

Molality and Molarity



Learning Competencies

- ❖ *use different ways of expressing concentration of solutions: percent by mass, mole fraction, molarity, molality, percent by volume, percent by mass, ppm*



Degrees of Concentration

- ❑ **Molality** (m), or molal concentration, is the amount of a substance dissolved in a certain mass of solvent. It is defined as the moles of a solute per kilograms of a solvent.
- ❑ **Molarity** (M) is the amount of a substance in a certain volume of solution. Molarity is defined as the moles of a solute per liters of a solution. Molarity is also known as the molar concentration of a solution.

Molality

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

What is the molality of a solution containing 0.46 mole of solute in 2.0 kg water?

Given:

moles of solute =

mass of solvent (H₂O) =

Find: molal concentration

$$\text{molality} = \frac{\quad}{\quad} =$$

Molality

Calculate the molal concentration of a solution that contains 18 g of sodium hydroxide in 100 mL of water.

Given:

moles of solute (NaOH) = 18 g

mass of solvent (H₂O) = 100 mL

Find: molal concentration

$$X \text{ ————— } X \text{ ————— } =$$

$$X \text{ ————— } =$$

Molality

Calculate the molal concentration of a solution that contains 18 g of sodium hydroxide in 100 mL of water.

Given:

moles of solute (NaOH) = 18 g

mass of solvent (H₂O) = 100 mL

Find: molal concentration

$$\text{molality} = \frac{\text{moles of solute}}{\text{mass of solvent in kg}} =$$

Molality

What is the molality of a solution that contains 63.0 g HNO_3 in 0.500 kg H_2O ?

Given:

moles of solute (HNO_3) =

mass of solvent (H_2O) =

Find: molal concentration

$$X \text{ ————— } = \boxed{}$$

$$\text{molality} = \text{—————} = \boxed{}$$

Molality

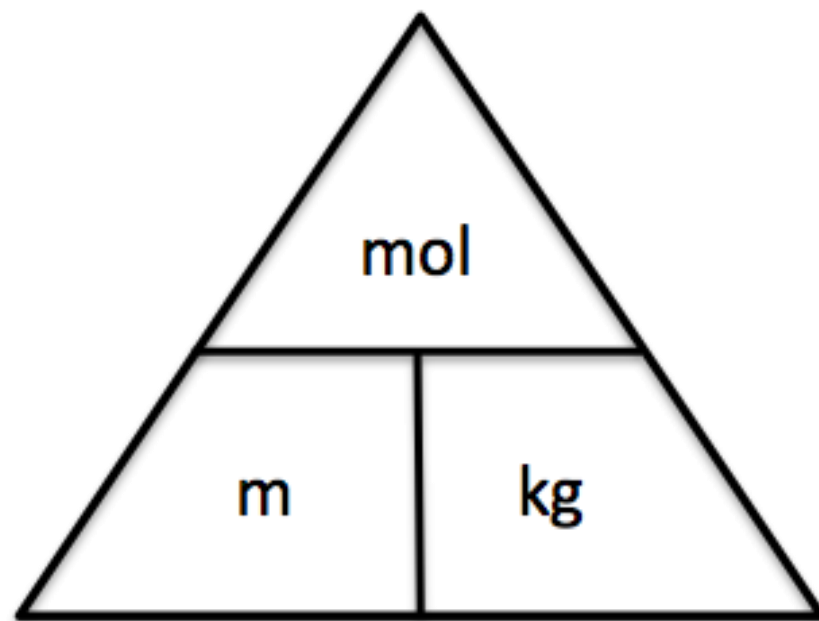
What mass of methanol (CH_3OH) is required to dissolved in 8.00 kg of water to produce 2.00 molal solution?

Given:

molal concentration =

mass of solvent (H_2O) =

Find: moles of solute



$$\left(\quad \right) \left(\quad \right) = \boxed{\quad}$$

$$X \text{ ————— } = \boxed{\quad}$$

Molarity

$$\text{molarity} = \frac{\text{moles of solute}}{\text{volume of solution (in L)}}$$

1.0 moles of potassium fluoride is dissolved to make 0.10 L of solution.

Given:

moles of solute =

volume of the solution =

Find: molar concentration

$$\text{molarity} = \frac{\quad}{\quad} =$$

Molarity

Determine the molar concentration of a solution that contains 25 g of potassium hydroxide in 250 mL of solution.

Given:

moles of solute =

volume of the solution =

Find: molar concentration

$$X \text{ ————— } =$$

$$X \text{ ————— } =$$

Molarity

Determine the molar concentration of a solution that contains 25 g of potassium hydroxide in 250 mL of solution.

