

BAE 103
Energy in Biological Systems

Dimensions, Units and Conversions

Dimensions - are used to describe physical quantities and are independent of units. Examples: length, mass, time, electric current, temperature.

Units - are a measure (quantity) of a dimension. Example, meters or feet are used to measure length.

Base Units - SI has seven base units in which nearly all other units are derived.

Base Unit	Name	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric Current	ampere	A
Thermodynamic Temp.	kelvin	K
Amount of Substance	mole	mol
Luminous Intensity	candela	cd

* Note: that Ampere and Kelvin are capitalized because they derive from a proper name.

SI Derived Units - SI has numerous derived units of which many have special names.

Derived Units	Name	Symbol
Frequency	hertz	Hz
Force	newton	N
Pressure, stress	pascal	Pa
Energy, work, heat	joule	J
Power, radiant flux	watt	W
Electric charge	coulomb	C
Electric potential	volt	V
Capacitance	farad	F
Electric resistance	ohm	W
Inductance	henry	H
Celcius Temperature	degree Celcius	°C
Luminous flux	lumen	lm

SI Customary Units - some units are not formally a part of SI, but are so commonly used that are recognized by internationally.

Customary Units	Symbol
Minute of time	min
Hour	h
Day	d
Degree	°
Liter	l, L
Tonne, metric ton	t

SI Prefixes – in general, numbers should be expressed using appropriate multipliers such that they fall between 0.1 and 1000. For example, 1250 m is best written as 1.25 km.

Factor	Prefix	Symbol		Factor	Prefix	Symbol
10^{24}	yotta	Y		10^{-1}	deci	d
10^{21}	zetta	Z		10^{-2}	centi	c
10^{18}	exa	E		10^{-3}	milli	m
10^{15}	peta	P		10^{-6}	micro	μ
10^{12}	tera	T		10^{-9}	nano	n
10^9	giga	G		10^{-12}	pico	p
10^6	mega	M		10^{-15}	femto	f
10^3	kilo	k		10^{-18}	atto	a
10^2	hecto	h		10^{-21}	zepto	z
10^1	deca	da		10^{-24}	yocto	y

Length Conversions

1 angstrom (light wave measurement)	0.1 nanometer 0.000 000 1 millimeter 0.000 000 004 inch
1 cable's length	120 fathoms 720 feet 219.456 meters
1 centimeter	0.3937 inch
1 chain (Gunter's or surveyor's)	66 feet 20.1168 meters
1 decimeter	3.937 inches
1 dekameter	32.808 feet
1 fathom	6 feet 1.8288 meters
1 foot	0.3048 meter
1 furlong	10 chains (surveyor's) 660 feet 220 yards ¹ / ₈ statute mile 201.168 meters
1 inch	2.54 centimeters
1 kilometer	0.621 mile
1 league (land)	3 statute miles 4.828 kilometers
1 link (Gunter's or surveyor's)	7.92 inches 0.201 168 meter
1 meter	39.37 inches 1.094 yards
1 micrometer	0.001 millimeter 0.000 039 37 inch
1 mil	0.001 inch 0.025 4 millimeter
1 mile (statute or land)	5,280 feet 1.609 kilometers
1 mile (nautical international)	1.852 kilometers 1.151 statute miles

	0.999 U.S. nautical miles
1 millimeter	0.03937 inch
1 nanometer	0.001 micrometer or 0.000 000 039 37 inch
1 point (typography)	0.013 837 inch ¹ / ₇₂ inch (approximately) 0.351 millimeter
1 rod, pole, or perch	16.5 feet 5.0292 meters
1 yard	0.9144 meter

Area and Surface Conversions

1 acre	43,560 square feet 4,840 square yards 0.405 hectare
1 are	119.599 square yards 0.025 acre
1 hectare	2.471 acres
1 square centimeter	0.155 square inch
1 square decimeter	15.5 square inches
1 square foot	929.030 square centimeters
1 square inch	6.4516 square centimeters
1 square kilometer	0.386 square mile 247.105 acres
1 square meter	1.196 square yards 10.764 square feet
1 square mile	258.999 hectares
1 square millimeter	0.002 square inch
1 square rod, square pole or square perch	25.293 square meters
1 square yard	0.836 square meters

