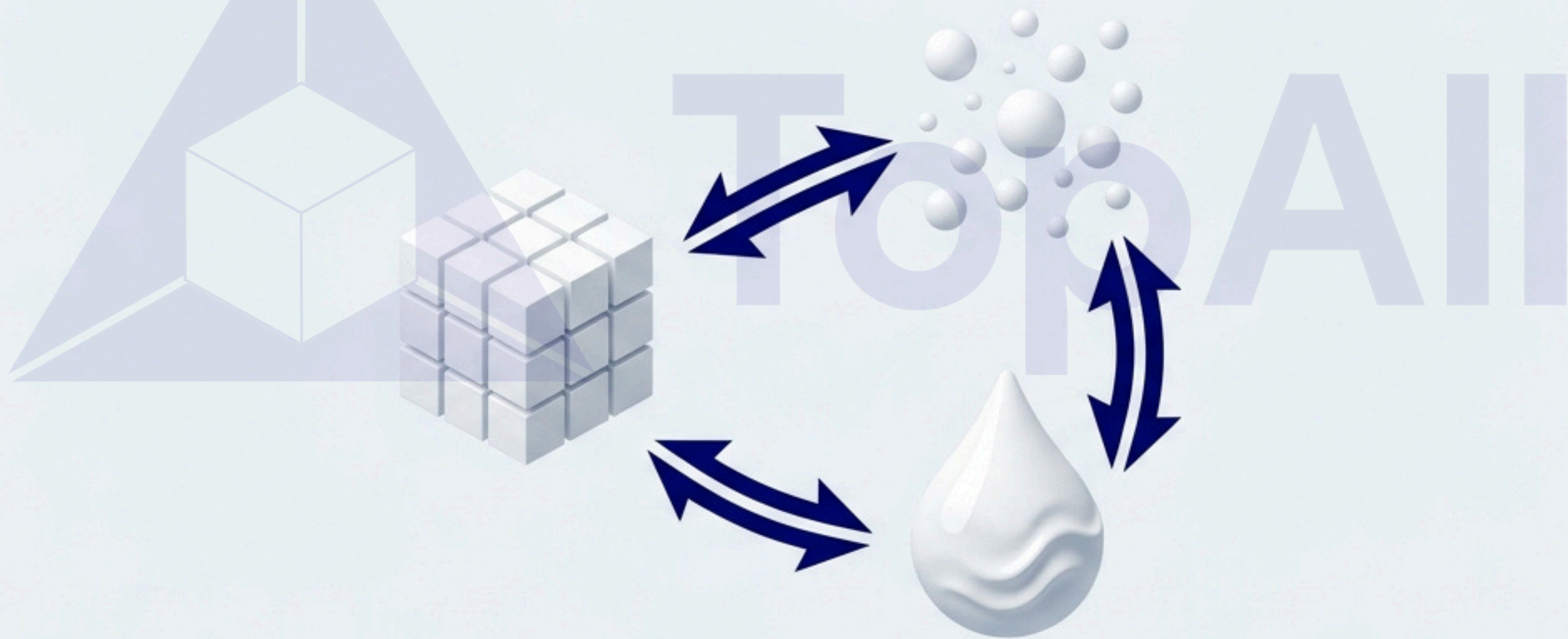


6.5 Heterogeneous Equilibria

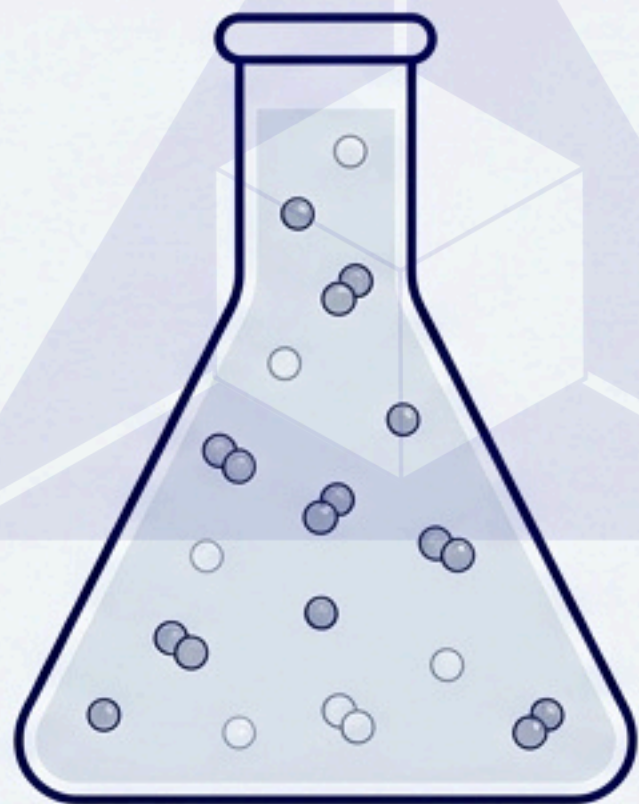
Equilibrium across more than one phase



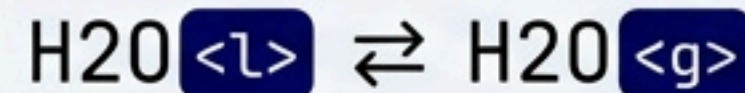
