

NEET/JEE • CHEMISTRY • SOLUTIONS • UNIT 1.6.4

Osmosis and Osmotic Pressure

JEE Weightage: High

The most precise colligative property for finding protein molar masses.

Formula Bank


$$\Pi = CRT = (n_2 / V)RT$$

$$M_2 = w_2 RT / (\Pi V)$$

Π = Osmotic Pressure

C = Molarity of the solution

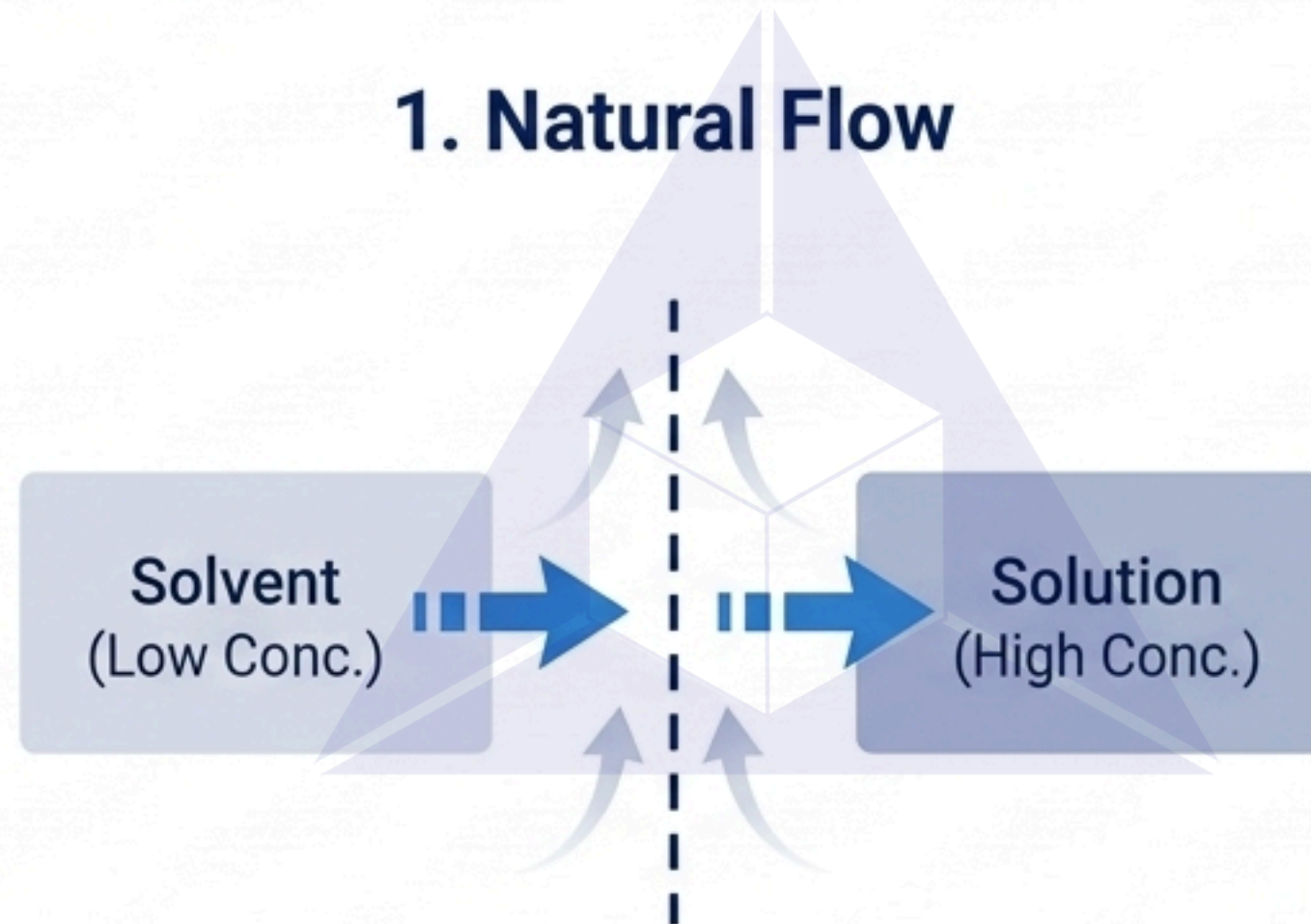
R = Gas constant

w_2 = Mass of solute | M_2 = Molar mass of solute

T = Temperature

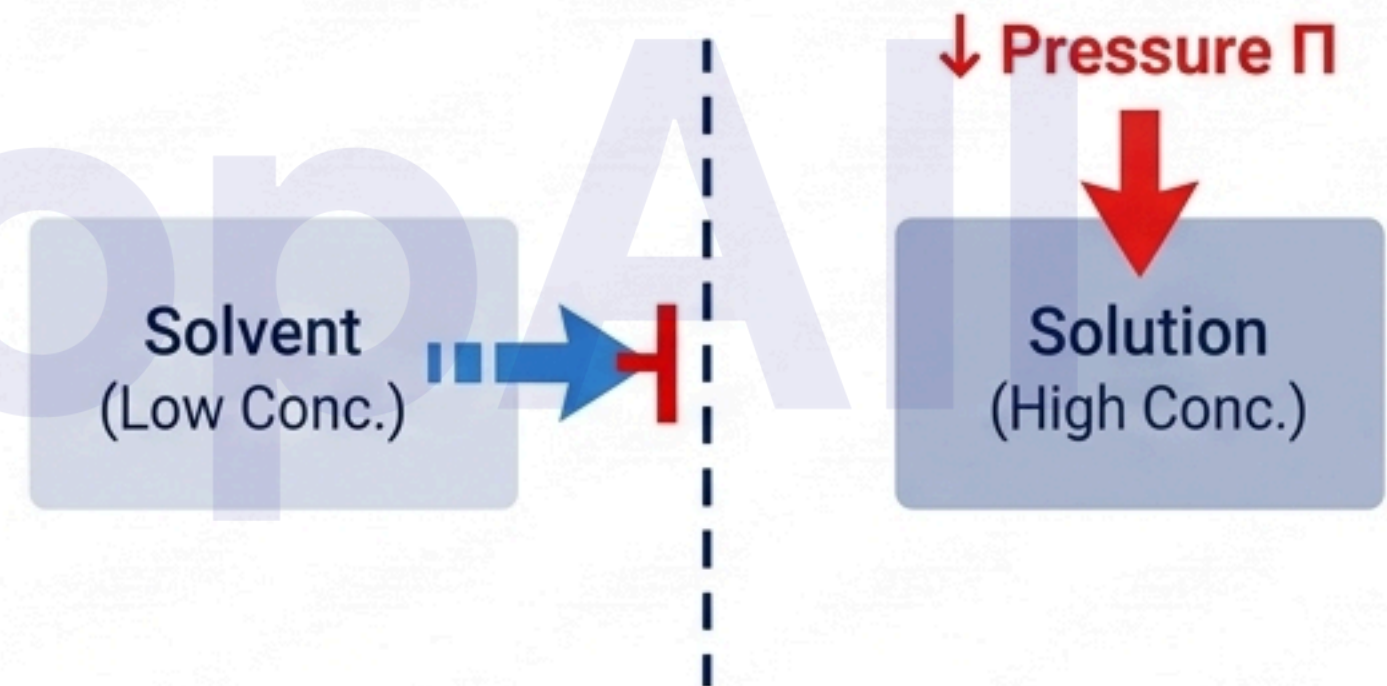
The Mechanism of Osmosis

1. Natural Flow



Solvent naturally rises through the Semipermeable Membrane (SPM) into the solution.

2. Osmotic Pressure (Π)



Excess pressure (Π) applied to the solution side perfectly halts the flow of solvent.



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

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



At prep.topall.app

Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Worked Example: Finding Molar Mass

Question (Ex 1.11): 200 cm³ of an aqueous solution contains 1.26g of a protein. The osmotic pressure at 300K is 2.57×10^{-3} bar. Calculate the molar mass.

