Chapter 3. Unit of measurement

What's the meaning of measurement ?

Measurement is a process that uses numbers to describe a physical quantity based on what we can observe. This is done to be able to compare them to each other. We can measure how big things are, how warm they are, how heavy they are, and lots of other features as well. Units of Measurement provide standards for our comparisons, so that the numbers from our measurements refer to the same thing.

In past centuries many different units were used in different countries. Today, most units of measure fall into one of three systems :

The older two, the British imperial system and the closely related US customary system use the foot as a measure of length, the pound as a measure for weight, and the second as a measure for time. They use other units as well. The number of smaller units that make the bigger units in these two systems varies: For example, there are 12 inches in a foot and 16 ounces in a pound.

The newest of the three systems is the metric system or SI system which usually use 10, 100 or 1000 of a smaller unit to make a bigger one: For instance, there are 100 centimeters in 1 meter or 1000 grams in 1 kilogram. This system uses the meter for length, the kilogram for weight, and, like the other two systems, the second for time.

Number and Unit *of measure*

The property of the thing being measured is given as a number of units of measure. The number only has sense when the unit of measurement is also given. For example, The Eiffel Tower in Paris, France is 300 meters tall. That is, the distance from the top to the bottom of the Eiffel Tower is 300 meters. The property of the Eiffel Tower being measured is a distance. The number

measured is 300. This number does not make sense without the unit of measure. The unit of measure is the meter.

Measurement Standards

Standards are special objects that are used to make measurements in terms of fixed units of measurement. A meter stick is an example of a standard. When you measure something with a meter stick, you can compare that measurement to anything else that is also measured with a meter stick. This makes measurement easier and comparisons between measurements easier.

Size of Units of Measurement

There are units of measurement of different sizes. There are small units of measurement to measure small things. There are big units of measurement to measure big things. There are medium units of measurement to measure medium things.

Science, medicine and engineering use smaller units of measurement to measure small things with less error. It is easy to measure large things using larger units of measurement. Large measurements like the width of a galaxy and small measurements like the mass of an atom use special units of measurement.

Systems of Units of Measurement

There are many different standards and units used all over the world. Most became less used during the 19^{th} and 20^{th} centuries.

Metric System

The metric system is a system of measurement used in most of the world. It is also called the International System of Units, or SI. Units of measure in the metric system include :

The units of length or linear size are based on the meter. They include the kilometer (km) which is 1000 meters, the centimeter (cm), and the millimeter (mm) which is 1/1000 of a meter. The unit of volume is the liter. It is used for measuring an amount of liquid.

The unit of mass is the kilogram. A kilogram (kg) weighs the same as a liter of water (at normal temperature, and pressure). 1 gram (g) is the weight of 1 milliliter of water at 0 degrees Celsius. The metric tonne is 1000 kilograms or a million grams.

British imperial Units

Imperial units were defined in the United Kingdom in 1825. These units sometimes based on similar units that were in use before 1825. Imperial units were used in countries that were part of the British Empire. While many of these countries, including the United Kingdom, have officially adopted SI, the older system of units are still used.

US customary units

US customary units are the official units used in the US. These are similar to the British imperial units and also based on the units used in the United Kingdom from before American Independence. Some of the units are different to the British ones. For example, there are 20 imperial fluid ounces in an imperial pint, but 16 US fluid ounces in a US pint. Additionally, the US fluid ounce is slightly bigger than the imperial fluid ounce. The result is that US pints and gallons are smaller than imperial pints and gallons. In the United States, the metric system has been legal for trade since 1866 but other measurements such as the gallon, inch, and the pound are still widely used.

Imperial and US units of measurement include:

Length - inch (in), foot (ft), yard (yd), and mile.

1 foot = 12 inches

1 yard = 3 feet (plural of foot) = 36 inches

1 mile = 1760 yards = 5280 feet

Imperial volume - imperial fluid ounce (floz), imperial pint (pt), and imperial gallon (gal).

1 imperial pint = 20 imperial fluid ounces

1 imperial gallon = 8 imperial pints

US volume - US fluid ounces (floz), US cup (cp), US pint (pt), US quart (qt), and US gallon (gal).

1 US cup = 8 US fluid ounces

1 US pint = 2 US cups = 16 US fluid Ounces

1 US quart = 2 US pints = 4 US cups = 32 US fluid ounces

1 US gallon = 4 US quarts = 8 US pints = 16 US cups Weight and mass are measured in ounces (oz) and pounds (lb), and stone (st) in imperial only.

1 pound = 16 ounces1 stone = 14 pounds

The ounces for weight and volume are different. Even when measuring water, the number of ounces of weight is not the same as the number of fluid ounces.