

Metric System

Length

Kilometer

Hectometer

Dekameter

Meter

Decimeter

Centimeter

Millimeter

Base

Mass

Kilogram

Hectogram

Dekagram

Gram

Decigram

Centigram

Milligram

Base

Volume

Kiloliter

Hectoliter

Dekaliter

Liter

Deciliter

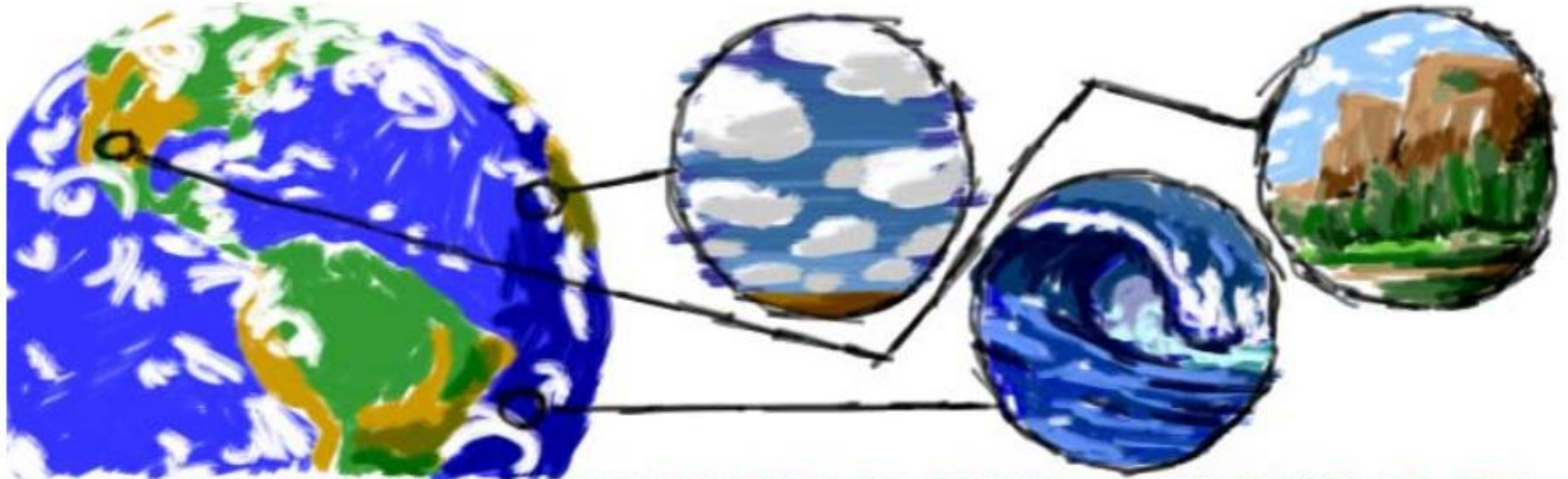
Centiliter

Milliliter

Matter

Matter refers to anything that has mass and takes up space.

