

# Magnification, Size, and Scale Bars

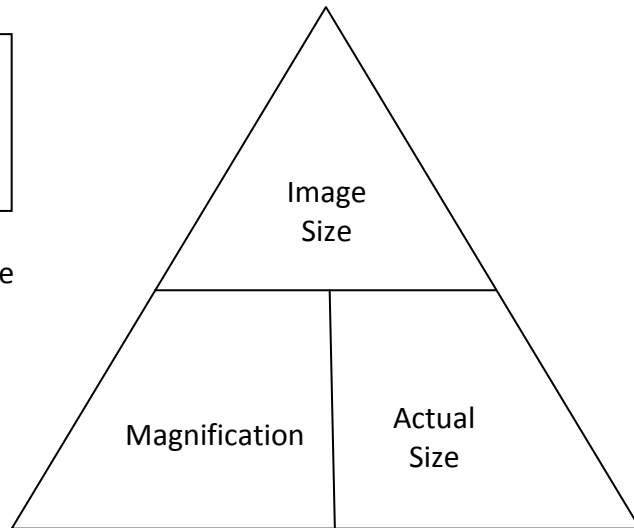
Cells are extremely small but knowing the sizes of objects viewed under the microscope can be really useful. For example, a plant scientist might want to compare the relative sizes of pollen grains from plants in the same genus to identify to help identify different species.

With a compound microscope, the magnification is the product of both lenses, so if microscope has a 10x eyepiece and an 40x objective, the total magnification is 400x.

Magnification is defined as the ratio of the size of the image to the size of the object.

$$\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}$$

The relationship between these three values can be shown using the equation triangle to the right, which offers a quick way of rearranging the values in order to derive related formulas.

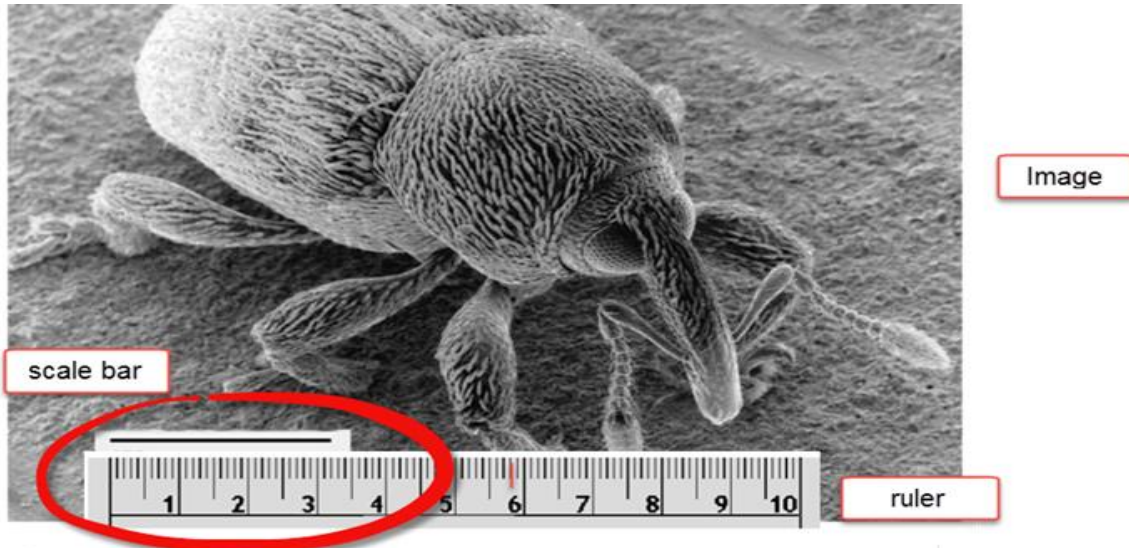


We use micrometers for specimen size under the microscope. The conversion is:  
1mm = 1000 μm (micrometers)

## Complete the following Chart:

Actual Specimen Size	Image (Drawing) Size	Magnification
0.5 mm	2 cm	
200 μm	1 cm	
40 μm	2 cm	
100 μm		200X
	5 cm	100X
	4 cm	50X
100μm	10mm	
4mm		3X
	10cm	25X

