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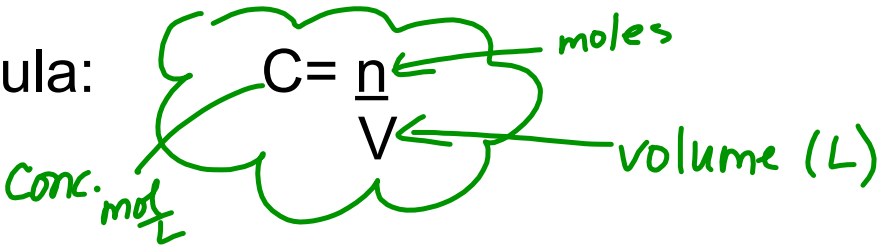
Concentration or Molarity

Concentration: The measure of the amount of solute dissolved in a given quantity of solvent.

Molar Concentration: also known as MOLARITY is a unit of concentration that measures the *moles* of solute per *liters* of solutions.

Formula: $C = \frac{n}{V}$



C=Concentration (mol/L)
n= moles (mol)
V= Volume (L)

**Your textbook uses M instead of mol/L for molarity unit- you need to be able to use them interchangeably! 0.31 M or 0.31 mol/L
Example: Concentrated HCl has a molarity of 11.6M Therefore it has a molar concentration of 11.6mol/L.

Calculating Concentration

Example:
A 250.0 mL sample of cleaning solution contains 1.25mol of dissolved ammonia. What is the concentration of this solution?

$$c = \frac{n}{V} = \frac{1.25\,mol}{0.2500\,L} = 5.00\,M$$

Example:
Bleach has a molar concentration of 0.70M. How many moles are present in 1.5L of solution?

$$c = \frac{n}{V} \qquad n = c \cdot V = 0.70\,mol \cdot 1.5\,L$$

$$= 1.1\,mol$$

What variable can be found in both C=n/V and n=m/M???

By calculating the Molar Mass of a substance you can also determine how many grams of that substance is in the solution and use that information to calculate the molar concentration. This combines the two formulas!

Example:
A saline solution contains 0.90g of NaCl in 100.0mL of solution. What is the molarity of the solution?

