MICROSCOPE LAB PARTS & FUNCTION

Activity 1. *How can we use the compound microscope?*

PRE-LAB

History tells us that the first man to see microscopic life was the Dutchman Anton Van Leeuwenhoek. Can you imagine how thrilled he must have been to see tiny protozoa in a drop of water or bacteria in material scraped from his teeth? Leeuwenhoek's microscope was really very primitive compared with the instruments in your school. What he used was nothing more than a high-powered magnifying glass, ground very carefully, to be sure, but really a simple and clumsy device. But that was in the late 17th century. Nowadays, even inexpensive microscopes use combinations of lenses (compound microscopes) to enlarge and clarify microscopic objects.

Your textbook undoubtedly describes the theory of the microscope in detail. For purposes of the laboratory it is important for you to remember a few facts.

One lens, made up of several pieces of specially ground glass, is near the object you are studying. Since it is near the object, this is called the *objective* lens. Most student microscopes have two of these objectives on a revolving nosepiece. The most common objectives have powers of 10X (low power) and 40X, 43X, or 44X (high power). The lens you look through is called the *eyepiece* (ocular) since it is near your eye. Normally, this eyepiece has a power of 10X, but it may be 15X or 5X or some other power.

Light passes through your specimen, which rests on a glass slide on a platform called the *stage*. Let's assume we are using a microscope with objectives of 10X and 40X. This light continues its path through the objective and produces a magnified image of the specimen, 10 times or 40 times larger, depending on which objective is being used. This image is then further enlarged 10 times by the eyepiece for a *total magnification* of either 100 or 400 times. In order to find the total magnification of a compound microscope, you must multiply the power of the objective lens by the power of the eyepiece. Thus 10 x 10 = 100X and 40 x 10 = 400X.

The light which passes through the slide, objective, and eyepiece is usually reflected up from a mirror and goes through the opening in the stage. The source of this light may be daylight (not direct sunlight!), the room light, or a substage lamp. If your microscope has a condenser (ask your teacher) you will use the flat side of your mirror for reflecting. If it has no condenser, you will use the *concave* side of the mirror.

The distance of the objective lens from the slide is very small, and the higher the power, the smaller the distance. There are two pairs of adjustment wheels on your instrument. The larger, or *coarse adjustment,* moves the *whole* body tube and lenses rather rapidly. The *fine adjustment* moves the body tube very slightly. You will soon learn when to use these wheels to bring your specimen into sharp focus.

The function of the other parts of the microscope will become clear to you as you go through this activity. Remember that the microscope is a precision instrument that must be handled with great care. When you have learned to handle your microscope with skill, a new world of adventure will open up to you. Memorize as much of Figure 1 as possible before you enter the lab. Meanwhile, answer these questions to help summarize your understanding.

Questions

1. A light microscope using a combination of lenses is a _____ microscope.
2. The lens nearest the stage is the _____ lens. The lens you look through is the _____.
3. Total magnification is found by multiplying the power of the _____ by that of the _____.

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DIRECTIONS: **Write all answers right on this lab in pencil.** Unless it is a yes or no answer write all answers in full complete sentences.

PART A. PRELIMINARY PROCEDURES

PROCEDURE: 1. Remove your microscope from the cabinet and carry it with two hands. Place one hand beneath the base and with the other hand firmly grasp the arm of the microscope.

PROCEDURE: 2. Place the microscope on the lab table with the arm toward you and the stage away from you. Also place the microscope on the table so it is away from the edge of the table.

PROCEDURE: 3. Identify the following parts of the microscope.

PART	FUNCTION
1) Ocular Lens (eyepiece)	Contains lens closest to your eye for magnification
2) Body tube	Maintains a set distance between eyepiece and objective lens
3) Arm	Supports the body tube
4) Course adjustment	Moves body tube up and down
5) Fine adjustment	Sharpen the image, fine focus
6) Nosepiece	Contains the 3 objective lenses & allows them to be switched into place (4x, 10x and 40x or 43x)
7) Stage	Supports the slide on the stage
8) Diaphragm	Regulates the light
9) Base	Supports the microscope
10) Objective Lens(es)	Lens closest to the object that can be changed by the revolving nosepiece

PART B PREPARING A WET MOUNT

PROCEDURE: 4. Cut out the smallest **capital** (upper case) letter H that you can find from the **classified ads** in the newpaper.

PROCEDURE: 5. Place the H in the center of the slide and add a drop of water to the letter.

PROCEDURE: 6. Place a cover slip at a 45 degree angle over the letter and gently lower the cover slip onto the slide. This prevents the trapping of air bubbles. If air bubbles are present gently tap the cover directly over the bubbles with the eraser of your pencil.

PART C FOCUSING UNDER THE 4X OBJECTIVE

PROCEDURE: 7. *(1)* Raise the body tube of the microscope with the course adjustment.

PROCEDURE: 8. *(2)* Place the wet mount slide in the exact center of the stage and **position it so the letter H is facing you.** Fasten the stage clips on the slide so the letter will stay in place on the stage.

