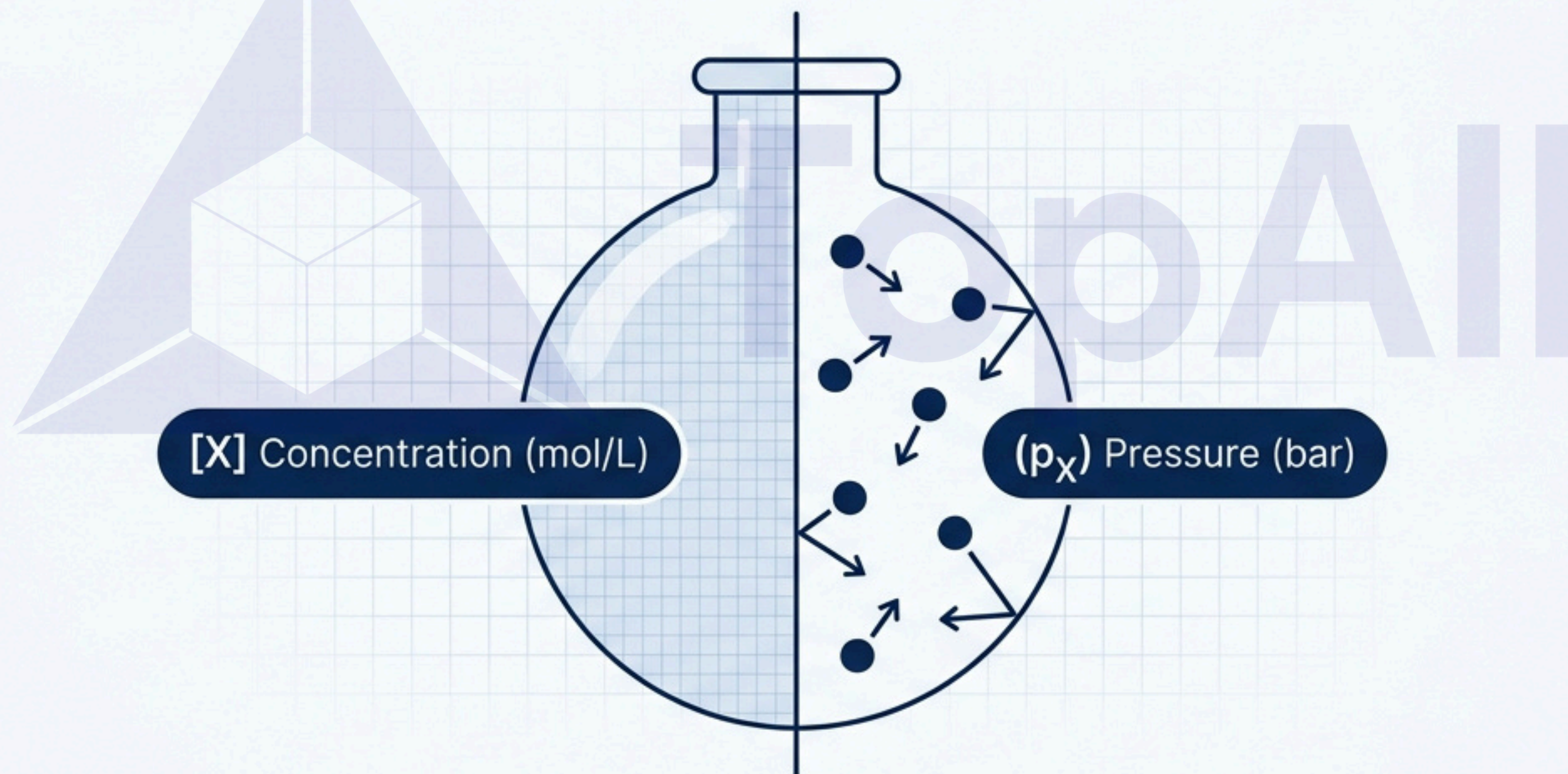


Equilibrium Constant in Gaseous Systems

Moving from molar concentration (K_c) to partial pressure (K_p)



Why Use Pressure for Gases?

Aqueous Solutions



Metric: Molar Concentration (c)

Unit: mol/L (Molarity)

Constant: K_c

Best for liquids and dissolved solutes where volume is relatively fixed.

