Department of biology

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((Analytical Chemistry))

Stage (First Year)

LEC- ((-4-))

Ionic StrengthBy

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Introduction

In aqueous solutions, chemical substances mostly exist as ions, not intact compounds.

These ions interact electrically, which affects properties like:

Ionic activity

Chemical equilibria

Solubility

pH

To describe the overall effect of all ions, the concept of ionic strength is used.

Definition of Ionic Strength

Ionic strength (I) measures the total effect of all ions in solution.

It depends on:

The concentration of each ion

The charge of each ion

It does not depend on whether the ion comes from a reactant or product, and solids or undissociated species are not included.

Formula $\quad I = 1/2 \sum \ C_i Z^2$

Where:

I= ionic strength (mol/L)

C_i= concentration of ion

Z_i= charge of ion

$\sum$ = sum over all ions present

Only ions present in solution are included.

How to Calculate

Write the dissociation equation

Identify the ions in solution

Determine their concentrations and charges

Substitute into the formula

Examples

Example 1

Question:What is the ionic strength of an aqueous NaCl solution?

Given:NaCl = 0.10 M

Formula: $I = 1/2 \sum C_i Z^2$

Solution: NaCl$\rightarrow$ $Na^+ + Cl^-$

$I = ½ [(0.1)(1) + (0.1)(1)] = 0.1$

Example 2

Question:Determine the ionic strength of KNO_3 solution.

Given:KNO_3 = 0.20 M

Formula:

Solution: $KNO_3 \rightarrow K + NO_3$

Example 3

Question:What is the ionic strength of $CaCl_2$ solution?

Given:$CaCl_2$ = 0.10 M

Formula:

Solution:

Example 4

Question:Determine the ionic strength of a solution containing Na^+ = 0.30 M and Cl^- = 0.30 M.

Formula:

Solution:

Example 5

Question:What is the ionic strength of a solution containing Mg^{2+} = 0.05 M and Cl^- = 0.10 M?

Formula:

Solution:

Example 6

Question:Determine the ionic strength of $AlCl_3$ solution with a concentration of 0.05 M.

Formula:

Solution: $AlCl_3 \rightarrow Al^{+3} + 3Cl^-$