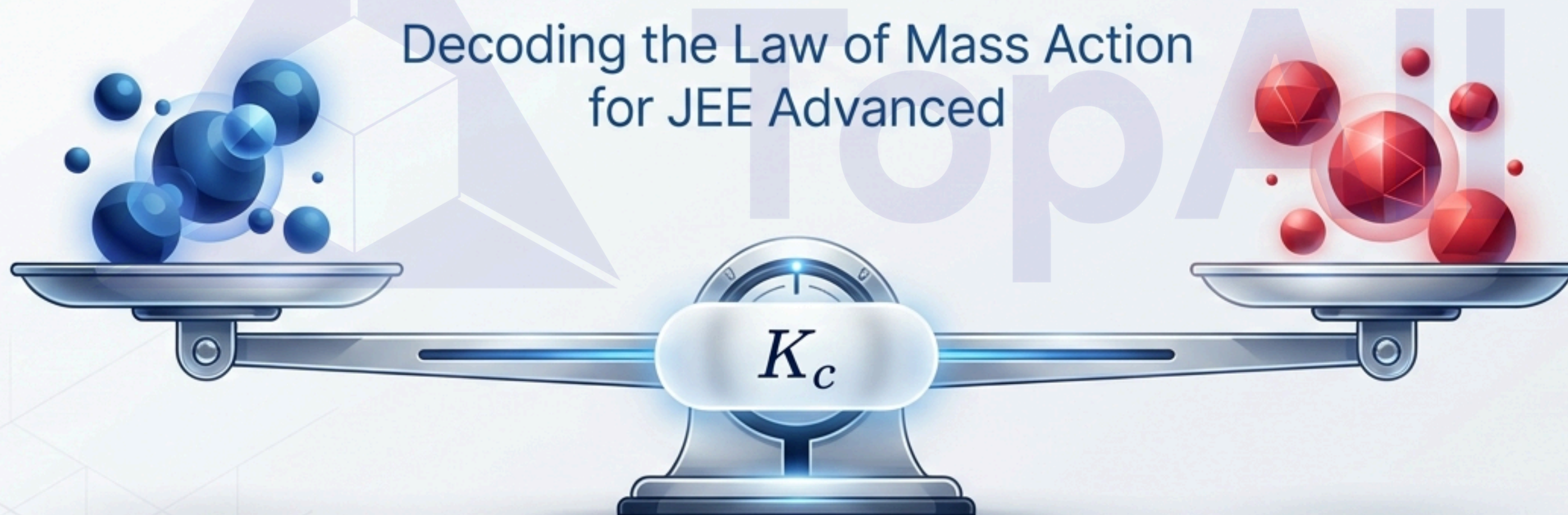


Reading Chemical Equilibrium Through K_c

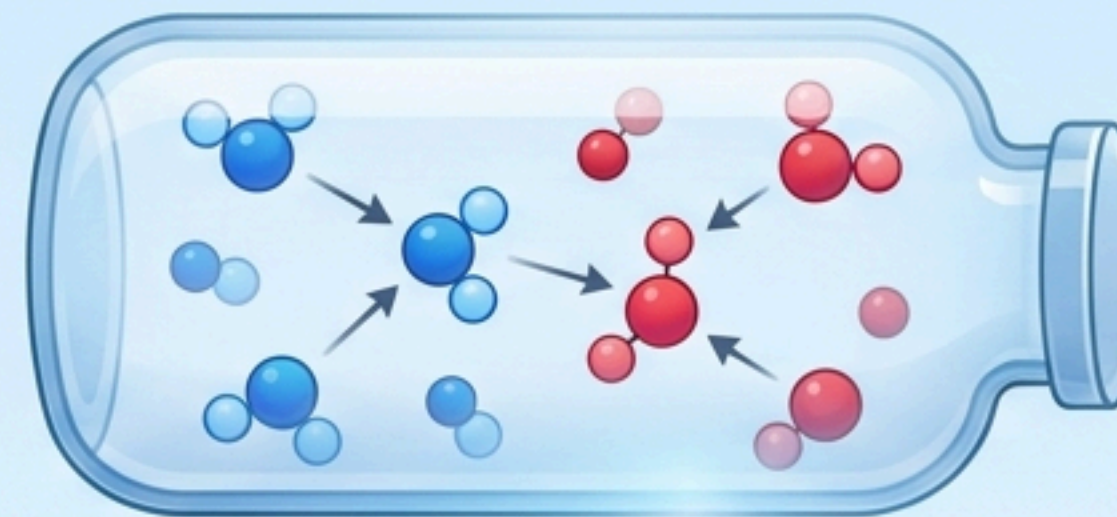
Decoding the Law of Mass Action
for JEE Advanced



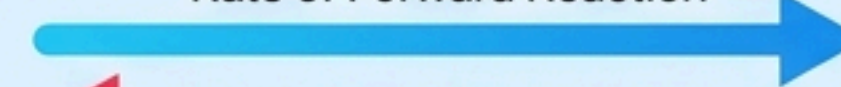
The Law of Chemical Equilibrium

At a given temperature, the ratio of product concentrations to reactant concentrations (raised to their stoichiometric powers) is a constant value.

