

How to Use a Microscope

Overview Welcome to our unit on microscopes! We're going to learn how to use our microscope to make things appear larger so we can study them more easily. If you've ever wondered what you're eating for dinner, how many toes ants have, or if caterpillars have armpits, then this is the lab for you. How do the lenses work to make objects larger? We're going to take a closer look at optics, magnification, lenses, and how to draw what you see with this lesson.

What to Learn The compound microscope is a set of lenses stacked so they work together to make things look bigger. For example, if you're using a 10x eyepiece (where your eye looks into) and a 40x objective (the lens near the slide), then you're using a 400x power setting. You use a dry mount to get your specimens ready for viewing.

Materials

- microscope
- slides
- coverslips
- tape
- a penny
- the letter "e"
- scissors
- an object to dry mount, such as a strand of hair

Experiment

1. Take a look at the eyepiece of your microscope. Do you see a number followed by an X? That tells you the magnification of your microscope. If it's a 10X, then it will make objects appear ten times larger than usual.
2. Now look at the objective lenses. They're on the nose of the microscope, and there are usually 3 or 4 of them. Do you see the little numbers printed on the side of the lenses, also followed by an X? What is that number on your microscope?
3. Here are the settings on a microscope. Fill out the table to figure out how to set the lenses for the different magnification powers:

Eyepiece	Objective	Total Magnification
10X	4X	
10X		100X
	40X	400X
10X		1000X

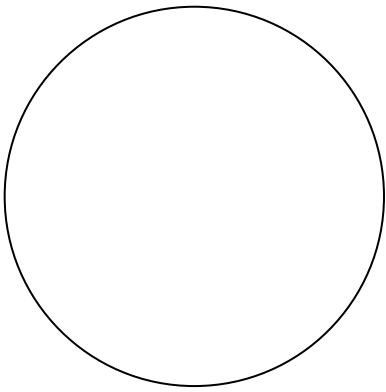
4. Carefully cut a single letter (like an “a” or “e”) from your lab sheet here → a e
5. Use your tweezers to place the small letter on a slide and place a coverslip over it (be careful with these – they are thin pieces of glass that break easily!) If your letter slides around, add a drop of water and it should stick to the slide.
6. Lower the stage to the lowest setting using the coarse adjustment knob (look at the *stage* when you do this, not through the eyepiece).
7. Place your slide in the stage clips.
8. Turn the diaphragm to the largest hole setting (open the iris all the way).
9. Move the nose so that the lowest power objective lens is the one you’re using.
10. Bring the stage up halfway and peek through the eyepiece.
11. If you’re using a mirror, rotate the mirror as you look through the eyepiece until you find the brightest spot. You’ll probably only see a fuzzy patch, but you should be able to tell bright from dim at this point.
12. Use the coarse adjust to move the stage slowly up to bring it into rough focus. If you’ve lowered the stage all the way, you’ll see it pop into focus easily. (Be careful you don’t ram the stage into the lens!)
13. Use the fine adjust to bring it into sharp focus.
14. Draw a picture of that the letter looks like under the lowest power setting in your first circle (see *Microscope Lab Data* below) and label it ‘right side up’.
15. Give the slide a half turn and draw another picture in a new circle. Label this one ‘upside-down’.
16. If you’re using a mechanical stage, twist one of the knobs so that the slide physically moves to the right as you look from the side (not through the eyepiece) of the microscope. If you’re using stage clips, just nudge the slide to the right with your finger.
17. Now peek through the eyepiece as you move the slide to the right – which way does your letter move?
18. Now do the same for the other direction – make the slide move toward you. Which way does the letter appear to move when you look through the eyepiece?
What effect do the two lenses have on the letter image as you move it around?
19. Look back at your two drawings. Let’s make them so they are totally useful, the way scientists label their own sketches. We’re going to add a border, title, power of magnification, and more to get you in the habit of labeling correctly. Here’s how you do it:
 - a. **Border** You need to frame the picture so the person looking at it knows where the image starts and ends. Use a water glass to help make a perfect circle every time. When I sketch at the scope, I’ll fill

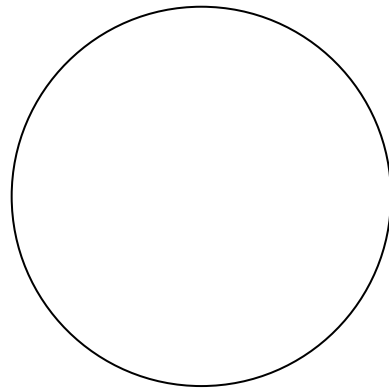
an entire page with circles before I start so I can quickly move from image to image as I switch slides.