PROCEDURE: 9. *(3)* Looking from the side lower the body tube until it stops with the coarse adjustment. Your microscope is equipped with an automatic stop, so do not force the body tube to go down any further.

PROCEDURE: 10. *(4)* Raise the body tube while looking through the ocular with your coarse adjustment until the slide comes into view. If for some reason you should not find the field of view while raising the body tube, **do not lower the body tube while looking through the eyepiece.** Lower the body tube while looking to the side and start your procedure all over again.

PROCEDURE: 11. *(5)* After the letter has come into view, use the fine adjustment to bring the slide into proper (sharp) focus.

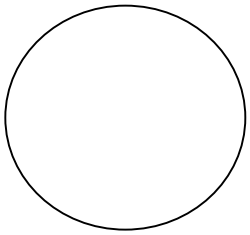
PROCEDURE: 12. *(6)* Adjust the diaphragm so the proper amount of light for viewing may be attained.

PROCEDURE: 13. *(7)* Recenter the slide so the letter will appear in the middle of the field of view.

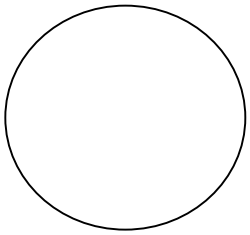
PROCEDURE: 14. You are now ready to make your observations.

PROCEDURE: 15. In the first circle draw a sketch of the letter H as seen with the naked eye.

PROCEDURE: 16. In the second circle draw a careful sketch of what you see under the low power (4x) objective.



Naked eye



4x

QUESTION: 1. Compare the way the letter H looks in the field of view to the naked eye.

PART D FOCUSING UNDER THE 10X OBJECTIVE

PROCEDURE: 17. *(8)* Make sure the letter is in sharp focus and looking to the side carefully rotate the nosepiece so that the 10x objective clicks into place.

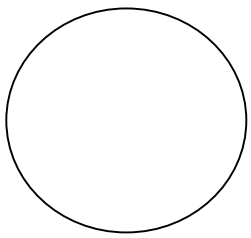
PROCEDURE: 18. *(9)* Now turn the fine adjustment only very slightly for sharp focus. 1) **Never** use the coarse adjustment with high power and 2) **Never** move the body tube down while looking through the eyepiece.

REMINDER If you do not see anything, start over again at 4x.

PROCEDURE: 19. *(10)* Adjust the light for proper viewing.

PROCEDURE: 20. *(11)* Recenter the slide if necessary.

PROCEDURE: 21. Draw in the circle the letter H as you now see it.



10x

PART E FOCUSING UNDER THE 40X (43X) OBJECTIVE

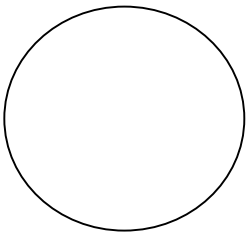
PROCEDURE: 22. *(12)* Make sure the letter is in sharp focus under 10x and then looking to the side CAREFULLY rotate the nosepiece so that the high power objective (40x or 43x) clicks into place. Notice how close to the slide the objective comes. If the objectives hits the slide at all, please notify your teacher.

PROCEDURE: 23. *(13)* Now turn the fine adjustment only very slightly for sharp focus. Again, never use the coarse adjustment with high power. If you move your coarse adjustment down at all you may hear a crunch of glass as the objective breaks the slide.

PROCEDURE: 24. *(14)* Adjust the light for proper viewing.

PROCEDURE: 25. *(15)* Recenter the slide if necessary.

PROCEDURE: 26. In the circle, draw what you can still see of the letter.



40X or 43x

QUESTION: 2. Upon switching to your higher powers, does the letter change positions? (If the slide is properly placed, do you find the letter in a different place?) (Yes or No) _____

QUESTION: 3. **Compare** how the letter looked under 4x and 40x (43x).

QUESTION: 4. When you switched to high power, what happened to the brightness of the field of view?

QUESTION: 5. Give a **reasonable** explanation for this.

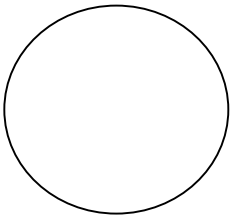
PART F PREPARING AND OBSERVING OTHER WET MOUNTS

PROCEDURE: 27. Prepare the same way that you did for the capital letter H, a wet mount of the capital letter A

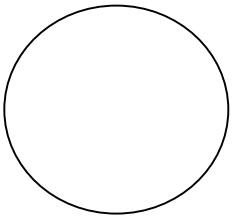
PROCEDURE: 28. <u>Place the slide on the stage so the letter is facing you</u> and view under the 4x objective.

QUESTION: 6. Describe the difference in position of the letter A as you see it with the naked eye and under 4x.

PROCEDURE: 29. Make a drawing of the letter A as you see it with the naked eye and under the 4x objective.



