

Microscope

Instruction and Activity Guide

A large circular graphic containing a silhouette of a person's head and shoulders in profile, looking through the eyepiece of a microscope. The microscope is also in silhouette, positioned below the person's eye. The background within the circle is a light, textured pattern.

Introduce you to the hidden wonders of the microscopic world!

CAUTION:

To avoid eye injury, do not reflect direct sunlight through the microscope.

Getting acquainted with the microscope

Before students begin observing specimens, have them take some time to learn about the different parts of the microscope. Their experiments will be more successful!

To begin: carefully remove the microscope from the package using both hands to grasp the back and the base of the unit. Place the microscope on a flat surface near a light source such as a lamp or a window. Next, introduce students to the microscope by using this diagram to locate the different parts:

- A. Eyepiece: has a 10X-20X zoom lens.
- B. Body Tube: extends below the eyepiece and is used to focus the lenses.
- C. Focus Knobs: are located at the arm top. Turn these two knobs and see the focus change in the eyepiece. Turn slowly to get the best focus.
- D. Rotating Objective Turret with Power Indicator: has three lenses attached with varying powers of magnification.
 - * The shortest lens (5x) has the weakest magnifying power.
 - * The longest lens (60x) has the highest level of magnifying power.
 - * If the 60x lens is used, and the zoom eyepiece is turned to maximum power, the object under the microscope will be magnified 1200 times. It will appear 1200 times larger than when viewed with the naked eye.
- E. Stage: is located just below the rotating objective turret. The stage is a flat surface with a hole in the center to allow light to reflect from the mirror, or the battery-operated viewing light, to the microscope lenses.
- F. Stage Clips: hold the slide firmly in place.
- G. Reflecting Mirror / Viewing Light: are located just below the stage. The angle of the mirror can be adjusted to control the amount of light entering the microscope. The viewing light is located beneath the mirror. If additional light is needed, flip the mirror over and the light will turn on. When facing down, the light will be off.

Important: To switch from mirror to light, and vice versa, flip the light up and down. Do not turn the mirror/light from side to side in a clockwise or counterclockwise manner. If you inadvertently do so, the light will not go on in the upright position. To correct, make a 1 / 2 rotation clockwise.

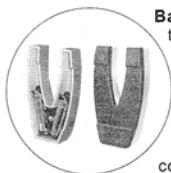
H. Horseshoe-Shaped Base: features a rubberized, non-skid bottom. Remove the base to replace the two AA batteries.



I. Projector Hood: projects and image of the specimen viewed on the stage onto a wall or screen. Ideal for group study. (When not in use, unscrew the projector hood by turning counterclockwise. Replace it with the zoom eyepiece.)



Battery Installation: The light on the microscope requires fresh AA alkaline batteries. The battery compartment is located in the base of the unit. Carefully remove the cover on the base to insert or replace two AA batteries inside as shown in the diagram. Do not mix old and new batteries. Be sure to put the batteries in correctly.



USING THE PROJECTOR HOOD

The projector hood lets small or large groups of students view a specimen at the same time. The projector hood can be used to project an image in two ways: viewing screen on the hood itself (for small groups), and via wall or screen projection (for class wide viewing). Here is how to use the projector hood:

To attach the projector hood:

1. Remove the eyepiece by turning it counterclockwise.
2. Place the hood on top of the body tube.
3. Turn the projector hood clockwise until it is securely in place.



Using the projector hood with a small group

1. When using the projector hood, the light bulb, rather than the mirror, will be used. Flip the mirror down so the light bulb is upright projecting light through the stage.
2. Place a slide onto the microscope stage.
3. You will see the specimen projected on the viewing screen. Adjust the focus knobs until the image is sharp and clear.

Using the projector hood for projecting on a wall or screen

1. Attach a piece of paper to the wall at the same height as the projector hood.
2. Place the microscope 15 to 20 inches from the wall. Aim the viewing port toward the paper (or screen).
3. Remove the viewing screen from the projector hood.
4. Make the room as dark as possible. An image of the specimen on the stage will be projected on the wall.



activity

This activity will help students understand the process of increasing magnification.