# Calculating Magnification of an Image Using it's Scale Bar



**A** use a ruler to measure the length of the scale bar in mm = 32 mm

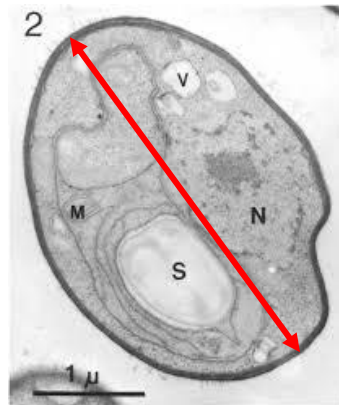
**B** convert this measurement into the same units as the scale bar = 32000  $\mu$ m

**C** divide the image scale bar length by the actual object scale bar length = 32000 / 100

**Magnification= 320x**

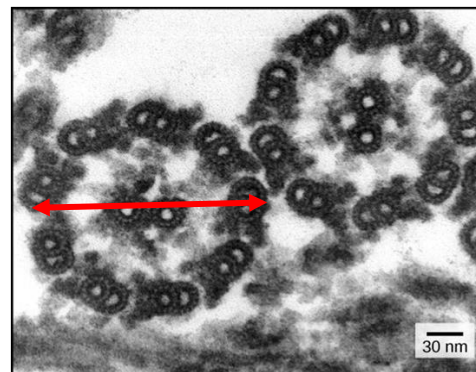
1. Calculate the magnification the cell. (show work)

