N-40 – Solution Calculations

Target: I can perform calculations to determine various things such as the concentration of a solution.

Link to YouTube Presentation: https://youtu.be/A80wcIy9VVk

Calculations

Lots of different formats for our answers, sometimes certain units are more helpful than others. Some branches of chemistry have a tendency to use one unit more than another.

Assumptions to make…

UNLESS TOLD OTHERWISE…

- **Assume your solvent is water…it is the "Universal Solvent"**
- **Assume the density of your solution is the same as water (1mL = 1g)**

UNLESS TOLD OTHERWISE…

REMEMBER!!!!!!!!!!

SOLUTION = SOLUTE + SOLVENT

Mass Percent or Percent Composition

Ratio of masses expressed as a %

$$Mass\ percent = \left(\frac{mass\ of\ solute}{mass\ of\ solution} \right) x100$$

Parts per Million - ppm

Ratio of masses but not expressed as a %, but rather out of one million – used when very low levels are significant like for pollution.

$$ppm = \left(\frac{mass\ of\ solute}{mass\ of\ solution}\right) x\ 1{,}000{,}000$$

Grams/Liter

Ratio of mass of solute to volume of solution. Easy for when measuring a solid solute dissolved in a liquid. Used to test solubility. "Quick and dirty" unit.

$$Grams\ per\ Liter = \left(\frac{mass\ of\ solute}{Volume\ of\ solution}\right)$$

Mole Fraction

Ratio of moles of solute n_A, to moles of total solution (solute n_A + solvent n_B)

$$Mole\ fraction of\ A = \chi_A = \frac{n_A}{n_A + n_B}$$

Molarity – the best one! ☺

Ratio of moles of solute to liters of solution. Similar to grams/L but converting it to moles lets us perform chemistry calculations better. Always trying to get to moles anyway!

$$Molarity = M = \frac{moles\ of\ solute}{Liter\ of\ solution}$$

Practice #1

734 grams of lithium sulfate are dissolved to make 2500 mL of solution. What is the Molarity?

Convert 734 grams of Li_2SO_4 in moles.

$$\frac{734g\ Li_2SO_4 \mid 1\ mol\ Li_2SO_4}{\mid 109.962\ g\ Li_2SO_4} = 6.68\ mol\ Li_2SO_4$$

$$M = \frac{Moles\ of\ solute}{Liters\ of\ solution} = \frac{6.68\ mol}{2.500\ Liters} = 2.67\ M$$

Practice #2

6.7 x 10^{-2} grams of $Pb(C_2H_3O_2)_4$ are dissolved to make 3.5 mL of solution. What is the concentration?

When not told what unit to use, assume molarity!

$$\frac{6.7 \times 10^{-2}\ g\ Pb(C_2H_3O_2)_4}{} \left| \frac{1\ mol\ Pb(C_2H_3O_2)_4}{443.2\ g\ Pb(C_2H_3O_2)_4} \right. = 1.51 \times 10^{-4}\ mol\ Pb(C_2H_3O_2)_4$$

$$M = \frac{Moles\ of\ solute}{Liters\ of\ solution} = \frac{1.51\ x\ 10^{-4} mol}{0.0035\ Liters}$$

$$= 0.0432\ M$$

Making Dilutions

When you take one more concentrated solution and take a small amount of it and dilute it down by adding more solvent.

$$M_1V_1 = M_2V_2$$

Volumetric Flasks

Very accurate marking for a specific volume. You can fill the flask with your strong V1 amount and then fill to the line to get the desired solution volume.

Volumetric Flasks

- Add solute to a beaker.
- Add a small amount of distilled water to dissolve the solute.
- Pour into the volumetric flask.
- Add distilled water until you get to the etched line. Make sure to read it from the bottom of the meniscus!
- Swirl/invert the flask so it mixes well.

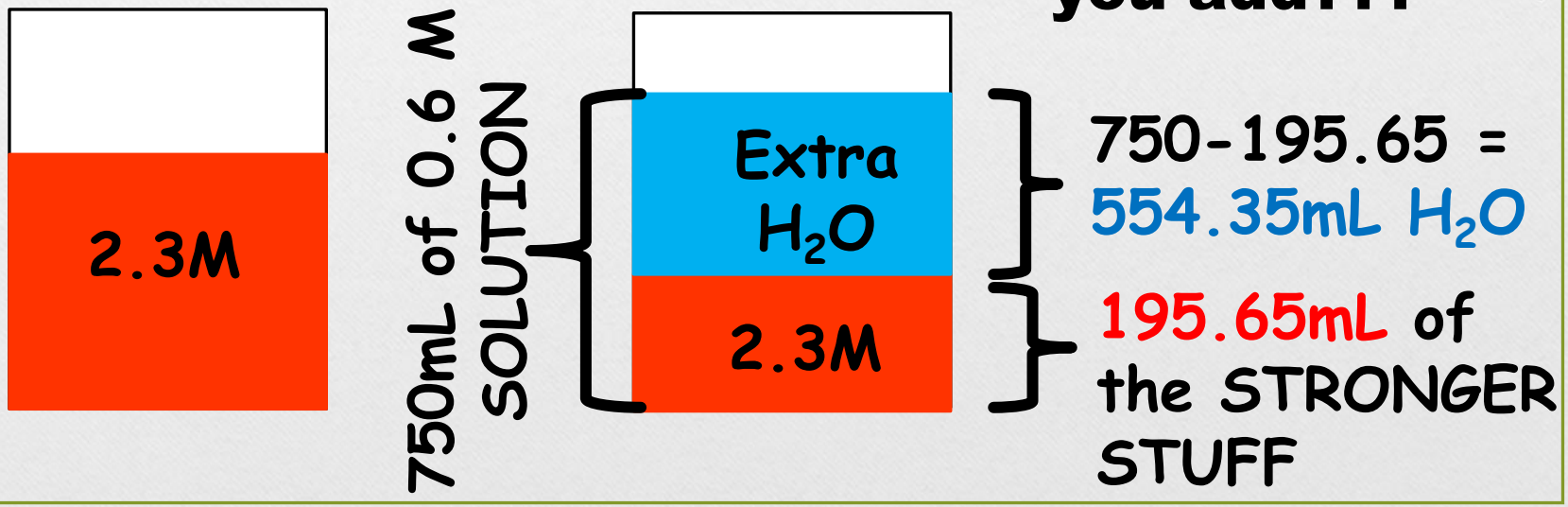
Practice #1

How much of a 2.3 M solution do you have to use in order to make 750mL of a 0.6 M solution?

$$(2.3M)(V_1) = (0.6M)(750mL)$$

$$V_1 = 195.65\ mL\ of\ the\ 2.3M\ solution\ is\ needed$$

How much water did you add???



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