Square 1: Concentration Units and Measurements

Things to do:

- Review SI units
- Review metric prefixes:
- Know *at least* **mega-** down to **atto-**

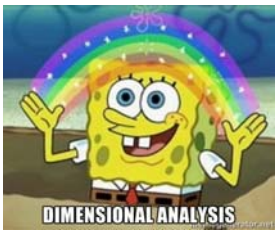
TABLE 1-3 Prefixes

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

Harris, *Quantitative Chemical Analysis*, 8e

A word to the wise when doing calculations:

- KEEP TRACK OF UNITS!!
- Remember *dimensional analysis*
- If your units don't work, there's no way the result can be correct!



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Concentration Units Based on Moles

Molarity, M

Molarity vs *Formality*

Molality, m

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Molar Concentrations

Example: How many grams of MgF_2 are needed to make 250.0 mL of a 0.150 M MgF_2 solution?

How about 250.0 mL of 0.150 M F^- solution?

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Concentrations Based on Mass or Volume Ratios

Percents

- weight %, (% w/w)
- volume %, (% v/v)
- % weight per volume, (% w/v)

For very dilute samples:

- parts per million (ppm)
- parts per billion (ppb)

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Concentrations Based on Mass or Volume Ratios

Example: What is the mercury concentration in ppm of a 12.0 μM mercury solution?

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One More Example

Example: Most contact lens saline solutions are 5.0% sodium chloride. Calculate the molarity of these sodium chloride solutions. The density of the solution is 1.4 g/mL.

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Dilution

Often you will start with a solution of a given concentration and need to prepare a solution of lesser concentration. How do you determine the volume that must be diluted to prepare this solution?

$$M_{conc}V_{conc} = M_{dil}V_{dil}$$

Look at the units:

"Dilution by mass" works and may be more convenient!

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Dilution

Example: How many milliliters of concentrated (18.0 M) sulfuric acid must be diluted to 500.0 mL to make a 0.100 M solution?

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Taking Advantage of Stoichiometry:

Use stoichiometric relations to calculate an unknown quantity based on the quantity of a product produced or reactant consumed on a reaction.

$$A + B \rightarrow C + D$$

- Gravimetric Methods

- Titrimetric (Volumetric) Methods

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