Answer \_\_\_\_\_

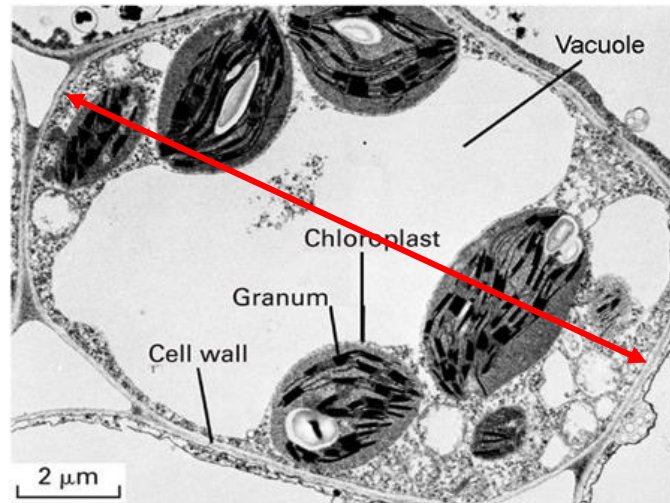


2. Calculate the magnification of the cilia base. (show work)

Answer \_\_\_\_\_



3. Calculate the magnification of the plant cell. (show work)

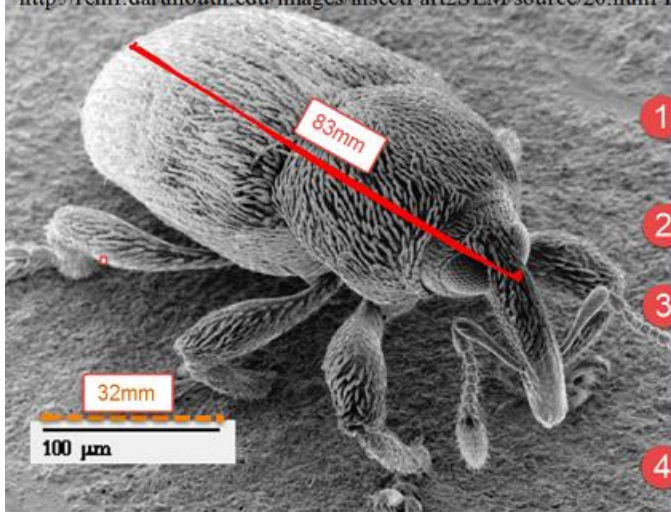


Answer \_\_\_\_\_

### Calculating the Size of a Specimen Using it's Scale Bar

Scanning electron microscope image of a snout beetle

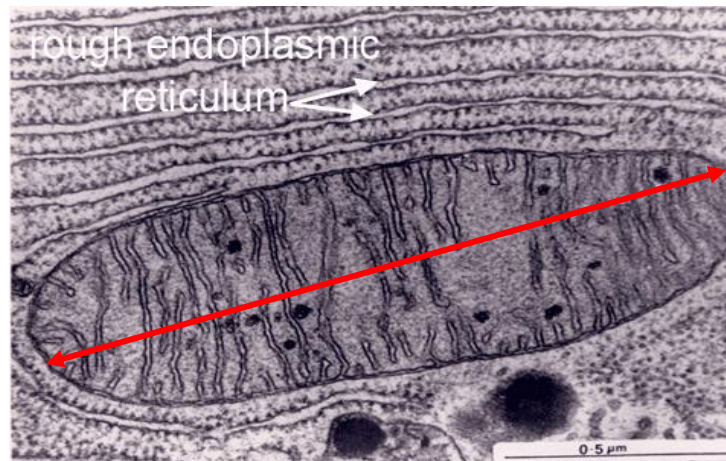
<http://remf.dartmouth.edu/images/insectPart2SEM/source/20.html>



Calculating Specimen Size using a scale bar

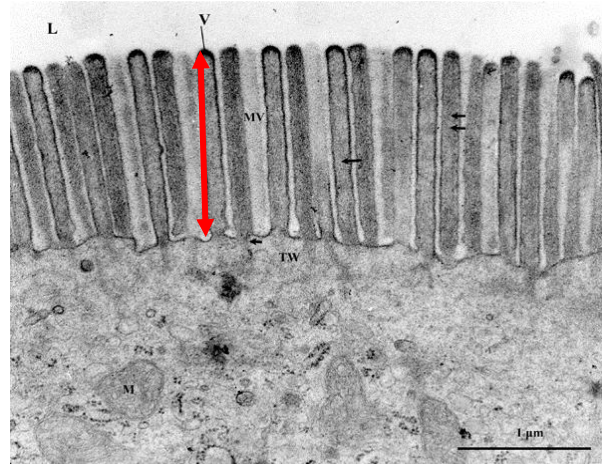
- 1 Measure the length of the Specimen in mm.  
(show working) **83mm**
- 2 Measure the length of the scale bar in mm.  
**32mm**
- 3 Calculate how many scale bar lengths make the specimen.  
(Divide length of specimen by length of scale bar)  
 **$83\text{mm} / 32\text{mm} = 2.6$  (no units)**
- 4 Calculate the size. Multiply the scale bar label by the last answer.  
(UNITS are the same as the scale bar)  
 **$100\mu\text{m} \times 2.6 = 260\mu\text{m}$**

4. Calculate the size of the mitochondria. (show work)



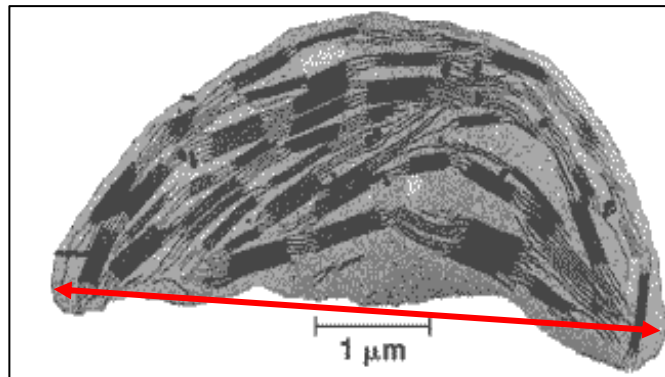
Answer \_\_\_\_\_

5. Calculate the size of a cilia. (show work)



Answer \_\_\_\_\_

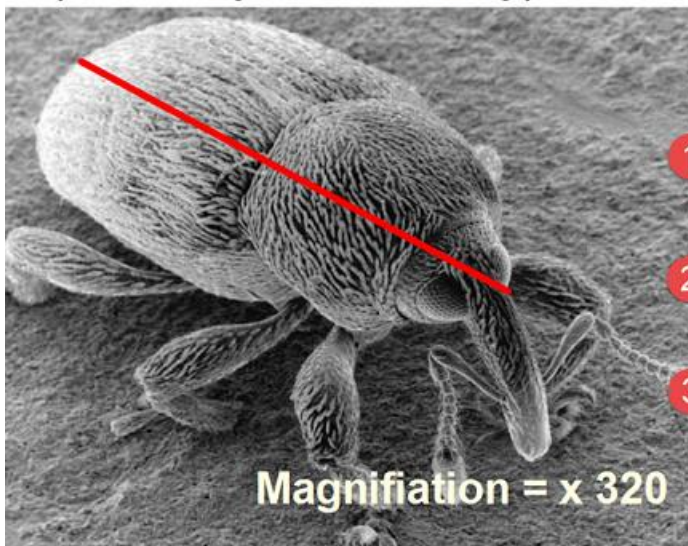
6. Calculate the size of the chloroplast.  
(show work)



