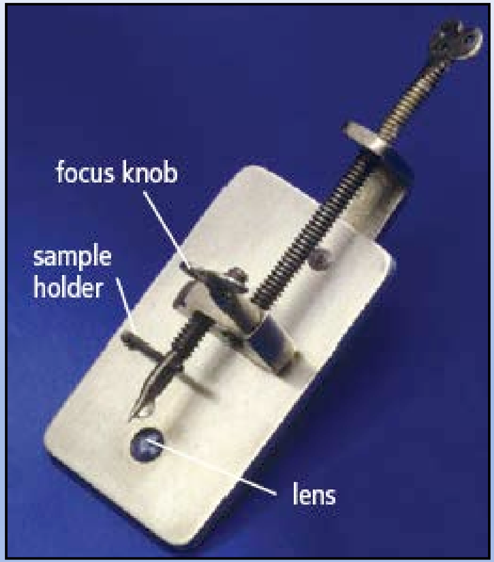
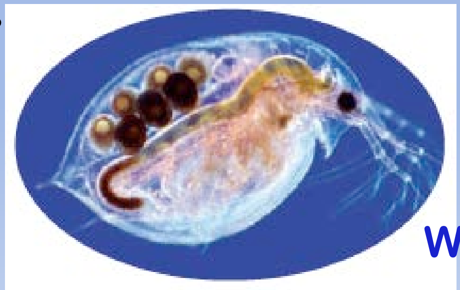
Examining Very Small Living Things

- The microscope is used by scientists to observe very small unicellular and multicellular living things.
- Early microscopes were built in the late 1600's.
- Anton van Leeuwenhoek was one of the first people to build a microscope.
- He could magnify up to 250x, and used it to observe microscopic living things.



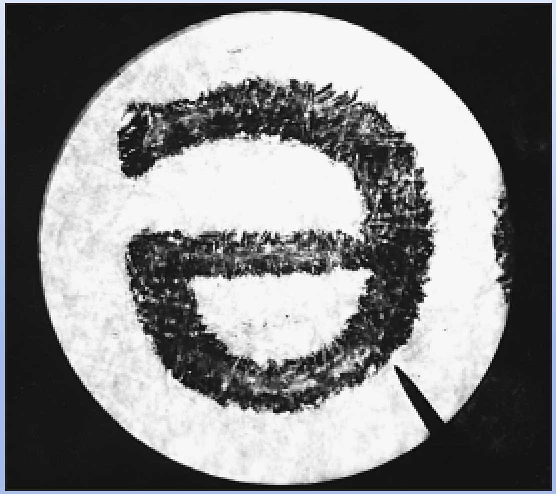


Water flea (Daphnia)

