

HOW TO USE A MICROSCOPE

New Mexico State University
All About Discovery!
nmsu.edu



www.clipartbest.com



WHAT IS A MICROSCOPE?

A microscope is an optical instrument.
It contains a
magnifying lens or a combination
of lenses for examining objects too
small to be seen distinctly and in detail by the
unaided eye.

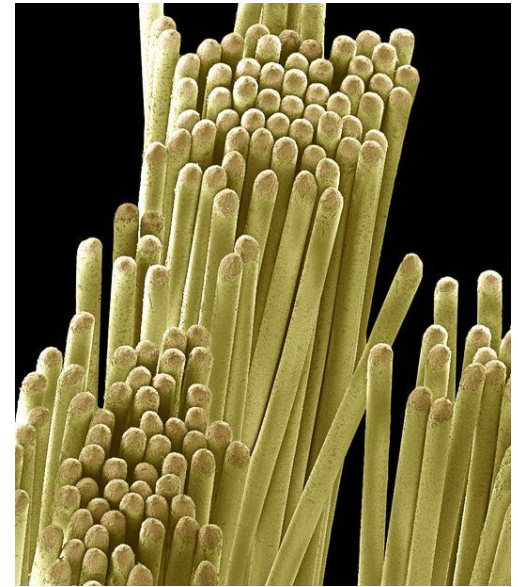


WHAT DOES A MICROSCOPE DO?

A microscope **MAGNIFIES** an object.



Tooth brush bristles



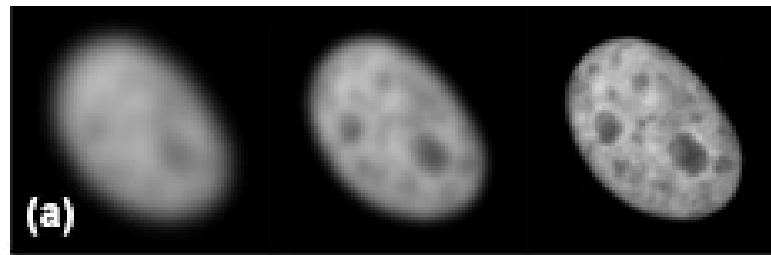
us-professional.gumbrand.com and fineartamerica.com

WHAT DOES A MICROSCOPE DO?

A microscope gives *resolution* to an object within a *field of view*.

The field of view is what you are able to see when looking into a microscope.

Resolution is the smallest distance between two points within the field of view and that can be noted as two distinct points.



—Increasing Optical Resolution—→

www.microscopyu.com

HISTORY OF MICROSCOPES



Leeuwenhoek
Microscope
(circa late 1600s)



British
Microscope
(circa 1865)



Microscopes Over the Ages

Hand-Held Microscope
(circa early 1700s)



Winkel-ZEISS
Dissecting
Microscope
(circa 1927)



ZEISS
Primo Star
(circa 2010)

Figure 1

<http://zeiss-campus.magnet.fsu.edu>

HISTORY OF MICROSCOPES

Zacharias and Hans Janssen – usually credited for inventing the first microscope.



Robert Hooke – built a compound microscope and looked at a piece of cork and noticed the many empty spaces, which he called cells.



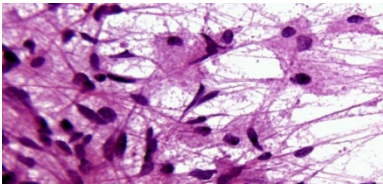
www.history-of-the-microscope.org, www.cas.miamioh.edu

HISTORY OF MICROSCOPES

Anton van Leeuwenhoek – built simple microscopes where he observed lake water, scrapings from teeth and gums, then found a variety of one-celled organisms, which he called *animalcules*.



Schleiden, Schwann and Virchow – helped develop the *cell-theory*; whereas, all living things are made up of cells.