1. Remove the dust cap from the eyepiece.
2. Rotate the focus knob to raise the body tube to the highest point. Turn the turret to the lowest power of magnification (50x/100x).
3. Cut a single alphabet letter out of an old newspaper or magazine.
4. Place this letter on a clear slide.
5. Fill the dropper with water and place a drop on the slide.
6. Place a cover slip over the water and letter.
7. Using the stage clip, place the slide on the stage and move the "letter" towards the center hole.
8. Rotate the focus knob and lower the body tube to the lowest point.
NOTE: TO AVOID BREAKAGE, DO NOT TOUCH THE SLIDE WITH THE VIEWING LENS.
9. Now rotate the focus knob slowly to raise the body tube until a clear image of the letter is seen through the eyepiece.
10. Adjust the angle of the mirror to let an adequate amount of light enter the microscope. (Use the light if necessary.) The image you will see is upside down and reversed. When you move the slide to the left, the image will move to the right and vice versa.
11. By rotating the objective turret, you can change the magnification of the image. Notice that when the image is enlarged, less of the subject is visible. When the magnifying power is increased, the viewing area and its illumination will decrease accordingly. Doubling the magnifying power reduces the brightness by 75%. Adjust the mirror to allow more light to enter the microscope.
12. Repeat this process of magnification several times until you are familiar with the process of increasing magnification.

using slides to observe

Specimens

The Microscope Set includes some slides that have already been prepared. Students can also make their own.

PREPARING A SLIDE

You will need: a slide, tweezers, water dropper, water, specimen, cover slip, blank label, gum media (for permanent mounts).

1. To prepare a slide of an object, place a drop of water in the center of a clean slide.
2. Use tweezers to place the object in the water. (If the object is already in water, place a drop of it in the center of a clean slide.)
3. To place a cover slip over the object, hold the cover slip at a 45-degree angle to the drop of water and carefully lower the slip onto the water is edge.

4. Gently lay the rest of the cover slip over the water. Do not press down on it. Pressure may break the cover slip or squash the object. Remove any extra water that leaks outside the cover slip by blotting it with a tissue.
5. Next, place the slide on the stage, using the stage clips to hold the slide in place.

Adjust the microscope for viewing.

When you are finished viewing the slide, take it off the stage. Carefully lift the cover slip. If you are not going to make a permanent mount, rinse the slide and the cover slip with tap water and dry with a soft, clean cloth. If the slide is very dirty, soak it before rinsing.



WARNING: Handle the tweezers and scalpel only under direct adult supervision. Always handle these tools with care (with the sharper ends pointed away from your body).

USING THE COLOR FILTER UNIT

Color filters are used to enhance contrast and detail when viewing slides. The color filter included with this microscope is located on the underside of the stage. Press the color filter onto the bottom of the stage will accommodate the opening in the center of the filter. (The others model just turn the dial at the front of the stage to switch filters)

MAKING A PERMANENT MOUNT

If you want to observe the same specimen many times you will need to make a permanently mounted slide. Follow the steps above, except that in place of water, put one or two drops of gum media. Allow about one day to dry. Be sure to label your permanent specimen.

MAKING SMEARS

Here is how to make a smears:

You will need: a clean slide, water dropper, spatula, cover slip, potato, and scalpel (for cutting a piece off the potato).

1. With the edge of the spatula, gently scrape the surface of a freshly cut potato.
2. Smear the potato substance onto a clean slide.
3. Use the water dropper to add a drop of water to the specimen slide.
4. Place a cover slip over the specimen.
5. Now take the slide and place it on the microscope. You'll see hundreds of starch grains.

Try making smears from these items: apple, pear, peach, banana, and corn. Compare their appearance with that of the potato.

STAINING SMEARS

You will need: a clean slide, water dropper, spatula, cover slip, and eosin stain.

1. Make a fresh smear as described in Steps 1 to 3 above.
2. **DO NOT** cover with a cover slip. Instead, set the slide aside to dry.

The following experiments will give students a good introduction to using slides with the microscope.

- When the slide is dry, use the water dropper to place one drop of eosin stain onto the slide. (Be sure to clean the dropper with fresh water when you are finished.)
- Pick up the slide and slightly tilt it to spread the stain completely over the specimen area. Set the slide down and wait about two minutes.
- After two minutes, hold the slide at an angle over a sink or waste container. Gently and slowly rinse the slide with a water dropper full of clean water. This flushes away excess stain and stops the staining action.
- With a paper towel, pat the excess moisture off the slide, taking care not to touch the specimen. Then allow the specimen to continue to air dry.

Note: Most of the specimen will have been flushed away with the stain, but enough will remain on the slide for viewing.

GROWING & OBSERVING CRYSTALS

Crystals are fascinating to look at. They have smooth, flat surfaces and sharp-edged corners. There are seven different types of crystals: cubic, tetragonal, triclinic, trigonal, orthorhombic, monoclinic, and hexagonal. The following experiments will help students see some of these shapes.

