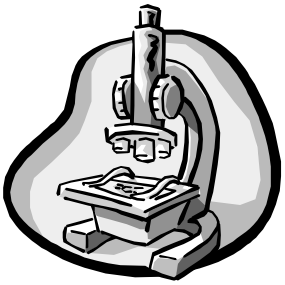
Science 10-Biology
Activity 3
Actual Size and Drawing Magnification Lab



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Name _____

Due Date _____

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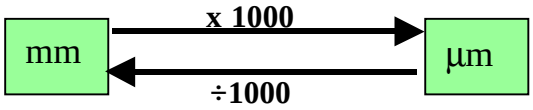
Purpose:

To measure the field of view in each magnification of the compound monocular microscope.
To learn how to calculate the actual size of an object using the microscope.
To learn how to calculate the drawing magnification of a sketch.

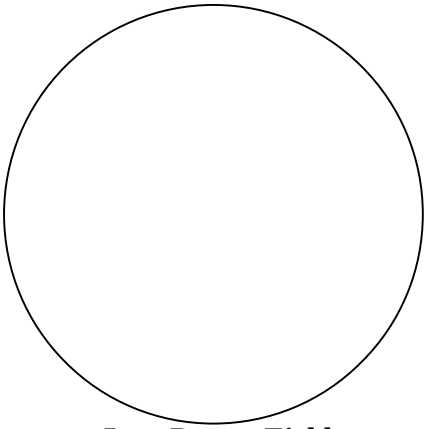
Procedure: Part 1—Field of View

1. Using a clear ruler, measure the field of view diameter on **low**, **medium** and **high** power on your microscope. Estimate to the nearest 0.1 mm. **Sketch how the ruler looks in each magnification on page 2 of this lab**. Calculate the total magnification, and also convert the field of view to micrometers (μm) and record in the table below:
(Remember: 1 mm = 1000 μm)

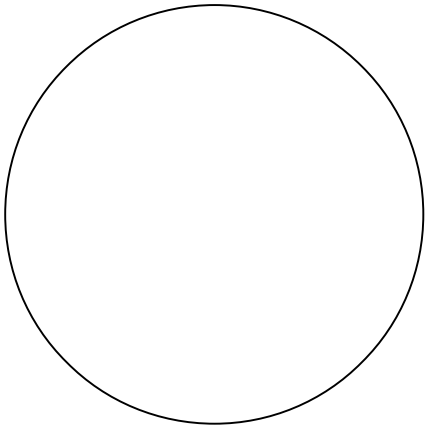


Microscope Power	Total Magnification	Field of View (mm)	Field of View (μm)
Low			
Medium			
High			

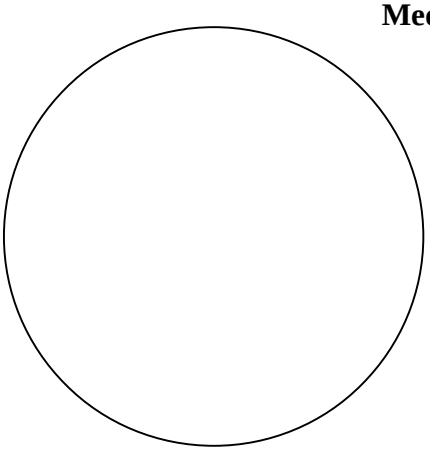
2. Record what you actually see of the ruler in the microscope in the circles below:



Low Power Field



Medium Power Field



High Power Field

Procedure: Part 2—Actual Size

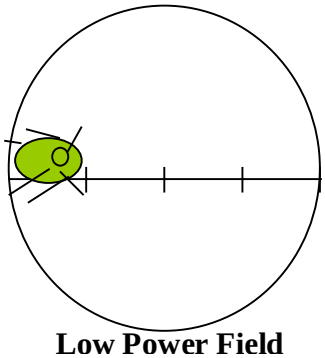
Actual size is the **real** size of the object that you are looking at. Larger objects are occasionally measured in mm. but you will mostly be measuring the object with micrometers (μm) (1/1000 of a mm.)

To estimate the **actual size** of an object you need to know two things first:

1. The microscope **magnification** you are using.
2. The **field of view** (diameter) at that magnification.

Use the table on page 1 of this lab to help you with this.

You will also need to know the approximate **number of times the object fits** across the field of view:



Low Power Field

For example:

This object would fit across the field of view about **4 times.**

The formula for finding **Actual Size** is:

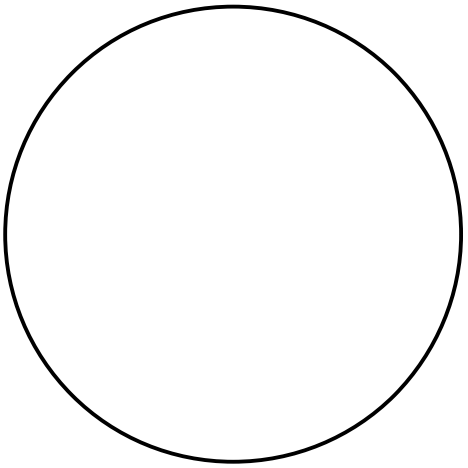
$$\textbf{Actual Size } (\mu m) = \frac{\textbf{Field of View Diameter (in } \mu m)}{\textbf{\# of Times it Fits}}$$