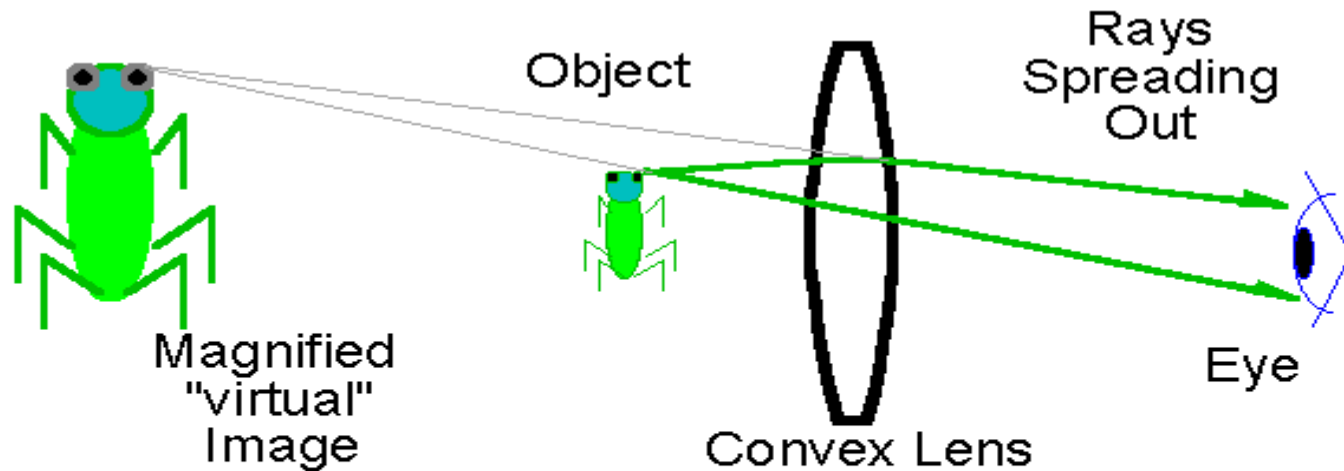
animacules.wordpress.com www.leafscience.com

HOW DOES A MICROSCOPE WORK?

A microscope works by using lights, mirrors and glass to magnify. The mirrors and glass bend the light in a certain way that it makes small objects appear larger.



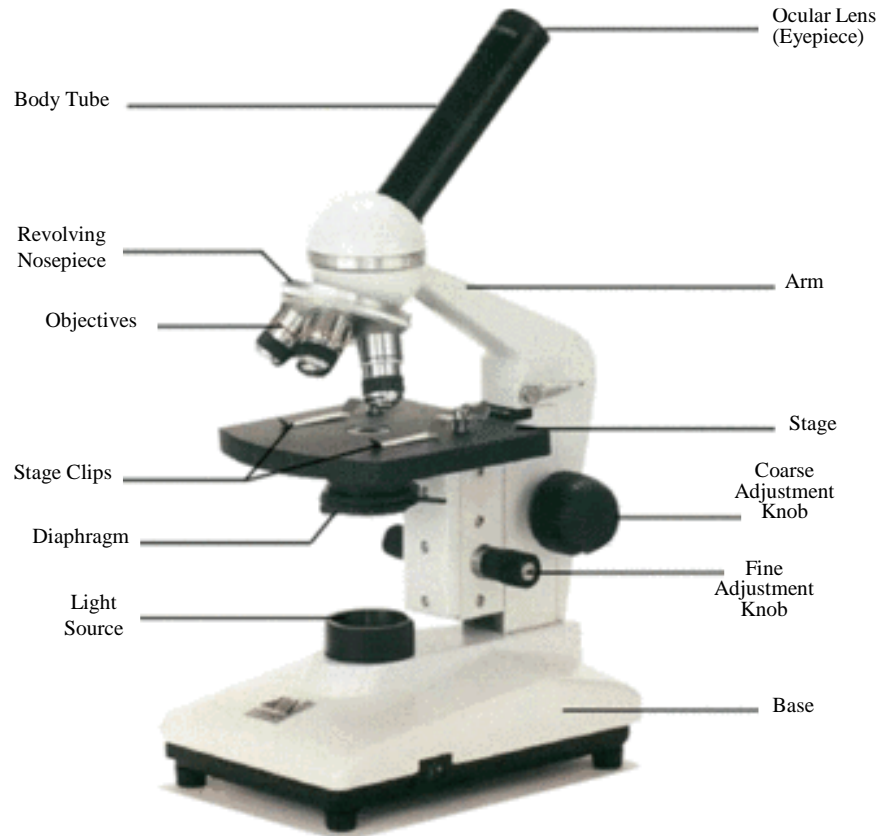
HOW A MICROSCOPE WORKS



If a convex lens is held near an object, the object looks bigger because the lens bends the light rays inward. The eyes trace the light rays back in straight lines and see a "virtual" image that is magnified.

