Molarity

Molarity (M): the number of moles of solute per liter of solvent

Units: M *ex: 3.0 M is "3 molar"*

M m 3M

$$\text{molarity (M)} = \frac{\text{moles of solute}}{\text{L of solvent}}$$

Apr 25-7:54 AM

Molality

Molality (m): the number of moles of solute per kilogram of solvent

Units: m *ex: 3.0 m is "3 molal"*

$$\text{molality (m)} = \frac{\text{moles of solute}}{\text{kg of solvent}}$$

Apr 25-7:54 AM

Conversion Info:

- **1000 mL = 1 L**
- **1000g = 1 kg**
- **1 mL of water = 1 g of water**

Apr 25-7:54 AM

Practice

$K^{+1} I^{-1} \rightarrow KI$

What is the molality of a solution of 47.3 grams of potassium iodide dissolved in 500.0 g of water?

$\frac{mol}{kg} = m$ $500.0g \times \frac{1kg}{1000g} = 0.500kg$

$47.3gKI \times \frac{1molKI}{166gKI} = 0.285molKI$

$K = 1 \times 39 = 39$
$I = 1 \times 127 = 127$
$166g/mol$

$\frac{0.285mol}{0.500kg} = .57m$

Apr 25-8:04 AM

Practice

$K^{+1} CO_3^{-2} \rightarrow K_2CO_3$

How many grams of potassium carbonate are needed to make 150 mL of a 5.5 M solution?

$\frac{mol}{L}$

$150mL \times \frac{1L}{1000mL} = .150L$

$\frac{5.5}{1} = \frac{x\ mol}{.150L}$ $\times .150$ $0.825mol\ K_2CO_3$

$0.825molK_2CO_3 \times \frac{138gK_2CO_3}{1molK_2CO_3} = 114gK_2CO_3$

$K = 2 \times 39 = 78$
$C = 1 \times 12 = 12$
$O = 3 \times 16 = 48$
138

Apr 25-8:04 AM

Practice

What is the concentration (in M) of an aqueous solution with a volume of 650 mL that contains 300.0 grams of iron (II) chloride?

$M = \frac{mol}{L}$ $\frac{2.38}{.65} = 3.66M$

$650mL \times \frac{1L}{1000mL} = .65L$

$300.0gFeCl_2 \times \frac{1molFeCl_2}{126gFeCl_2} = 2.38molFeCl_2$

$Fe = 1 \times 56 = 56$
$Cl = 2 \times 35 = 70$
$126g/mol$

Apr 25-8:04 AM

Percent by Mass

$$\frac{\text{mass of solute}}{\text{mass of solution}} \times 100$$

solute + solvent

Example:

In order to maintain a sodium chloride (NaCl) concentration similar to ocean water, an aquarium must contain 3.6 g NaCl per 100.0 g of water. What is the percent by mass of NaCl in the solution?

solute solvent

$\frac{3.6\text{g NaCl}}{103.6\text{g sol.}} \times 100\% = 3.5\%$ NaCl by mass

Apr 25-8:04 AM

Percent by Volume

$$\frac{\text{volume of solute}}{\text{volume of solution}} \times 100$$

solute + solvent

Example:

What is the percent by volume of ethanol (C_2H_5OH) in a solution that contains 35 mL of ethanol dissolved in 155 mL of water?

solute solvent

$\frac{35\text{mL}}{190\text{mL}} \times 100\% = 18\%\ C_2H_5OH$ by volume

Apr 25-8:04 AM

Practice

What is the percent by volume of isopropyl alcohol in a solution that contains 24 mL of isopropyl alcohol in 1.1 L of water?

solute solvent

$24\text{mL} \times \frac{1\text{L}}{1000\text{mL}} = .024\text{L}$

$\frac{.024\text{L}}{1.124\text{L}} \times 100\% = 2.1\%$ iso. by vol.

Apr 25-8:04 AM

Practice

What is the percent by mass of $NaHCO_3$ in a solution containing 20.0 g of $NaHCO_3$ dissolved in 600.0 mL of H_2O?

Apr 25-8:04 AM

Attachments

solutionSalt.zip

clipboard(20615).galleryitem