Name: _____

Date: _____ Section:_____

Cell Structures

Microscope Madness

Life Science: Cells

THE BIG Idea

Cells are the basic unit of life and contain specific parts that do specific jobs.

LEARNING GOALS:

By successfully completing this lab…

> I will be able to identify the parts on a microscope and know what they do.

> I will be able to use a microscope properly.

KEY INFO

Microscopes are very important tools in biology. The term microscope can be translated as "to view the tiny," because microscopes are used to study things that are too small to be seen with the naked eye.

The type of microscope that we will be using in this lab is a compound light microscope. The compound light microscope has **two lenses**, which magnifies, and different **knobs to focus** the image of the specimen. The term compound means that this microscope passes light through the specimen and then through two different lenses.

The lens closest to the specimen is called the **objective lens,** while the lens nearest to the user's eye is called the **ocular lens** or **eyepiece.** When you use a compound light microscope, the specimen being studied is placed on a glass slide. The slide may be either a prepared slide from a science supply company, or it may be a wet mount slide that you make in class.

When an image is formed it is actually magnified twice. First, the image is formed at the bottom by the objective lens. Then the image is projected through a tube and magnified again by the eyepiece at the top. The image is always upside down, so what you see through a microscope shows up as the opposite of what you are doing. Get ready to view the fascinating world of microscopy!

KEY TERMS

- **Arm –** holds the upper portion of the microscope above the stage. This is also where you grab the microscope anytime you pick up the microscope.
- **Base –**holds the microscope up.
- **Coarse Adjustment Knob**- a big round knob that allows you to move the microscope up and down so you can focus on the slide.
- **Diaphragm –** controls how much light is let in. Some objects are easier to see with less light and some need more.
- **Eyepiece –** the piece with lenses that you look into to see the image of the specimen.
- **Fine Adjustment Knob**-moves the stage to fine-tune the image.
- **Nosepiece-**holds the two or three objective lenses. It rotates around in a circle, allowing you to chose which objective lens you want to use.
- **Objective –** the objective lenses are the ones at the bottom of the microscope tube, closest to your specimen. The <u>shortest lens is the least powerful and the longest lens is the most powerful</u>.
- **Stage –** the flat surface on top of which you place your slide or specimen.
- **Stage clips-** the shiny clips that hold the slides in place.
- **Stage-** the large flat area under the objective lenses that have a hole in the middle of it so you can see the specimens.

Pre-Lab

MICROSCOPE MADNESS [DO THIS PAGE NOW!]

Self-Check

1. Can you name all the parts on a microscope? _____ **YES** _____ **NO**
2. Can you use a microscope? _____ **YES** _____ **NO**
3. Can you prepare slides of objects to be viewed under a microscope? _____ **YES** _____ **NO**
4. Can you examine an object under the microscope? _____ **YES** _____ **NO**
5. Can you explain how the lens system of your microscope changes the position of an object viewed through the eyepiece? _____ **YES** _____ **NO**

Q: Why should you always begin to use a microscope with the low-power objective?

A: _____

Q: Why should you only use the fine adjust when the high-power objective is in position?

A: _____

Q: Why must the specimen be centered before switching to high power?

A: _____

Q: If you placed a letter "g" under the microscope, how would the image look in the field of view?

A: _____

Q: If a microscope has an ocular with a 5x power, and has objectives with powers of 10x and 50x, what is the total magnification of: (Show your math for full credit!)

A: (low power) _____

A: (high power) _____

Q: If you are looking through a microscope at a freshly prepared wet mount and you see several perfect circles that are completely clear surrounding you specimen, what is the most likely explanation?

A: _____

Q: At which power do you see the greatest detail? _____

Q: At which power do you see the largest amount of the sample? _____

Q: At which power do you see the smallest amount of the sample? _____

Q: What do you notice about the images as you increased the magnification? _____

Post Lab

MICROSCOPE MADNESS
[SKIP THIS PAGE NOW… DO IT LAST!]