optics.synopsys.com

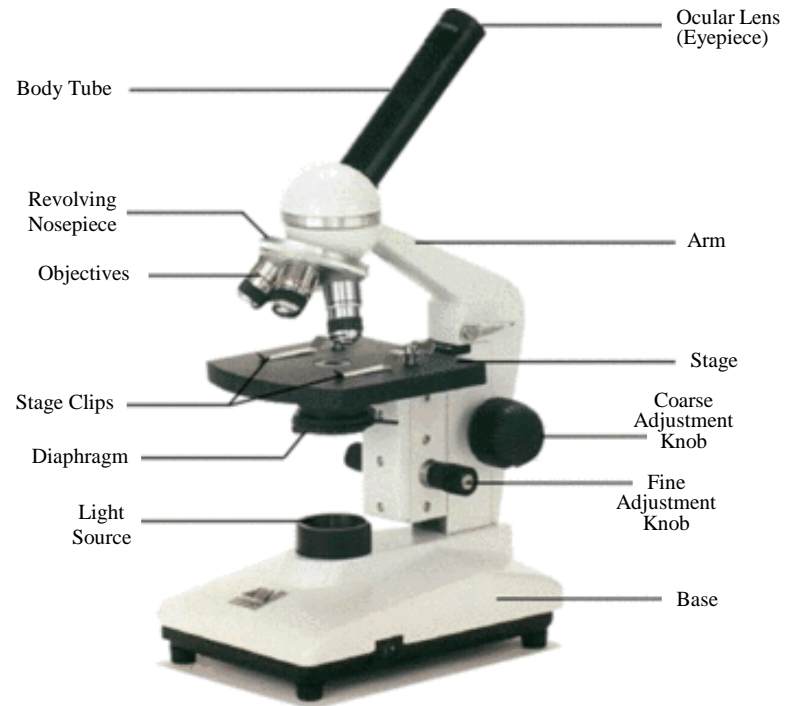
PARTS OF A MICROSCOPE



<https://mrsmaine.wikispaces.com>

PARTS OF A MICROSCOPE

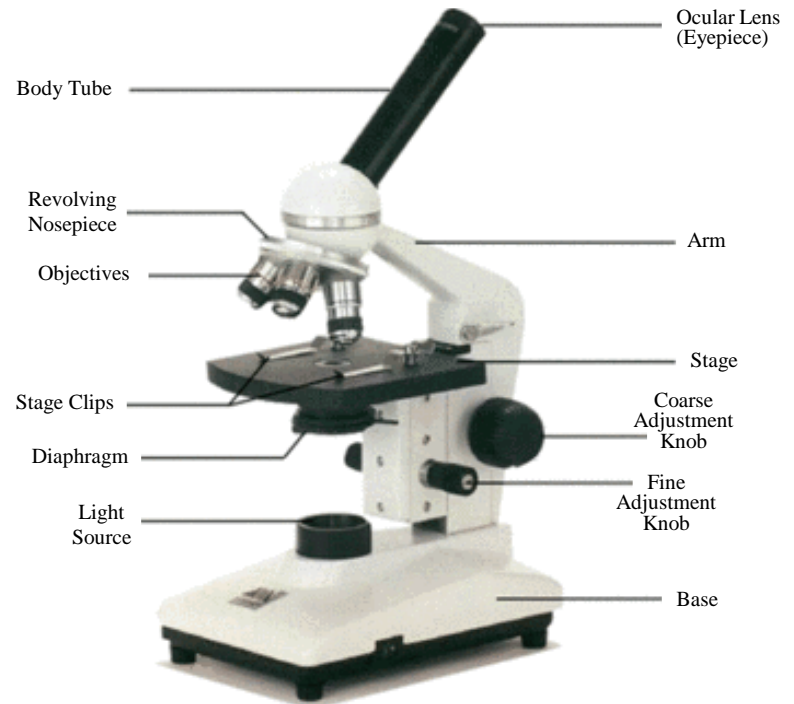
1. **Ocular** (eyepiece) – the lens you look through, magnifies specimen.
2. **Nosepiece** – holds the objective lenses.
3. **Objective lens** – magnifies the specimen.



<https://mrsmaine.wikispaces.com>

PARTS OF A MICROSCOPE

- 4. Stage** – where the slide is placed.
- 5. Stage clips** – holds the slide in place.
- 6. Diaphragm** – regulates the amount of light reaching the objective lens.



