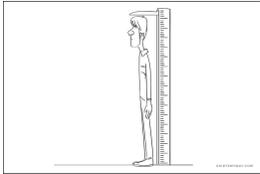


Size, Scale and Quantity

Learning Target: *Students will understand that microscopic phenomena can be observed using scale models to study systems that are too small.*

Do Now: Name the Unit of Measure

Word Bank <i>*Words may be used more than once.</i>				
yards feet	inches gram	liter miles millimeter	centimeters gallon micrometer	gallon micrometer
<p>1. What's the best unit to measure the distance from Hawaii to California?</p> 	<p>2. What is the best unit to measure how tall you are?</p> 	<p>3. What is the best unit to measure the length of your pencil?</p> 	<p>4. What's the best unit to measure the width of your fingernail?</p> 	<p>5. What's the best unit to measure the thickness of one single strand of hair?</p> 

How Small is Small?

How big are your feet? If you describe them as simply "large" we still don't know how *much* bigger your feet are than the general population's. Are they the size of an average sized adult's, the size of a basketball player's, or the size of two small canoes? The point is this: **size** is only meaningful if it tells us something about an object's dimensions *in relationship to* other things. The term we use when comparing a model to the actual thing is called a **scale** image.



Rather than endlessly comparing one thing to another, most cultures agree on **systems of measurement** that help to establish clear **dimensions** of an object. In science, we use the *International System of Units* which is sometimes called the metric system. In this system, the base unit for measuring length is the **meter**.

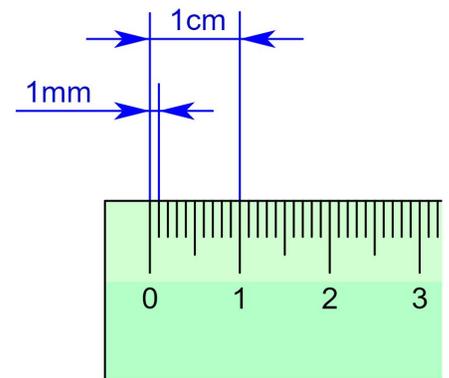
**Think
about it!**

What objects can you measure using a meter?

Centimeters and Millimeters

Notice that a meter is **divided** into smaller units called *centimeters*. There are 100 centimeters in a meter. This means a centimeter is $\frac{1}{100}$ (one one-hundredth) of a meter

★ *What objects can we measure using a centimeter?*



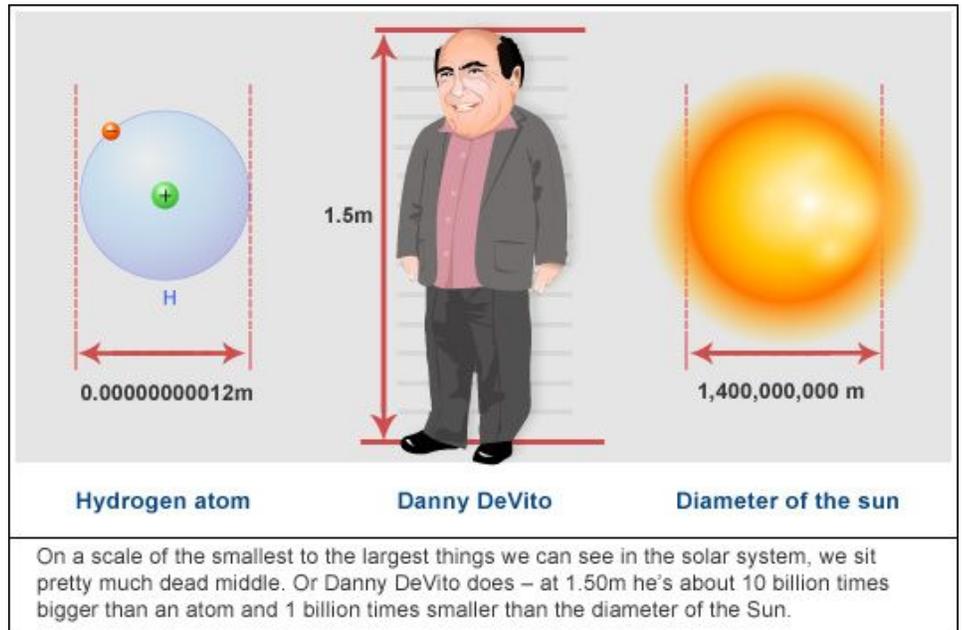
If we wanted to measure objects that are even smaller, it's best if we use a smaller unit. Notice that the meter is **divided** in even smaller units; these are called *millimeters*. There are 1000 millimeters in a meter. This means a millimeter is $\frac{1}{1,000}$ (one one-thousandth) of a meter. Our unaided eyes can still see objects that are millimeters in size.

★ *Can you think of any objects that we would want to measure in millimeters?*

Cell Size, Molecules and Scale

Our bodies are made up of cells, and compared to us they're tiny. The average human cell is about 10 micrometers (μm) wide.

What's a micrometer? A micrometer is a very small unit we use to measure objects that can only be seen using a powerful microscope. If you were to divide a meter into 1 million parts, one part would equal one micrometer! Now that's small.



Thanks to money, or what we can buy with it, most of us can wrap our heads around quantities like thousand, a hundred thousand and a even a million. But once we get past a few million it all starts to get harder to picture. The same goes for the small stuff — we know cells are small but molecules are even smaller... It's easy to get a grip on just how huge or tiny something is: you just compare its size to the size of things we're familiar with, like us.

Just how small is a molecule? In the microscopic world, cells are giants compared to molecules. In order to measure a molecule like water, we need a teeny-tiny unit called a picometer. If you were to divide a meter into ONE TRILLION parts, one part would equal one picometer. Think about that for a second, a trillion is a monstrous number. One trillion equals one million times one million.

[Million, Billion, Trillion Video](#) [Cell Size and Scale Model](#)