Self-Check

1. Can you name all the parts on a microscope? _____ **YES** _____ **NO**
2. Can you use a microscope? _____ **YES** _____ **NO**
3. Can you prepare slides of objects to be viewed under a microscope? _____ **YES** _____ **NO**
4. Can you examine an object under the microscope? _____ **YES** _____ **NO**
5. Can you explain how the lens system of your microscope changes the position of an object viewed through the eyepiece? _____ **YES** _____ **NO**

Q: Why should you always begin to use a microscope with the low-power objective?

A: _____

Q: Why should you only use the fine adjust when the high-power objective is in position?

A: _____

Q: Why must the specimen be centered before switching to high power?

A: _____

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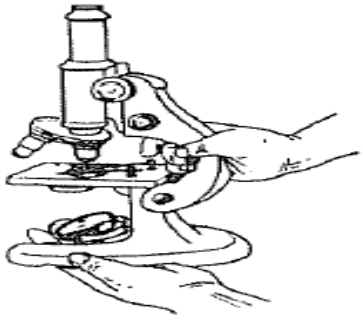
Q: At which power do you see the largest amount of the sample? _____

Q: At which power do you see the smallest amount of the sample? _____

Q: What do you notice about the images as you increased the magnification? _____

MICROSCOPE USE

ALWAYS USE BOTH HANDS TO CARRY A MICROSCOPE. Microscopes are precision instruments and should be handled with care. Place one hand underneath the base of the microscope to support its weight, and with the other hand firmly hold the arm of the microscope.



PICK THE MICROSCOPE UP; DO NOT DRAG IT ACROSS THE TABLE. Hold it upright and do not turn it upside down or the objective lenses can fall out and get damaged. If the microscope is too heavy or large to handle easily, get help or use a cart to transport it. Make sure the microscope is placed upright so its base is flat on the cart or table and so it will not tip over.

Place the excess cord **on the table!** If you let the excess cord dangle over the edge, your knee could get caught on it, and the next sound you hear will be a **very expensive crash.** I will bill you later!

MAKE SURE THE ELECTRICAL CORD IS WRAPPED UP NEATLY AND DOES NOT DRAG ON THE FLOOR. Wrap a rubber band, twist-tie or strap around the cord and tuck the coiled cord under the stage. If the cord detaches from the microscope's light source, it's best to disconnect the cord and handle it separately.

ALWAYS START AND END WITH LOW POWER!
Place the slide on the microscope stage, with the specimen directly over the **center** of the glass circle on the stage (directly over the light). Then you have a 9 out of 10 chance of finding the specimen **as soon as you look through the eyepiece!**

NOTE: *If you wear* **glasses***, try taking them* **off***; if you see only your* **eyelashes***, move* **closer.** *Be sure to* **close***, or* **cover** *your* **other** *eye!!*

ANOTHER NOTE: If you see a **dark line** that goes *part way* across the *field of view*, try turning the eyepiece. That dark line is a pointer that will be **very valuable** when you want to *point out* something to your *lab partner*, or your *teacher*!

If, ***and ONLY if***, you are on ***LOW POWER***, lower the objective lens to the **lowest point**, then focus using first the coarse knob, then the fine focus knob. **The specimen will be in focus when the *LOW POWER* objective is close to the *lowest point,* so start there and focus by *slowly* raising the lens.** If you can't get it **at all** into focus using the coarse knob, then switch to the fine focus knob.

Adjust the **Diaphragm** as you look through the **Eyepiece**, and you will see that **MORE** detail is visible when you allow in **LESS** light! **Too much** light will give the specimen a ***washed-out*** appearance. **TRY IT OUT!!**

Once you have found the specimen on Low Power unless **center** the specimen in your field of view, then, **without changing the focus knobs,** switch it to High Power. If you don't center the specimen you will lose it when you switch to **High Power.**

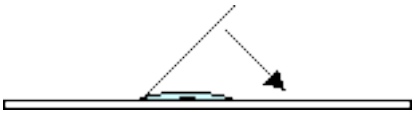
Once you have it on **High Power** remember that you **only use the fine focus knob!**

CAUTION! The High Power Objective is **very close** to the slide. Use of the coarse focus knob will **scratch** the lens, and **crack** the slide. More expensive sounds!