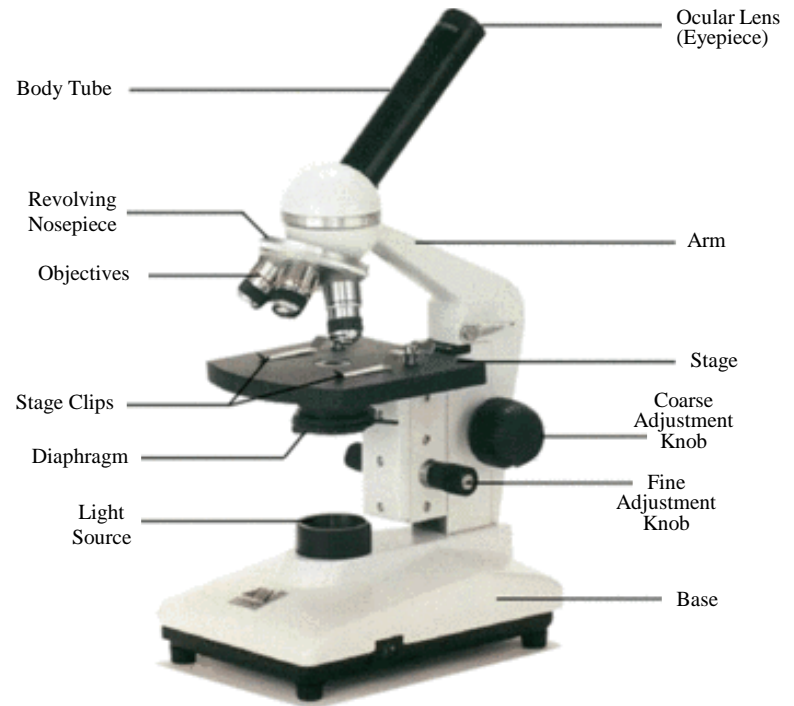
<https://mrsmaine.wikispaces.com>

PARTS OF A MICROSCOPE

7. Arm – supports the upper parts and used to carry the microscope.

8. Coarse focus knob – moves the objectives closer to the stage and to focus when using low power objectives.

9. Fine focus knob – used to focus when using high power objectives.

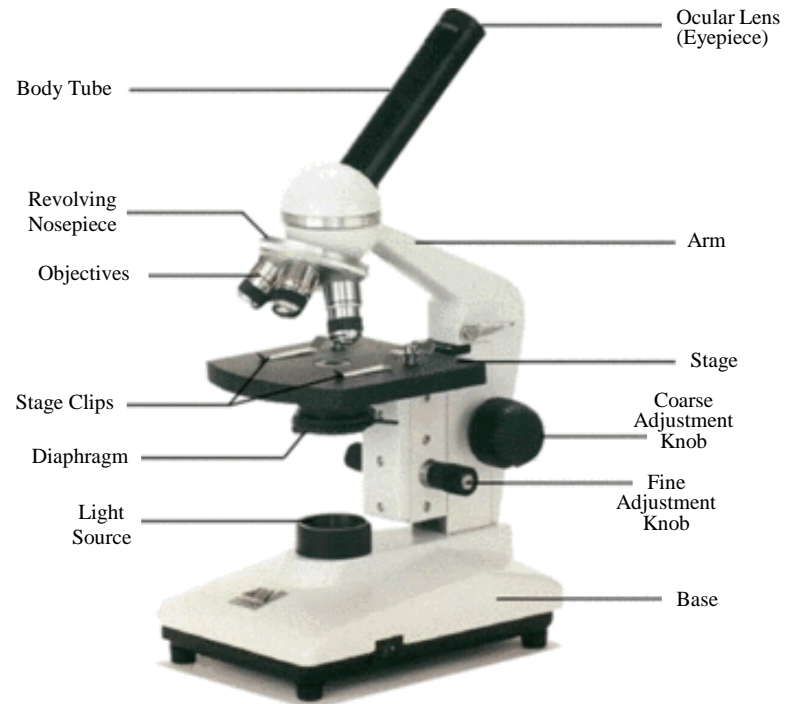


<https://mrsmaine.wikispaces.com>

PARTS OF A MICROSCOPE

10. Light source – provides light when microscope is turned on.

11. Base – supports the microscope and used to carry the scope. Use two hands!



<https://mrsmaine.wikispaces.com>

MAGNIFICATION

The total magnification of the microscope is determined by the product of the magnifying power of two lenses:

1. The eye piece (ocular lens) -



2. The objective lens -



<http://www.cas.miamioh.edu>

MAGNIFICATION

The eye piece magnification will stay constant, usually 10X.

