

## Using SI Units of Measure

The metric system is a standard system of measurement in the sciences. It is easy to use since all conversions (volume, mass, or length) are in units of 10. Then ten-based system is similar to our monetary system in which 10 cents equals a dime and 10 dimes equals a dollar.

**Objective:** to be able to convert in SI units of measure

### Pre-Lab:

1. What does SI stand for? \_\_\_\_\_
2. What is the basic unit of measure and abbreviation for:
  - a. Length: \_\_\_\_\_
  - b. Mass: \_\_\_\_\_
  - c. Volume: \_\_\_\_\_
  - d. Temperature : \_\_\_\_\_



3. Which unit would you use to measure the following lengths? (Use your notes!)
  - a. length of a car \_\_\_\_\_
  - b. distance to New York City \_\_\_\_\_
  - c. length of a single cell in your body \_\_\_\_\_
  - d. length of the smallest of viruses \_\_\_\_\_

4. Which unit would you use to measure the following volumes?
  - a. water in a water cooler \_\_\_\_\_
  - b. drop of water \_\_\_\_\_
  - c. water in a swimming pool \_\_\_\_\_
  - d. water in the Freeport water tower \_\_\_\_\_

5. Which unit would you use to measure the following masses?
  - a. postage stamp \_\_\_\_\_
  - b. car \_\_\_\_\_
  - c. aspirin \_\_\_\_\_
  - d. steak \_\_\_\_\_

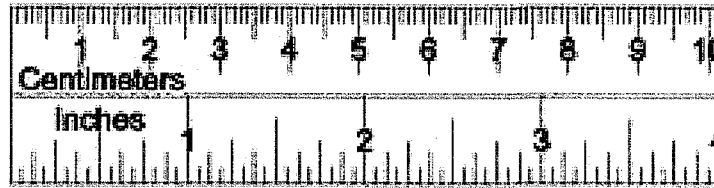
6. A paramecium (a single celled organism) measures 200 micrometers ( $\mu\text{m}$ ). What is the paramecium's length in millimeters (mm)? Remember that a mm is 1000 times larger than a  $\mu\text{m}$  so you either divide by 1,000 or move the decimal point 3 places to the left. Average length of a paramecium is \_\_\_\_\_ mm.

7. The average length of the largest species of earthworms (Giant Gippsland, found in Australia) measures 800 millimeters in length. How many micrometers ( $\mu\text{m}$ ) does this worm measure?

The average length of a Gippland earthworm is \_\_\_\_\_  $\mu\text{m}$ .

