

Molarity

Molarity is defined as moles of solute per liter of solution.

The abbreviation for molarity is M

M = moles of solute/liter of solution

Molarity is a measure of concentration.

Solute - the part of a solution that gets dissolved
(often but not always a solid)

Solvent - the part of a solution that does the dissolving (very often water)

Molarity

Molarity is important in chemistry because it allows us to measure a quantity of a substance by measuring the volume of a solution.

Molarity will be used in future calculations and labs.

Reminders - 1 liter = 1000 mL, 1 mL = 1 cm³

Example Problems

What is the molarity of a solution where 750.0 mL of solution contains 35.29 grams of sodium hydroxide?

Solution: we need to find the molarity - “moles over liters”.

We need to convert the mass of sodium hydroxide to moles, convert the mL of solution to liters and then divide the moles by the liters.

$$\frac{35.29 \text{ g NaOH} \times \frac{1 \text{ mole NaOH}}{39.99711 \text{ g NaOH}}}{750.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}}} = 1.176 \text{ M}$$

$$750.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}}$$

What is the mass of potassium carbonate in 56.2 ml of a 7.31 M solution?

7.31 M \Rightarrow 7.31 moles potassium carbonate
1 L of solution

$$56.2 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{7.31 \text{ moles}}{1 \text{ L}} \times \frac{138.2055 \text{ g}}{1 \text{ mole K}_2\text{CO}_3}$$

56.8 g K_2CO_3

What volume of a 3.50 M solution of sulfuric acid (hydrogen sulfate) is required to provide 6.32 grams?

$$6.32 \text{ g H}_2\text{SO}_4 \times \frac{1 \text{ mole H}_2\text{SO}_4}{98.07948 \text{ g H}_2\text{SO}_4} \times \frac{1 \text{ L of solution}}{3.50 \text{ moles H}_2\text{SO}_4}$$

$$\times \frac{1000 \text{ mL}}{1 \text{ L of solution}} = 18.4 \text{ mL}$$

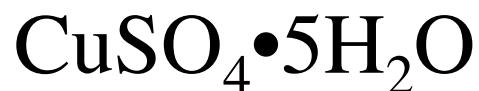
Hydrates

A hydrate is a compound that has water attached.

The hydrate is named using the Latin prefixes that we use for binary covalent compounds to indicate the number of water molecules attached to the ionic compound.

Hydrates

Example : copper (II) sulfate pentahydrate

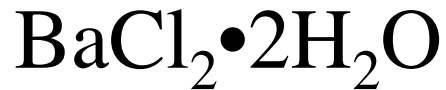


The “dot” indicates that the water is attached to the rest of the formula.

The number of “waters” is indicated by the prefix on the “hydrate” in the name.

Examples

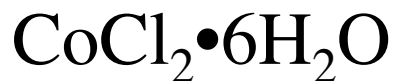
barium chloride dihydrate



magnesium sulfate heptahydrate (Epsom salt)

Hydrates

With hydrates we are often asked to find the percent of water. i.e.: What is the percent of water by mass in cobalt (II) chloride hexahydrate?



1 – Co	58.93320 g/mole	
2 – Cl	2(35.4527 g/mole)	
12 – H	12(1.00794 g/mole)	<u>108.09168g/mole</u>
6 – O	6(15.9994 g/mole)	237.93028 g/mole
	237.93028 g/mole	x100 = 45.43%
		water