The objective lenses are usually 4X (low power), 10X (medium power), and 40X (high power).

In our case, we have 10X and 43X power objectives. Double check the numbers etched into the side of the objective to make sure.

MAGNIFICATION

To find the total magnification you multiply the magnification from the eye piece and the objective lens, for example: 10 (ocular) x 4 (low power objective) = 40, total magnification is 40X.

Table 1. Calculating Total Magnification in the Light Microscope

Ocular Lens	Objective Lens	Total Magnification
10x	4x	40x
10x	10x	100x
10x	40x	400x
10x	100x	1000x

<http://openwetware.org>

MAGNIFICATION

You're turn!

If the ocular lens has a magnification of 10X and the objective lens has a magnification of 43X, what is the total magnification?

MAGNIFICATION

You're turn!

$$10 \times 43 = 430$$

Total magnification is 430x



MAGNIFIED BEE



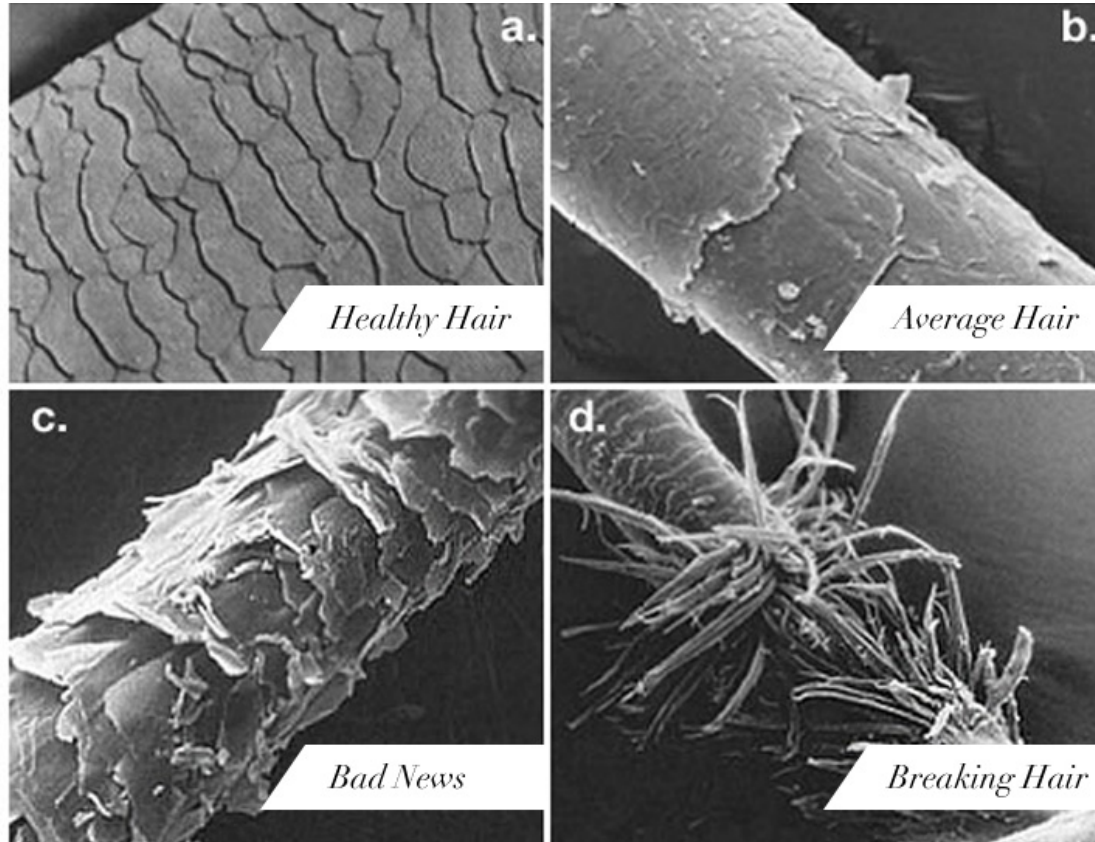
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MAGNIFIED HAIR



<http://sandra-markle.blogspot.com>



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PROPER HANDLING AND MAINTENANCE OF A MICROSCOPE

1. Always carry the microscope with TWO hands; by the arm and the base.
2. Only use lens cleaning paper to clean the microscope. Anything else will scratch the lenses.
3. Do not force the knobs.
4. Always store the microscope covered.