Given:

moles of solute =

volume of the solution =

Find: molar concentration

$$\text{molarity} = \frac{\text{moles of solute}}{\text{volume of solution in L}} =$$

Molarity

What is the molarity of 650 ml of solution containing 63 grams of NaCl?

moles of solute =

volume of the solution =

Find: molar concentration

X _____ =

X _____ =

Molarity

What is the molarity of 650 ml of solution containing 63 grams of NaCl?

moles of solute =

volume of the solution =

Find: molar concentration

molarity = _____ =

Molarity

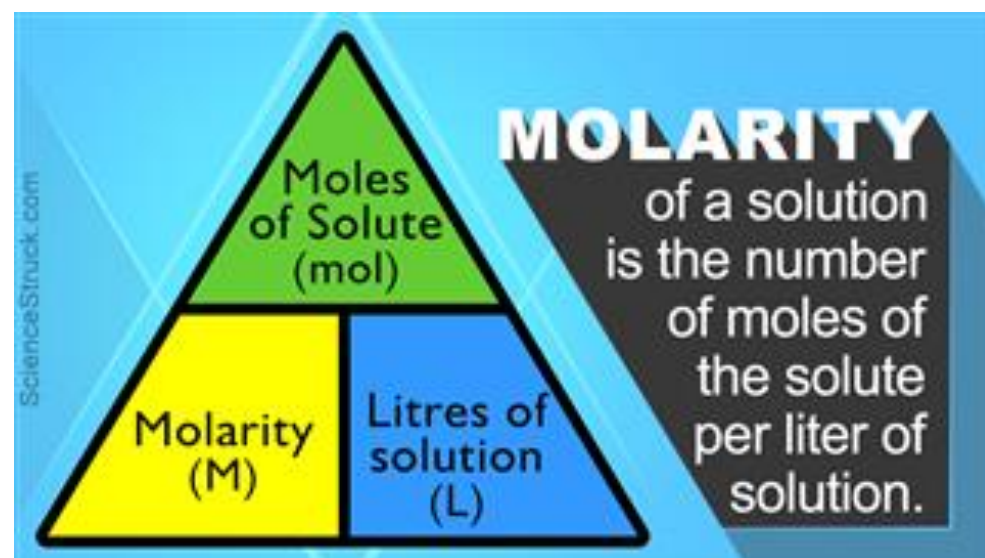
How many moles of $\text{Ca}(\text{OH})_2$ are needed to produce 500 ml of 1.66 M $\text{Ca}(\text{OH})_2$ solution?

Given:

molar concentration =

volume of the solution =

Find: moles of solute



$$X \text{ ————— } =$$

$$(\quad) (\quad) =$$

Molarity

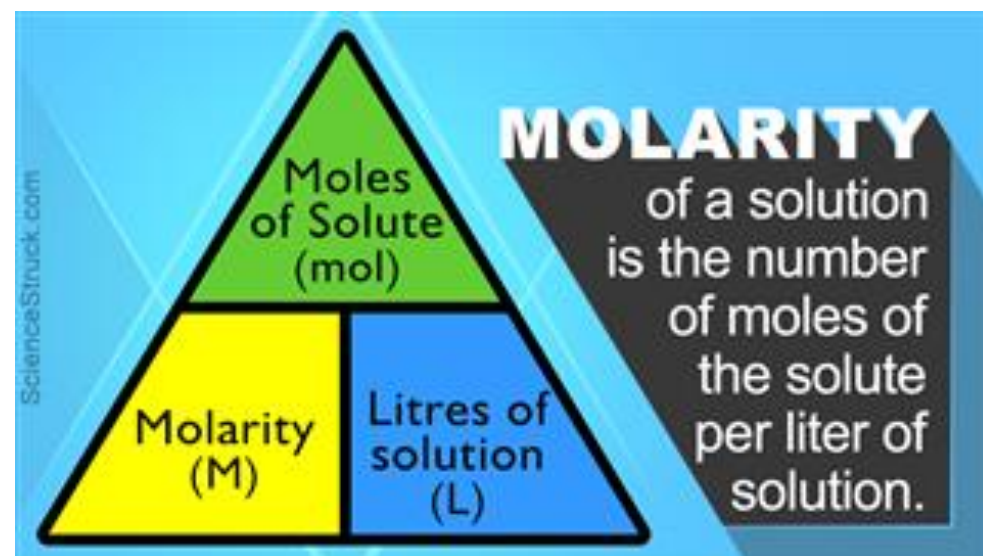
How many liters of solution are needed to make a 1.66 M solution containing 237 grams of KMnO_4 ?

Given:

molar concentration =

moles of solute =

Find: volume of the solution



$$X \text{ ————— } = \boxed{}$$

$$\text{Liters of solution} = \text{—————} = \boxed{}$$

Parts Per Million

- ❑ It can be expressed as milligrams per liter (mg/L). This measurement is the mass of a chemical or contaminant per unit volume of water.

$$\text{ppm} = \frac{\text{Mass of Solute}}{\text{Mass of Solution}} \times 10^6$$

Parts Per Million

25.0 grams of sodium chloride (NaCl) is dissolved in 100 grams of solution. What is the concentration of the solution in parts per million (ppm)?

Given:

mass of solute =

mass of solution =

Find: parts per million

Parts per
million

$\times 10^6 =$

Parts Per Million

Suppose 17 grams of sucrose is dissolved in 183 grams of water. What is the concentration of sucrose ppm?

Given:

mass of solute =

mass of solution =

Find: parts per million

Parts per
million

$\times 10^6 =$

Parts Per Million

The concentration of a solution is 284,000 ppm. How many grams of solute is contained in 100grams of solution?

Given:

parts per million =

mass of solution =

Find: mass of solute

Parts per
million

$\times 10^6 =$