See page 11

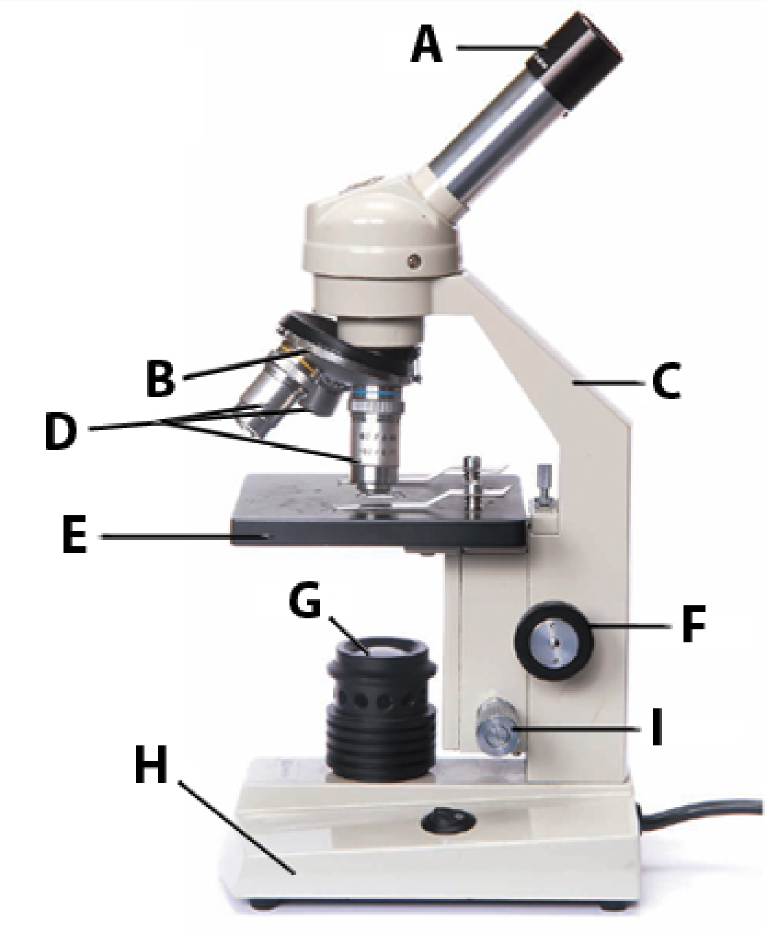
Compound Light Microscope

- **When you look through a compound light microscope you will observe an image that is magnified, inverted and reversed**



Compound Light Microscope

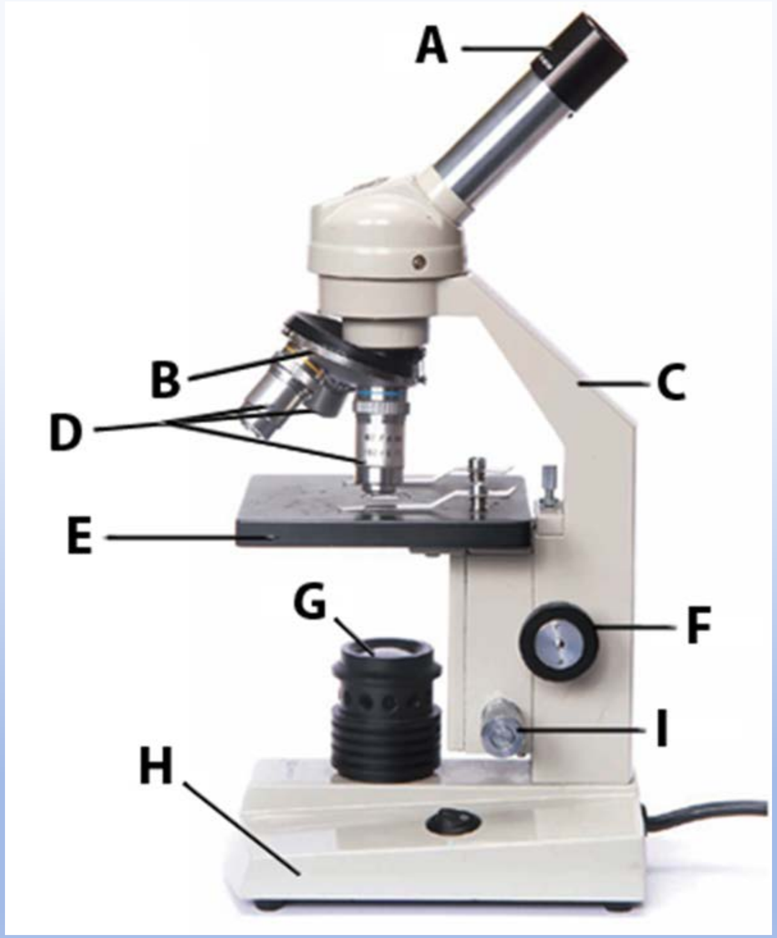
- The compound light microscope has two sets of lenses that magnify an image.
- Each of the objective lenses has a different magnification power.
- The eyepiece lens has a power of 10X
  - Low power = 4x objective
  - Med power = 10x objective
  - High power = 40x objective
- Multiply the objective by the eyepiece for total magnification.
  - Ex: High Power: Ocular 10X multiplied by 40X = 400X



A
B
C
D
E
F
G
H
I

Part of microscope	Function
Eyepiece	Is used for viewing and contains a lens that magnifies
Arm	Supports the eyepiece
Coarse focus knob	Brings an object into focus on low or medium power
Fine focus knob	Brings an object into focus at high power
Objective lenses	Magnifies the image. Most have three or four lenses
Revolving nosepiece	Holds the objective lenses and allows you to switch between them
Stage	Supports the slide, some have clips to hold slide in place
Light source	Supplies the light needed to view the slide
Base	Supports the entire microscope