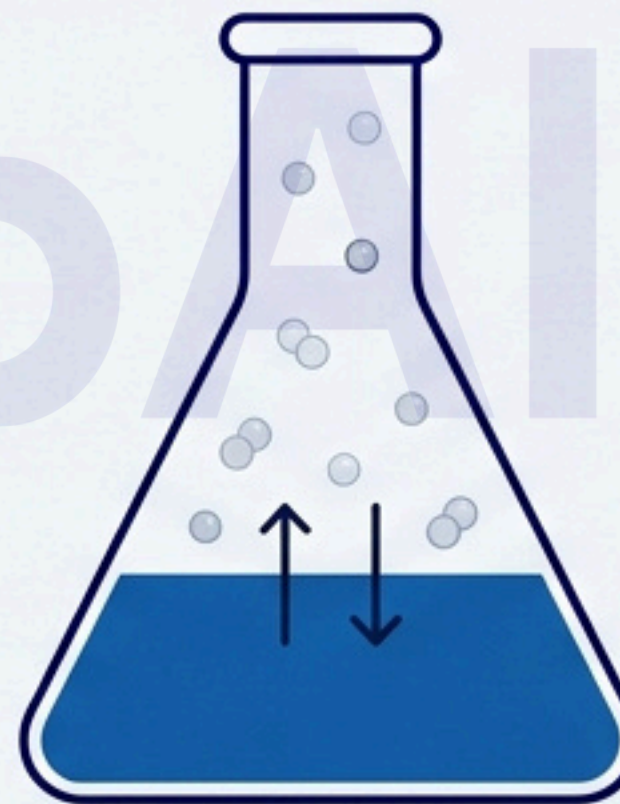
What Is Heterogeneous Equilibrium?

Equilibrium in a system having more than one phase. It involves intense dynamic activity at the boundaries between different states of matter.

