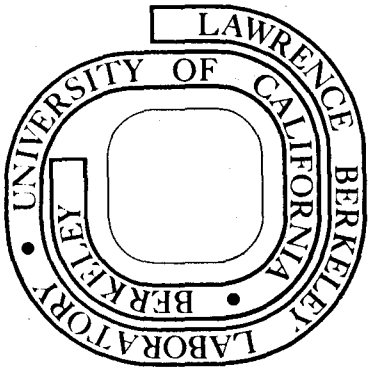
EVERYDAY USE OF THE METRIC SYSTEM.

April 1985



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CODE	SERIAL	PAGE
AA0139	M6371A	1 of 6

AUTHOR	DEPARTMENT	LOCATION	DATE
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PROGRAM — PROJECT — JOB
MECHANICAL DEPARTMENT METRICATION

TITLE
EVERYDAY USE OF THE METRIC SYSTEM

Revision A,- 5/2/85

For ordinary usage, the meter, the liter (a non-SI unit)[1], and the gram are of most concern. Similarly, the list of metric prefixes can be shortened considerably. The chart below indicates the commonly used prefixes.

kilo	one thousand	1000
hecto	one hundred	100
deka	ten	10
deci	one tenth	0.1
centi	one hundredth	0.01
milli	one thousandth	0.001

Notice the relationship of the prefixes with our decimal system of counting. This may be illustrated as follows:

Thou-ands	Hun-dreds	Tens	Ones	Tenths	Hun-dredths	Thou-sandths
1000	100	10	1	0.1	0.01	0.001
kilo	hecto	deka	base unit	deci	centi	milli

By combining roots and prefixes, all the units of measurement needed can be derived.

LENGTH

The base unit for length is the meter. The meter is a little longer than one yard, or about 39.37 inches. A standard meter stick is divided into 100 centimeters and 1000 millimeters. A millimeter is one-tenth of a centimeter. A kilometer is 1000 meters long, which is a little more than one-half mile. Long distances are measured in kilometers.

Length measurement may be expressed in various forms. An object which measures 26 centimeters may be expressed as 260 millimeters, 2.6 decimeters, or 0.26 meters. The relationships of 10 make it convenient to express measures in any of its terms. However, it is more common to use a term which will avoid the use of decimals. The common units for measuring length are listed below.

kilometer (km)	1000 meters
hectometer (hm)	100 meters
dekameter (dam)	10 meters
meter (m)	1 meter
decimeter (dm)	0.1 meters
centimeter (cm)	0.01 meters
millimeter (mm)	0.001 meters

*This work was supported by the U.S. Department of Energy, Office of Basic Energy Science, under Contract No. DE-AC03-76SF00098.

AREA

Area measures in the metric system are stated in much the same way they are with customary measures—in square units. However, square centimeters, square meters, or square kilometers are used instead of square inches or square yards. For very small areas, square millimeters are used.

In the metric system, the term hectare (ha) is used exclusively with land measures. The hectare can be defined as the area of a square of land measuring 100 meters to a side. A hectare of land is about the same amount of land as two and one-half acres in customary measurements. A second term sometimes used with land measures is the term "are." The are can be defined as the area of a square of land measuring 10 meters on a side.

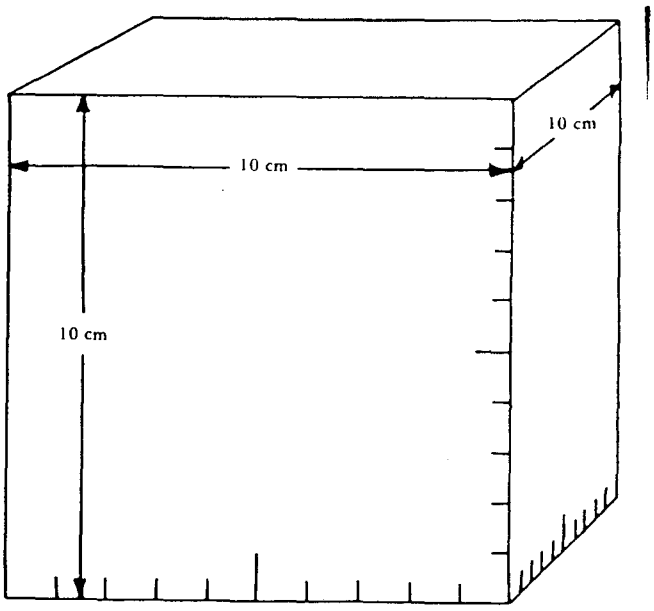
For measuring land in the United States, the customary acre, which is 43,560 sq ft, is used in millions of deeds and other legal documents. For this reason, it is unlikely that this term will go out of existence in the foreseeable future.

