

Metric Measurements

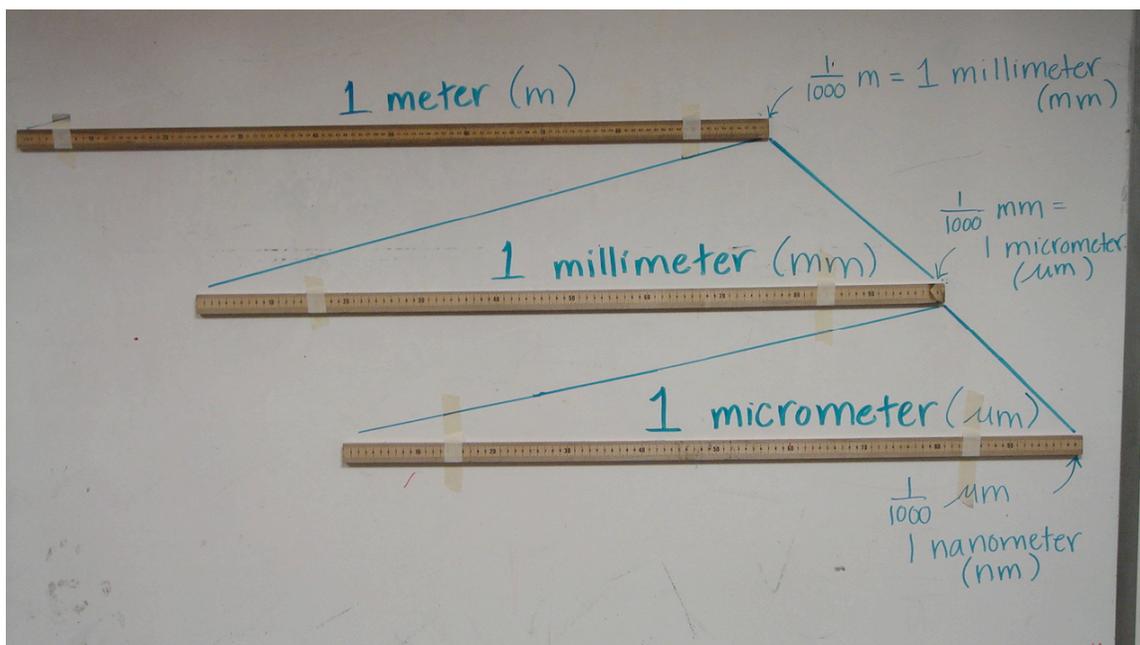
Background: When we use measurements such as millimeters, micrometers, and nanometers, students don't necessarily have a good idea about how small these measurements are, nor do they realize the relative sizes of these different units.

Materials:

Several meter sticks or paper meter tapes
Tape
White board or wall
Appropriate markers

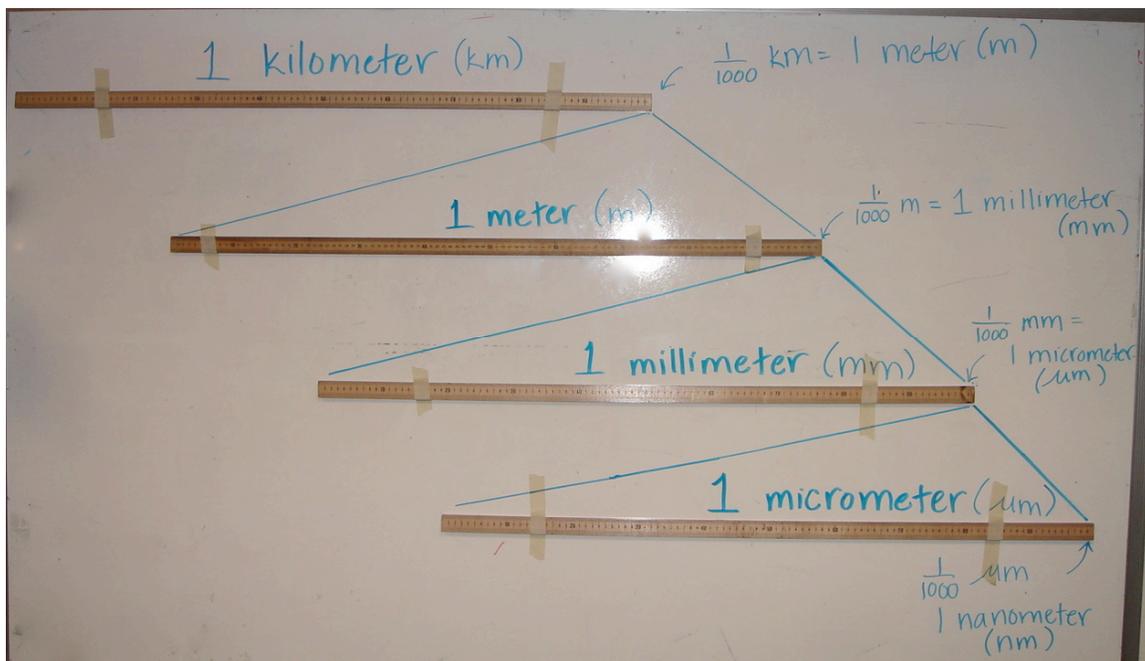
To Do and Notice:

1. Tape 1 meter stick to the board in the upper left-hand corner.
2. Label it "1 meter (m)".
3. Discuss the other units on the meter stick – centimeters and millimeters. Explain the fractional relationships with centimeters and millimeters to 1 meter. Identify and label the 999th millimeter.
4. Tape a second meter stick to the board below and slightly to the right of the first.
5. Explain that this meter stick represents an expanded version of the 999th mm from the meter stick above.



6. At this scale, we have our millimeter divided into thousandths. One 1000th of a millimeter is a micrometer, or μm . Notice that the micrometer is three orders of magnitude smaller than the millimeter, which is three orders of

- magnitude smaller than the meter. Therefore, one micrometer is $1/1,000,000$ of a meter. Identify and label the 999^{th} μm .
7. Tape the third meter stick to the board. This meter stick represents a scaled up version of a micrometer.
 8. We have changed our scale again, and now each one thousandth of our scaled up micrometer is equal to one nanometer (nm). Notice that the nanometer is three orders of magnitude smaller than the micrometer, which is three orders of magnitude smaller than the millimeter, which is three orders of magnitude smaller than the meter. Therefore, one nanometer is one billionth of a meter.
 9. Using the same technique, we can use the meter sticks to represent scaled down versions of measurements larger than 1 m. For example, the meter is one 1000^{th} of a kilometer.



What's Going On?

Most of the metric measurements we use have exponents that are divisible by three. A kilometer is 10^3 meters, a meter is 10^0 meters, a millimeter is 10^{-3} meters, a micrometer is 10^{-6} meters, and a nanometer is 10^{-9} meters.

Here is a chart of metric prefixes and their powers of 10:

<http://www.metricconversion.us/prefixes.htm>