Single Phase

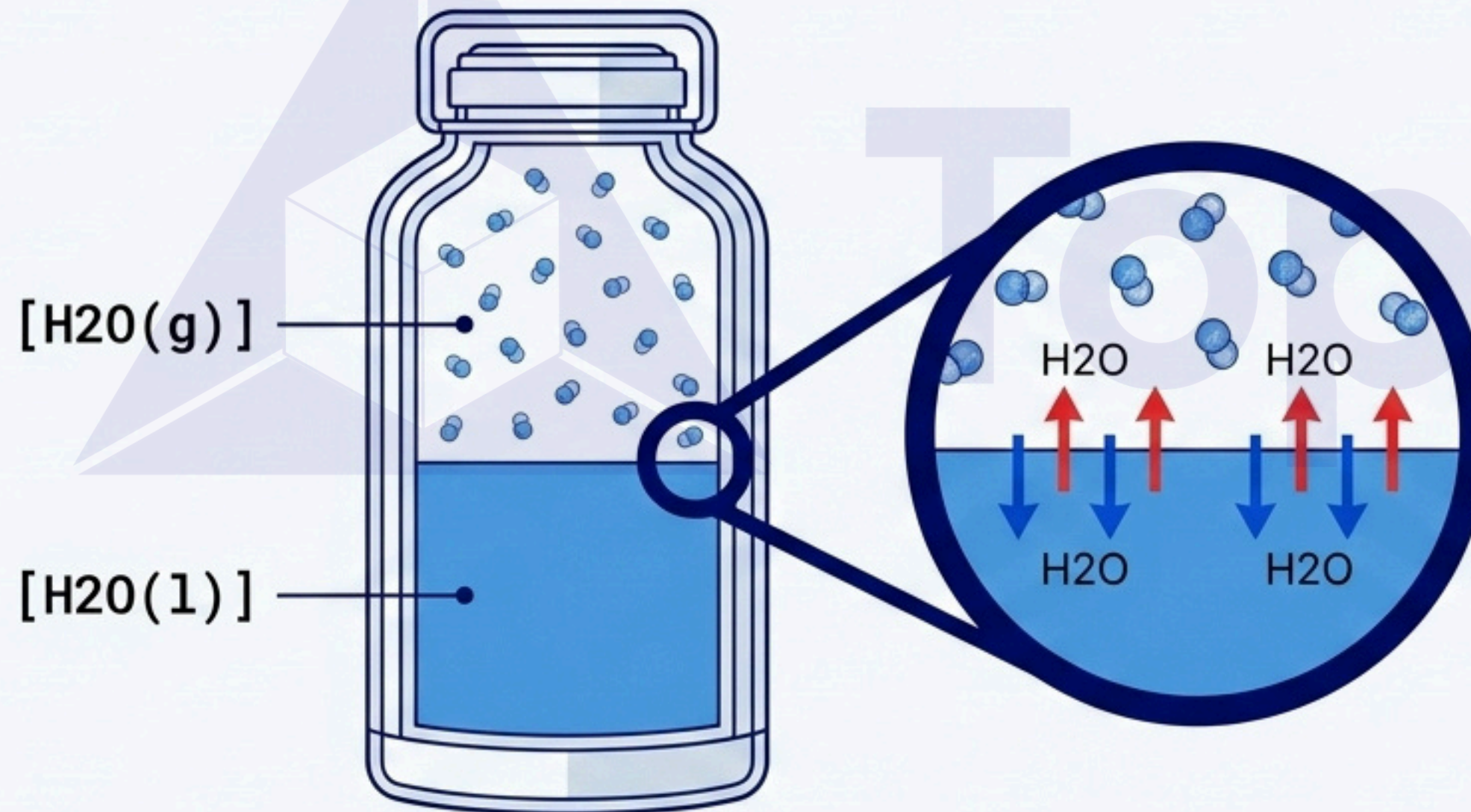


Multiple Phases



Example 1: Physical Equilibrium

A phase transformation process occurring in a closed container at a constant temperature.



Rate of evaporation =
Rate of condensation



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$$E=mc^2$$



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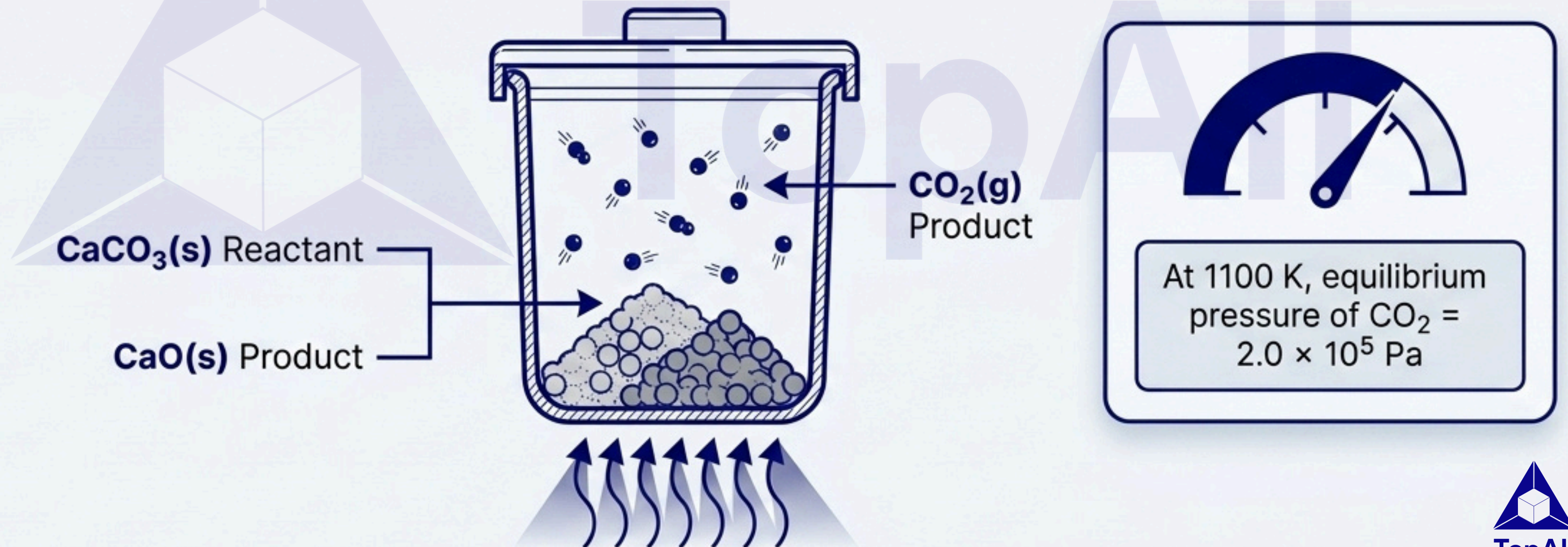
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Example 2: Chemical Equilibrium