**Part I: Measuring Length (please use proper units in all answers)**

1. Obtain a metric ruler. Look at the side marked centimeters as pictured below.



2. What measure does each line between the 1 and 2 centimeter marks indicate? \_\_\_\_\_

3. How many millimeters are there in 1 centimeter? \_\_\_\_\_

4. If you were to measure a penny, what measure would you use? (circle the correct answer)

- a. centimeter                      b. millimeter                      c. meter

5. Obtain a penny from your teacher and measure the diameter and its width (thickness).

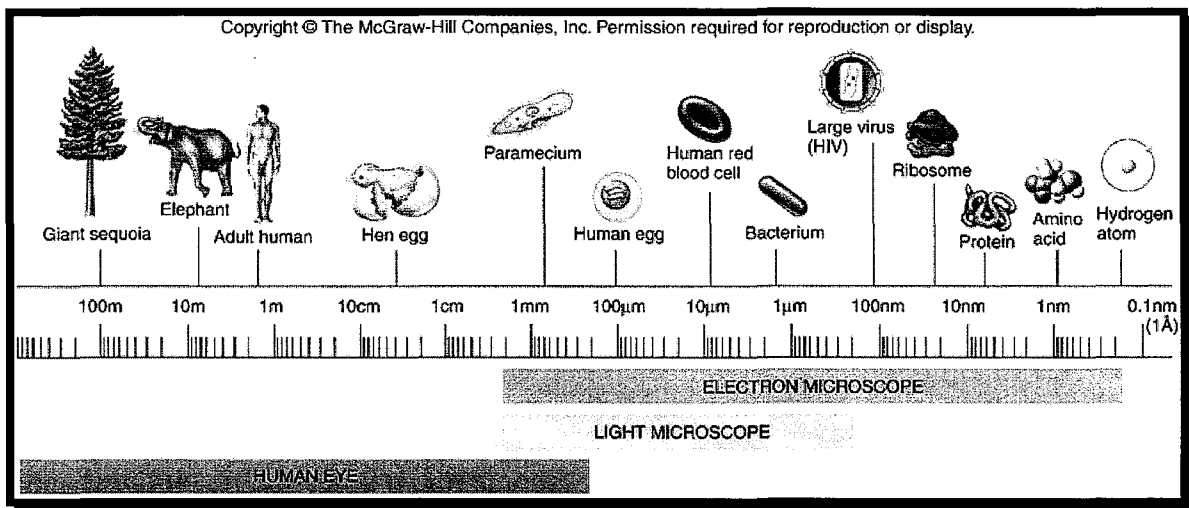
Diameter: \_\_\_\_\_ Width: \_\_\_\_\_

6. Use a meter stick or a metric ruler to measure the following: (you may have to make some conversions:

- a. width of classroom door opening in centimeters: \_\_\_\_\_
- b. length of the chalkboard in meters: \_\_\_\_\_
- c. height of your partner in decimeters: \_\_\_\_\_
- d. width of your pen in millimeters: \_\_\_\_\_
- e. Which of your fingernails is closest to 1 cm. in width? \_\_\_\_\_

**Part II: Millimeter, Micrometer, and Nanometer**

As you soon will discover, micrometers ( $\mu\text{m}$ ) are useful when measuring specimens under a microscope. In general, cells are much smaller than mm in size.

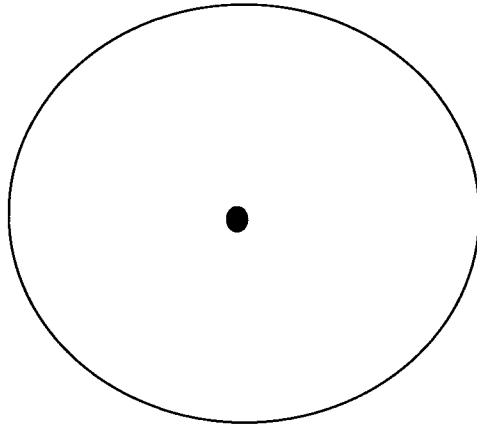


1. Assume that the circle below represents the field of view (FOV) of a compound light microscope.

a. Using a metric ruler, measure the diameter of the circle in millimeters. \_\_\_\_\_