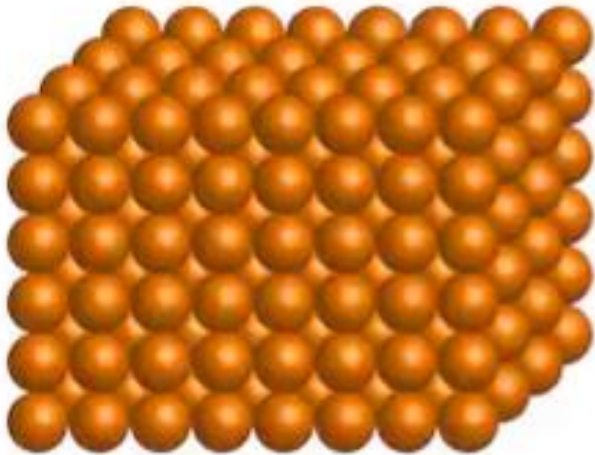
Matter is the Stuff Around You



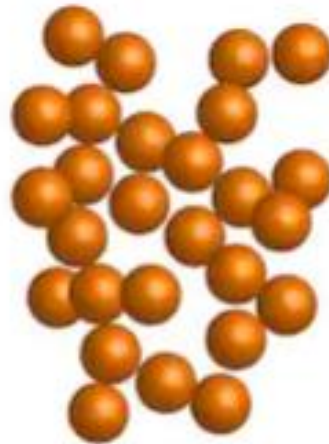
THE EARTH IS ONE LARGE MIXTURE OF GASES, LIQUIDS AND SOLIDS

Atoms

All matter is made up of atoms and can exist as a solid, liquid, or gas.



