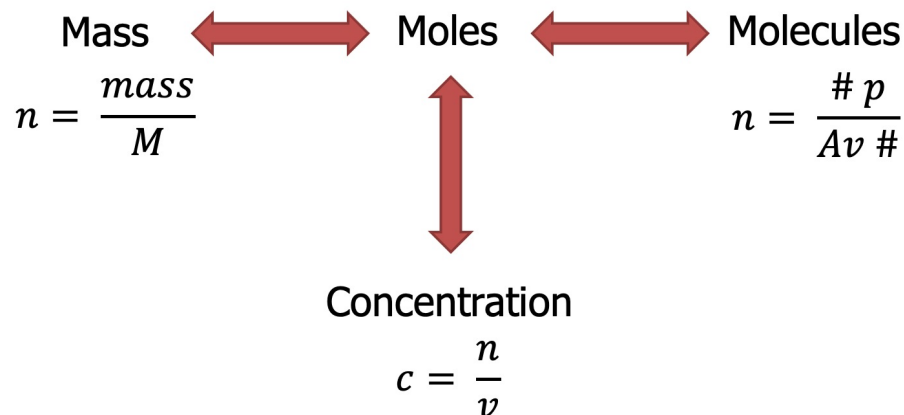


Calculating Concentration and Molarity

- Solutions, Solvents, and Solutes
- Concentration
- Calculating % Solution by Mass
- Mass/Volume % Concentration
- Calculating Molarity (mol/L → M)
- Mole Equations
- Calculating Molarity
- Calculating Ion Concentrations
- Preparation of Solutions



Preview File

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Solutions, Solvents, and Solutes

- A solution is a uniform mixture of particles of atomic, ionic, or molecular size.
- The solvent is the fluid medium in which all of the solutes are dissolved.
- A solvent can be a solid, liquid or a gas but the most common solvent is water (aqueous solutions).
- Solutes are any substance dissolved in the solvent (solid, liquid or gas).

Concentration

$$\text{Concentration (} [] \text{ or } c \text{)} = \frac{\text{amount of solute}}{\text{amount of solution}}$$

Concentration

Four main methods to describe the concentration of a solution (or the amount of solid in the solution).

1) _____

- $(\text{mass of solute} / \text{mass of solution}) \times 100 \%$

2) _____

- $(\text{mass of solute} / \text{volume of solution}) \times 100 \%$

3) _____

- $(\text{volume of solute} / \text{volume of solution}) \times 100\%$

4) _____

- (Moles of solute per volume, L, of solution)

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Mass/Volume % Concentration

What is the mass/volume percentage concentration of 250mL of aqueous sodium chloride solution containing 5g NaCl?

Given:

- mass solute (NaCl) = 5 g
- volume of solution = 250 mL

Unknown:

- % [] = ?

$$\% \text{ (m/v)} = \frac{\text{mass of solute (g)}}{\text{volume of solution (mL)}} \times 100\%$$