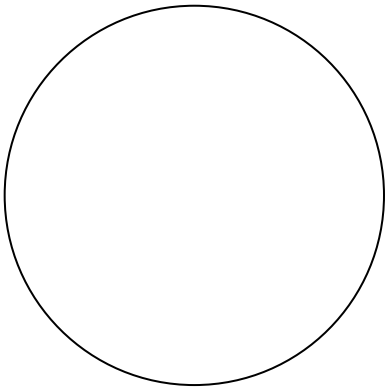
- b. **Title** What *IS* it? Paramecia, goat boogers, or just a dirty slide? Let everyone (including you!) know what it is by writing exactly what it is. You can use bold lettering or underline to keep it separate from any notes you take nearby.
- c. **Magnification Power** This is particularly useful for later, if you need to come back and reference the image. You'll be quickly and easily able to duplicate your own experiment again and again, because you know how it was done.
- d. **Proportions** This is where you need to draw only what you see. Don't make the image larger or smaller – just draw exactly what you see.

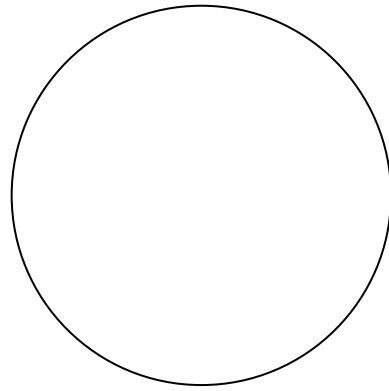
- 20. Pull a hair from your head and lay it on a slide. If it's super-curly, use a bit of tape at either end, stretching it along the length of the slide. Keep the tape near the ends so it doesn't come into your field of view when you look through the microscope.
- 21. Lower the stage to the lowest setting and rotate the nose piece to the lowest magnification power.
- 22. Place the slide on the stage in your clips.
- 23. Focus the hair by looking through the eyepiece and slowly turning the coarse adjustment knob. When you're close to focus, switch to the fine adjustment knob until it pops into sharp view.
- 24. Sketch what you see (don't forget the title and mag power!) in the third circle in *Microscope Lab Data* below.
- 25. Stop and look around the classroom. Find at least six things to look at. We're not only learning how to look and draw, but hammering a habit of how to handle the scope properly, so do as many as you can find. Don't forget to check the windowsills for interesting bits. Use baby food jars or film canisters to collect your specimens in and keep them safe until you need them.
- 26. Lower the stage all the way and insert a new slide... and repeat this process for all six specimens.