solid



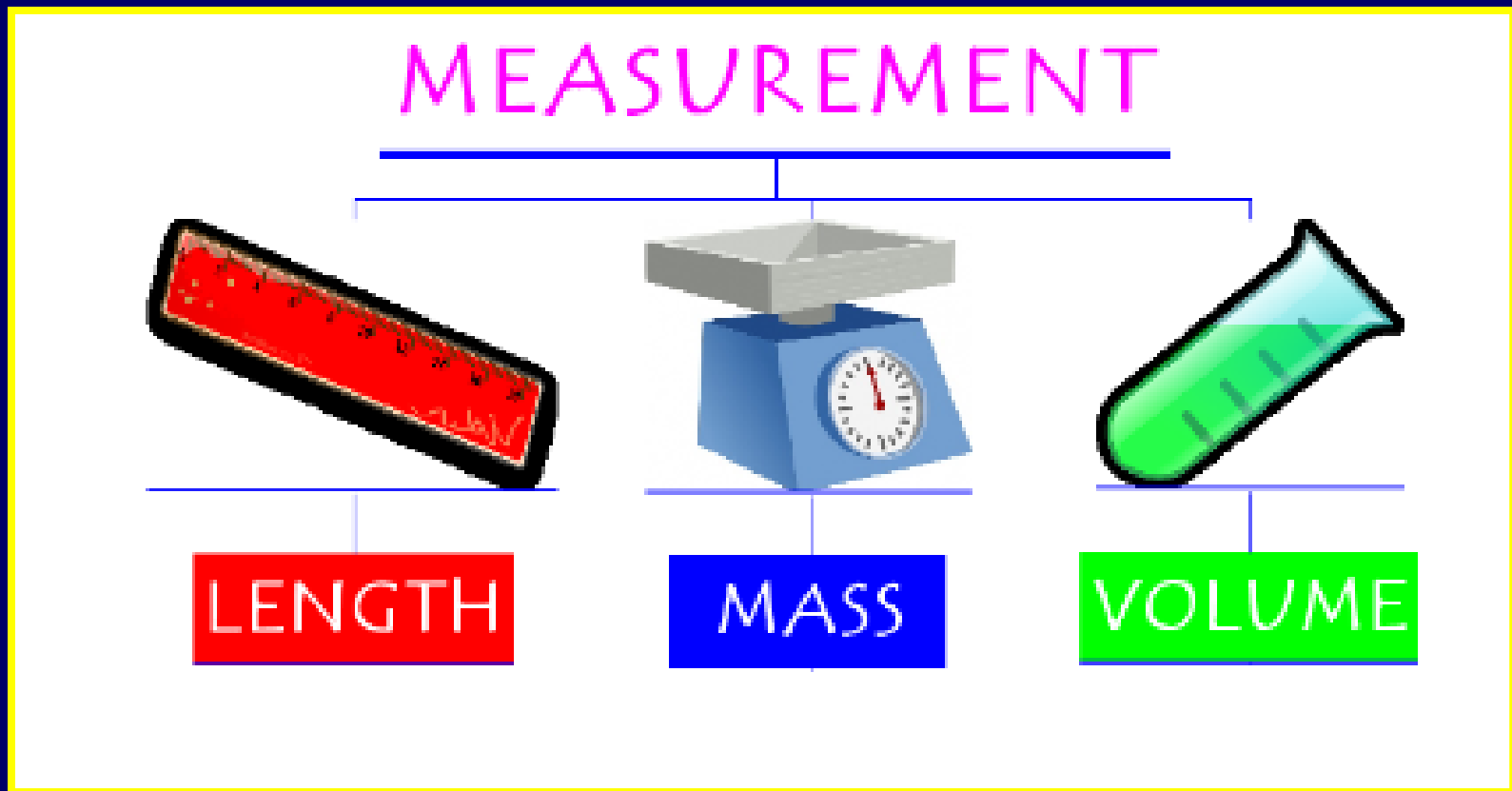
liquid



gaseous

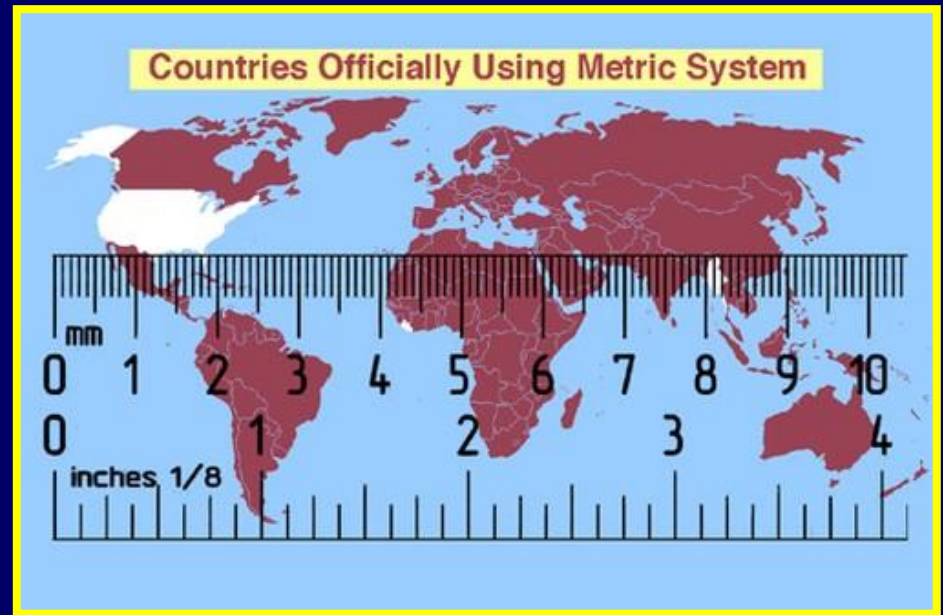
Measuring Matter

We can measure matter according to its length, mass, or volume.



Metric System

Science and most countries use the Metric System when making measurements.



Prefixes

The metric systems add prefixes to the base units of meter, grams, and liter.

Kilo

Hecto

Deca

Centi

Deci

Milli

The prefixes are based on powers of 10.