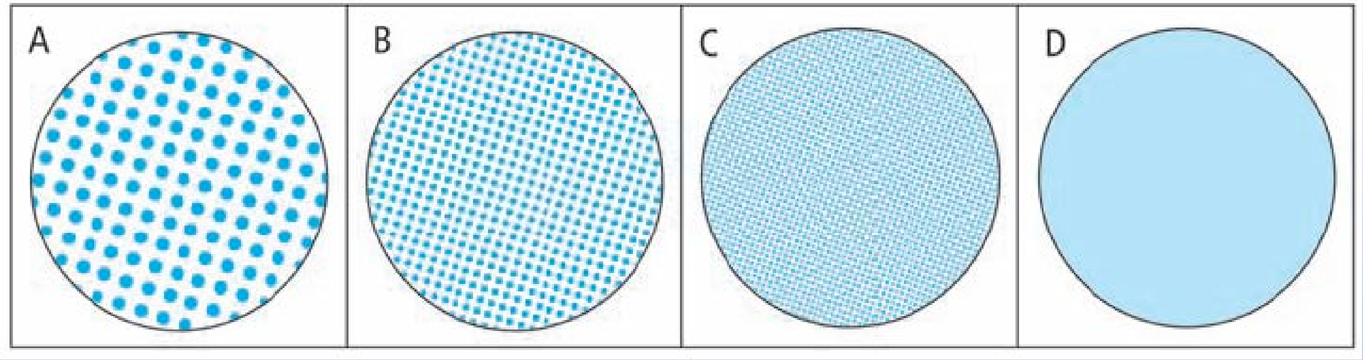
Microscope cut and Paste Activity



Resolving Power

- The ability to distinguish between two dots or objects that are very close together is called resolving power.

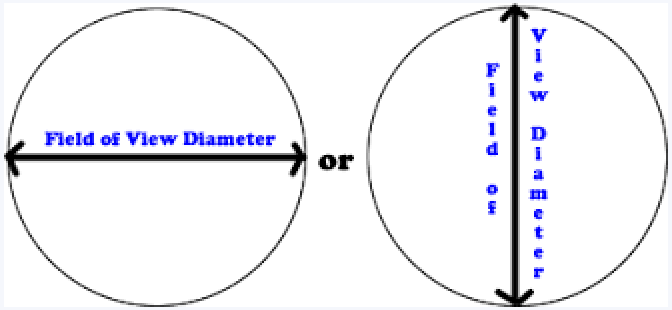
- A micron is one millionth of a meter

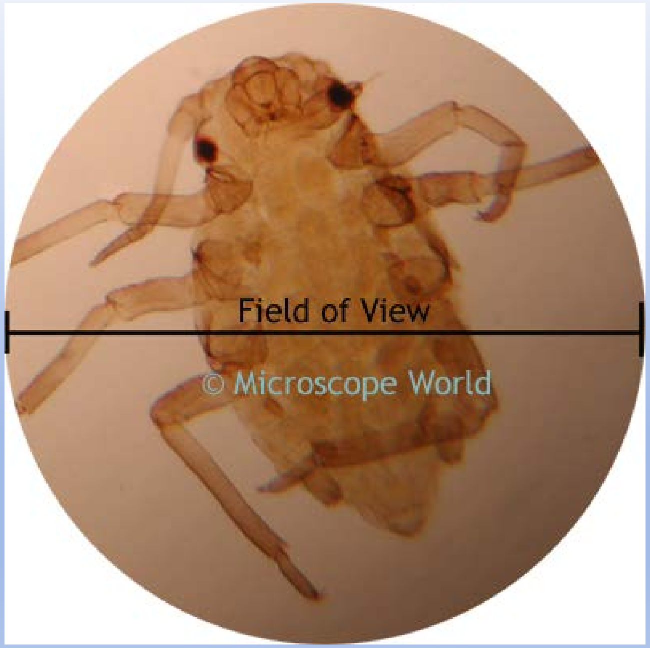


- The human eye has an average resolving power of 200 micrometers .
- You can see the individual dots in diagrams A, B and C. The human eye does not have the resolving power to see the dots in diagram D.

