Cut a strip of "b"s for each pair of students.

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

b b b b b b b b b b

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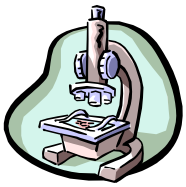


My Science Journal

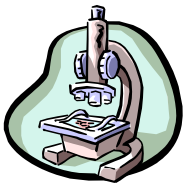
Scope It Out!

Scientists use journals to write down information about their observations and experiments. The following suggestions will help you complete an interesting and informative journal to show what you have learned about magnifying systems:

1. Dedicate **one** notebook for your journal. A composition book is the best choice because pages can't be torn out easily.
2. Write your first and last name on the cover of the journal.
3. The first page should be titled "Table of Contents." This can be filled in after each of your journal entries have been completed.
4. You may only write on the front of each page for entries.
5. Skip to the third page of your journal. Number the upper right hand corner of each page, beginning with number 1, until you reach the end.
6. Each journal entry page should be dated, and should have a title to help remind you of the science concept experienced. Labeled drawings of your experiences are important observations!
7. Each journal entry should **explain what you know** or **why you think something happened**. Here are some sentence starters to try:

I wonder why…	This observation reminds me of…
This relates to…	I was really surprised when…
What if…	During the discussion, I wondered…
I observed that…	My inference about our data is…

Name: _____



Scope It Out!

Student Data Sheet

Calculating the Power of Magnification of a Compound Microscope

A compound microscope has two or three objective lenses, so it has the ability to change the magnification of the image you are viewing. You will need to write the power of magnification under any microscope drawings made after observing specimens. To determine the power of magnification, follow the steps below.

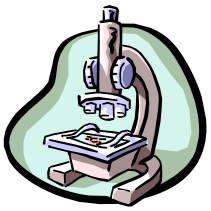
1. Look at the markings 10x on the eyepiece. The x stands for "times" and the number tells you how much the image is increased. If you could look through just the eyepiece alone, it would magnify the object **10 times** larger than it is in real life.
2. Look at the markings 4x on the smallest objective. That tells you that the lens magnifies the object 4 times larger than it is in real life. The medium size objective is usually 10x, and the third objective is usually 40x or 43x. If your microscope only has two objective lenses, the small one is called low power, and usually magnifies 10x, and the larger one is called high power, and either magnifies 40x or 43x.
3. To determine the power of magnification, **multiply** the power of the eyepiece times the power of the objective lens that is over the hole or aperture. If the smallest objective (4x) is over the hole, and the eyepiece is 10x, we would calculate magnification by saying 4 x 10 is 40x. In other words, looking at an image under low power combined with the magnification power of the eyepiece makes it look 40 times larger than its actual size.

Practice calculating the power of magnification in the following exercises:

Eyepiece	Objective lens	Power of Magnification
10x	4x	
10x	10x	
10x	40x	
10x	43x	

How do you calculate the power of magnification?

Name: _____



Microscope Basics

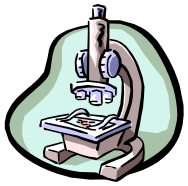
Focusing the Microscope

1. Place the slide on the **stage** so that the object to be viewed is directly over the hole in the stage. Make sure the **clips** are placed carefully over the ends of the slide.
2. Turn on the **lamp**. Turn the **diaphragm** so the largest hole is directly under the hole or **aperture**. Raise the microscope from the back so they can see how the diaphragm rotates to allow control of how much light can enter the microscope.
3. Rotate the nosepiece so that it is on the **low power** objective. The low power objective has 10x written on the side. It will click into place.
4. Look at the slide on the stage as you carefully turn the **coarse adjustment knob** until the **nosepiece** is as close as it can get to the slide. Always begin focusing on low power, and look from the side, (not through the eyepiece), while lowering the nosepiece to prevent accidents.
5. Look into the eyepiece with both eyes open. Slowly rotate the coarse adjustment knob, which raises the nosepiece. The object on the slide will slowly come into focus.
6. Use the fine adjustment knob to sharpen the image.
7. To view the object on high power, simply rotate the nosepiece to the high power objective. Do not touch either of the adjustment knobs before changing to high power, because this will cause you to lose your focus.
8. Once the high power objective clicks into place, you may use only the fine focus knob to sharpen the image. **Do not use the coarse adjustment knob on high power**! It might cause the objective lens to hit the slide.