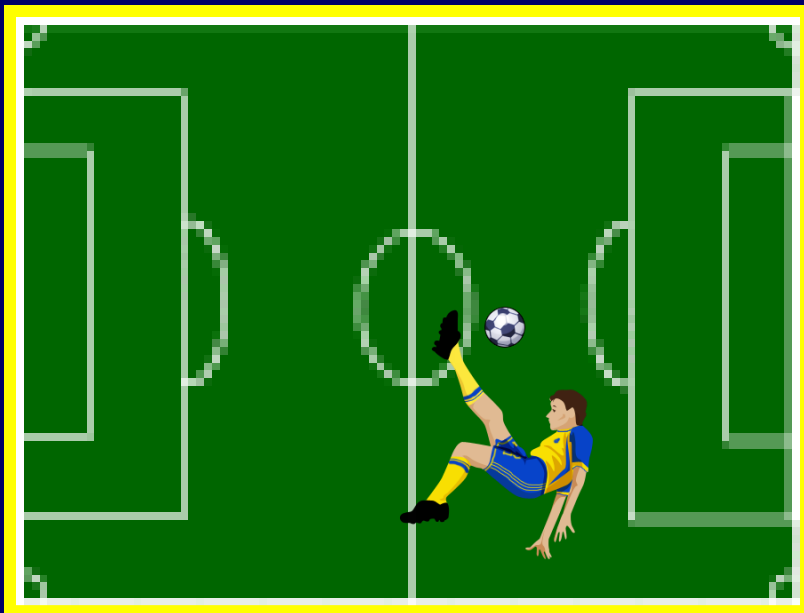
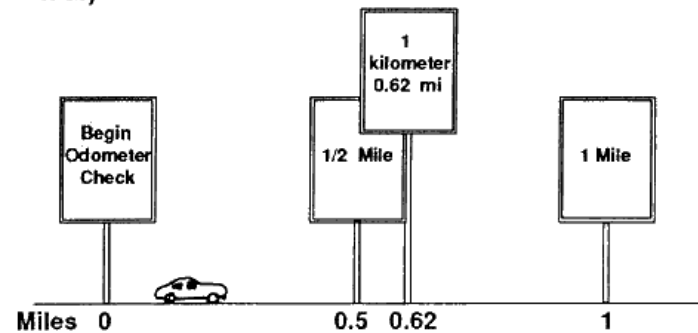
Kilo (k)

Thousand

1,000

10^3

1 kilometer (or 1 km) = a little more than half a mile (pronounced KILL-oh-meet-ur not kill-AHM-it-ur)



Hecto (h)

Hundred

100

10^2

Deca (da)

Ten or 10



50's



60's



70's



80's

Deci (d)

Tenth or 0.1

Centi (c)

Hundredth

0.01

10^{-2}



Milli (m)

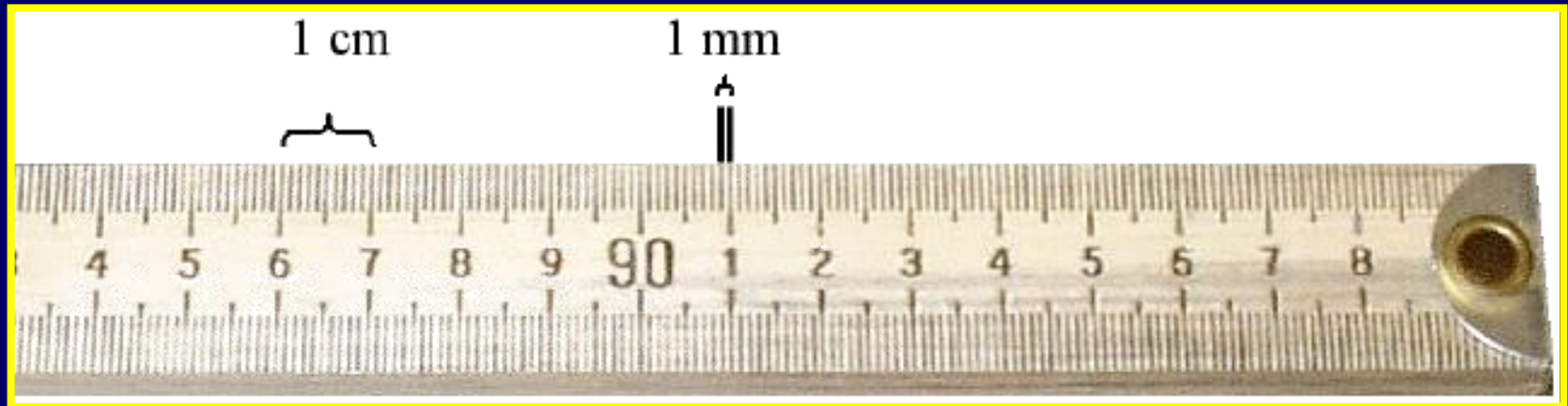
Thousandth

0.001

10^{-3}

Measuring Length

The common tool for measuring length, in the metric system, is the meter stick.



