UNITS AND CONCENTRATION

SI units are recommended (see Pilson, 1998; Appendix B)

SI Base Units

Quantity	Name	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Other Recommended Units and Symbols

Name	Symbol	Definition
Minute	min	1 min = 60 s
Hour	h	1 h = 3600 s
Day	d	1 d = 86,400 s
Liter	L	1 L = 10^{-3} m^3
Metric ton	t	1 t = 10^3 kg
Nautical mile		1852 m
Knot		(1852/3600) m/s
Angstrom	Å	1 Å = 10^{-10} m
Bar	bar	1 bar = 10^5 Pa
Curie	Ci	1 Ci = 3.7 x 10^{10} Bq

The amount of solute per unit amount of solution (or solvent) is the solute concentration. A solution exists when ever a solute dissolves completely into a solvent. The substance present in largest amount in a solution is the solvent; the other substances are solutes. In seawater, water is the solvent, and the salts are solutes.

There are of course many different concentration units; here are some commonly used units in chemical oceanography; molar, molal, mol solute per kg of solution, parts solute per part solution (by mass), and parts solute per part solution by volume (by volume).

The molar unit is: moles of solute per liter of solution = moles/L or M

The molal unit is: moles of solute per kg of solvent = moles/kg or m

The "molinity" unit is: moles of solute per kg of solution = moles/kg

The parts solute per part solution (by mass) scale takes on several different names, depending on the concentrations found, e.g.:

parts solute per thousand parts solution by mass = ppt = pptm = ppt (w/w)

(example) 1 gram solute per 1000 grams solution = 1 gram per kg = 1 mg per gram, etc.
parts solute per million parts solution by mass= ppm = ppmm = ppm (w/w)
parts solute per trillion parts solution by mass = ppt = pptm = ppt (w/w) (not to be confused with parts per thousand!) etc

Similarly, the parts solute per part solution (by volume) scale also has a variety of units:

parts solute per thousand parts solution by volume = ppt = pptv = ppt (v/v)
(example) 1 mL solute per 1000 mL solution = 1 mL per L = 1 L per L, etc.
parts solute per million parts solution by volume = ppm = ppmv = ppm (v/v)
parts solute per trillion parts solution by volume = ppt =pptv = ppt (v/v) (not to be confused with parts per thousand!)

In addition there are a completely analogous set of units based on weigh and volume (w/v)

The prefixes of the SI system are employed in all of these concentration scales. Some of the most important in oceanography are:

Yotta = Y = 10^{24}
Zetta = Z = 10^{21}
Exa = E = 10^{18}
Peta = P = 10^{15}
Tera = T = 10^{12}
Giga = G = 10^{9}
Mega = M = 10^{6}
kilo =k = 10^{3}
Deka = D = 10^{1}
deci = d = 10^{-1}
centi = c = 10^{-2}
milli = m = 10^{-3}
micro = = 10^{-6}
nano = n = 10^{-9}
pico = p = 10^{-12}
femto = f = 10^{-15}
atto = a = 10^{-18}
zepto = z = 10^{-21}
yocto = y = 10^{-24}