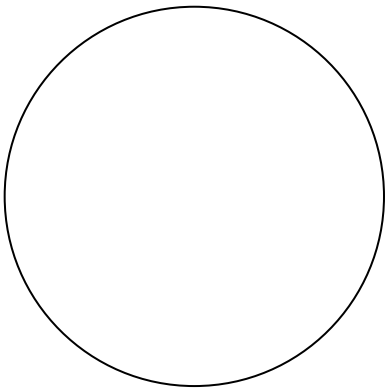
Microscope Lab Data

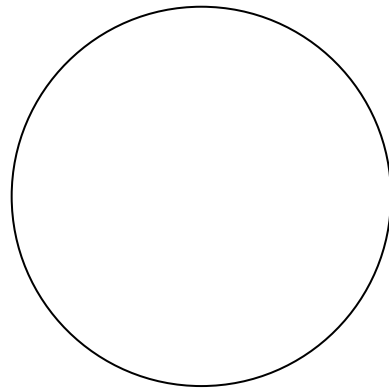




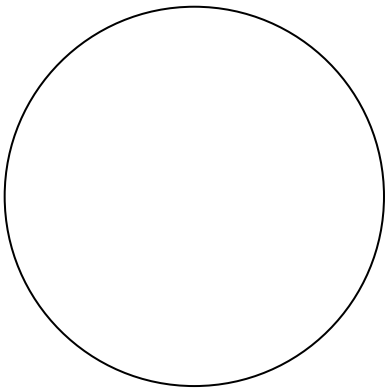


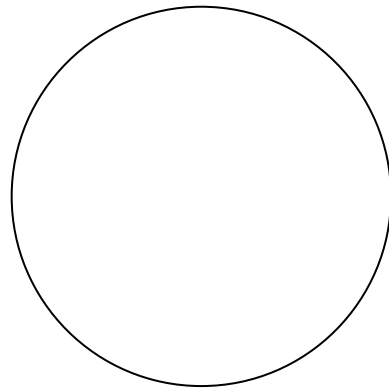


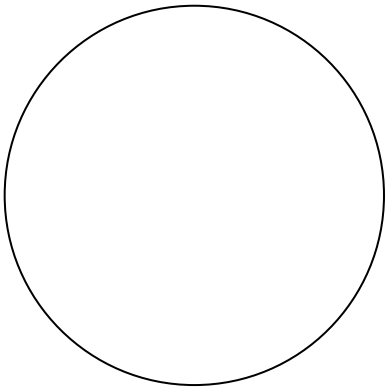


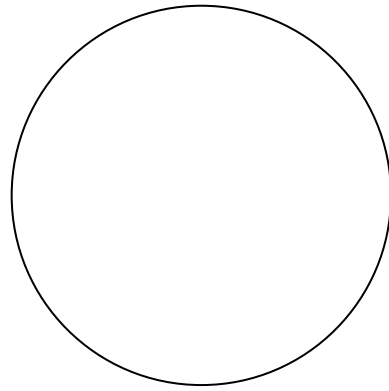


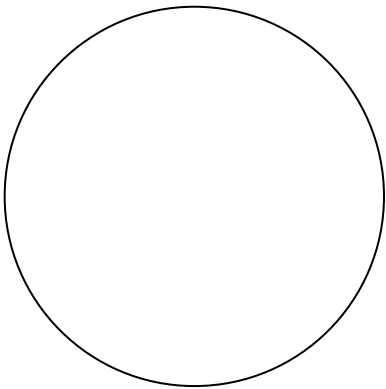
Microscope Lab Data

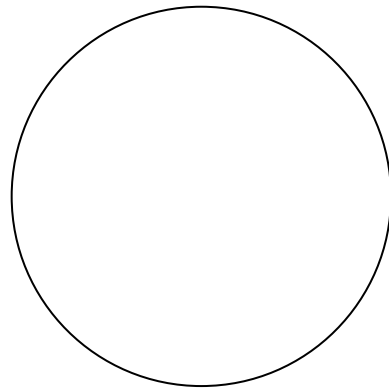












Reading

A compound microscope is really just a set of lenses stacked so they work together to make things look bigger. For example, if you're using a 10x eyepiece (where your eye looks into) and a 40x objective (the lens near the slide), then you're using a 400x power setting.

Not only is it important to learn how to work the scope, but you need to learn how to sketch what you see, or the information on the slide is only useful to one person – you. Make sure you always add a border (so your viewer knows where your drawing starts and ends), title (so you know what you were looking at), power of magnification (so you can do it again if needed), and keep your proportions accurate when you draw the image.

You can use either a dry or wet mount to get your specimens ready for viewing. A dry mount doesn't use any chemicals, water, or glue... and sometimes not even a coverslip. Just stick it on the slide and you're good to go. This is a great place to start when first using a scope.

Anatomy of Microscope

Nose? Objective? Stage? What kind of class is this? Well, some of the names may sound a bit odd, but this video will show you what they are and how they are used. As you watch the video, touch the corresponding part of your microscope to get a feel for how it works.