Volume/Volume % Concentration

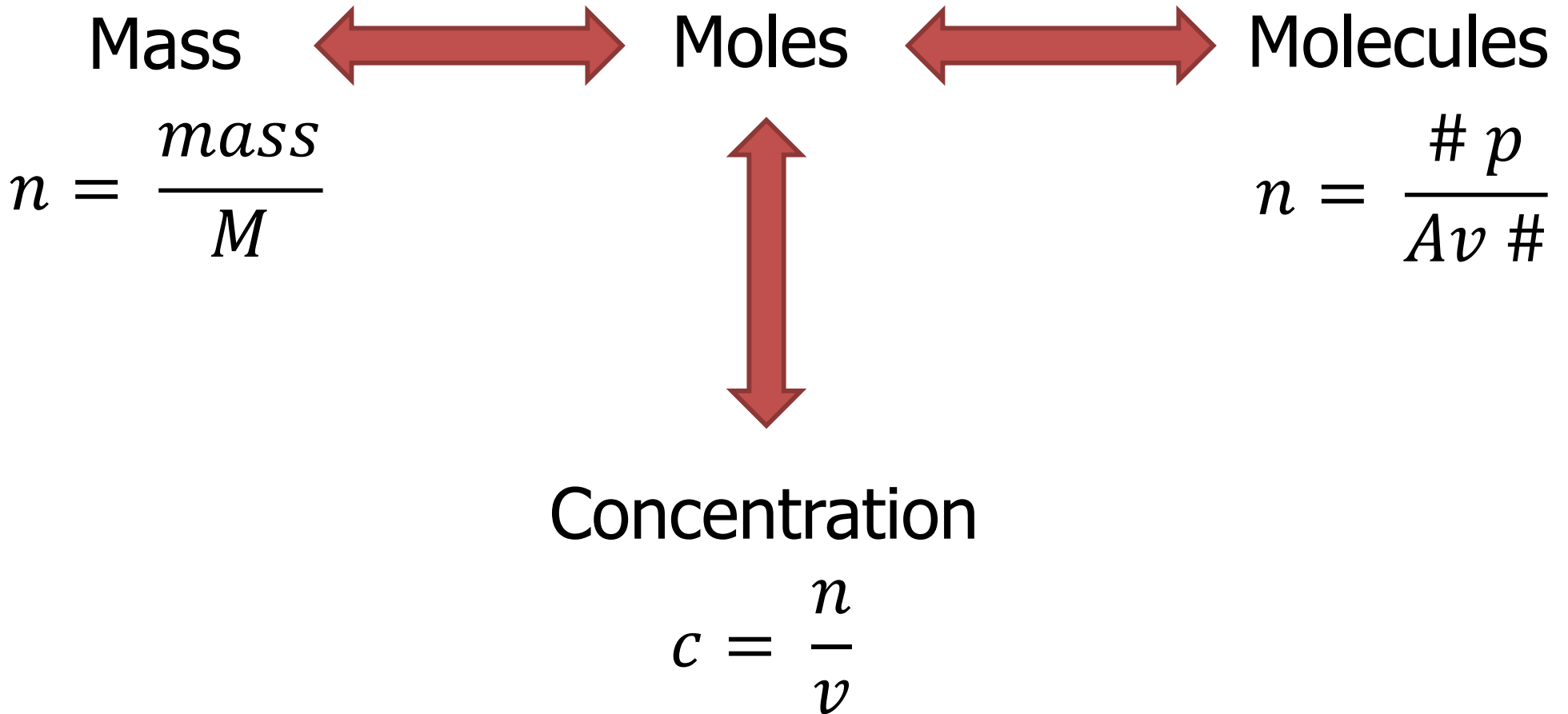
How much pure water should be added to 15.0mL of pure acetic acid to make a 5.00% (v/v) solution of acetic acid?

$$\% \text{ (v/v)} = \frac{\text{volume of solute}}{\text{volume of solution}} \times 100\%$$

Calculating Molarity (mol/L $\rightarrow$ M)

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Mole Equations



Calculating Molarity

If you dissolve 2.70 g of potassium phosphate in water to make 270 mL of solution, what is the Molarity of the solution?

Given:

- potassium phosphate (solute) = 2.70 g
- Solution amount = 270 mL = 0.270 L

$$M_{\text{K}_3\text{PO}_4} = \frac{n_{\text{K}_3\text{PO}_4}}{V_{\text{solution}}}$$

Calculating Ion Concentrations

- Calculating ion concentrations involves one extra step beyond that of normal molar concentrations
- One formula unit of an ionic compound can release multiple ions of a specific element

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Preparation of Solutions

Another very common problem

.....

This is also very practical in the lab. In fact, it is done every time we make up solutions.



Check Your Understanding

How do you prepare 500 mL of 0.150 M Na_2CO_3 solution?

- What we really want to know is
- Many labels read in M. Na_2CO_3 is found as a white powder (or solid). The equipment used to measure a specific amount is a balance, which reads in grams.
- Before we can calculate the number of grams, we need to know the number of moles then we find the grams

How do you prepare 500 mL of 0.150 M Na_2CO_3 solution?

$$c = \frac{n}{V} \rightarrow \text{rearrange equation to solve for } n:$$

$$n = c \times V \text{ (remember in L)}$$

How to make the actual solution

1. _____

2. _____

3. _____