

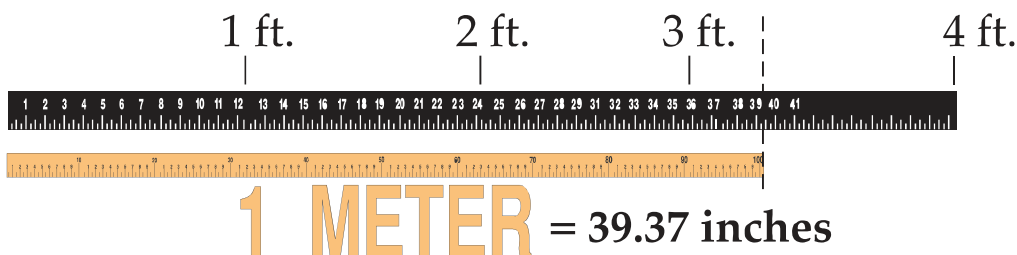
Introduction

Measurement is a very important tool in science. We use measurement to solve problems, compare objects, and record our answers. We will use the **Systeme Internationale (SI)** of measurement to measure **length, mass and weight, volume, and temperature**. The most well-known part of SI is the **metric system**. The metric system is a system for measuring mass and weight, distances, and volume. The metric system is easier to use than the system of inches, feet, ounces, and pounds because the metric system is based on the decimal system. This makes it easy to convert from one unit to another by multiplying or dividing it by the appropriate multiple of 10.

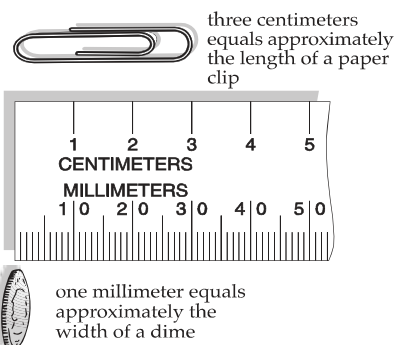
Length

A **meter (m)** is the basic unit of *length*. It is a little longer than one yard, which measures 36 inches.

One meter is the same as 39.37 inches. We can use meters to measure the length and width of rooms. Many races are measured in meters.



How do we measure small objects? Each meter is divided into 100 **centimeters (cm)**. One centimeter is equal to $\frac{1}{100}$ of a meter. Think of a dollar. Each penny is equal to $\frac{1}{100}$ of a dollar. Each centimeter can be divided into 10 parts. These smaller parts are called **millimeters (mm)**. A millimeter is the same as $\frac{1}{1000}$ of a meter. It takes 1,000 millimeters to make a meter.

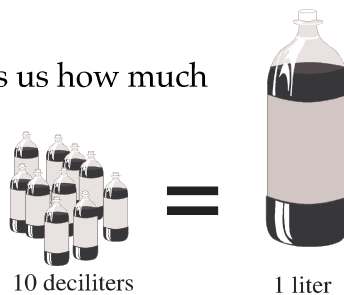


A **decimeter (dm)** is equal to $\frac{1}{10}$ a meter. In other words, 10 decimeters are equal to one meter.

Kilometers (km) are used to measure long distances. A *kilometer* is 1,000 meters. You use kilometers to measure the distances between cities.

Volume

The **liter (l or L)** measures volume. Volume tells us how much space something takes up. One liter is a little more than a quart. A liter can be divided into smaller parts. There are 1,000 liters in one **kiloliter (kl or kL)**. A **deciliter (dl or dL)** is $\frac{1}{10}$ of a liter. In other words, it takes 10 deciliters to equal one liter. A **centiliter (cl or cL)** is $\frac{1}{100}$ of a liter. It takes 100 centiliters to make a liter. A **milliliter (ml or mL)** is $\frac{1}{1000}$ of a liter. It takes 1,000 milliliters to make a liter.



Solid volume is often measured in **cubic centimeters (cm³)**. A small die has the volume of about 1 cm³. To measure the volume of a solid object, such as a brick, you would measure its length, width, and height, and multiply the three figures together. The measurements of the brick would be in centimeters and the volume would be in cubic centimeters.

Mass and Weight



However, we need to know the difference between mass and weight. Weight is the pull of gravity on an object. Mass is the amount of material in the object. On Earth, the mass and weight of an object are the same, but astronauts weigh less in space than they do on Earth because the pull of gravity is less. Their mass is the same on Earth as in space, but their weight is different. In the metric system, we measure mass and weight by using grams, milligrams, and kilograms.

Because the units of mass and weight were both developed on Earth, the units are the same. We can talk about the mass of a ball or the weight of the ball. We will use the units of grams, milligrams, and kilograms. The measurements would be the same, too. Most times, though, we will discuss mass.

The **gram (g)** is used to measure mass and weight. One regular size paper clip has a mass of about one gram. A paper clip that has a mass of one gram also has a weight of one gram. A gram can be divided into smaller parts. These small parts are called **decigrams (dg)**, **centigrams (cg)**, and **milligrams (mg)**. A decigram is $\frac{1}{10}$ of a gram, a centigram is $\frac{1}{100}$ of a gram, and a milligram is $\frac{1}{1000}$ of a gram. It takes 1,000 milligrams to equal a gram.

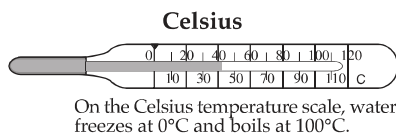
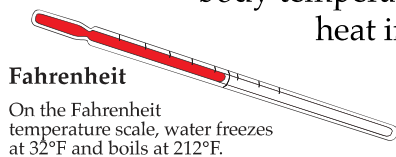
The mass of a gram of salt is about one milligram. Items which are sold in small amounts, such as medicine, are measured in milligrams.

How do we weigh heavier objects? We use kilograms. A **kilogram (kg)** is 1,000 grams. The mass of a baseball bat is about one kilogram. Heavier objects measured in kilograms are people, large animals, vehicles, and metals.

Temperature

At times we must measure *temperature*. Temperature tells us how hot or cold something is at the moment. A **thermometer** measures temperature in **degrees**. The symbol for degrees is $^{\circ}$. There are two common ways to measure temperature. On the **Fahrenheit (F)** temperature scale, water freezes at 32°F and boils at 212°F . This is the temperature scale most often used in the United States. Your normal body temperature is 98.6°F . On the **Celsius (C)** temperature scale, water freezes at 0°C and boils at 100°C .

Your body has a temperature of 37°C . Whether you measure your body temperature in *Fahrenheit* or *Celsius*, the amount of heat in your body is the same and only the terms



used to describe measurement are different. For most scientific work, temperature is measured on the Celsius scale.

When something feels cold, it is because it lacks enough heat energy to bring it up to 37°C . Cold is not the presence of something but rather an absence of heat. If you are hungry, it is because you lack food. If you are cold, it is because you lack heat. Try to think of things that become cold as things that are losing heat. This is what happens as anything cools: it loses heat.

Whether we use cool objects or heat them, we will use the Celsius temperature scale. Since the Celsius scale is based on the decimal system, it is easy to use.

Summary

Measurement is highly important in science. The SI units of measurement are used in science. These include the metric units of grams and kilograms for mass and weight, meter and kilometer for distance, and liter and kiloliter for volume. The Celsius scale is used to measure temperature.