Answer \_\_\_\_\_

## Calculating specimen size using magnification of an image

Scanning electron microscope image of a snout beetle  
<http://remf.dartmouth.edu/images/insectPart2SEM/source/20.html> Image: public domain, Feb. 2012



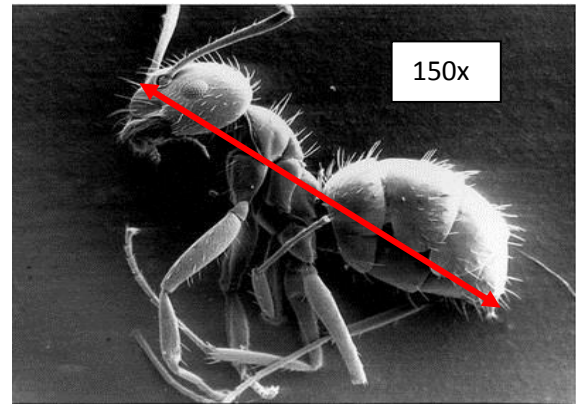
### Calculating Specimen Size using magnification

- 1 Measure the length of the Specimen in mm.  
(show working) **83mm**
- 2 convert the length of the specimen image to  $\mu\text{m}$ .  
**83000 $\mu\text{m}$**
- 3 Divide the length of the specimen by the magnification.  
(units will be  $\mu\text{m}$ )  
 **$83000\mu\text{m} / 320 = 260\mu\text{m}$**



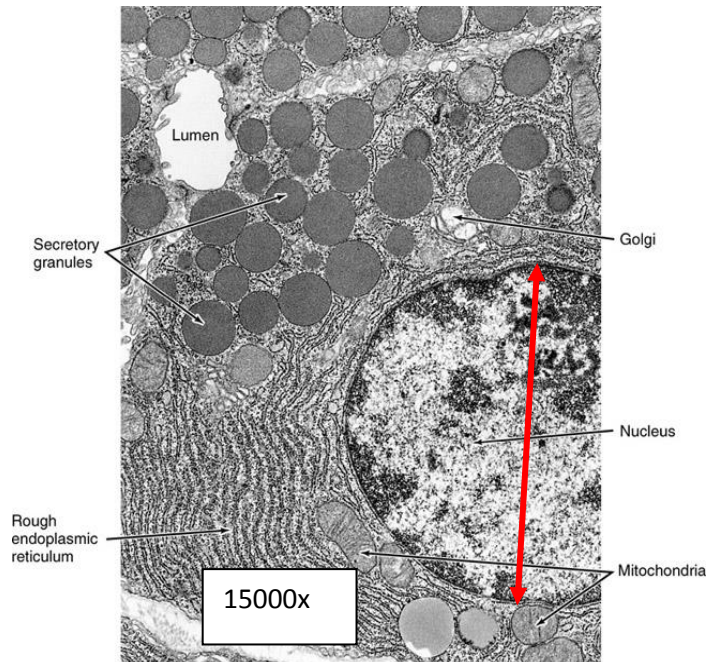
7. Calculate the size of the ant. (show work)

Answer \_\_\_\_\_



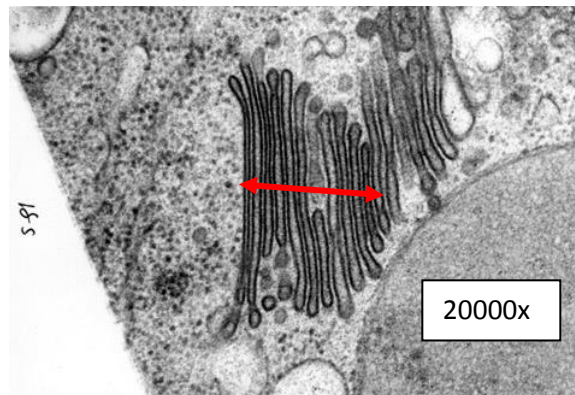
8. Calculate the size of the nucleus. (show work)

