COLLIGATIVE PROPERTIES

→ depend on the # of dissolved particles
- vapor pressure lowering
- boiling point elevation
- freezing point depression

CONCENTRATION

$M = \frac{n}{L}$

mol / M | L

MOLARITY = $\frac{\text{moles of solute}}{\text{liters of solution}}$

pro: easy to measure volume
mole quantities

con: V is T dependent

0.45M $NaNO_3$

$NaNO_{3(s)} \xrightarrow{H_2O} Na^+_{(aq)} + NO_3^-{}_{(aq)}$

$[Na^+] = 0.45M \quad [NO_3^-] = 0.45M$

0.20M $Al_2(SO_4)_3$

$Al_2(SO_4)_3 \xrightarrow{H_2O} 2Al^{3+}_{(aq)} + 3SO_4^{2-}{}_{(aq)}$

$[Al^{3+}] = 0.40M \quad [SO_4^{2-}] = 0.60M$

DILUTING A SOLUTION → add more SOLVENT ⇒ ↑L ↓M

moles$_1$ = moles$_2$

$M_1V_1 = M_2V_2$ DILUTION EQUATION

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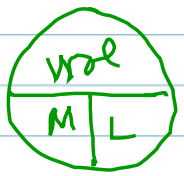

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$moles_1 = moles_2$

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What volume of 5.00M NaOH would be needed to make 2.00×10² mL of 0.300M NaOH?

(M_2: 5.00M NaOH; V_1: 2.00×10² mL; M_1: 0.300M)

$$V_2 = \frac{M_1 V_1}{M_2} = \frac{(0.300\,M)(200\,mL)}{5.00\,M} = 12.0\,mL \text{ of } 5.00M\ NaOH$$

What is the new molarity if 37 mL of H_2O are added to 83 mL of 1.12 M HCl?

(V_1: 83 mL; M_1: 1.12 M)

$$V_2 = 37 + 83 = 120\,mL$$

$$M_2 = \frac{(1.12\,M)(83\,mL)}{120\,mL} = 0.77M\ HCl$$

What is the molarity of the solution AND ions present if

a) 10.0 g of $Na_3PO_{4(s)}$ is dissolved in $H_2O \Rightarrow 2.00\times10^2$ mL of sol'n

b) 17.5 g of $K_3PO_{4(s)}$ is dissolved in $H_2O \Rightarrow 135$ mL of soln

c) the solutions are mixed AND 165 mL of H_2O is added?

a) $10.0\,g\ Na_3PO_4 \times \frac{1\,mol}{163.94\,g} = 0.0610\,mol$

$$\frac{0.0610\,mol}{0.200L} = 0.305M\ Na_3PO_4$$

$[Na^+] = 0.915M$

$[PO_4^{3-}] = 0.305M$

b) $17.5\,g\ K_3PO_4 \times \frac{1\,mol}{212.27\,g} = \frac{0.0824\,mol}{0.135\,L} = 0.611\,M\ K_3PO_4$

$[K^+] = 1.83\,M$

$[PO_4^{3-}] = 0.611\,M$

c) total volume: $200\,mL + 135\,mL + 165\,mL = 500\,mL = 0.500\,L$

a] $0.0610\,mol\ Na_3PO_4 \rightarrow 0.183\,mol\ Na^+$, $0.0610\,mol\ PO_4^{3-}$

b] $0.0824\,mol\ K_3PO_4 \rightarrow 0.247\,mol\ K^+$, $0.0824\,mol\ PO_4^{3-}$

$0.143\,mol\ PO_4^{3-}$

$[Na^+] = \frac{0.183\,mol}{0.500\,L} = 0.366\,M\ Na^+$

$[K^+] = \frac{0.247\,mol}{0.500\,L} = 0.494\,M\ K^+$

$[PO_4^{3-}] = \frac{0.143\,mol}{0.500\,L} = 0.286\,M\ PO_4^{3-}$