

NEET/JEE • CHEMISTRY • SOLUTIONS • UNIT 1.3.2

Henry's Law

JEE Weightage: High

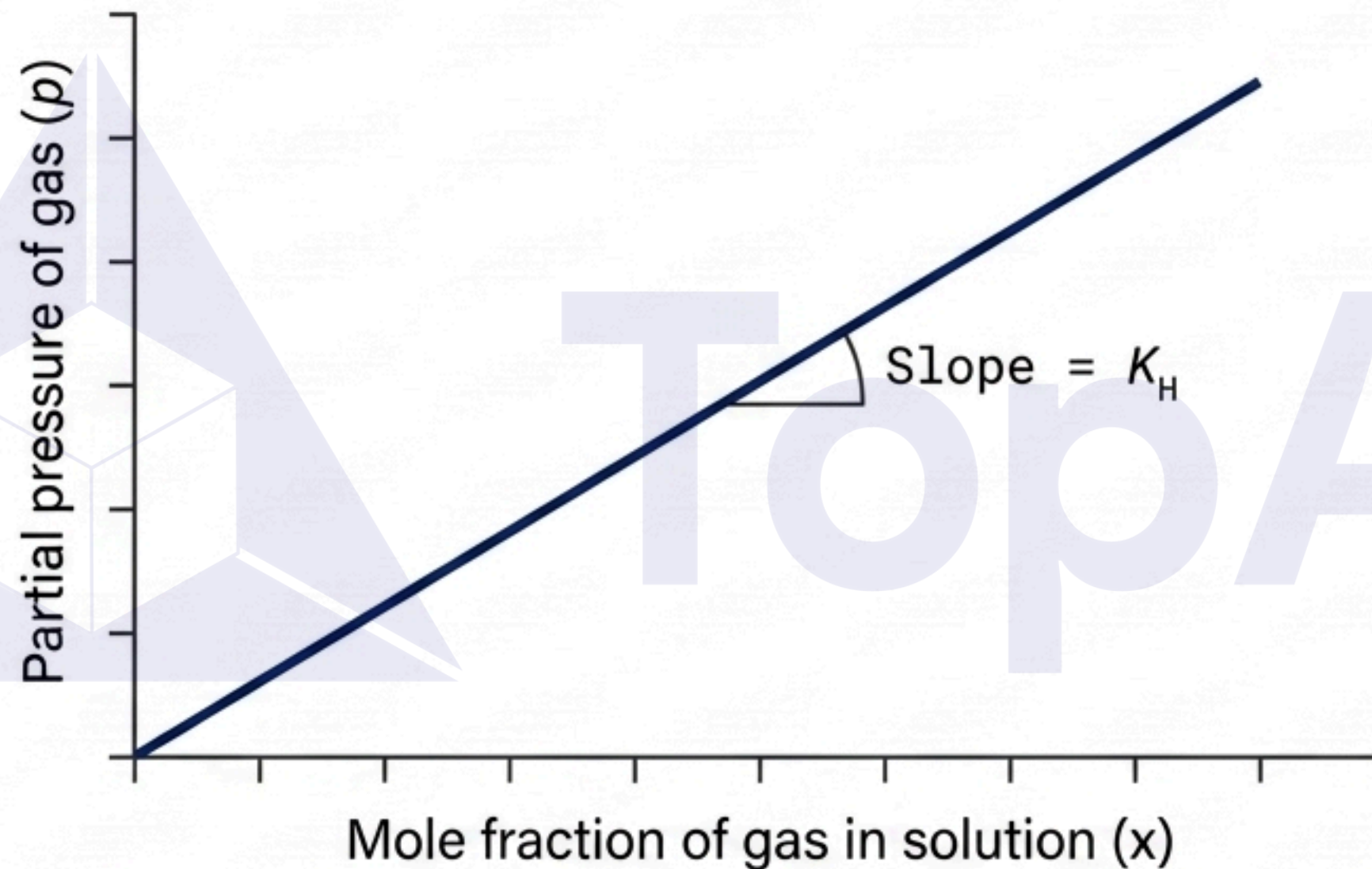
One equation explains soda fizz, scuba accidents, and altitude sickness.

The Governing Equation


$$p = K_H \cdot x$$

K_H = Henry's law constant, unique to each gas at a given temperature.

Direct Proportionality



The partial pressure of the gas in the vapour phase is directly proportional to its mole fraction in the solution.



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 **Trap: Higher K_H = LOWER solubility (not higher).**

Students instinctively read 'bigger constant' as 'more soluble' — **it's inverted.**

$$x = \frac{p}{K_H}$$

Assuming constant pressure (p), as the denominator (K_H) grows larger, the resulting mole fraction (x) must get smaller.



Trap: K_H rises with temperature $\rightarrow$ gas solubility FALLS.

Dissolution of a gas is an exothermic process ($\Delta H < 0$).
By Le Chatelier's principle, increasing temperature pushes the equilibrium backward, decreasing solubility.



This is why aquatic life (fish) are more comfortable in cold water — there is significantly more dissolved O_2 at lower temperatures.

Applying the Law (NCERT Ex 1.4)

**N₂ gas bubbled through 1L water at 293K. $p = 0.987$ bar.
 $K_H = 76.48$ kbar. Find millimoles dissolved.**

Step 1: $p = K_H \cdot x \rightarrow x(\text{N}_2) = \frac{p}{K_H}$

Step 2: $x(\text{N}_2) = \frac{0.987 \text{ bar}}{76,480 \text{ bar}} = 1.29 \times 10^{-5}$

Step 3: 1L of water ≈ 55.5 moles. Since n is very small, $x \approx \frac{n}{55.5}$

Step 4: **$n = 1.29 \times 10^{-5} \times 55.5 = 7.16 \times 10^{-4} \text{ mol} = 0.716 \text{ mmol}$**

Biological & Industrial Phenomena



The Fizz (High p)

Soda bottles are sealed under high pressure to force a higher concentration of CO_2 to dissolve into the liquid.



The Bends (Changing p)

Deep dives increase pressure, dissolving excess in blood. Rapid ascent drops pressure, forming dangerous N_2 bubbles in capillaries.



Anoxia (Low p)

High altitudes have low O_2 partial pressure, resulting in low dissolved O_2 in the blood, causing weakness and confusion.

Key Takeaways

- Apply $p = K_H \cdot x$ directly for gas solubility numericals.
- Remember higher K_H means lower solubility at the same pressure (Inverse relationship).
- Connect K_H 's temperature trend to real phenomena (e.g., bends, cold-water fish preference).



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