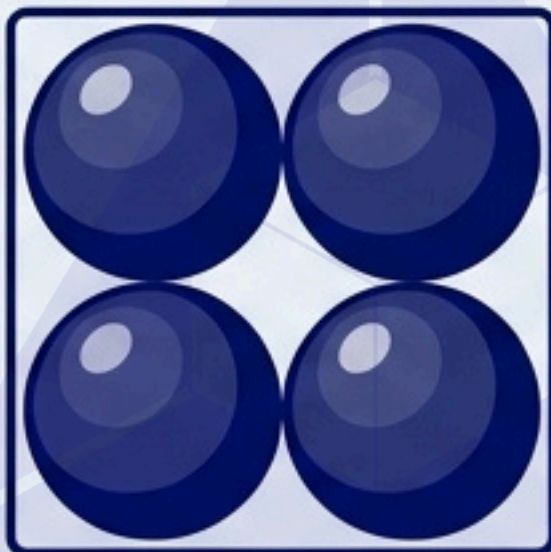
Thermal dissociation of calcium carbonate. Three distinct chemical species exist across two different phases.



Why Pure Solids & Liquids Do Not Appear in K

The molar concentration of a pure solid or liquid is independent of the amount present. Density and molar mass remain constant regardless of volume.

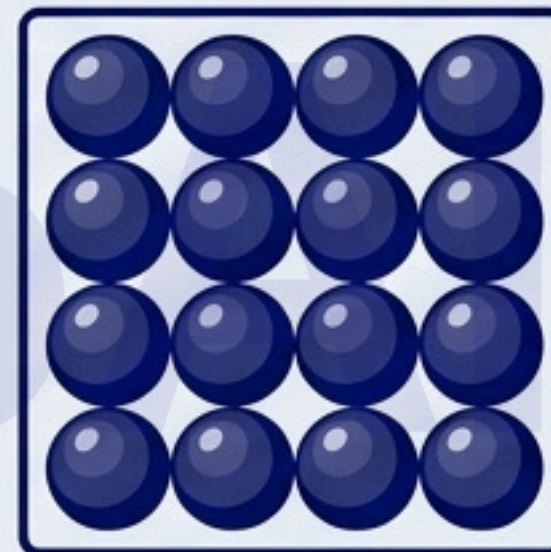
Small Amount of Solid [X]



Mass: m | Volume: V

$$\text{Concentration} = m / V = \text{Constant } C$$

Large Amount of Solid [X]



Mass: $4m$ | Volume: $4V$

$$\text{Concentration} = 4m / 4V = \text{Constant } C$$



Because $[X(s)]$ and $[X(l)]$ are constant, they are absorbed into the equilibrium constant K_c .



Rule Card

Pure solids and liquids are physically essential for the equilibrium to exist, but they are omitted mathematically from the K expression.

Mathematical Derivation

1. Initial Expression:

$$K_c = \frac{[\text{CaO}(s)] [\text{CO}_2(g)]}{[\text{CaCO}_3(s)]}$$

2. Absorbing Constants:

$[\text{CaCO}_3(s)]$ and $[\text{CaO}(s)]$ are constant.

3. Modified K_c :

$$K'_c = [\text{CO}_2(g)]$$

4. The Result:

$$K_p = p\text{CO}_2$$



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