PROPER HANDLING OF MICROSCOPE SUPPLIES

1. If a slide breaks, DO NOT pick up the glass. Let your teacher know and they will clean it up.
2. Never share a toothpick when collecting skin cells. Always dispose of the toothpick immediately after use.



HOW TO FOCUS THE MICROSCOPE

Use the smallest power objective lens first.

The stage should be all the way down (farthest away from the objective lenses).

While looking through the ocular, turn the coarse focus knob so the objective lens gets closer to the stage. Be sure to also watch the objective so it doesn't touch the slide.

Once you can see the specimen, use the fine focus knob to get the specimen into focus.



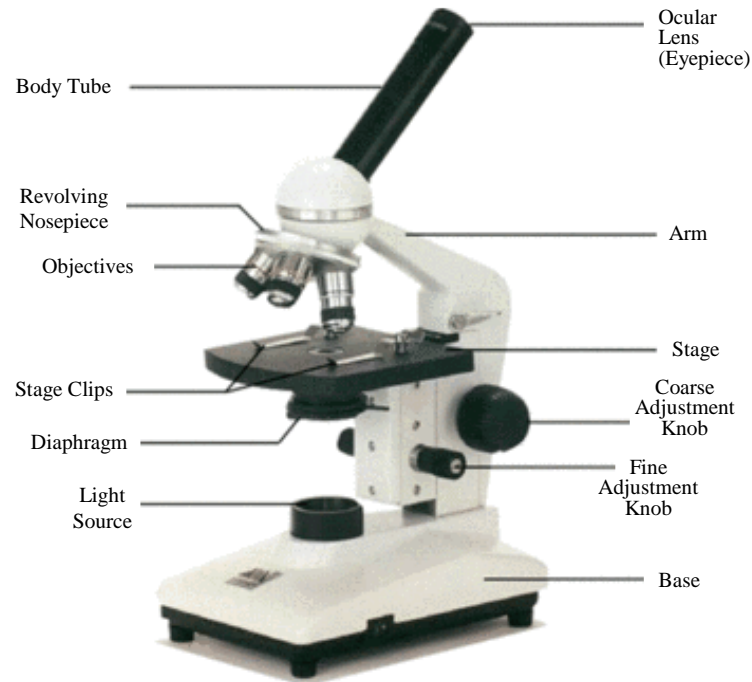
QUESTION

What adjustment knob do you use to move the objective lenses closer to the stage?



ANSWER

Coarse Adjustment Knob



QUESTION

Why do you have to watch the objective lenses from the side when moving the lenses with the coarse adjustment knob?



ANSWER

So you don't lower it to the point that it touches the slide and cracks it.



TROUBLE SHOOTING

Occasionally you may have trouble with working your microscope. Here are some common problems and solutions.

1. The image is too dark.

Adjust the diaphragm, make sure your light is on.

2. There's a spot in my viewing field, even when I move the slide the spot stays in the same place.

The lens is dirty. Use lens cleaning paper ONLY, to carefully clean the objective and ocular lenses. The ocular lens can be removed to clean the inside. The spot is probably a spec of dust.

TROUBLE SHOOTING

3. I can't see anything under high power.

Remember to start on low power, you won't be able to focus anything under high power.

Start at scanning and walk through the steps again.

4. Only half of my viewing field is lit, it looks like there's a half-moon in there.

You probably don't have your objective fully clicked into place.

LET'S GET STARTED!

1. Get a microscope from your teacher. Make sure to carry it with TWO hands!
2. Get 1 clean slide, 1 cover slip, scissor and paper with letters to cut out.
3. Cut out any letter from the sheet of paper.
4. Place the letter on the slide.
5. Gently place the coverslip over the letter.
6. Plug in the microscope

LET'S GET STARTED!

7. Make sure the lowest power objective lens is in place.
8. Place the slide securely under the stage clips.
9. Turn on the light. It's underneath the stage.
10. Using the coarse adjustment knob, carefully lower the objective lens until you see the specimen.
11. Once you see the specimen, use the fine adjustment knob to get the specimen in focus.
12. HAVE FUN!