NOTE: Be very careful NOT to raise the stage too high or you'll crack the objective lens! Always leave a space between the stage and the lens!! Anytime you use the coarse adjustment knob, always look at the stage itself, NOT through the eyepiece (for this very reason). When you use the fine adjustment knob, that's when you look through the eyepiece.

Care and Cleaning

1. Pick up the microscope with two hands. Always grab the arm with one hand and the legs (base) with the other.
2. Don't touch the lenses with your fingers. The oil on your fingers will smudge and etch the lenses. Use an optical wipe if you must clean the lenses. Steer clear of toilet paper and paper towels – they will scratch your lenses.
3. When you're done with your scope for the day, reset it so that it's on the lowest power of magnification and lower the stage to the lowest position. Cover it with your dust cover or place it in its case.

Preparing a Dry Mount

This is simplest form of slide preparation! All you need to do is place it on the slide, use a coverslip (and you don't even have to do that if it's too bumpy), and take a look through the eyepiece. No water stains or glue required.

You know that this is the mount type you need when your specimen doesn't require water to live. Good examples of things you can try are cloth fibers (the image here is of cotton thread at 40X magnification), wool, human hair, salt, and sugar. It's especially fun to mix up salt and sugar first, and then look at it under the scope to see if you can tell the difference.

Exercises

1. Why do we use microscopes?
2. What's the highest power of magnification on your microscope? Lowest?
3. Where are the two places you should NEVER touch on your microscope?
4. Fill in the blanks with the appropriate word to describe care and cleaning of your microscope:

fingers
arm

lowest
toilet paper

hands
legs dust cover

1. Pick up the microscope with two _____. Always grab the _____ with one hand and the _____(base) with the other.
2. Don't touch the lenses with your _____. The oil will smudge and etch the lenses. Use an optical wipe if you must clean the lenses. Steer clear of _____ and paper towels – they will scratch your lenses.
3. When you're done with your scope for the day, reset it so that it's on the _____ power of magnification and lower the stage to the lowest position. Cover it with your _____ or place it in its case.
5. What things must be present on your drawing so others know what they're looking at?
6. What's the proper way to use the coarse adjustment knob so you don't crack the objective lens?
7. List three possible combination of eyepiece and objective lenses if the power of magnification is 100X.

8. Briefly describe how to dry mount a slide.

9. How could you view a copper penny with your microscope?

Answers to Exercises : How to Use a Microscope

1. Why do we use microscopes? (To see into the tiny world of microorganisms)
2. What's the highest power of magnification on your microscope? Lowest?(answers may vary. Make sure students calculate magnification power properly: multiply the objective lens by the eyepiece power)
3. Where are the two places you should NEVER touch on your microscope?(the glass part of the objective lens or the glass part of the eyepiece).

4. Fill in the blanks with the appropriate word to describe care and cleaning of your microscope:

fingers	lowest	hands	
arm	toilet paper	legs	dust cover

1. Pick up the microscope with two __hands__. Always grab the __arm__ with one hand and the __legs__(base) with the other.
2. Don't touch the lenses with your _fingers_. The oil will smudge and etch the lenses. Use an optical wipe if you must clean the lenses. Steer clear of __toilet paper_ and paper towels – they will scratch your lenses.
3. When you're done with your scope for the day, reset it so that it's on the _lowest_ power of magnification and lower the stage to the lowest position. Cover it with your _dust cover_ or place it in its case.
5. What things must be present on your drawing so others know what they're looking at? (a border, a title, the magnification power, proper proportions).
6. What's the proper way to use the coarse adjustment knob so you don't crack the objective lens? (Look at the stage as you raise it with the coarse adjustment knob, and don't allow the stage to touch the objective lens.)
7. List three possible combination of eyepiece and objective lenses if the power of magnification is 100X. (10x and 10x; 4x and 25x; 5x and 20x)
8. Briefly describe how to dry mount a slide. (Put the object on the slide. Tape it down on the sides if it curls up too much. Put a cover slip on it, if the object is not too bumpy or bulky).
9. How could you view a copper penny with your microscope? (Put the penny on a slide without a cover slip. Tape it down on the sides.)