b. Now, calculate the the diameter in micrometers. \_\_\_\_\_

c. What is the diameter of the FOV in nanometers? \_\_\_\_\_

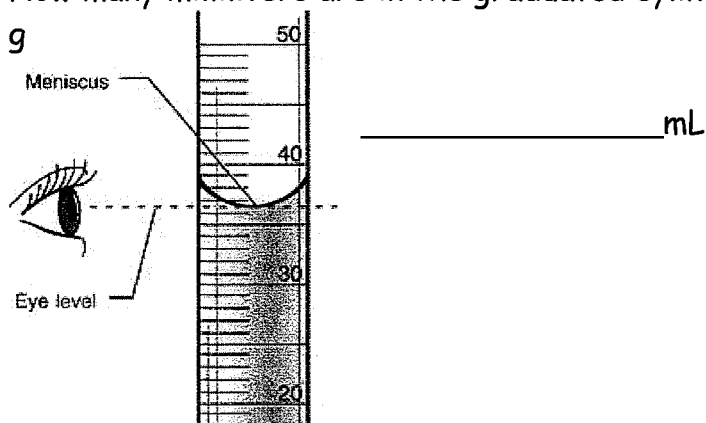


2. If a cell measured 20 mm in length, how many cells would fit across the diameter of the field of view? \_\_\_\_\_

### Part III. Volume

In the biology lab, liquid volume is usually measured in **milliliters (mL)** using a appropriately sized graduated cylinder. The measurements etched on the sides are called **graduations**. When the liquid is poured in, the top of the liquid forms in a slight curve called a **meniscus**. To measure the volume of liquid accurately, the volume of liquid should be determined by reading the bottom of the meniscus. For further accuracy, the graduated cylinder should be on a flat surface and you should **crouch down and read the mensicus at eye level**.

1. How many milliliters are in the graduated cylinder pictured below?



2. From the lab table, obtain small plastic bottle, a test tube, and a plastic pipette. Determine the volume each in mL. (use a graduated cylinder and faucet to help you with this task!)
- a. Volume of the plastic bottle \_\_\_\_\_

b. Volume of the test tube \_\_\_\_\_

c. Volume of the pipette \_\_\_\_\_

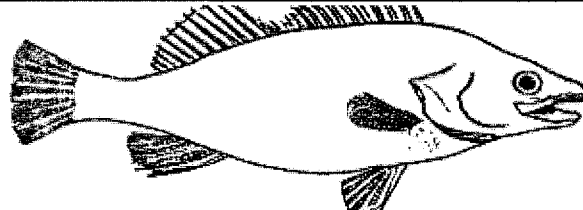
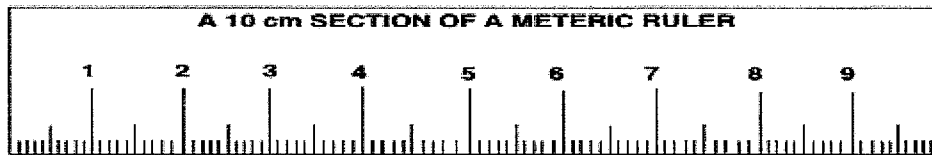
#### Part 4: Measuring by Displacement

The volume of solid objects can be obtained by measuring how much water they displace in a graduated cylinder. To measure the volume of an object using this method, first partially fill a graduated cylinder with water. Record the initial volume of water. Next submerge the object into the water in the graduated cylinder. Then record the volume of water. The increase in the water's volume is equal to the object's volume.

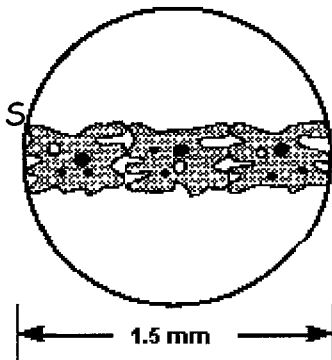
1. Use the graduated cylinder and water to determine the volume of the following objects in milliliters.
  - a. Marble: \_\_\_\_\_
  - b. Golf Tee: \_\_\_\_\_
  - c. Large Paper Clip: \_\_\_\_\_

#### Part V: Conclusions

1. Calculate the length of the fish in millimeters. \_\_\_\_\_

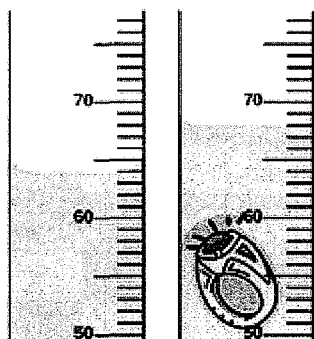


2. Calculate the length of one cell in micrometers pictured in the diagram below if the diameter of the FOV is 1.5 mm. (Hint - there are three cells in the diagram)



Size of one cell in micrometers: \_\_\_\_\_

3. Calculate the volume of the ring in mL using the information provided in the diagram below:



volume of ring \_\_\_\_\_

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Use this space for calculations for this lab. Please label any work you do with the corresponding part and question number!