## Preparation of solution

Solution is a homogenous mixture composed of only one phase. In such a mixture, a solute is a substance dissolved in another substance, known as a solvent

A buffer solution ( pH buffer or hydrogen ion buffer) is an aqueous solution consisting of a mixture of a weak acid and its conjugate base, or vice versa. Buffer solution are used for keeping pH at a nearly constant value in a wide variety of chemical applications. One example of a buffer solution found in nature is blood.

## 1- w/v (weight / volume) solutions:

$1 \% \mathrm{w} / \mathrm{v}$ means: 1 g solute in a final volume of 100 ml .
Example (1): Prepare 50 ml of $\mathbf{2 \%} \mathbf{~ N a C l}$.

| 2 g NaCl in |  |  |
| :---: | :---: | :---: |
| $?$ in | $\square$ | $100 \mathrm{ml} \mathrm{H}_{2} \mathrm{O}$ (distill water D.W) |
| 50 ml |  |  |

$\frac{50 \times 2}{100}=1 \mathrm{~g}$ [mean 1 g of NaCl dissolved in $50 \mathrm{ml} \mathrm{H}_{2} \mathrm{O}$ (D.W) ].
Example (2): prepare 200 ml of $\mathbf{0 . 8 5 \%} \mathbf{N a C l}$.
$\begin{array}{ll}\begin{array}{c}0.85 \mathrm{~g} \mathrm{NaCl} \\ ?\end{array} & =\begin{array}{c}100 \mathrm{ml} \mathrm{H}_{2} \mathrm{O} \\ 200 \mathrm{~m} \mathrm{o}^{2} .\end{array} \\ \frac{85 \times 200}{100}= & 17 \mathrm{~g} \text { [mean17 } \mathrm{g} \text { of } \mathrm{NaCl} \text { dissolved in } 200 \mathrm{ml} \mathrm{H}_{2} \mathrm{O} \text { (D.W)]. }\end{array}$

2- V/V (volume/volume) solutions:
$1 \% \mathrm{v} / \mathrm{v}$ means: 1 ml completed to a final volume of 100 ml .

## Example (1): prepare 100 ml of $\mathbf{1 0 \%}$ acetic acid?

10 ml of acetic acid $+90 \mathrm{ml} \mathrm{H}_{2} \mathrm{O}=100 \mathrm{ml}$ ( $10 \%$ acetic acid )

Example (2): prepare 20 ml of 0.2 \%acetic acid?
$\begin{array}{ccc}\begin{array}{c}0.2 \mathrm{ml} \text { acetic acid } \\ ?\end{array} \longrightarrow & \longrightarrow & 100 \mathrm{ml} \mathrm{H}_{2} \mathrm{O} \\ 20 \mathrm{ml}\end{array}$
$\begin{array}{ll}\frac{2 \times 20}{100} & 0 . \\ =0.04 \mathrm{ml}\end{array}$
[mean 0.04 ml of acetic acid completed to 20 ml with $\mathrm{H}_{2} \mathrm{O}$ (D.W)].

## 3- Molarity:

To prepare a solution in Moles/ Liter $=\mathbf{M}$

$$
\begin{gathered}
\text { Molarity }(M)=\frac{\text { Weight }(w t)}{\text { Molecular Weight }(m . w t)} \times \frac{1000}{\operatorname{Volum}(v)} \times \\
W \text { Weight }(w t)=\frac{\text { Molarity }(M) \times \text { Molecular Weight }(M . W t) \times \operatorname{Volume}(V)}{1000}
\end{gathered}
$$

Example (1): Prepare 100 ml of $0.5 \mathrm{M} \mathrm{NaCl}(\mathrm{M} . \mathrm{Wt}=58.88)$ ?

$$
(M)=\frac{(W t)}{M \cdot W t} \frac{1000}{V} \times
$$

$$
\begin{aligned}
& 0.5=\overline{W t \times} 10 \overline{0058.88} \\
& 0 . \\
& \mathrm{Wt} \\
& =\frac{5 \times 58.88 \times 100}{1000}
\end{aligned}
$$