Preparing Wet and Dry Mount Slides

1. A dry mount slide is simply placing an object on a slide, and covering it with a cover slip. No water is added, hence the name dry mount.
2. Adding a drop of water to the specimen before the adding the cover slip makes a wet mount slide. Wet mount slides hold the specimen in place and are useful for living organisms.

Name: _____



Scoping Out a "b"

Student Data Sheet

Question: How does a microscope change the letter "b"?

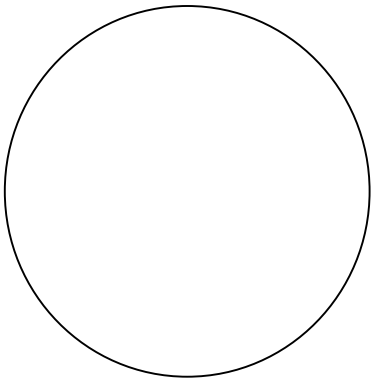
Prediction: I think that the letter "b" will look like a _____ under the microscope.

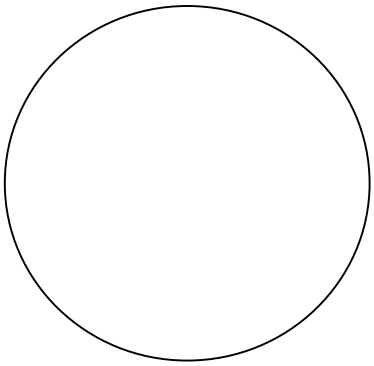
Materials: microscope, droppers, slides, coverslips, newsprint

Procedure:

1. Prepare a wet mount slide of the letter "b".
2. Cut out a lower case letter e from a piece of newspaper. Place it on the middle of the slide; making sure it is right side up so you can read it.
3. Squeeze a drop of water on the e with a pipette or dropper.
4. Hold the cover slip between your fingers, and set one side down on the edge of the drop of water. Slowly lower the cover slip so that it spreads the water out into a thin film and prevents the formation of bubbles.
5. Hold the prepared slide by the edges to prevent smudges.
6. Place the stage on the slide do that the "b" is directly over the hole in the stage. When you look at the "b" directly, not through the eyepiece, it should be right side up.
7. Turn on the lamp. Turn the diaphragm so the largest hole is directly under the aperture.
8. Rotate the nosepiece so that it is on the **low power** objective. It will click into place. Look at the slide on the stage as you carefully turn the coarse adjustment knob until the nosepiece is as close as it can get to the aperture. Always begin focusing on low power, and look from the side, (not through the eyepiece), while lowering the nosepiece to prevent accidents.
9. Look into the eyepiece with both eyes open. Slowly rotate the coarse adjustment knob, which raises the nosepiece. The "b" will slowly come into focus.
10. Use the fine adjustment knob to sharpen the image. To view the "b" on high power, simply rotate the nosepiece to the high power objective. Do not touch either of the adjustment knobs before changing to high power, because this will cause you to lose your focus. Once the high power objective clicks into place, you may use only the fine focus knob to sharpen the image. **Do not use the coarse adjustment knob on high power**!
11. Rotate the nosepiece back to the 10x objective, and complete the activities below:

A. The circles mean "drawings as viewed through a microscope."
B. Calculate the magnification on low power, and write it on the line under each circle in front of the x.
C. Draw a picture of what the "b" looks like under low power in the left hand circle below. Then rotate the slide 180 degrees and draw a picture of what you see in the right hand circle.





_____x

Right side up

_____x

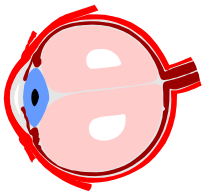
Upside down

Turn the slide right side up again, and move the slide as directed in the chart below.

Direction to Move the "b" Slide	**Direction the "b" Appears to Move**
Move slide to the right	
Move slide to the left	
Move slide away from you	
Move slide toward you	

How is the letter "b" changed when it is observed under a compound microscope?