The metric base unit for length is the meter (m).

Measuring Length

When measuring length, just add the prefix to the base word, meter (m).

Examples

1,000 meters (m) = 1 kilometer (km)

100 meters (m) = 1 hectometer (hm)

10 meters (m) = 1 decameter (dam)

10 decimeters (dm) = 1 meter (m)

100 centimeters (cm) = 1 meter (m)

1,000 millimeters (mm) = 1 meter (m)

Measuring Mass

Mass refers to the amount of matter there is in a substance or object.



Matter is made up of atoms, but atoms come in all different sizes, sort of like a bag of marbles.

Measuring Mass

The periodic table lists all the different types of atoms.

PERIODIC TABLE OF THE ELEMENTS

<http://www.kjf-split.hr/periodni/en/>

PERIODIC TABLE OF THE ELEMENTS

LEGEND:

- Metal
- Semimetal
- Nonmetal
- 1 Alkali metal
- 2 Alkaline earth metal
- 3-10 Transition metals
- Lanthanide
- Actinide
- 16 Chalcogens element
- 17 Halogens element
- 18 Noble gas

STANDARD STATE (25 °C; 101 kPa)

- Ne - gas
- Fe - solid
- Ga - liquid
- Tc - synthetic

PERIODIC TABLE DATA:

PERIOD	GROUP I	GROUP IIA	GROUP IIIA	GROUP IVA	GROUP VA	GROUP VIA	GROUP VIIA	GROUP VIIIA										
1	1.0079 H HYDROGEN							2 4.0026 He HELIUM										
2	3 6.941 Li LITHIUM	4 9.0122 Be BERYLLIUM						10 20.180 Ne NEON										
3	11 22.990 Na SODIUM	12 24.305 Mg MAGNESIUM						18 39.948 Ar ARGON										
4	19 39.098 K POTASSIUM	20 40.078 Ca CALCIUM	21 44.956 Sc SCANDIUM	22 47.867 Ti TITANIUM	23 50.942 V VANADIUM	24 51.996 Cr CHROMIUM	25 54.938 Mn MANGANESE	26 55.845 Fe IRON	27 58.933 Co COBALT	28 58.693 Ni NICKEL	29 63.546 Cu COPPER	30 65.39 Zn ZINC	31 69.723 Ga GALLIUM	32 72.64 Ge GERMANIUM	33 74.922 As ARSENIC	34 78.96 Se SELENIUM	35 79.904 Br BROMINE	36 83.80 Kr KRYPTON
5	37 85.468 Rb RUBIDIUM	38 87.62 Sr STRONTIUM	39 88.906 Y YTRITIUM	40 91.224 Zr ZIRCONIUM	41 92.906 Nb NIObIUM	42 95.94 Mo MOLYBDENUM	43 (98) Tc TECHNETIUM	44 101.07 Ru RUTHENIUM	45 102.91 Rh RHODIUM	46 106.42 Pd PALLADIUM	47 107.87 Ag SILVER	48 112.41 Cd CADMIUM	49 114.82 In INDIUM	50 118.71 Sn TIN	51 121.76 Sb ANTIMONY	52 127.60 Te TELLURIUM	53 126.90 I IODINE	54 131.29 Xe XENON
6	55 132.91 Cs CAESIUM	56 137.33 Ba BARIUM	57-71 La-Lu Lanthanide	72 178.49 Hf HAFNIUM	73 180.95 Ta TANTALUM	74 183.84 W TUNGSTEN	75 186.21 Re RHENIUM	76 190.23 Os OSMIUM	77 192.22 Ir IRIDIUM	78 195.08 Pt PLATINUM	79 196.97 Au GOLD	80 200.59 Hg MERCURY	81 204.38 Tl THALLIUM	82 207.2 Pb LEAD	83 208.98 Bi BISMUTH	84 (209) Po POLONIUM	85 (210) At ASTATINE	86 (222) Rn RADON
7	87 (223) Fr FRANCIUM	88 (226) Ra RADIUM	89-103 Ac-Lr Actinide	104 (261) Rf RUTHERFORDIUM	105 (262) Db DUBNIUM	106 (266) Sg SEABORGIUM	107 (264) Bh BOHRINIUM	108 (277) Hs HASSIUM	109 (268) Mt MEITNERIUM	110 (281) Uun UNUNNIUM	111 (272) Uuu UNUNUNIUM	112 (285) Uub UNUNBIUM	114 (289) Uuq UNUNQUADIUM					