Field of View

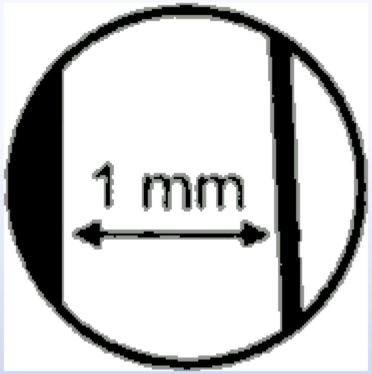
- How much of a specimen that is visible at any given time
  - The diameter of the circle of light visible when looking through the microscope
- What happens to FOV as magnification increases?
  - FOV Decreases





Estimating size

- Diameter of the FOV is needed
  - Use a transparent ruler on low power
  - Record the FOV in millimeters (mm)



- Convert mm into µm (micro meters)
  - 1mm=1000µm
    - 4 mm X 1000 = 4000µm

FOV at medium and high power

- **Often as you increase magnification it will be difficult to determine the FOV using a ruler.**
- **You can use the following equation to determine FOV at medium and high power**

  - **Medium power:** $FOV\#2 = \frac{FOV\#1\ X\ Magnification\ \#1}{Magnification\ \#2}$

    OR

  - **High power:** $FOV\#3 = \frac{FOV\#1\ X\ Magnification\ \#1}{Magnification\ \#3}$

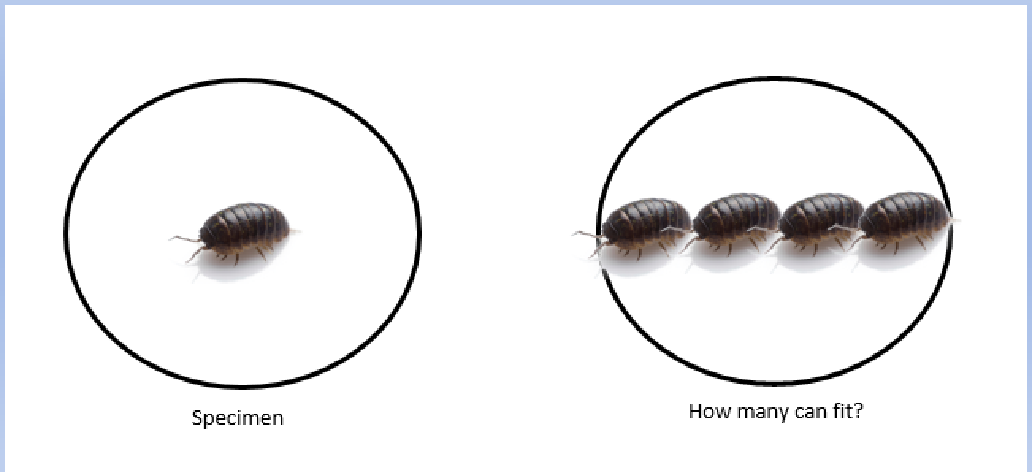
Try this: Determining FOV

- On low power you determine that the FOV is 2.5 mm.
  - What is the FOV in micrometers?
  - What is the FOV on medium power in mm and μm?
  - What is the FOV on high power in mm and μm?