Name: _____



The Eye – *A Magnificent Optical System*

Materials: hollow plastic baseballs, clear plastic wrap, clear marble, blue or brown felt, glue, tape, scissors, fold-over-top baggie, straw, drill to cut ball, clear hair gel, foil, markers

Procedure:

1. Your teacher has sliced the baseballs in half for you, and has cut circular holes in the center of each of the halves.
2. Cut a circle of blue or brown felt a little larger than the hole in the center of the ball. This is the **iris**, or colored part of the eye. Cut a hole in the middle for the **pupil,** where light enters the eye.
3. Glue around the edges of the felt, and glue it on the inside of the ball in the center of the pre-cut hole.
4. Cut a circle of clear plastic wrap about the size of the felt, and glue on the outside of the felt to represent the **cornea**.
5. Fill the baggie ¾'s full of hair gel to represent the **vitreous humor** fluid inside the eyeball, and tape edges to form an oval that will fit in the ball.
6. Glue the clear marble in the center of the oval for the **lens**.
7. Line the half of the ball that has a tiny hole cut in the center with foil to represent the **retina**. **Rods** (black) and **cones** (color) can be drawn on the retina in marker.
8. Insert a 3" piece of straw through the hole and foil lining to represent the **optic nerve**.
9. Place the baggie inside the first half of the baseball, making sure the lens is behind the pupil.
10. Tape the half with the straw optic nerve to the first half to complete the eyeball.

Research the parts of the eye that are in bold print, and prepare a key for the eyeball that tells the job or function of each part.

Scope It Out
Performance Assessment
Scoring Rubric A

Task	Criteria	
1. Lab Skills, Safety, and Participation	Selects and uses appropriate equipment with care and proficiency. Listens attentively, and stays actively involved in an organized approach.	4
	Uncertain about equipment selection, but uses equipment carefully. Listens to instructions and stays involved, but may wait for others to lead.	3
	Is not familiar with use of equipment, so chooses inappropriate equipment, but does not abuse equipment. Distracted during instructions, so must rely on others for directions.	2
	Uses equipment improperly, and is haphazard and disorganized. Is distracted during instructions, and needs constant reminders to stay on task.	1
	Does not use equipment or abuses equipment. Is disruptive during instructions and activity.	0
2. Proficient and Safe Use of the Microscope	Understands the functions of the parts of the microscope needed for focusing. Is skilled and efficient at focusing on low and high power. Handles the microscope with great care.	4
	Understands most of the functions of the parts of the microscope needed for focusing. Is efficient at focusing on low and high power. Handles the microscope with care.	3
	Understands some of the functions of the parts of the microscope needed for focusing. Can focus on low and high power after minimal prompting. Handles the microscope with care, but may need reminders.	2
	Understands few of the functions of the parts of the microscope needed for focusing. Can focus on low and high power with repeated prompting. Needs to review rules for safe handling of the microscope.	1
	Understands few of the functions of the parts of the microscope needed for focusing. Unable to focus on low and high power even with repeated prompting. Handles the microscope carelessly.	0
3. Scope It Out Science Journal	Contains very detailed entries and labeled drawings that clearly communicate each learning experience, no omissions. Asks astute questions, and makes relevant inferences and connections with optical systems concepts. Very neat and well organized.	4
	Contains detailed entries and labeled drawings that communicate each learning experience, with one omission. Asks relevant questions, and makes inferences and connections with optical systems concepts. Neat and organized.	3

	Contains fairly detailed entries and drawings, with two omissions. Asks questions, and makes some inferences and connections with optical systems concepts. Neat, but may need to spend more time organizing entries.	2
	Contains some entries and drawings, with three omissions. Asks few questions, and makes few inferences and connections with optical systems concepts. May need to spend more time on neatness and organizing entries.	1
	Contains minimal entries and drawings, with four or more omissions. Makes no inferences or connections with optical systems concepts. Needs to spend more time on neatness and organizing entries.	0

Scope It Out
Performance Assessment
Scoring Rubric B

Research	Product Design	Application	Presentation
4 Research is accurate, clear, and very detailed.	4 Creative design & use of materials.	4 A clear, unique application of concepts through explanation, construction, or illustrations	4 Explanations are accurate, clear, and very detailed. Entertaining and creative!
3 Research is accurate, clear, and fairly detailed.	3 Good choice of design and materials.	3 A clear application of concepts through explanation, construction, or illustrations	3 Explanations are accurate, clear, and fairly detailed. Creative!
2 Research is limited in scope. More preparation needed.	2 Design and use of materials are similar to previous activities.	2 A partial application of concepts through explanation, construction, or illustrations.	2 Explanations are limited but accurate, and are somewhat clear. More preparation needed.
1 Very little research is attempted.	1 The product is incomplete.	1 Product is not an application of concepts.	1 Explanations are limited, unclear, and inaccurate

Comparing Two Optical Systems