

Concentration of Solutions

(1) Molarity = $\frac{\text{# moles of solute}}{\text{Volume of solution (L)}}$

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

$$\frac{n}{M \cdot V}$$

Ex (1) what is the molarity of a solution made by dissolving 63.4 g of sodium hydrogen carbonate in 225 mL of solution? Na HCO₃

$$M = ?$$

$$n = \frac{63.4 \text{ g}}{84.01 \text{ g}} | \frac{1 \text{ mol}}{1 \text{ mol}} = .7548 \text{ mol}$$

$$V = 225 \text{ mL} = .225 \text{ L}$$

$$M = \frac{n}{V} = \frac{.7548 \text{ mol}}{.225 \text{ L}}$$

$$= 3.35 \text{ mol/L}$$

or
3.35M

(2) what volume of solution is needed to dissolve 25.00 g sulfuric acid to make a 1.67 M solution?

$$M = 1.67 \text{ mol/L}$$

$$n = \frac{25.00 \text{ g}}{98.09 \text{ g}} | \frac{1 \text{ mol}}{1 \text{ mol}} = .2549 \text{ mol}$$

$$V ?$$

$$V = \frac{n}{M} = \frac{.2549 \text{ mol}}{1.67 \text{ mol/L}}$$

$$V = .153 \text{ L}$$

(3) What mass of lithium sulfite was dissolved in 300. mL to make a 1.11 M solution?

$$M = 1.11 \text{ mol/L}$$

$$n = ?$$

$$V = 300. \text{ mL} = .300 \text{ L}$$

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

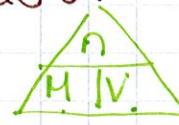
$$n = M \cdot V = (1.11 \frac{\text{mol}}{\text{L}})(.300 \text{ L})$$

$$n = .333 \text{ mol}$$

$$\frac{.333 \text{ mol Li}_2\text{SO}_3}{1 \text{ mol}} | \frac{93.95 \text{ g}}{1 \text{ mol}} = 31.39 \text{ g}$$

Dilutions

↳ adding more solvent to decrease the concentration. However, the moles of solute remains constant!



$$n_{\text{before}} = n_{\text{after}}$$

$$(M \cdot V)_{\text{before}} = (M \cdot V)_{\text{after}}$$

$$M_1 V_1 = M_2 V_2$$

Ex (4) What $\frac{V_1}{M_1}$ volume of 1.50M NaOH is needed to create $\frac{.600\text{L}}{M_2}$ of a 1.00M solution?

$$(1.50\text{M})V_1 = (1.00\text{M})(.600\text{L})$$

$$\frac{(1.50\text{M})V_1}{1.50\text{M}} = \frac{.600\text{M} \cdot \text{L}}{1.50\text{M}} \quad (V_1 = 0.400\text{ L})$$

(5) You have $\frac{7.50\text{mL}}{M_1}$ of 12.0M H_2SO_4 . You need $\frac{.500\text{M}}{M_2}$, what is the volume of the new solution? $M_1 V_1 = M_2 V_2$

$$(12.0\text{M})(.00750\text{L}) = (.500\text{M})V_2$$

$$\frac{.09\text{M} \cdot \text{L}}{.500\text{M}} = \frac{(.500\text{M})V_2}{.500\text{M}}$$

$$.18\text{L} = V_2$$

(2) Molality = $\frac{\text{# moles of solute}}{\text{kg of solvent}}$

$$m = \frac{n}{kg}$$

$$\frac{n}{m/kg}$$

& 6) Determine the molality when 36.0g NaCl is dissolved in 1000. g. of water.

$$m = ?$$

$$n = \frac{36.0\text{g NaCl}}{58.44\text{g}} | \frac{1\text{mol}}{1\text{mol}} = .616\text{mol}$$

$$kg = 1000.\text{g} = 1.000\text{kg}$$

$$\text{solute, } 36.0\text{g}$$

$$m = \frac{.616\text{mol}}{1.000\text{kg}}$$

$$m = .616\text{ mol/kg}$$

or .616m

7) 34.76g of AlF₃ is dissolved in 250. g of ethanol. calculate the molality. $m = \frac{n}{kg}$

$$m = ?$$

$$n = \frac{34.76\text{g}}{83.98\text{g}} | \frac{1\text{mol}}{1\text{mol}} = .4139\text{mol}$$

$$kg = 250.\text{g} = .250\text{kg}$$

$$m = \frac{.4139\text{mol}}{.250\text{kg}}$$

$$m = 1.66\text{ mol/kg}$$

8) How many kg of solvent are needed to dissolve 26.00g K₂C₂O₄ (M.M. = 166.21g) and make a 1.25m solution?

$$m = \frac{n}{kg}$$

$$m = 1.25\text{ mol/kg}$$

$$n = \frac{26.00\text{g}}{166.21\text{g}} | \frac{1\text{mol}}{1\text{mol}} = .1564\text{mol}$$

$$kg = ?$$

$$kg = \frac{n}{m} = \frac{.1564\text{mol}}{1.25\text{mol/kg}} = .125\text{kg}$$