Estimating size continued

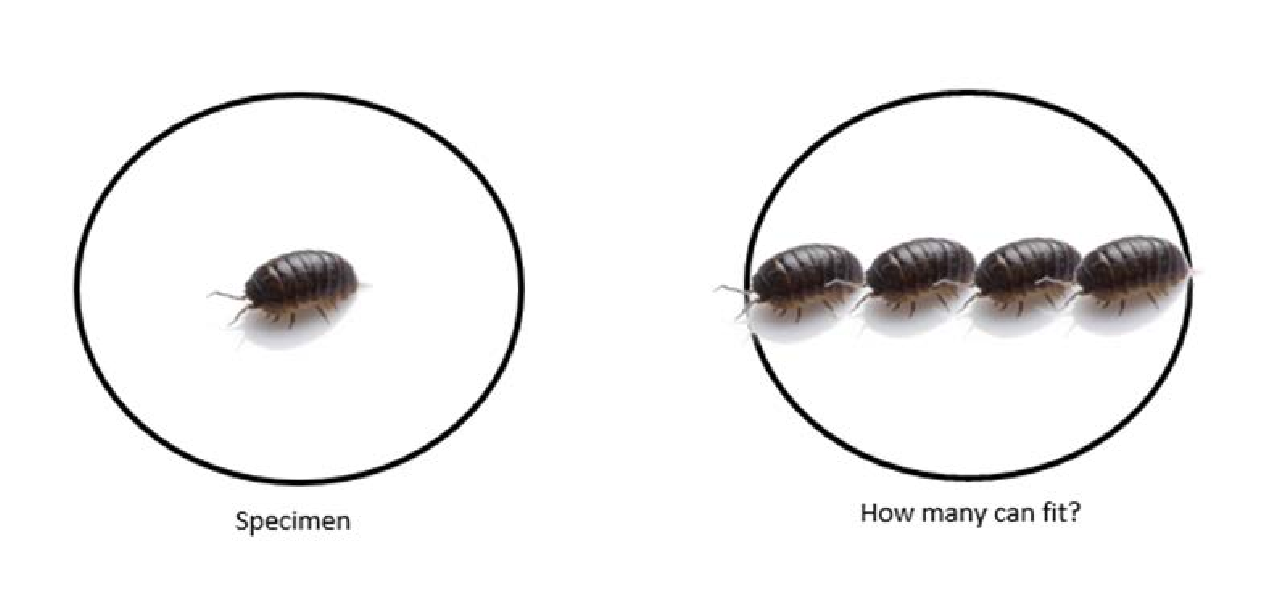
- Once you know the diameter you can estimate the size of the object you are viewing.
- Look at your object, count how many times it can fit across the diameter of FOV
- Use the following formula to estimate size

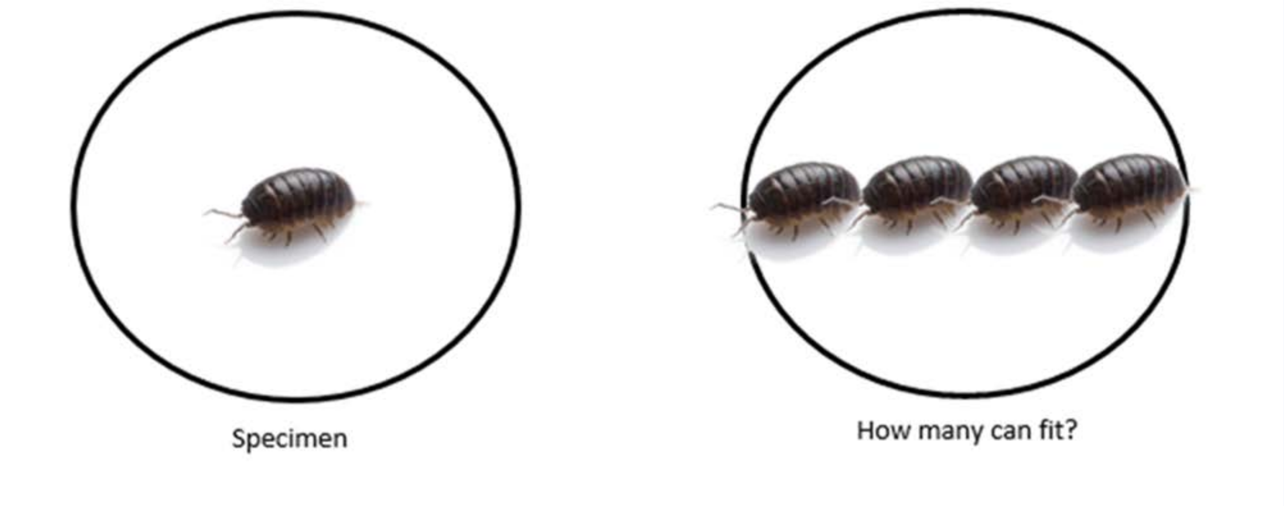
$$Estimated\ size = \frac{Field\ of\ View}{\#\ of\ time\ object\ fits\ across\ diameter}$$



