

# Measuring with a Microscope

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 Date Created: Summer 2007  
 Subject: Biology (and Chemistry)  
 Level: High School  
 Standards: 1: Analysis, Inquiry and Design  
 4: Physical Setting and Living Environment  
**Schedule: 80 minutes (double lab period)**

## Objectives:

Learn how to measure and/or calculate field of view under various magnifications and thus determine relative sizes of an object and/or organism using a compound light microscope

## Students will:

- Observe different tools used for magnification such as a water drop, hand lens or microscope
- Measure field of view in low power of a compound light microscope
- Calculate field of view in high power with a given formula
- View thin sectioned samples found in the classroom or brought from home
- Compare and estimate relative sizes of cells and certain organisms
- Use acquired skills in future lab activities

## Vocabulary:

**Micrometer**  
**Field of view**  
**Resolution**

**Magnification**  
**Scale**

## Materials:

### For Each Student:

- Microscope
- prepared slides (to share)
- \*paramecium
- \*corn stem cross section
- material from home to view
- Worksheet: Size determination in compound light microscopes Intro
- Lab Packet: Measuring with a microscope
- Transparent metric ruler
- Pencil

## Safety:

Care in handling and proper use of the microscope and any prepared slide is important. Broken slides and glassware may cut skin easily.

**Science Content for the Teacher:** It is assumed that students come into the high school level with some idea of the concept of magnification. However, it is important to give a brief mention of why this occurs. The bending of light that occurs when it travels through different mediums, such as water and glass, causes things to appear bigger or smaller than they actually may be.

**Preparation:** Typical Lab set-up as necessary:

- Demo with item in beaker to show bending of light and magnification
- Newsprint available for measuring letters
- Eyedroppers and beakers with water for small groups or individuals
- Transparent rulers for scopes
- Prepared slides (may be manipulated depending on availability)
- Extra pencils are always handy in the classroom
- Plentiful copies of the lab and intro activity...one for each student minimum



## Classroom Procedure:

### *Engage (Time: 10 minutes )*

- Introduce the importance of scale showing some images without scale and try to have students guess what they are, then do the same with some objects that have scale
- Show the “The Universe within” (Powers of Ten) website
  - <http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/index.html>
- Have students measure the width of normal newsprint, then place a drop of water on in and re-measure to determine the magnification power of water

### *Explore (Time: 50 minutes)*

- Students will follow along with and complete the lab activity “Measuring with a microscope”
  - Includes measuring the field of view in scanning power (40X) and low power (100X) with a thin transparent ruler on the stage of the microscope
  - Will calculate the field of view in high power (400X)
  - Will observe prepared specimens and answer included questions

### *Explain (Time: 5 minutes)*

- Have student get together with a partner and come up with an explanation of how to determine an objects size using field of view
- Have students explain why as magnification increases, field of view decreases

### *Expand (Time: 15minutes...and beyond)*

- Students should observe other materials found throughout the room or brought in from home
  - They should provide sketches of these observations including a scale
- Have students come up with 3 other objects/materials/tools that maybe used magnify an object
- Provide students with newspaper or magazines so they may find pictures with and without scale to share with their classmates
- Students can complete an extra credit assignment for a classroom poster representing Field of View for the 3 magnifications present with the compound microscopes. These will be place in the classroom for reference throughout the year as the microscopes will continue to be in use



**Assessment: (Evaluation...the 5<sup>th</sup> E)**

The following rubric can be used to assess students during each part of the activity. The term “expectations” here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

1= exceeds expectations

2= meets expectations consistently

3= meets expectations occasionally

4= not meeting expectations

	Engage	Explore	Explain	Expand/Synthesis
1	Student took an interest in the introduction and was able to express real life situations. They were successful with the waterdrop/handmag and helped others with the task	Student is self motivated and follows all directional procedures, completing the lab accurately. Offers assistance to those around them	Worked well with a partner and came up with a logistical reasoning for the question posed	Student looked at 5+ additional items and provided representations with scale and was able to come up with 3+ items used to magnify. Brought in many pictures with and without scale and devised a poster to show Field of View
2	Student was focused during intro and took part in activities	Completes lab on their own successfully	Worked with partner to come up with a generic or broad idea for the question	Student observed about 3 additional items and had 3 items used to magnify. Brought in a few pictures with scale etc, but did not complete a poster
3	Student was off task at times during the intro and made some errors in the activities	Complete lab, but with errors and units missing	Discussed some with partner, but spent time off task talking to other people. Idea was not totally related to the question	Student looked at only 1-2 additional items and could not come up with 3 items for magnification. Found 1 picture with and without scale. No poster completed
4	Does not show interest during the introduction or experiment with the activities.	Does very little to complete assignment on their own. Tries to get all answers from neighbors	Did not participate with a partner or come up with ideas on their own	Student did not look at additional items or come up with items used to magnify.



**Extension Activities:** Students will be doing additional activities throughout the year with microscopy. Have them bring materials into the class when they find something.

**Supplemental Information:**

**Safety:** Care in handling and proper use of the microscope and any prepared slide is important. Broken slides and glassware may cut skin easily.

**Acknowledgments:** CCMR, Jane Earle, John Grazul, John Hunt, Mick Thomas, and Solvay High School