The chart belows lists terms used in area measure. Note that one hundred is the basic conversion factor for metric units of area.

1 square kilometer (km^2)	=	100 hectares
1 hectare (ha)	=	100 ares
1 are	=	100 square meters
1 square meter (m^2)	=	100 square decimeters
1 square decimeter (dm^2)	=	100 square centimeters
1 square centimeter (cm^2)	=	100 square millimeters

VOLUME

Although not an SI unit,[1] the most widely used unit of volume in the metric system is the liter.



(Not to scale)

The cube above has faces which are decimeter squares. The cube is called a cubic decimeter (dm^3). It measures 10 centimeters on each side, and it has a capacity of one liter. Liters, of course, can take several different shapes. We find liter containers for juice, milk, soft drinks, etc. A liter is slightly larger than one quart. The metric prefixes have the same relationship to the liter as they do to the SI base units. However, the most common prefix used with the liter is milli.

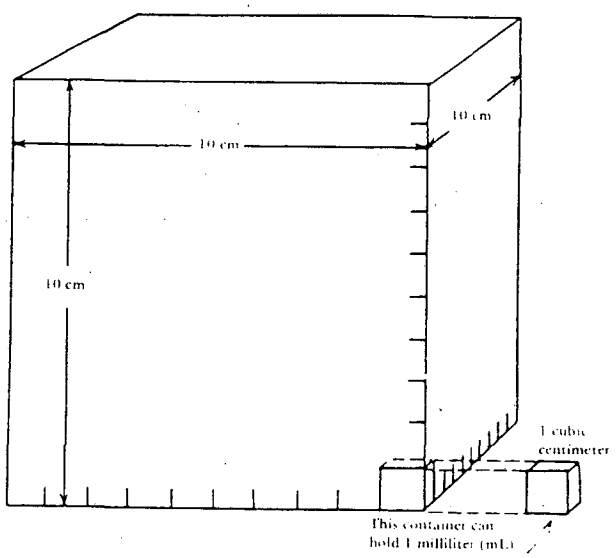
The chart below indicates units used for measuring capacity or volume.

1 kiloliter (kL)	1000 liters
1 hectoliter (hL)	100 liters
1 dekaliter (daL)	10 liters
1 liter (L)	1 liter
1 deciliter (dL)	0.1 liters
1 centiliter (cL)	0.01 liters
1 milliliter (mL)	0.001 liters

One cubic centimeter (cm^3) is 0.001 dm^3. Hence, one cubic centimeter has a volume of one milliliter (mL). Very small capacities, such as liquid medicines, are measured in milliliters.

VOLUME

Volumes of solids are measured in cubic units, such as cubic centimeters (cm^3), cubic decimeters (dm^3), cubic meters (m^3), etc. The volume of any solid shape can be measured by finding out how many cubic units fit into it.



(Not to scale)

The figure above represents a cubic decimeter, which measures 10 centimeters on each side. The small cube is a cubic centimeter. It would take 1000 of the cubic centimeters to fill the cubic decimeter. Thus, the volume of one cubic decimeter is 1000 cubic centimeters (1 dm^3 = 1000 cm^3). This same relationship exists between cubic centimeters and cubic millimeters (1 cm^3 = 1000 mm^3) and between cubic decimeters and cubic meters (1 m^3 = 1000 cm^3).