LANTHANIDE

57 138.91 La LANTHANUM	58 140.12 Ce CERIUM	59 140.91 Pr PRASEODYMIUM	60 144.24 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 150.36 Sm SAMARIUM	63 151.96 Eu EUROPIUM	64 157.25 Gd GADOLINIUM	65 158.93 Tb TERBIUM	66 162.50 Dy DYSPROSIUM	67 164.93 Ho HOLMIUM	68 167.26 Er ERBIUM	69 168.93 Tm THULIUM	70 173.04 Yb YTTERIUM	71 174.97 Lu LUTETIUM
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ACTINIDE

89 (227) Ac ACTINIUM	90 232.04 Th THORIUM	91 231.04 Pa PROTACTINIUM	92 238.03 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM
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(1) Pure Appl. Chem., 73, No. 4, 667-683 (2001)
Relative atomic mass is shown with five significant figures. For elements having no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element.
However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.

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Measuring Mass

Some atoms, like lead (Pb), are very large and very heavy.



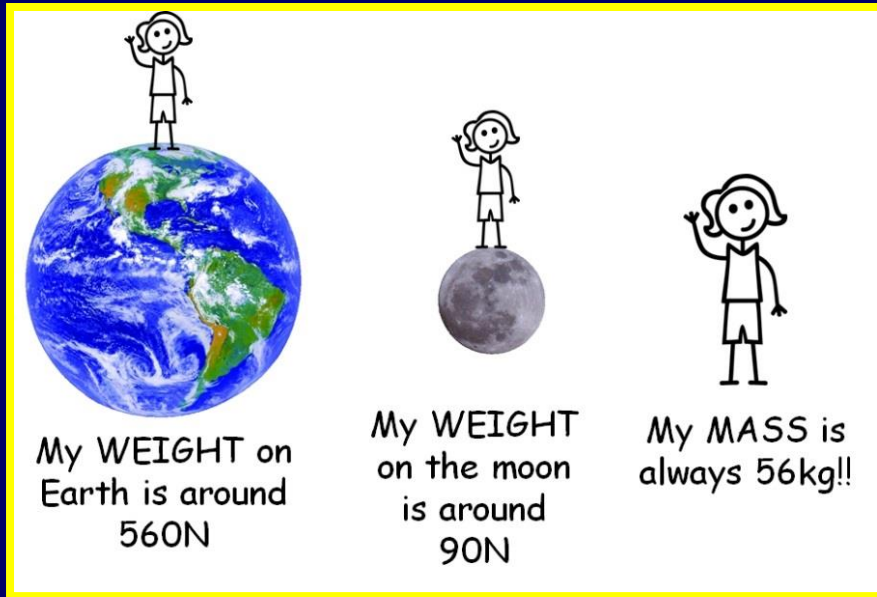
Other atoms like nitrogen (N), are very small and very light.

Nitrogen makes up 78% of our air.

When measuring mass, we are measuring the amount of atoms present, as well as how heavy or light the atoms are in a substance.