HOW TO MAKE A WET MOUNT SLIDE
1. Gather a **thin** slice/piece of whatever your specimen is. If your specimen is too thick, then the cover slip will wobble on top of the sample like a seesaw:

2. Place **ONE** drop of water **directly over** the specimen. If you put **too much water** over the specimen, then the cover slip will float on top of the water, making it harder to draw the specimens **as they float past the field of view!**

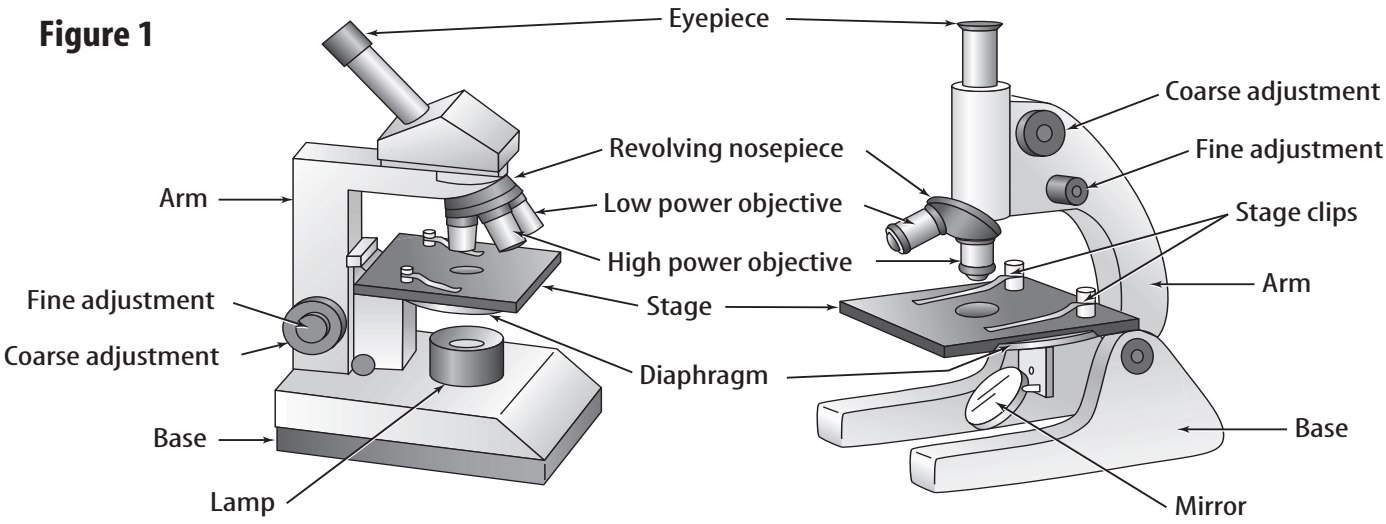
3. Place the cover slip at a 45-degree angle (approximately), with one edge touching the water drop, and **let go.**



PART 1

MICROSCOPE PARTS

Figure 1



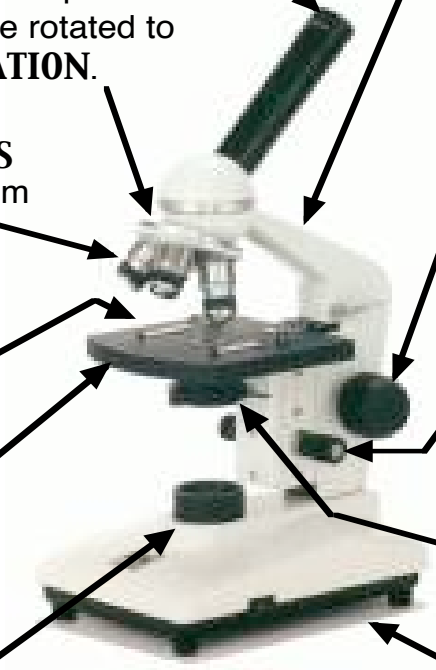
A. **EYEPIECE**
Contains the **OCULAR** lens

K. **ARM**
Used to **SUPPORT** the microscope when carried

B. **NOSEPIECE**
Holds the **HIGH**- and **LOW**- power objective **LENSES**; can be rotated to change **MAGNIFICATION**.