Capacity and Volume Conversions

1 barrel, liquid	31 to 42 gallons
1 barrel, standard for fruits, vegetables, and other dry commodities except cranberries	7,056 cubic inches 105 dry quarts 3.281 bushels, struck measure
1 barrel, standard, cranberry	5,286 cubic inches $86\frac{45}{64}$ dry quarts 2.709 bushels, struck measure
1 bushel (U.S.) struck measure ³	2,150.42 cubic inches 35.238 liters
1 bushel, heaped (U.S.)	2,747.715 cubic inches 1.278 bushels, struck measure
1 cord (firewood)	128 cubic feet
1 cubic centimeter	0.061 cubic inch
1 cubic decimeter	61.024 cubic inches
1 cubic foot	7.481 gallons 28.316 cubic decimeters
1 cubic inch	0.554 fluid ounce 4.433 fluid drams 16.387 cubic centimeters
1 cubic meter	1.308 cubic yards
1 cubic yard	0.765 cubic meter
1 cup, measuring	8 fluid ounces $\frac{1}{2}$ liquid pint
1 dram, fluid or liquid (U.S.)	$\frac{1}{8}$ fluid ounces 0.226 cubic inch 3.697 milliliters 1.041 British fluid drachms
1 dekaliter	2.642 gallons 1.135 pecks
1 gallon (U.S.)	231 cubic inches 3.785 liters 0.833 British gallon

	128 U.S. fluid ounces
1 gallon (British Imperial)	277.42 cubic inches 1.201 U.S. gallons 4.546 liters 160 British fluid ounces
1 gill	7.219 cubic inches 4 fluid ounces 0.118 liter
1 hectoliter	26.418 gallons 2.838 bushels
1 liter	1.057 liquid quarts 0.908 dry quart 61.024 cubic inches
1 milliliter	0.271 fluid dram 16.231 minims 0.061 cubic inch
1 ounce, fluid or liquid (U.S.)	1.805 cubic inch 29.574 milliliters 1.041 British fluid ounces
1 peck	8.810 liters
1 pint, dry	33.600 cubic inches 0.551 liter
1 pint, liquid	28.875 cubic inches 0.473 liter
1 quart, dry (U.S.)	67.201 cubic inches 1.101 liters 0.969 British quart
1 quart, liquid (U.S.)	57.75 cubic inches 0.946 liter 0.833 British quart
1 quart (British)	69.354 cubic inches 1.032 U.S. dry quarts 1.201 U.S. liquid quarts
1 tablespoon, measuring	3 teaspoons 4 fluid drams $\frac{1}{2}$ fluid ounce
1 teaspoon, measuring	$\frac{1}{3}$ tablespoon $1\frac{1}{3}$ fluid drams

1 assay ton	29.167 grams
1 carat	200 milligrams 3.086 grains
1 dram, apothecaries'	60 grains 3.888 grams
1 dram, avoirdupois	27 ¹¹ / ₃₂ (=27.344) grains 1.772 grams
1 grain	64.798 91 milligrams
1 gram	15.432 grains 0.035 avoirdupois ounce
1 hundredweight, gross or long ⁶	112 pounds 50.802 kilograms
1 hundredweight, net or short	100 pounds 45.359 kilograms
1 kilogram	2.205 pounds
1 microgram (Φg—the Greek letter mu in combination with the letter g)	0.000 001 gram
1 milligram	0.015 grain
1 ounce, avoirdupois	437.5 grains 0.911 troy or apothecaries' ounce 28.350 grams
1 ounce, troy or apothecaries'	480 grains 1.097 avoirdupois ounces 31.103 grams
1 pennyweight	1.555 grams
1 point	0.01 carat 2 milligrams
1 pound, avoirdupois	7,000 grains 1.215 troy or apothecaries' pounds 453.592 37 grams
1 pound, troy or apothecaries'	5,760 grains 0.823 avoirdupois pound 373.242 grams

1 ton, gross or long ⁶	2,240 pounds 1.12 net tons 1.016 metric tons
1 ton, metric	2,204.623 pounds 0.984 gross ton 1.102 net tons
1 ton, net or short	2,000 pounds 0.893 gross ton 0.907 metric ton