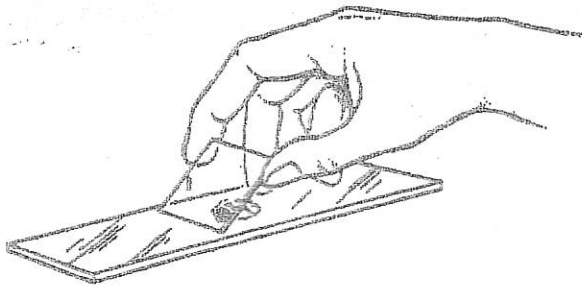
4. Before putting the microscope away, turn the low power objective into place over the opening in the stage. Then lower the tube with the coarse adjustment knob so that the microscope can be fitted into its case.

5. Always focus by moving the objective up, never down while looking through the microscope. (The fine adjustment knob can be turned down to sharpen the focus.)

After you have studied this diagram and these general instructions, continue the investigation as described on the following page.

NAME \_\_\_\_\_

(Turn the page)



or "e" from the piece of newspaper. Place the letter on a glass slide with the letter right side up. With a medicine dropper put one drop of water on the piece of paper. Hold the edges of a cover slip between your thumb and forefinger and drop it gently over the water drop. (Be very careful! Cover slips are thin and break easily.) It is best to hold the cover slip at about a 45° angle with one edge resting on the glass slide, then drop the cover slip. If there are air bubbles in the water after the cover slip is in position, tap the surface of the cover slip gently with the rubber eraser on a pencil.

**Part B. Focusing and observing motion.** Place the slide you just prepared on the *stage* of the microscope. Center the letter over the opening in the stage. While observing from the side, lower the low power objective until the stop prevents the objective from going down any farther or until the objective almost touches the cover slip.

Look through the *ocular*, or eyepiece, lens. Try to keep both eyes open. This will take some practice, but you will soon learn to ignore objects seen by the eye not looking through the microscope. Using the coarse adjustment knob, raise the tube slowly until the printed letter comes into focus. You can sharpen the focus by turning the fine adjustment knob. Observe the position of the letter under the microscope compared with its real position on the stage. Also observe the texture of the paper and the condition of the printer's ink.

Move the slide slowly to the right while observing the letter through the microscope. Now move the slide to the left. Try moving the slide toward you and away from you. Observe what happens each time the slide is moved.

**Part C. Using high power and observing focal depth.** Prepare another wet mount, using either a black and a white thread or a black and a blond hair. Cross the threads or hairs on the slide and place one drop of water on them. Remember which one is on top. Apply a cover slip as you did before.

If the hairs or threads do not cross in the microscope field, move your slide until the hairs or threads are centered. Then, by moving the low power, focus on the point where the hairs or threads cross.

Find the *diaphragm*—the part extending a bit beyond the front of the stage. While observing the hairs or threads, turn the diaphragm slowly, but continue turning until the diaphragm makes one complete revolution. Observe how the light is affected by the sizes of the openings in the diaphragm.

Having selected a bright light, change from low power to high power while the cross of hairs or threads is still focused in the center of your view. (Do not raise or lower the tube.) While looking from the side, carefully turn the revolving nosepiece until the high power objective clicks into position. If the high power seems about to touch the cover slip, raise the tube a tiny bit by using the fine adjustment knob, then complete the turn of the nosepiece. While observing the hairs, slowly sharpen the focus by using only very small movements of the fine adjustment knob. Observe which of the hairs is in sharp focus. While observing, try to bring the other hair into focus by slightly turning the fine adjustment knob in either direction.

**OBSERVATIONS AND DATA:** While carrying out your investigation, record your observations in the blanks below.

Part B. What is the apparent position of the letter? .....

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