Microscopy Virtual Lab:

A Web-Based Simulation for Students Learning to use a Compound Microscope

Find the virtual microscope at
http://www.udel.edu/biology/ketcham/microscope/scope.html

Follow the animation through the sequence of steps to complete the checklist:

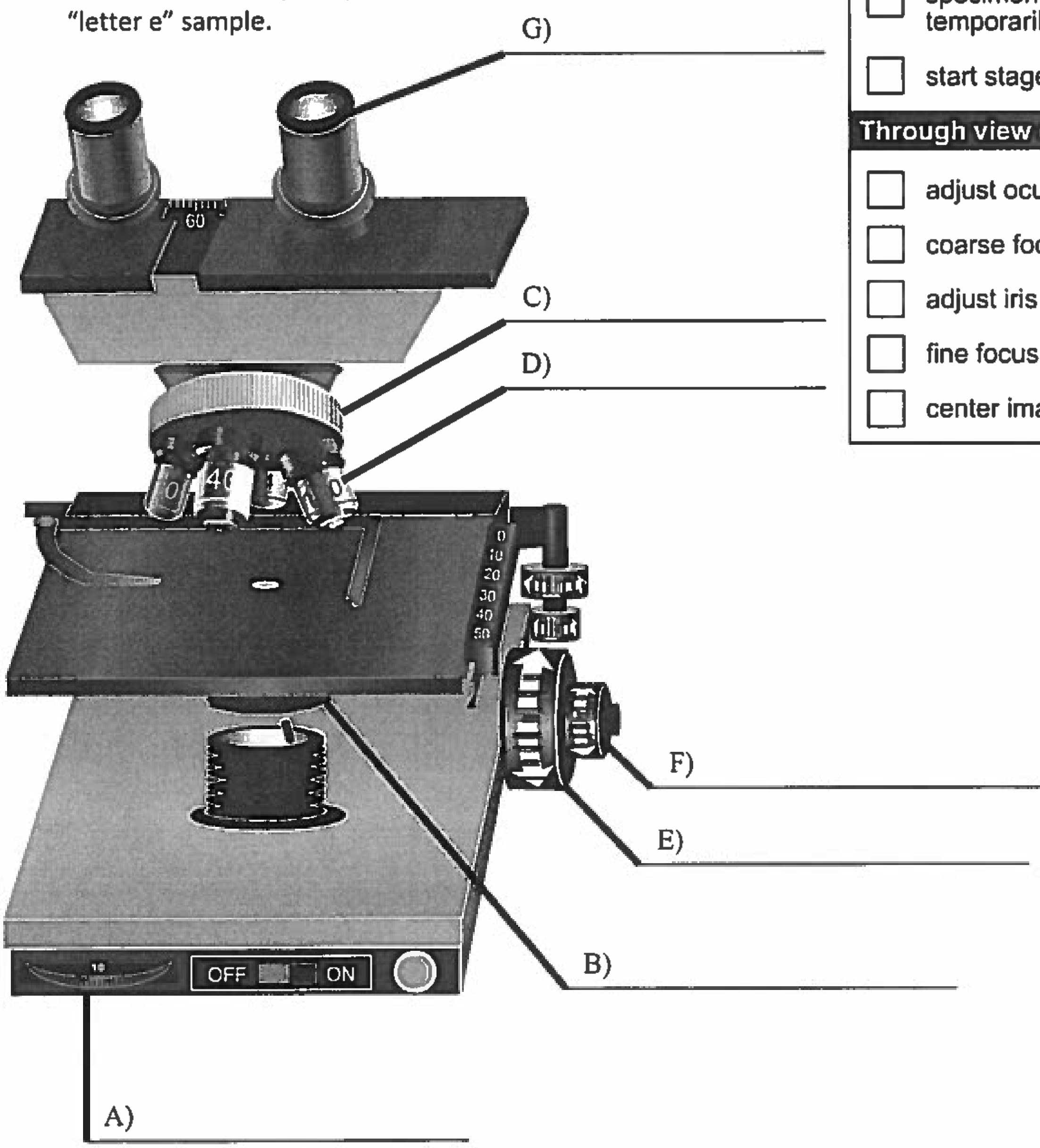
At view checklist X

- ☐ light on
- ☐ rheostat at 10
- ☐ slide chosen
- ☐ scanning (4X) lens in place
- ☐ specimen centered (open iris temporarily to do this)
- ☐ start stage at top position