J. **COARSE ADJUSTMENT KNOB**
Moves the stage up and down for **FOCUSING**

C. **OBJECTIVE LENSES**
Magnification ranges from **10** X to **40** X



D. **STAGE CLIPS**
HOLD the slide in place

I. **FINE ADJUSTMENT KNOB**
Moves the stage slightly to **SHARPEN** the image

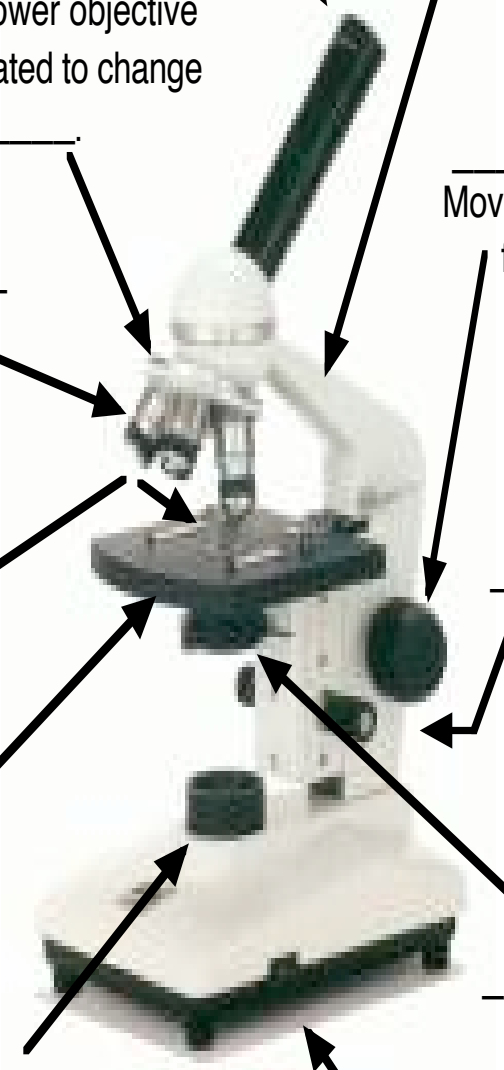
E. **STAGE**
Supports the **SLIDE** being viewed

H. **DIAPHRAGM**
Regulates the amount of **LIGHT** on the specimen

F. **LIGHT SOURCE**
Projects light **UPWARDS** through the diaphragm, the **SPECIMEN**, and the **LENSES**

G. **BASE**
Supports the **MICROSCOPE**

Use the previous diagrams to fill in the blanks:



A. _____
Contains the _____ lens

B. _____
Holds the ___- and ___- power objective _____; can be rotated to change _____.

C. _____ _____
Magnification ranges from ___ X to ___ X

D. _____ _____
_____ the slide in place

E. _____
Supports the _____ being viewed

F. _____ _____
Projects light _____ through the diaphragm, the _____, and the _____

G. _____
Supports the _____

H. _____
Regulates the amount of _____ on the specimen

I. _____
_____ _____
Moves the stage slightly to _____ the image

J. _____
_____ _____
Moves the stage up and down for _____

K. _____
Used to _____ the microscope when carried

GO GET A MICROSCOPE AND CONTINUE>>>

The ocular lens is marked with its magnification power. (This is how much larger the lens makes objects appear.)

What is the magnification power of the ocular lens of your microscope? _____

The three objective lenses are marked with their magnification power. The first number marked on each lens is the magnification power of that lens.

What is the magnification of the lowest power lens of your microscope? _____

What is the magnification of the high power lens? _____

To find the total magnification of your microscope as you are using it, multiply the ocular lens power times the power of the objective lens that you are using. For example, if the ocular lens of a microscope has a power of 5x and you use an objective that is 10x, then the total magnification of the microscope at that time is 50x (5x10=50).