Gaseous Systems



Metric: Partial Pressure (p)

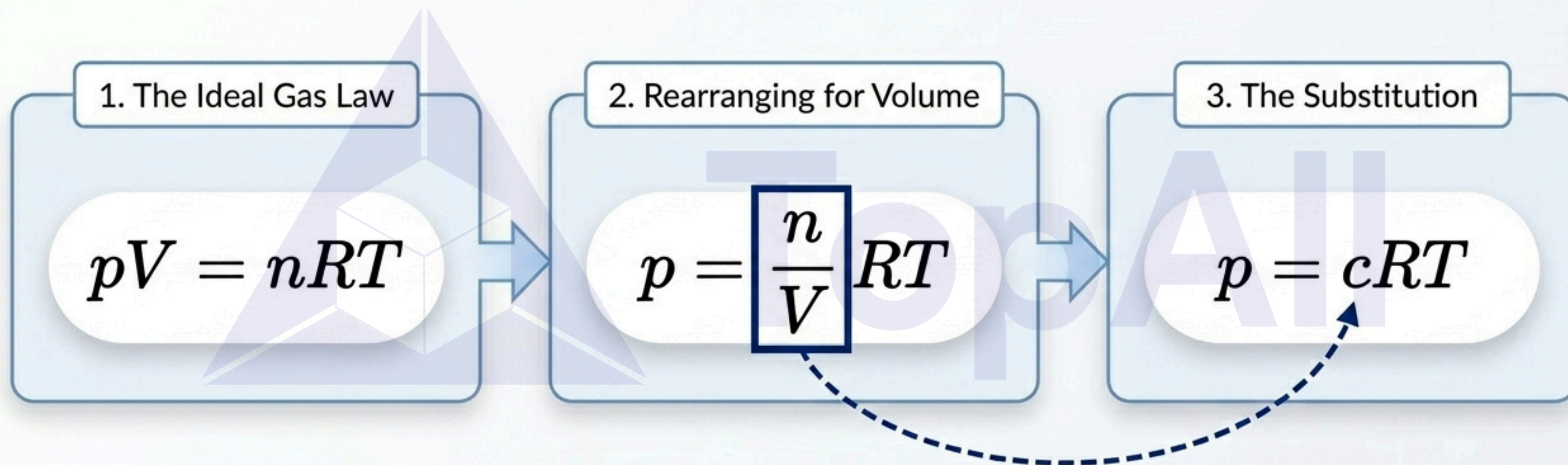
Unit: bar or Pa

Constant: K_p

More convenient for compressible gases. Pressure is a direct measure of a gas's active mass.

While K_c can be used for gases, K_p is the standard and preferred metric for gaseous equilibria.

The Ideal Gas Link



c = molar concentration (mol/L)

$$R = 0.0831 \frac{\text{bar L}}{\text{mol K}}$$

T = Temperature in Kelvin



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$$E=mc^2$$



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Defining K_p

Reaction Card



Concentration Expression

$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$$

Uses Brackets []

Partial Pressure Expression

$$K_p = \frac{(p_{\text{HI}})^2}{p_{\text{H}_2} * p_{\text{I}_2}}$$

Uses Parentheses ()

Rule: The power rule remains identical—stoichiometric coefficients become exponents.

Converting Between K_p and K_c

Equilibrium Constant (Pressure)

Gas Constant = 0.0831 bar L / mol K

$$K_p = K_c (RT)^{\Delta n}$$

Change in
gaseous moles

Equilibrium Constant (Concentration)

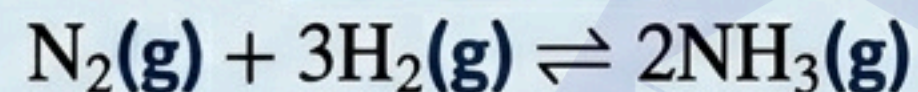
Absolute Temperature
(Kelvin)

$\Delta n = (\text{moles of product gas}) - (\text{moles of reactant gas})$

The Δn Special Cases

$$\Delta n < 0$$

Reaction Chip



Math Chip

$$\Delta n = 2 - 4 = -2$$

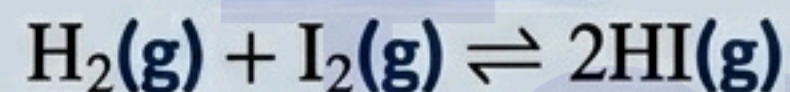
Result Badge

$$K_p < K_c$$

KEY EXAM CASE

$$\Delta n = 0$$

Reaction Chip



Math Chip

$$\Delta n = 2 - 2 = 0$$

Note Chip

$$\text{Since } (RT)^0 = 1$$

Result Badge

$$K_p = K_c$$

$$\Delta n > 0$$

Reaction Chip



Math Chip

$$\Delta n = 2 - 1 = +1$$

Result Badge

$$K_p > K_c$$

Pressure-Based Equilibrium Shortcut Sheet

The Core Formula

$$K_p = K_c(RT)^{\Delta n}$$

Standard Pressure State = 1 bar

The Δn Trick

$$\text{If } \Delta n = 0, \text{ then } K_p = K_c$$

Always check stoichiometry first before calculating!

The Notation Rule

Use $(p_X)^y$ for K_p

Use $[X]^y$ for K_c

The Ideal Gas Bridge

$$p = cRT$$

$$R = 0.0831$$

$$T = \text{Kelvin}$$

Exam Strategy: Count gaseous moles on both sides before applying any formula.



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