For example:

If the field of view diameter in the view above (low power) is 4000 µm, what is the **actual size** of the object?

$$\textbf{Actual Size} = \frac{\textbf{Field of View (Diameter) in } \mu m}{\textbf{\# of Times it Fits}} = \frac{\textbf{4000 } \mu m}{\textbf{4 times}} = \textbf{1000 } \mu m$$

1. Obtain a prepared slide with a suitable object for looking at in **Low Power**. (eg. human flea). Put in on the stage, and focus it in **Low Power**. Move the slide so that the left side of the object is at the left side of the field of view. (This will make is easier to estimate the number of times it fits.)
Draw what the object looks like under the microscope. Make sure you get the size of the object compared to the size of the field correct!
Label the **Name** of the object and the **Microscope Magnification** (Total) beside your drawing. At this point, leave spaces for "Actual Size" & "Drawing Magnification" blank!



Object in Low Power

Object _____

Microscope Magnification _____ X

Actual Size _____µm

Drawing Magnification _____ X

2. Look on page 1 of this lab to find the Field of View Diameter for Low Power. Use this and the information on the bottom of page 3 to fill in the following table:

Object Viewed Under Low Power

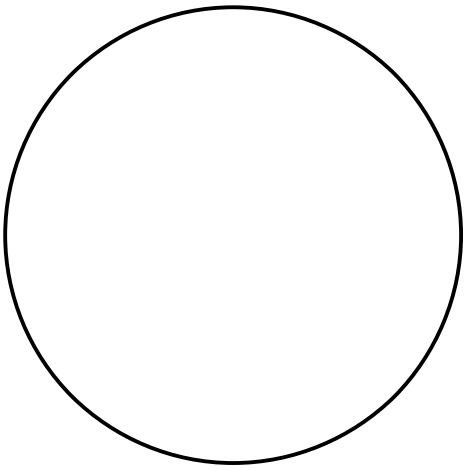
Name of Object	Microscope Magnification	Field of View Diameter (µm)	# of Times the Object Fits

3. Now, use the formula for calculating Actual Size to calculate the **Actual Size** of this object:

$$\textbf{Actual Size} = \frac{\textbf{Field of View (Diameter) in µm}}{\textbf{\# of Times it Fits}} = \frac{\_\_\_\_\_\ \mu m}{\textbf{times}} = \_\_\_\_\_\ \mu m$$

4. Now go back to the box on the right of your drawing on page 3 and write in the **actual size** of the object.

5. Obtain a prepared slide with a suitable object for looking at in **Medium Power**. Put in on the stage, and focus it in Low Power and then in Medium Power. Move the slide so that the left side of the object is at the left side of the field of view. (This will make is easier to estimate the number of times it fits.)
Draw what the object looks like under the microscope. Make sure you get the size of the object compared to the size of the field correct!
Label the **Name** of the object and the **Microscope Magnification** (Total) beside your drawing. At this point, leave spaces for "Actual Size" & "Drawing Magnification" blank!



Object in Medium Power

Object _____

Microscope Magnification _____ X

Actual Size _____µm

Drawing Magnification _____ X

6. Look on page 1 of this lab to find the Field of View Diameter for Medium Power. Use this and the information on the bottom of page 4 to fill in the following table:

Object Viewed Under Medium Power

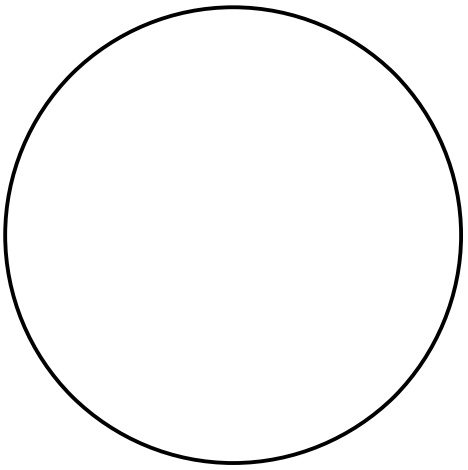
Name of Object	Microscope Magnification	Field of View Diameter (µm)	# of Times the Object Fits

7. Now, use the formula for calculating Actual Size to calculate the **Actual Size** of this object:

$$\textbf{Actual Size} = \frac{\textbf{Field of View (Diameter) in µm}}{\textbf{\# of Times it Fits}} = \frac{\_\_\_\_\_\ \mu m}{\textbf{times}} = \_\_\_\_\_\ \mu m$$

8. Now go back to the box on the right of your drawing on page 4 and write in the **actual size** of the object.

9. Obtain a prepared slide with a suitable object for looking at in **High Power**. Put in on the stage, and focus it in Low Power, center it then focus in Medium Power, center it then focus in High Power. Move the slide so that the left side of the object is at the left side of the field of view. (This will make is easier to estimate the number of times it fits.)
Draw what the object looks like under the microscope. Make sure you get the size of the object compared to the size of the field correct!
Label the **Name** of the object and the **Microscope Magnification** (Total) beside your drawing. At this point, leave spaces for "Actual Size"& "Drawing Magnification" blank!