Through view checklist

- ☐ adjust oculars
- ☐ coarse focus
- ☐ adjust iris diaphragm
- ☐ fine focus
- ☐ center image

1. Label the parts of the microscope as they are mentioned in the animation. When prompted to select a slide, please view the "letter e" sample.



NOTE: *this virtual microscope is a little different from ours at SHS. We don't have clips to hold our slides and we have a singular eye piece.*

2. Draw the "letter e" sample (as close to scale as possible) for each objective lens magnification.

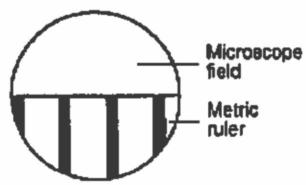
4x objective	
10x objective	
40X objective	

MICROSCOPE MATH and LINEAR MAGNIFICATION

PART A: Determining Magnification
A compound microscope has two sets of lenses. The lens you look through is called the **ocular.** The lens near the specimen being examined is called the **objective.** The objective lens is one of three or four lenses located on a rotating turret above the stage, and that vary in magnifying power. The lowest power is called the **low power objective (LP)**, and the highest power is the **high power objective (HP).**

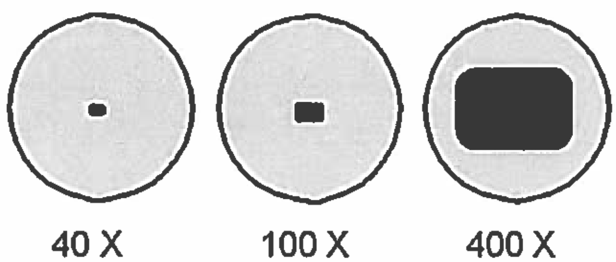
You can determine the magnifying power of the combination of the two lenses by multiplying the magnifying power of the ocular by the magnifying power of the objective that you are using. For example, if the magnifying power of the ocular is 10 (written 10X) and the magnifying power of an objective is 4 (4X), the magnifying power of that lens combination is 40X.

PART B: Determining the Diameter of the Field of View (FOV)
The **field of view** is the maximum area visible through the lenses of a microscope, and it is represented by a diameter. To determine the diameter of your field of view, place a transparent metric ruler under the low power (LP) objective of a microscope. Focus the microscope on the scale of the ruler, and measure the diameter of the field of vision in millimeters. Record this number.



In the pictured field of view at the left, it can be observed that there are approximately 3 1/2 divisions equal to a length of 3.5 mm. Therefore this field of view is equal to 3.5 mm or 3,500 micrometers.

When you are viewing an object under high power, it is sometimes not possible to determine the field of view directly. The higher the power of magnification, the smaller the field of view.



The diameter of the field of view under high power must be calculated using the following equation.

$$\frac{\text{diameter (LP)} \times \text{magnification of LP objective}}{\text{magnification of HP objective}} = \text{diameter (HP)}$$

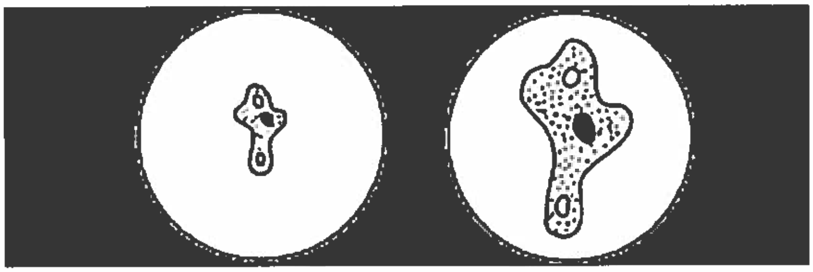
For example, if you determine that your field of view is 2.5 mm in diameter using a 10X ocular and 4X objective, you will be able to determine what the field of view will be with the high power objective by using the above formula. For this example, we will designate the high power objective as 40X.