Naked eye

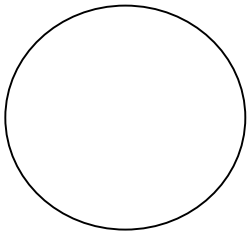


4x

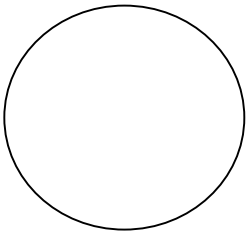
PROCEDURE: 30. Make a wet mount of the capital letter F. Place the slide on the stage so the letter is facing you. Observe with 4x.

QUESTION: 7. **Describe** the difference in position of the letter F as you see it with the naked eye and under 4x.

PROCEDURE: 31. Make a drawing of the letter F as you see it with the naked eye and under the 4x objective.



Naked eye



4x

QUESTION: 8. Name three differences that you have seen in observing the letters H, A and F when viewed with the microscope? Is this true of all three letters? (Full sentences)

PART G OBSERVING MOVEMENT IN THE FIELD OF VIEW

PROCEDURE: 32. Assume the field of view to be the face of a clock with six o'clock nearest to you, three o'clock to your right, nine o'clock to your left, and twelve o'clock the farthest away from you.

Looking into the ocular move the slide with a letter from the center toward three o'clock (toward the right). Recenter the letter and now move the slide toward nine o'clock (toward your left). Recenter the slide and now move the slide toward six o'clock (toward you). Once again center the slide and move it toward twelve o'clock (away from you).

QUESTION: 9. What happened to the letter when you moved the slide to the right (toward three o'clock)?

QUESTION: 10. What happened to the letter when you moved the slide to the left (toward nine o'clock)?

QUESTION: 11. What happened to the letter when you moved the slide toward you (six o'clock) and away from you (twelve o'clock)?

PART H DETERMINING TOTAL MAGNIFICATION

Consult the pre-lab for directions. The ocular of your microscope is 10x.
<u>Must label your answer for credit</u>

QUESTION: 12. What is the total magnification under 4x? _____
<u>LABEL YOUR ANSWERS</u>

QUESTION: 13. What is the total magnification under 10x _____

QUESTION: 14. What is the total magnification under 40x? _____

QUESTION: 15. What is the total magnification under 43x _____

PART I RESOLVING POWER AND DEPTH OF FOCUS

PROCEDURE: 33. The ability of a microscope to provide fine detail and to distinguish between objects is known as **resolving power.** Fine detail with the clearest focus is best seen under low power as the images are sharper and not so blurry.

Depth of focus is the thickness of the specimen that is being viewed. As magnification is increased the objects become "thicker" to the viewer thus the depth of focus (slice that is in focus) is decreased.

Make a **dry** mount (no water) of two different colored threads each about one (1) centimeter in length that cross each other like an X on the slide. Examine under 4x and 10x.

PROCEDURE: 34. Make a drawing of the threads with colored pencils as you see them under the 4x and 10x objectives.

4x 10x

QUESTION: 16. **Compare** the appearance of the threads as you see them under the microscope.

QUESTION: 17. Can you determine which thread overlays the other _____

QUESTION: 18. Which objective has the greatest resolving power? _____

QUESTION: 19. Under 10x, are both threads completely in focus at once. Hint - focus one thread and is the other thread completely in focus? _____

QUESTION: 20. Under which objective is the depth of focus the least? NOTE: Depth means thickness that is in focus _____

QUESTION: 21. From your observations, what kind of relationship can you state concerning the resolving power and depth of focus?

PART J SCIENTIFIC NOTATION

PROCEDURE: 35. Put the following numbers (answers) in scientific notation. Carry out all answers to two significant places.

EXAMPLE $44325783 = 4.43 \times 10^7$

134 = _____

1963 = _____

46783 = _____

673456 = _____

7333238 = _____

PART K DETERMINING THE SIZE OF THE FIELD OF VIEW

PROCEDURE: 36. In this part of the lab, the relative size of the field of view is to be determined. Take a small piece of the bibulous paper about the size of the cover slip. Draw very small circle on it that you would think would be the size of the field of view under 4x. Now place this paper on a slide but do not wet the paper. Focus on this small circle with your 4x objective. Keep trying until you have a small circle that is exactly the size of the field of view.

Once you have found this small circle that fills the field of view under 4x, cut & tape this circle in the correct box found in question #22.

PROCEDURE: 37. Repeat this procedure for 10x and 40x (43x)

QUESTION: 22. Drawings of the sizes of a circle that just fills the field of view

4x	10x	40x
(Sizes of the circles that fill the fields if view)		

Post Lab Questions

1-Briefly describe the function of the following microscope parts:

Eyepiece _____

Body tube _____

Objectives _____

Nosepiece _____

Coarse adjustment _____

Fine adjustment _____

Stage _____

Diaphragm _____

Arm _____

Base _____

Stage clips _____

2- Explain how the microscope should be carried.

3- Explain why you should center an object carefully under low power before switching to high power.

4- Suppose you are observing a protozoan that seems to be moving across your field of view from right to left.

a- In which direction is the protozoan actually moving?

b- Which way must you move the slice to keep the animal in your field of view?

5- What 2 things must you NEVER do when focusing your microscope?

1-

2-

6- Explain what you must do if you switch to a high power and you can not see anything when you try to focus with the fine adjustment.