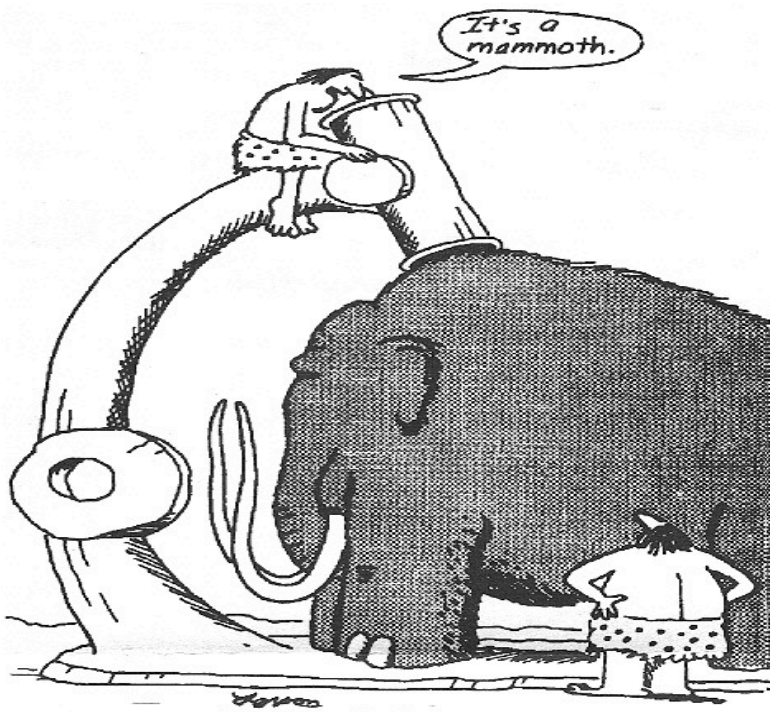
What is the total magnification of your microscope when using low power? _____

Eyepiece magnification _____	**(X)**	**Objective magnification** _____	**=**	**Total Magnification** _____**X**

What is the total magnification of your microscope when using high power? _____

Eyepiece magnification _____	**(X)**	**Objective magnification** _____	**=**	**Total Magnification** _____**X**

Teacher Check: _____



Early Microscope

PART 2

MICROSCOPE SLIDES

MATERIALS

Check off each item BEFORE you start.
___ Microscope ___ pencil
___ Glass Slide ___ scissors
___Cover slips ___ newspaper & magazine
___Dropper ___Metric Ruler
___Petri dish w/water

ALWAYS CARRY A MICROSCOPE IN AN UPRIGHT POSITION.

PROCEDURES

☐ **STEP 1**: Go to the rubric **on the last page** and read the criteria for level 3 and 4 work.

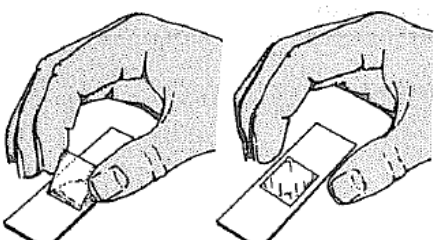
☐ **STEP 2**: Cut out a square piece of newspaper about 1cm wide that has a letter "e" (small font, not BOLD (8-12mm only – NO TITLES!) - place the paper on a glass slide as shown below.

☐ **STEP 3**: Using your eyedropper, put 1 drop of water on the paper square.

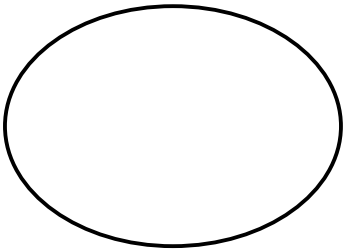
TECHNIQUE TIP: *Drop the water from about 1 cm above the slide; do not touch the dropper to the paper square or the paper will stick to it.*

☐ **STEP 4**: Now, cover the water drop with a clean cover slip. The best way to do this is shown in the diagram below. Hold the cover slip at a 45° angle to the slide and move it over the drop. As the water touches the cover slip, it will start to spread. Gently lower the angle of the cover slip to allow the water to evenly coat the under surface, then let the slip drop into place.