Object in High Power

Object _____

Microscope Magnification _____ X

Actual Size _____µm

Drawing Magnification _____ X

10. Look on page 1 of this lab to find the Field of View Diameter for High Power. Use this and the information on the bottom of page 5 to fill in the following table:

Object Viewed Under High Power

Name of Object	Microscope Magnification	Field of View Diameter (µm)	# of Times the Object Fits

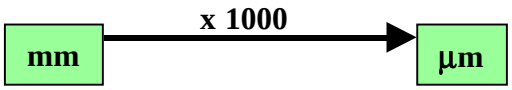
11. Now, use the formula for calculating Actual Size to calculate the **Actual Size** of this object:

$$\textbf{Actual Size} = \frac{\textbf{Field of View (Diameter) in µm}}{\textbf{\# of Times it Fits}} = \frac{\_\_\_\_\_\ \mu m}{\textbf{times}} = \_\_\_\_\_\ \mu m$$

12. Now go back to the box on the right of your drawing on page 5 and write in the **actual size** of the object.

Procedure: Part 3—Drawing Magnification

1. Using a ruler, measure the **length of the drawing in mm**.(***Drawing size***) of each object on the bottoms of pages 3, 4 and 5 of this lab. Record the lengths in **mm** in column **3** of the table below. Also, convert the lengths to **µm** and record in column **4**.



For each object also record the **actual size** in column **5**. (*This should now be found in each box next to the drawings of the objects.*)

Magnification	Object	Drawing Size (mm)	Drawing Size (µm)	Actual Size (µm)
Low Power				
Medium Power				
High Power				

The formula to calculate **Drawing Magnification** is:

$$\textbf{Drawing Magnification} = \frac{\textbf{Drawing Size (µm)}}{\textbf{Actual Size (µm)}}$$

2. Calculate the **Drawing Magnification** for the object viewed in **Low Power**. Get the **Drawing Size** and the **Actual Size** from the table on the bottom of page 6.

Drawing Magnification = $\frac{\textbf{Drawing Size (µm)}}{\textbf{Actual Size (µm)}}$ = $\frac{\text{\_\_\_\_\_ µm}}{\text{µm}}$ = _____ **X**

Enter this value for **Drawing Magnification** in the box next to the sketch of the object viewed under **Low Power** on **page 3** of this lab.

3. Calculate the **Drawing Magnification** for the object viewed in **Medium Power**. Get the **Drawing Size** and the **Actual Size** from the table on the bottom of page 6.

Drawing Magnification = $\frac{\textbf{Drawing Size (µm)}}{\textbf{Actual Size (µm)}}$ = $\frac{\text{\_\_\_\_\_ µm}}{\text{µm}}$ = _____ **X**

Enter this value for **Drawing Magnification** in the box next to the sketch of the object viewed under **Medium Power** on **page 4** of this lab.

4. Calculate the **Drawing Magnification** for the object viewed in **High Power**. Get the **Drawing Size** and the **Actual Size** from the table on the bottom of page 6.

Drawing Magnification = $\frac{\textbf{Drawing Size (µm)}}{\textbf{Actual Size (µm)}}$ = $\frac{\text{\_\_\_\_\_ µm}}{\text{µm}}$ = _____ **X**

Enter this value for **Drawing Magnification** in the box next to the sketch of the object viewed under **High Power** on **page 5** of this lab.

Questions:

1. A student sketches an organism and the sketch is 5.0 cm long. The actual size of the organism is 200 µm.

a) 5.0 cm = _____ mm = _____µm

b) Calculate the **Drawing Magnification.** Show the formula in your solution.

Answer _____ X

2. The **Drawing Magnification** of a sketch is 200 X and the **actual size** of the object is 100 µm.
   a) Calculate the length of the drawing (**drawing size**) in µm.

   Answer _____µm

   b) Calculate the drawing size in mm _____ in cm. _____

3. The Medium Power Field Diameter on a certain microscope is 1600 µm. An object's length measures 1/3 of the diameter of the field. Calculate the **actual size** of the object in µm. Show the formula in your solution.

   Answer _____µm

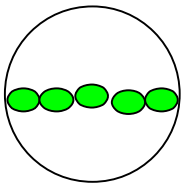
4. The Low Power Field Diameter in a certain microscope is 4000 µm. An organism stretches ½ of the way across the field.
   a) Calculate the **actual size** of the organism. Show the formula in your solution.

   Answer _____µm

   b) A student draws a sketch of the organism which is 10.0 cm long. Calculate the **Drawing Magnification** of the sketch. (*Don't forget to change the 10.0 cm to µm first!*) Show the formula in your solution!

   Answer _____ X

5. The picture shows five organisms stretched across the High Power Field of a microscope.

   The High Power Field Diameter of this microscope is 400 µm.

   a) Calculate the **actual size** of one of these organisms. Show the formula in your work!

   Answer _____µm

   b) Measure the length of one object in the drawing here and calculate the **drawing magnification** of this diagram.

   Answer: Drawing Magnification is _____ X