$\mathrm{Wt}=2.9440 \mathrm{~g} \mathrm{NaCl}$ dissolved in $100 \mathrm{ml} \mathrm{H}_{2} \mathrm{O}$ (D.W)

Example 2: prepare 100 ml of 50 mM (millimolar) sucrose.(M.Wt =342.3)

$$
\begin{aligned}
& 1 \mathrm{M}=1000 \mathrm{mM} \longrightarrow 50 \mathrm{mM}=\frac{50}{1000}=0.05 \mathrm{M} \\
& 0.05=\frac{(W t)}{342.3} \times \frac{1000}{100}
\end{aligned}
$$

$$
05 \times 342.3 \times 100
$$

$$
1000
$$

0. 

$W t==1.7115 \mathrm{~g}$ of sucrose dissolved in $100 \mathrm{ml} \mathrm{H}_{2} \mathrm{O}$ (D.W)


## 4- Dilutions:

$$
\begin{gathered}
\mathbf{C}_{1} \mathbf{V}_{1}=\mathbf{C}_{2} \mathbf{V}_{\mathbf{2}} \\
\mathrm{C}_{1}=\text { first concentration } \mathrm{V}_{1}=\text { first volume } \\
\mathrm{C}_{2}=\text { second concentration } \mathrm{V}_{2}=\text { second volume }
\end{gathered}
$$

Example (1): how much $\mathbf{~ m l ~ o f ~} 12 \mathrm{M} \mathrm{HCl}$ is required to prepare 250 ml of 2 M HCl solution?
$\mathrm{C}_{1} \mathrm{~V}_{1}=\mathrm{C}_{2} \mathrm{~V}_{2}$
$12 \mathrm{M} \times$ ? $=2 \mathrm{M} \times 250 \mathrm{ml}$
$\frac{2 \times 250}{12}=41.6 \mathrm{ml}$ of 12 M HCl
$250 \mathrm{ml}-41.6 \mathrm{ml}=208.4 \mathrm{ml} \mathrm{H}_{2} \mathrm{O}$
[Mean 41.6 ml of 12 M HCl completed to 250 ml with $\mathrm{H}_{2} \mathrm{O}$ (D.W)]
Example 2: what volume of 10 M acetic acid is required to prepare1Lof
0.50 M acetic acid? $\mathrm{C}_{1} \mathrm{~V}_{1}=\mathrm{C}_{2} \mathrm{~V}_{2}$
$10 \mathrm{M} \times$ ? $=0.50 \mathrm{M} \times 1000 \mathrm{ml}$
$\underline{50 \times 1000} 0$.
$10=50 \mathrm{ml}$ of 12 M HCl
$1000 \mathrm{ml}-50 \mathrm{ml}=950 \mathrm{ml} \mathrm{H} \mathrm{O}$
[Mean 50 ml of 12 M HCl completed to 1000 with $\mathrm{H}_{2} \mathrm{O}$ (D.W)]

## 5- Normality:

Normality $(\mathbf{N})=$ Molarity $(\mathbf{M}) \times$ Total positive oxidation number .
Example (1): measure the normality (N) of $\mathbf{N a}^{+} \mathbf{O H}^{-}(\mathrm{M}=5)$ ?
$\mathrm{N}=\mathrm{M} \times$ Total positive oxidation number
$\mathrm{N}=5 \times 1$
$\mathrm{N}=5$

## Example (2): What is the normality of 3.0 M of $\mathrm{H}_{2} \mathrm{SO}_{4}$ ?

Since the total positive oxidation number of $\mathrm{H}_{2} \mathrm{SO}_{4}$ is $+2(2 \mathrm{H}+)$
$\mathrm{N}=\mathrm{M} \times$ Total positive oxidation number
$\mathrm{N}=3 \times 2$
$\mathrm{N}=6$