Answer \_\_\_\_\_

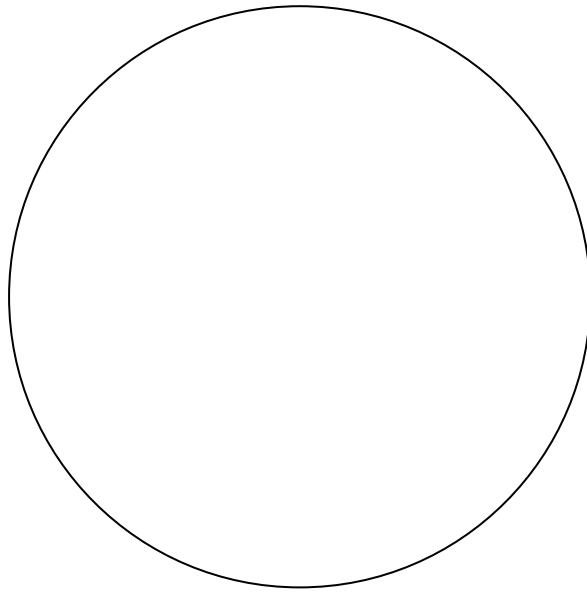


9. Calculate the size of the Golgi apparatus. (show work)

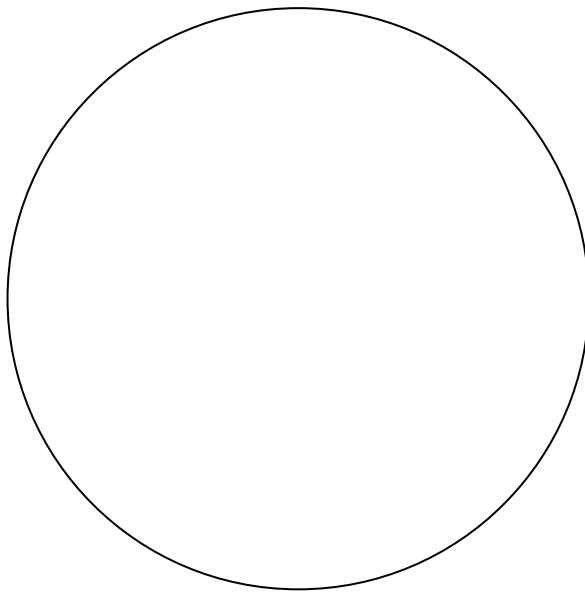
Answer \_\_\_\_\_



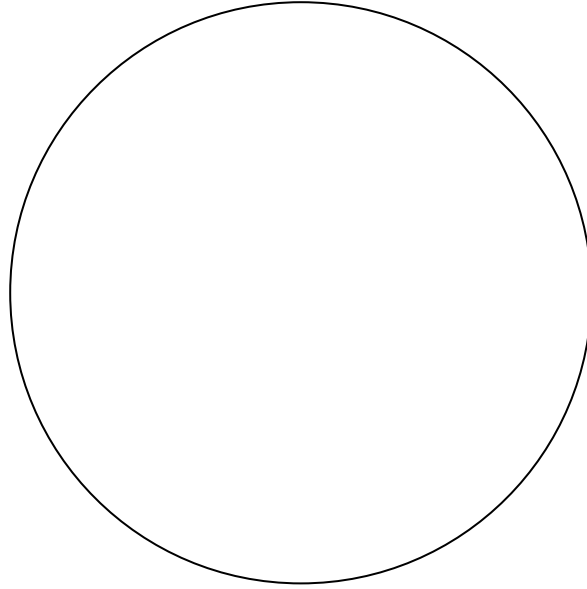
10. Prepare, observe, and sketch an onion cell. Record magnification, size of specimen, and add a scale bar.



11. Prepare, observe, and sketch a human cheek cell. Record magnification, size of specimen, and add a scale bar.



12. Observe and sketch a preserved slide of paramecium. Record magnification, size of specimen, and add a scale bar.



13. Observe and sketch a preserved slide of anabaena. Record magnification, size of specimen, and add a scale bar.