Example

- **FOV is 3 mm at low power**
- **What is the estimated size of the pillbug in micrometers?**





- $$Estimated\ size = \frac{Field\ of\ View}{\#\ of\ time\ object\ fits\ across\ diameter}$$
- $$Estimated\ size = \frac{3000\mu m}{4}$$

- Estimated size = 750µm

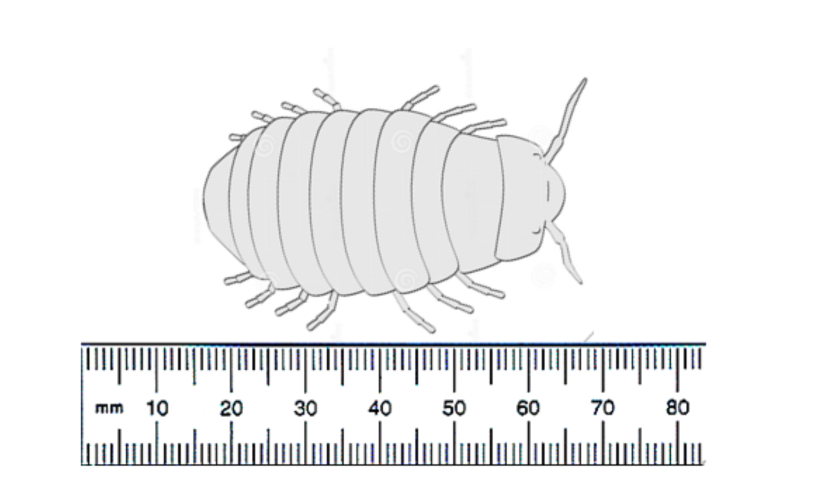
Drawing Magnification

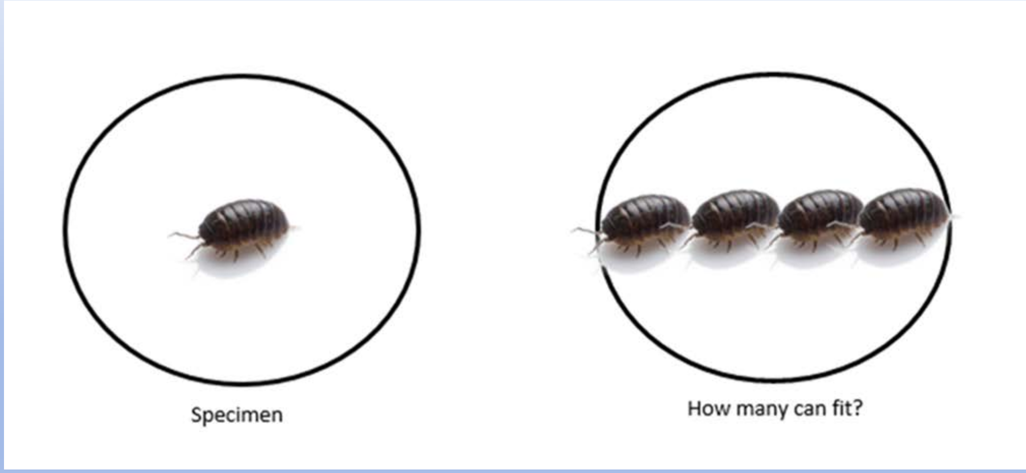
- **If you are asked to draw a diagram of the object you are observing, you can calculate the drawing magnification.**
  - **The number of times your drawing has been enlarged relative to the true size of the object.**

- **To calculate use the following formula**
  - $Drawing\ magnification = \frac{Drawing\ size}{Actual(Estimated)size}$
  - ***** ENSURE THE SAME UNITS ARE USED**

Example

- **Low power: FOV 3mm**
- **Calculate the drawing magnification**
  - $Drawing\ magnification = \frac{Drawing\ size}{Actual\ size}$
  - ***** ENSURE THE SAME UNITS ARE USED**





- $$Drawing\ magnification = \frac{Drawing\ size}{Actual(Estimated)size}$$

- Drawing Magnification$= \frac{50000\mu m}{750\mu m}$

- Drawing magnification = the drawing is 66.6 X larger than its estimated size