Dilution Calculations

- sometimes we create a more concentrated "stock" solution and then dilute it to make other solutions

<u>Simple Dilutions:</u>
***number of moles stays the same!!!

(2) 1. A student has 500.0 mL of a 0.4M NaCl solution. How much water is needed to make it a 0.1M solution?

orig = $\left(\frac{0.4\text{mol}}{\text{L}}\right)(0.500\text{L}) = 0.2\text{mol}$

new = $(0.2\text{mol})\left(\frac{\text{L}}{0.1\text{mol}}\right) = 2\text{L}$ ⇒ need to add 1.5L

(1) 2. A chemist adds water to 120.0 mL of a 6.0M solution of NaOH until the final volume is 2.0L. What is the concentration of the resulting solution?

A - calculating moles

$\left(\frac{6.0\text{mol}}{\text{L}}\right)(.120\text{L}) = 0.72\text{mol}$

new = $\frac{0.72\text{mol}}{2.0\text{L}} = 0.36\text{M}$

B - using DILUTION FACTOR = ratio of original volume to final volume

$C_{DIL} = \left(\frac{V_{conc}}{V_{DIL}}\right) C_{conc}$

$= \left(\frac{.120\text{L}}{2.0\text{L}}\right)(6.0\text{M}) = 0.36\text{M}$

(3) use $C_1V_1 = C_2V_2$ for both then add 2 [ ]

Mixing two solutions:

(1) 1) calculate total moles
2) calculate total volume
3) divide moles by volume to get molarity

$C_{1f} = \left(3.00\frac{mol}{L}\right)\left(\frac{2L}{6L}\right) = 1M$ + } 2.0M

$C_2 = \left(1.50\frac{mol}{L}\right)\left(\frac{4L}{6L}\right) = 1M$

examples:

1. Calculate the final concentration if 2.00 L of 3.00 M NaCl and 4.00 L of 1.50 M NaCl are mixed.

$moles_1 = (2.00L)\left(3.00\frac{mol}{L}\right) = 6.00mol$

$moles_2 = (4.00L)\left(1.5\frac{mol}{L}\right) = 6.00mol$

[NEW] $\frac{6.00mol + 6.00mol}{2.00L + 4.00L} = \frac{12.0mol}{6.00L} = 2.0M$

2. A 40.0 mL volume of 1.80 M $Fe(NO_3)_3$ is mixed with 21.5 mL of 0.808M $Fe(NO_3)_3$ solution. Calculate the molar concentration of the final solution.

① $mol = \left(1.80\frac{mol}{L}\right)(0.040L) = 0.072mol$

② $mol = \left(0.808\frac{mol}{L}\right)(.0215L) = 0.017\ mol$

$[final] = \frac{0.072mol + 0.017mol}{.040L + .0215L}$

$= 1.45M$

or $[1] = (1.80M)\left(\frac{40.0mL}{61.5mL}\right) = 1.171M$

$[2] = (0.808M)\left(\frac{21.5mL}{61.5mL}\right) = 0.282M$

$[TOTAL] = 1.171 + 0.282$
$= 1.45M$