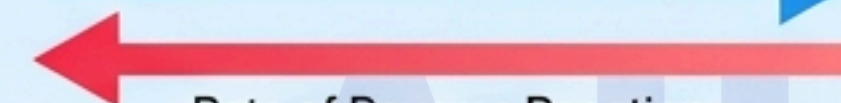
Subscript 'c' = Molar Concentration (mol L^{-1})



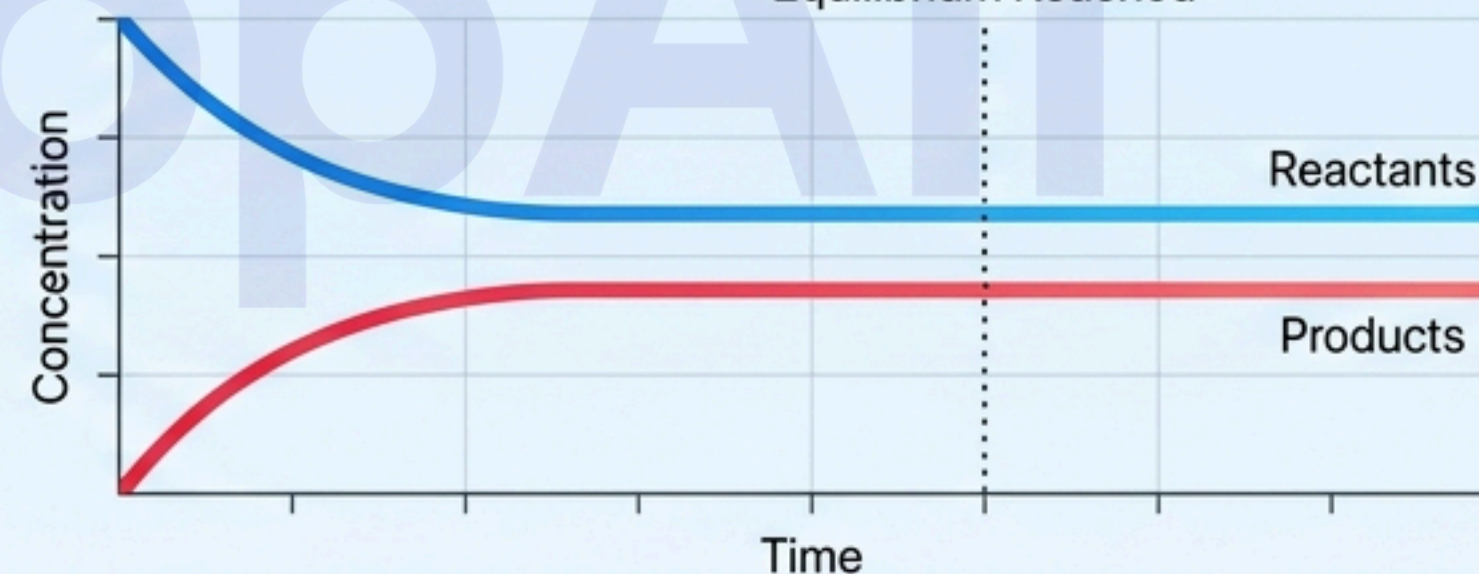
Rate of Forward Reaction



Rate of Reverse Reaction



Equilibrium Reached



Key Takeaway

Dynamic, not static: The reactions continue, but net concentrations freeze.



$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \left[\quad \right] = \text{Equilibrium Concentration}$$