The chart below indicates the relationship between volume in cubic units and capacity in liters.

1	m^3	= 1000	dm^3	= 1000 L
1	dm^3	= 1000	cm^3	= 1 L
1	cm^3	= 1000	mm^3	= 1 mL

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1. The SI unit of volume is the cubic meter. This unit, or one of the regularly formed multiples such as the cubic centimeter, is preferred. The special name liter (L) has been approved for the cubic decimeter, but use of this unit is restricted to volumetric capacity, dry measure, and measure of fluids (both gases and liquids). No prefix other than milli- or micro- should be used with liter.

(From: Section 14 - 1983 ASTM Standards E-280 X1.11.1.)

MASS

Mass is the measure of resistance to change of motion. The mass of an object refers to a measure of the amount of matter in that object. Under ordinary circumstances, mass is a physical constant for a given object. The kilogram (kg) is the base unit for measuring mass.

The term "weight" has been used commonly to mean mass. Technically, however, weight is a measure of the force which gravitation exerts upon a body, equal to mass times acceleration of gravity. In SI, weight in this technical sense is measured by the derived unit "newton" (N).

The common units used for measuring mass are listed below:

kilogram (kg)	1000 grams
hectogram (hg)	100 grams
dekagram (dag)	10 grams
gram (g)	1 gram
decigram (dg)	0.1 grams
centigram (cg)	0.01 grams
milligram (mg)	0.001 grams

The gram (g) has about the same mass as one cubic centimeter of water. This can be compared to the mass of a dollar bill. The gram is used for measuring quantities of small mass, such as breakfast cereals or other packaged foods. Though the kilogram is the base unit in SI, one can think of the gram as the base unit for the purpose of using metric prefixes.

The milligram (mg) is an extremely small mass, equal to 0.001 g. In everyday usage, the consumer might encounter the milligram in a pharmacy.

The kilogram has approximately the same mass as one liter of water. It measures about 2.2 pounds. The mass of numerous food items such as vegetables and meat are measured in kilograms.

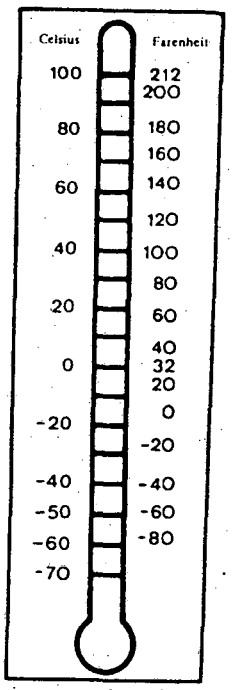
Objects with extremely large mass are measured by the megagram (Mg), commonly called the metric ton. The metric ton is equal to 1000 kilograms and is about 10 percent larger than the customary short ton. If one were to fill a cubic meter with water, the mass would be approximately one metric ton.

TEMPERATURE

The SI base unit of temperature is the kelvin (K). The kelvin scale is based on the scientific principle of absolute zero. On this scale, water freezes at 273.15 K, body temperature is 310.15 K, and water boils at 373.15 K.

However, the Celsius scale (formerly centigrade scale) is for everyday metric use. This scale was developed in 1742 by the Swedish astronomer, Anders Celsius, and it can be derived from the kelvin scale by subtracting 273.15 from the kelvin measure. Thus, on the Celsius scale the freezing point of water is zero degrees and the boiling point of water is 100 degrees. Each degree is 1/100 of the difference between the freezing and boiling points of water.

The thermometer below shows the relationship between degrees Celsius and our customary degrees Fahrenheit.



The following is a guide for commonly used temperatures:

0° C	freezing point of water	(32° F)
10° C	moderately cool day	(50° F)
25° C	pleasant spring day	(77° F)
30° C	warm summer day	(86° F)
37° C	normal body temperature	(98.6° F)
40° C	heat wave temperature	(104° F)
100° C	boiling point of water	(212° F)

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This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

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