Mass Vs. Weight

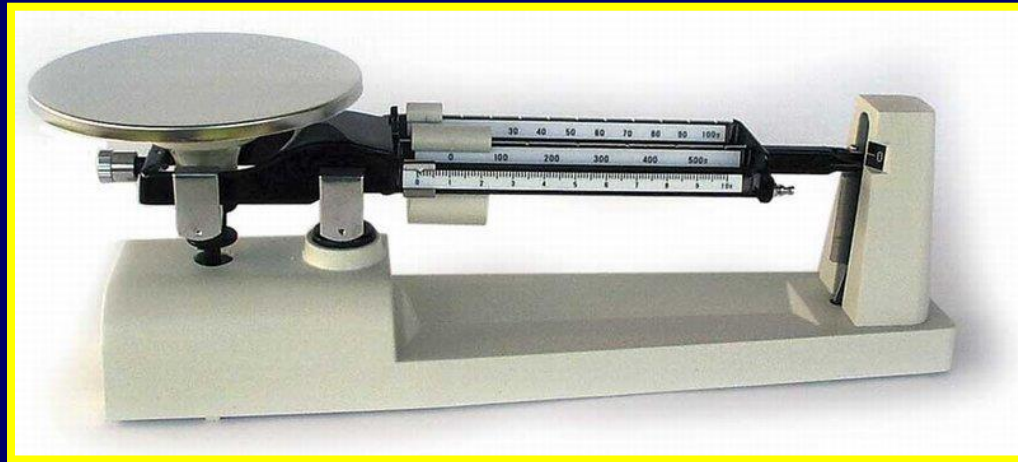
Mass and weight are two different measurements.



Weight includes the effect of gravity pulling down on a substance or object and varies with changes in gravity.

Measuring Mass

When we measure mass, we use a triple beam balance that is calibrated to ignore the effect of gravity.



The metric base unit for measuring mass is the gram (g).

Measuring Mass

When measuring mass, just add the prefix to the base word, grams (g).

Examples

1,000 grams (g) = 1 kilogram (kg)

100 grams (g) = 1 hectogram (hg)

10 grams (g) = 1 decagram (dag)

10 decigrams (dg) = 1 gram (g)

100 centigrams (cg) = 1 gram (g)

1,000 milligrams (mg) = 1 gram (g)

Measuring Volume

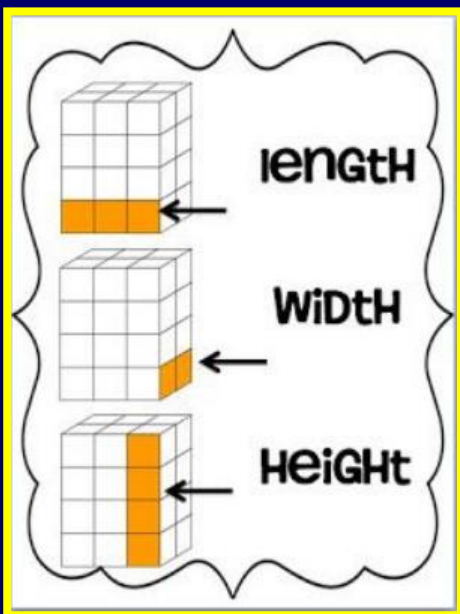
Volume refers to the amount of space that an object occupies.



A marble takes up a lot less space than Earth, so a marble has a lot less volume.

Measuring Volume

To find the volume for rectangular solids, we multiply the Length X Width X Height and the unit is always cubed (m^3 or cm^3).



$$3 \text{ cm} \times 2 \text{ cm} \times 4 \text{ cm}$$

$$24 \text{ cm}^3$$

Measuring Volume

When measuring the volume of liquids, we use graduated cylinders.



The metric base unit for measuring liquid volumes is the liter (L).

Measuring Volume

When measuring the volume of liquids, just add the prefix to the base word, liter (L).

Examples

1,000 liters (L) = 1 kiloliter (kL)

100 liters (L) = 1 hectoliter (hL)

10 liters (L) = 1 decaliter (daL)

10 deciiters (dL) = 1 Liter (L)

100 centiliters (cL) = 1 Liter (L)

1,000 milliliters (mL) = 1 Liter (L)

The End