You will need:

- | | |
|--|----------------|
| 1. Small amounts of sea salt, sugar, baking soda and Epsom salts | |
| 2. Water dropper | 5. Spatula |
| 3. 4 slides | 6. Toothpicks |
| 4. 4 blank labels | 7. Marking pen |

Follow these directions:

- * Make a label for each of the slides: sea salt, sugar, baking soda, and Epsom salts.
- * Using a spatula or small spoon, place a very small amount of each sample in the center of its labeled slide.
- * Add a drop of hot water to the first sample and gently stir with a toothpick.
- * Place the slide under the stage clips on the stage and look through the microscope at the crystal solution. As the solution cools, watch how the crystals form.
- * Draw or write what you see in the Crystal Observation Table (below). Look at the crystal shapes drawn on the table, and decide the crystal shape of your sample. Write it in the last column of the table.
- * Repeat this procedure with the Epsom salts, baking soda, and sugar.

Think about it!

Does each sample form a certain type of crystal shape?

Which sample had the best crystals?

Now that you've explored some common materials, you may want to test other materials. Try artificial sugar, flour, powdered drink mix, soap flakes, boric acid, and baking powder.

CRYSTAL OBSERVATION TABLE

Directions: Use this table to record the observations you make of your crystal experiments.

Sample	Observations and Drawings	Crystal Shape
Sea Salt		
Sugar		
Baking Soda		
Epsom Salts		
Others		

RAISING AND OBSERVING BRINE SHRIMP

Brine shrimp are easy to raise and fun to watch as they develop from eggs to adults. This activity will let students observe how brine shrimp hatch and grow into adults.

You will need:

1. a clean jar
2. brine shrimp hatchery
3. brine shrimp eggs
4. sea salt
5. water dropper
6. dried yeast



Getting Ready

1. In a clean jar, mix the vial of sea salt with approximately 5 1/2 ounces of water. Stir until all the salt is dissolved.
2. Put a sprinkle of brine shrimp eggs in the jar with the dissolved sea salt and cover it.
3. Set the jar in a safe, well-lit area. It should remain there (at room temperature) for 24 to 36 hours.

Hatching the Eggs

1. If the solution has been kept suitably warm, brine shrimp eggs should hatch in two to three days.
2. After the shrimp in the jar have hatched, you may remove them with the water dropper and transfer them to the hatchery (be sure to rinse the hatchery before using). (If you are doing more than one "batch," you may use the different compartments for different age groups.)
3. Add some of the sea salt solution to the compartment, making sure that the solution is the same strength throughout the life cycle.
4. Every other day, feed the shrimp sparingly by adding just a pinch of dried yeast to the solution. If the solution becomes cloudy, transfer the shrimp at once to a freshly prepared sea salt solution.

BRINE SHRIMP OBSERVATION TABLE

Directions: Use this observation table to make notes and drawings of the changes you see as the brine shrimp develop and grow.

Day / Hour	Notes and Drawings
Day 1	
Day 2	
Day 3	
Day 4	
Day 5	
Day 7 (feed)	
Day 9	
Day 14 (feed)	

Observing the Brine Shrimp

Once the brine shrimp hatch, use the water dropper to collect some of the eggs and wiggling hatchlings and look at them under the microscope. Have students use the Brine Shrimp Observation Table (below) to record daily observations about the growth of the brine shrimp. How are they changing? What do they look like?

Observing soil creatures

There are thousands of different types of interesting creatures living in moist soil. The following activity will introduce students to some of them.

You will Need:

1. Tweezers
2. Clean slides
3. Cover slips
4. Water dropper
5. Blank labels

Collecting Soil Samples:

Have students use tweezers or a spoon to take small samples of moist soil from different places around the school yard or at home. Some good places to collect from are: vegetable gardens, flower pots, grassy or lawn areas, compost piles, tree litter, farm land, and muddy areas. (Make sure students identify where each sample was taken.)

Observing Soil Samples:

1. Have students make slides of the samples. Remember to add a drop of water to the sample. Place slides on the microscope for viewing. (Remember to use the projector hood if working in groups.)
2. Be sure that students wash their hands after handling water samples.
3. Give students a copy of the Soil Creature Observation Table (below). As students observe the samples, they can record their findings on the table.

SOIL CREATURE OBSERVATION TABLE

Where the Soil Came From	Observations and Drawings	Creatures' Names

Observing Water Creatures

There are thousands of different types of fascinating creatures living in water. This activity will give students the opportunity to look at some of them close up!