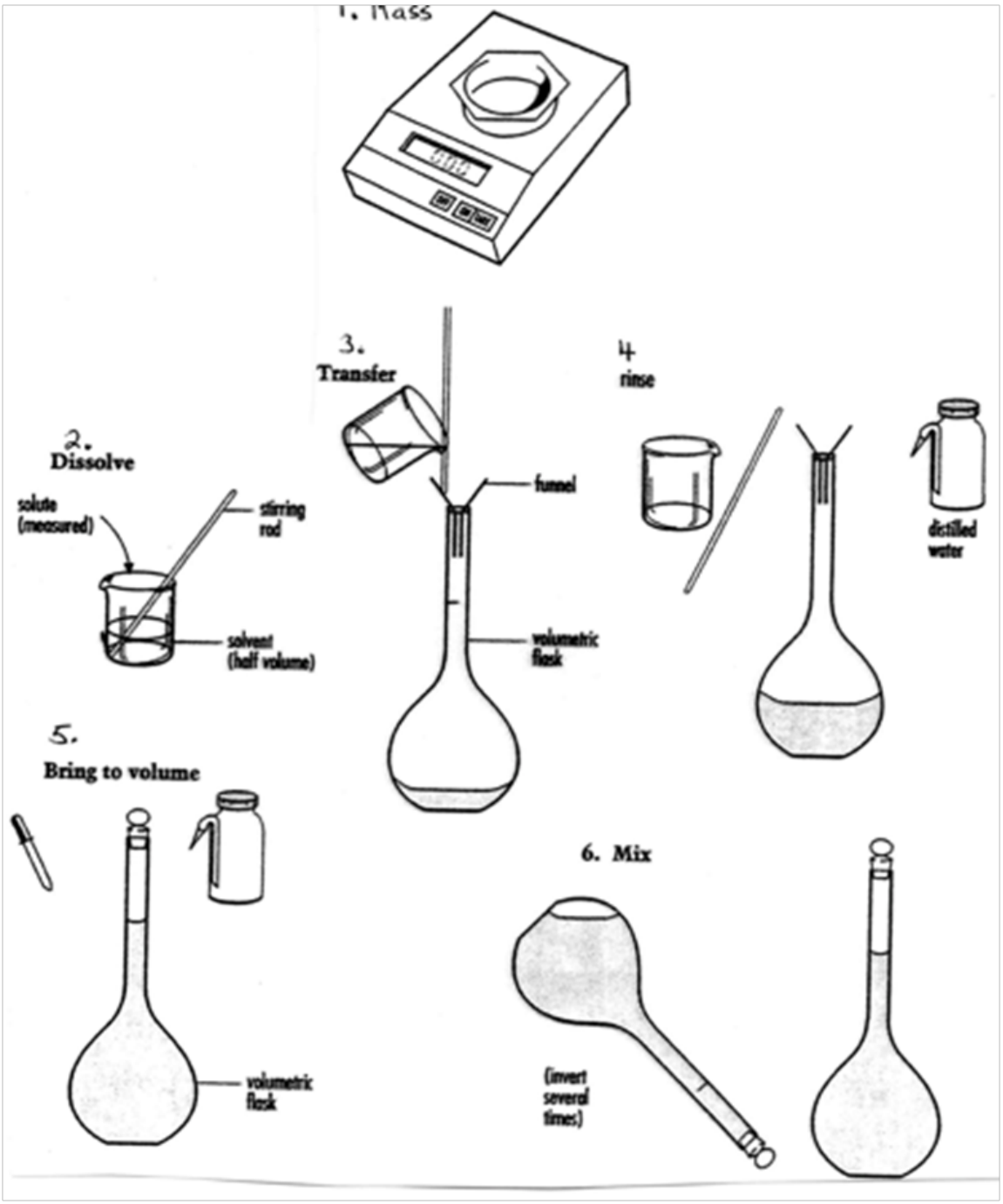
$C = \frac{n}{V}$

① moles of NaCl

$n = \frac{m}{M} = \frac{0.90\,g}{58.44\,g/mol} = 0.0154\,mol$

② conc of NaCl

$C = \frac{n}{V} = \frac{0.0154\,mol}{0.1000\,L} = 0.15\,M$


1. Mass
2.
Dissolve
solute
(measured)
stirring
rod
solvent
(half volume)
3.
Transfer
funnel
volumetric
flask
4
rinse
distilled
water
5.
Bring to volume
volumetric
flask
6. Mix
(invert
several
times)

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

- What amount of NaCl (in moles) is needed to prepare 12.0 L of 5.20 mol/L solution?

$n = c \cdot V = 5.20 \frac{mol}{L} \cdot 12.0 L = 62.4 mol$

- Calculate the mass of sodium carbonate in 10.0 mL of a 2.0 M solution. Na_2CO_3

$n = \frac{m}{M}$?

$n = c \cdot V = 2.0 \frac{mol}{L} \cdot 0.0100 L = 0.020 mol$

$m = n \cdot M = 0.020 mol \cdot 105.99 g/mol = 2.1 g$

- A solution of ammonia has a concentration of 2.50 mol/L. What volume of this would contain 0.500g of ammonia?

$c = \frac{n}{V}$? V

$n = \frac{m}{M} = \frac{0.500 g}{17.04 g/mol} = 0.0293 mol$

$\frac{cV}{c} = \frac{n}{c}$

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

$V = \frac{n}{c} = \frac{0.0293 mol}{2.5 \frac{mol}{L}} \cdot \frac{1}{1} = 11.7 mL$

$\hookrightarrow 0.0117 L$

- What volume of 12.0M HCl contains 1.25g of HCl?

$n = \frac{m}{M} = \frac{1.25 g}{36.46 g/mol} = 0.0343 mol$

$V = \frac{n}{c} = \frac{0.0343 mol}{12 \frac{mol}{L}} = 2.85 mL$

$\hookrightarrow 0.00285 L$

- 74.5 g of calcium chloride $CaCl_2$ can be dissolved in 100.0 mL of water. What is the molar concentration of this solution?

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

$n = \frac{m}{M} = \frac{74.5 g}{110.98 g/mol} = 0.671 mol$

$c = \frac{n}{V} = \frac{0.671 mol}{0.1000 L} = 6.71 M$