You should not just drop the cover slip onto the slide or air bubbles will get trapped. This makes the slide very difficult to study. If you do trap several air bubbles, remove the slip and try again. **NEVER PRESS ON THE COVER SLIP TO TRY TO REMOVE AIR BUBBLES**.
This will break the cover slip and/or damage your specimen.



STEP 5: Turn on the microscope and place the slide on the stage; making sure the "e" is facing the normal reading position (see the figure above). Using the course focus and low power, move the body tube down until the "e" can be seen clearly. Draw what you see in the space below.



Total Magnification:

STEP 6: Looking through the eyepiece, **move the slide to the upper right area of the stage.** What direction does the image move?

_____

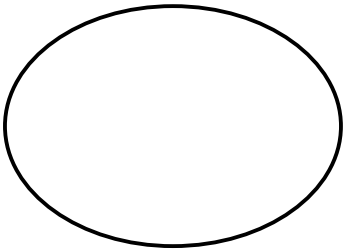
STEP 7: Now, move it to the lower left side of the stage. What direction does the image move?

_____

STEP 8: Re-center the slide and change the scope to high power. I**mportant Note:** Before switching to high power, you should **always** position the specimen in the center of the field of view and use the fine adjust to sharpen the focus of the image.

>>NEVER USE THE COARSE ADJUSTMENT KNOB WHEN USING HIGH POWER<<

Doing so could break the slide or the microscope! Watching from the side, switch to the high-power objective lens. Make sure that the lens does not hit the slide, but expect it to be very close. Draw what you see in the space below.



Total Magnification:

STEP 8: Look through the microscope (on high power) with the diaphragm at its largest setting. While looking through the ocular, switch the microscope to low-power. Compare the brightness of the field under high power and low power.

Which setting is brighter? _____ Why? _____

STEP 9: Select a picture from a magazine that has several bright colors. Cut out a 1 cm square from the picture that has a variety of colors. Clean off your slide from Part II and make a new wet mount with the magazine picture.

☐ **STEP 10**: Observe the magazine picture, starting on low power and scanning the image. Then switch to high power and observe the colors.

Record the colors seen **without** the microscope: Record the colors seen **with** the microscope:

_____ _____

☐ **STEP 11**: Prepare a new wet mount, this time using hair from people that are two different colors.
NOTE: <u>This does not mean to pull your or someone else's hair out!</u> Run your fingers through your hair and you'll probably find a strand or two. Better yet, if you have a comb or brush, slide that through your hair. If all else fails, cut a small specimen with scissors but…
UNDER NO CIRCUMSTANCES DO IT LIKE THIS >>

Cross the hairs on the slide (it may be easiest to cut each hair to about a 1 cm length) and cover them where they cross. View the slide under low power and focus on where they cross. Draw the image that you see in the circle below:

Total Magnification:

☐ **STEP 12**: Center the crossing point and switch to high power. Focus on the lighter of the two hairs, using the fine adjustment knob. Draw the image that you see in the circle below:

Total Magnification:

☐ **STEP 13**: Clean off your slides & cover slips. Follow the directions on page 4 when returning your microscope.

☐ **STEP 14**: **GO BACK** and complete the Post Lab on page 3, then fill out the rubric below.

My Effort Evaluation	My Achievement Evaluation
Scale: 4= Excellent **3**= Good **2**= Needs improvement **1**= Not acceptable	
☐ **4:** I worked on the task/lab until it was completed. I pushed myself to continue working even when I got distracted, difficulties arose or a solution was not obvious. I viewed difficulties as opportunities to strengthen my understanding.	☐ **4:** I exceeded the objectives and learning goals of this lesson/lab. I totally got the goal(s)!
☐**3:** I worked on the task/lab until it was completed. I pushed myself to continue working on the task even when difficulties arose or a solution was not obvious.	☐**3**: I met all the objectives and learning goals of this lesson/lab.
☐ **2**: I put some effort into the task/lab but I stopped working when difficulties arose and waited for the teacher or others to do it for me.	☐ **2**: I met some of the objectives and learning goals of this lesson/lab but did not get all of them.
☐ **1**: I put very little effort into the task/lab.	☐ **1**: I did not meet the objectives or learning goals of this lesson/lab.