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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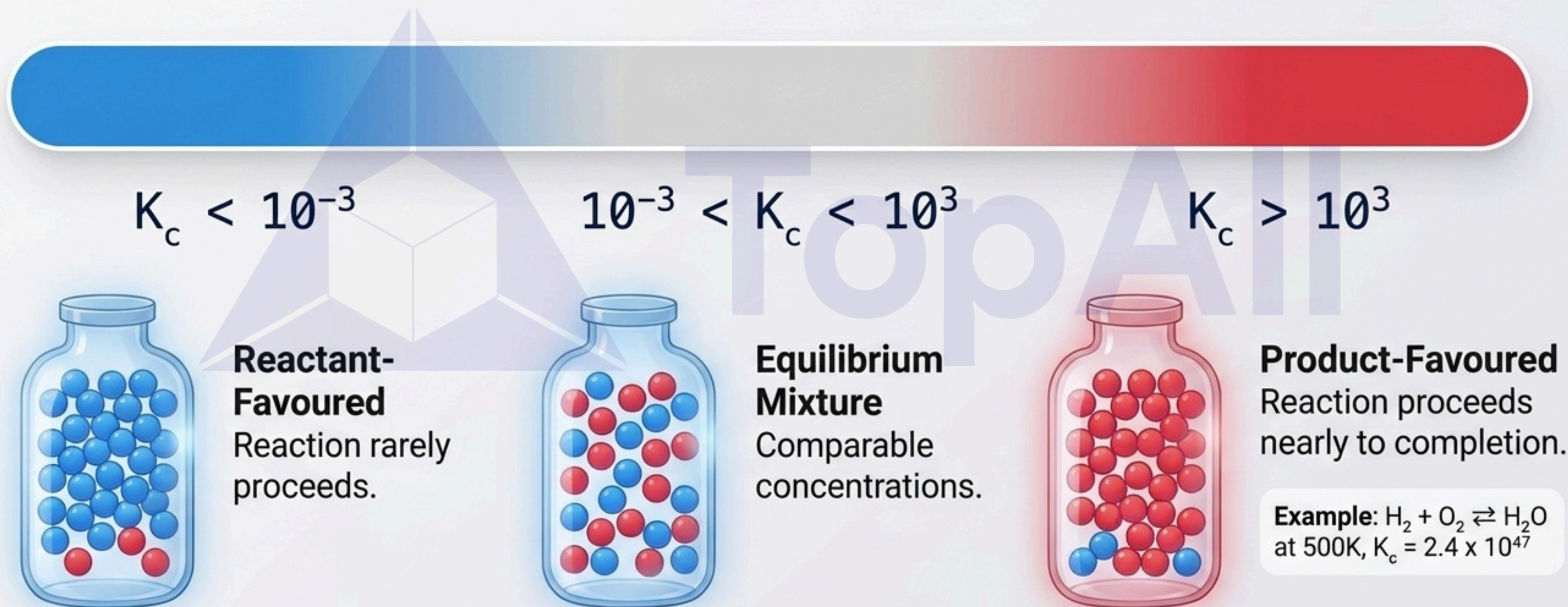
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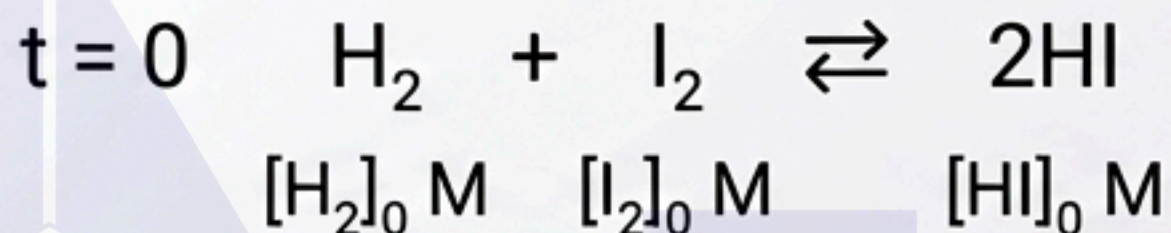
The Extent Spectrum: What the Magnitude Means



Numerical Interpretation: The ICE Framework

1. Initial

Define starting state.



2. Change

Define x via stoichiometry.



Choose the mathematical solution that makes chemical sense.

3. Equilibrium

Substitute into K_c .

K_c Expression

$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{([\text{HI}]_0 + 2x)^2}{([\text{H}_2]_0 - x)([\text{I}_2]_0 - x)}$$

By defining x as the concentration that reacts, we map the unknown directly to the stoichiometric ratios of the balanced equation.

JEE Trap Alert ⚠

Does K_c change when I add more reactant?

The Illusion

Changes the **Reaction Quotient** (Q_c).
Shifts the position of equilibrium
(**Le Chatelier's Principle**).



The Reality

INDEPENDENT of initial concentrations.
Remains **strictly constant**.



Key Takeaway

K_c is a thermodynamic constant. Only a change in **TEMPERATURE** can change the value of K_c .

Exam Snapshot: Manipulating K_c

Reversing the Reaction

If: $A \rightleftharpoons B$ has K_c

Then: $B \rightleftharpoons A$ has $K_c' = \frac{1}{K_c}$

Multiplying by factor 'n'

If: $A \rightleftharpoons B$ has K_c

Then: $nA \rightleftharpoons nB$ has $K_c' = (K_c)^n$

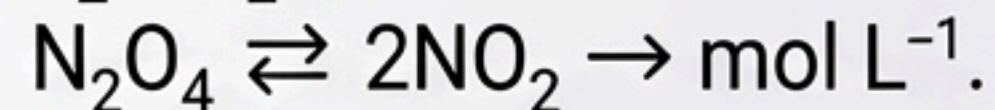
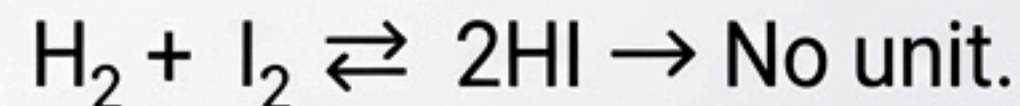
Pure Solids & Liquids

Omit pure solids (s) and pure liquids (l) from the K_c expression.

Their concentration remains constant (standard state activity = 1).

Units of K_c

Units strictly depend on stoichiometry.



(Dimensionless if standard states are specified).



You've Learned the Theory.

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