$$\frac{2.5 \text{ mm} \times (4\times)}{(40\times)} = .25 \text{ mm, or } 250 \text{ µm}$$

SKYLINE MICROSCOPES QUICK REFERENCE SHEET

EYEPIECE MAGNIFICATION	OBJECTIVE MAGNIFICATION	TOTAL MAGNIFICATION	FIELD OF VIEW
10	4		*Measured*
10	10		*Calculated*
10	40		*Calculated*

PART C: Estimating the Size of the Specimen Under Observation



It is often difficult to approximate the approximate size of the field of view, but this ameba considered lengthwise appears to occupy approximately 1/3 of the field of view. The field of view in the left image is 3 mm. Given that the ameba in the image takes up about 1/3 of that field, we can find its approximate length by multiplying the 3 mm X 1/3 = 1 mm length or 1,000 micrometers for the approximate length of this ameba.

The student is viewing the same ameba in the field of view at the right on a higher power. The field of view gets smaller which makes the ameba appear larger in this field.

To estimate the size of an object seen with a microscope, first estimate what fraction of the diameter of the field of vision that the object occupies. Then multiply the diameter you calculated in micrometers by that fraction. For example, if the field of vision's diameter is 400 μm and the object's estimated length is about one-tenth of that diameter, multiply the diameter by one-tenth to find the object's length.

$$400\ \mu m \times \frac{1}{10} = 40\ \mu m$$

PART D: DETERMINING DRAWING MAGNIFICATION 1.1.S1

Drawing magnification indicates how many times larger the drawing is compared to life size. To determine drawing magnification compared to life size, you must first add a scale bar to indicate the estimated or measured size of the sample.

Then, use this equation:

Measurement of the scale bar line

The estimated or measured size of the object being drawn as determined by figuring how much of the field of view it fills.

Drawing Magnification = $\frac{\text{Size of Drawing}}{\text{Size of specimen}}$

Be sure these numbers are in the same unit of measurement. If not, convert first before calculating linear magnification!

mm = µm / 1000
µm = mm x 1000

Since you are calculating magnification from an estimate, you must round your answer to one signification digit.

PART E: DETERMINING SIZE OF SPECIMENS FROM DRAWINGS/MICROGRAPHS

1.1.S1

If you know the magnification, you can rearrange the formula used above to determine the size of the specimen.

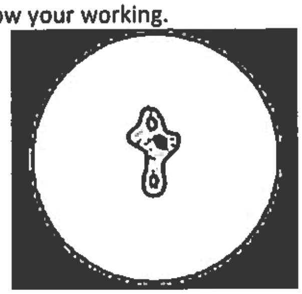
$$\text{Size of specimen} = \frac{\text{Size of Drawing}}{\text{Drawing Magnification}}$$

Measurement of the scale bar line.

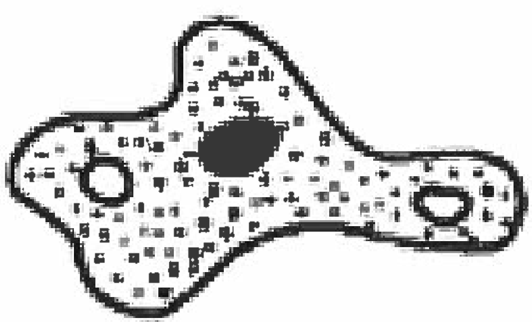
The given magnification amount

PRACTICE:

1) If the amoeba is being viewed a low power with a SHS microscope, **what is the estimated longest length of the organism?** Show your working.



2) **Add a labeled scale bar to the drawing of the same amoeba then determine the drawing magnification.** Show your working.



3) This cell is drawn 2000X larger than life size. **Add a labeled scale bar and determine the length of the cell.** Show your working.