You will need:

1. Clean slides
2. Cover slips
3. Water dropper
4. Blank labels

Collecting Water Samples

Use a water dropper to collect very small samples of water from different places such as: puddles, water fountains, streams, marshes and tide pools. Place samples in small jars or cups. Be sure to label where each sample was taken.

Observing Water Samples

1. Have students make slides of the samples. Place slides on the microscope for viewing. (Remember to use the projector hood if working in groups.)
2. Be sure that students wash their hands after handling water samples.
3. Give students copies of the Water Creature Observation Table (below). As students observe the samples, they can record their findings on the table.

WATER CREATURE OBSERVATION TABLE

Where the Water Came From	Observations and Drawings	Creatures' Names

Viewing Tip: Trying to look at water creatures that are moving too quickly to be observed effectively? To slow down a fast-moving creature, put a small drop of corn syrup on the slide. Other things that can be added to slow creatures' movements are cotton threads or a single speck of yeast. You might also use the edge of a paper towel to soak up some of the water.

Sections

Good section slides are very difficult to make without special equipment and procedures. Sections are extremely thin slices of tissue such as skin, flower stems, leaves and other similar materials.

There is one item to be found in your kitchen which will lend itself to sectioning without special equipment. The common onion. The onion is made up of layers of tissue.

Peel away the very thinnest layer you can. If you are careful and take your time, you will get a piece that will be nearly transparent. Cut this piece into three smaller pieces, each about 1/4x1/4 inch.

Put two drops of eosin stain in one bottle cap and two drops of methylene blue in a second cap. Pick up one piece of onion with your tweezers and place it in the eosin. Do the same with the second piece, but put it in the blue stain.

Wait for a minute or two. Then remove each piece from the stains and flush with clean water from your dropper or tube while holding the specimen with tweezers over the waste cup. Place the both pieces, side by side, on a clean slide.

Take the last piece of onion and place it in the eosin for about two minutes. Then remove and flush. Place the same piece into the blue stain for 30 seconds. Remove and flush. Place this piece along side the other two pieces on the slide and add cover glasses. Transfer the slide to the microscope.

Water borne life

Fill your wide mouth jar with fresh water. Allow it to stand for three or four days without the lid, then put in a handful of dry grass and a pinch or two of dirt. Cap the jar and place it where it will receive light, but not direct sunlight.

In about five days, you can start to examine the water for life, but first you need to make a special slide. Take a toothpick and make a ring of petroleum jelly on a clean slide, smaller than a cover slip. Height of the ring should be about half the thickness of a slide.

Transfer a drop of water from the jar onto the slide within the ring. Use the lowest power of your microscope to detect movement in the water. The movement will be caused by microscopic animals. Try to focus on the animal, which may not be easy as that little drop of water is like an ocean to it. It can swim up and down, into and out of focus.

If the animals are moving too fast or won't stay in focus long enough to study, use the edge of a paper towel to soak up some of the water.

There are thousands of other specimens you can observe. Using proper techniques, even solid objects such as soil and sand can be mounted for study. We hope these instructions have inspired you to learn more.

Good luck with your future discoveries!

This microscope will provide you with years of use and discovery fun!

MORE THINGS TO LOOK AT!

The introductory activities in this guide are just a beginning step. There are thousands of tiny mysteries in the microscopic world to check out. Here are a few ideas:

- * Compare different - colored hair, dyed hair, and permed hair.
- * Compare cat and dog fur.
- * Look at feathers, fingernails, fish scales, and butterfly and moth wings.
- * See how different fabrics and fibers of clothes, furniture, and rugs are woven.
- * Look at different - colored flower petals and leaves.
- * Compare and identify the crystals in the rocks and gems you find.
- * Examine samples of colored print from the newspaper and magazines.

TAKING CARE OF YOUR MICROSCOPE

- * Always handle the microscope with two hands -one hand around the arm and another around the base.
- * Always remove and clean the slides from the microscope stage after each use.
- * Always return the dust cap to the eyepiece when finished.
- * Place the microscope in a case or cover it with a plastic bag after each use.
- * Use ONLY lens paper to clean the glass lenses.
- * Avoid any direct contact between the viewing lenses and the Stage.
- * Never touch a slide with the objective lenses of the turret
- * Remove the batteries from the battery compartment in the base before storing the microscope for a month or longer.



WARNING:



CHOKING HAZARD--Small parts.
Not for children under five (5) years.
Use under direct supervision of an adult.

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