$$w_2 = 1.26 \text{ g}$$

$$T = 300 \text{ K}$$

$$\Pi = 2.57 \times 10^{-3} \text{ bar}$$

$$V = 200 \text{ cm}^3 = 0.200 \text{ L}$$

$$M_2 = (1.26 \times 0.083 \times 300) / (2.57 \times 10^{-3} \times 0.200)$$

$$M_2 = 61,022 \text{ g/mol}$$

JEE Trap Alert



Trap: Forgetting to convert cm^3 to litres, or mismatching R 's units.

Master unit conversions to secure these marks.
Examiners frequently provide Volume in cm^3 or mL, and Pressure in varying units (atm vs. bar).

- 1. Volume must be in Litres (L).** (e.g., $200 \text{ cm}^3 = 0.200 \text{ L}$)
- 2. Gas Constant (R) must match Π .** If Π is in bar, use $R = 0.083 \text{ L}\cdot\text{bar}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$. If Π is in atm, use $R = 0.0821 \text{ L}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$.

Biological Application: Tonicity

Isotonic



Equal Π

0.9% NaCl (Normal saline). No net water flow. Cell remains stable.

Hypertonic



More Solute Outside

> 0.9% NaCl. Water flows out of the cell. Cell shrinks.

Hypotonic



Less Solute Outside

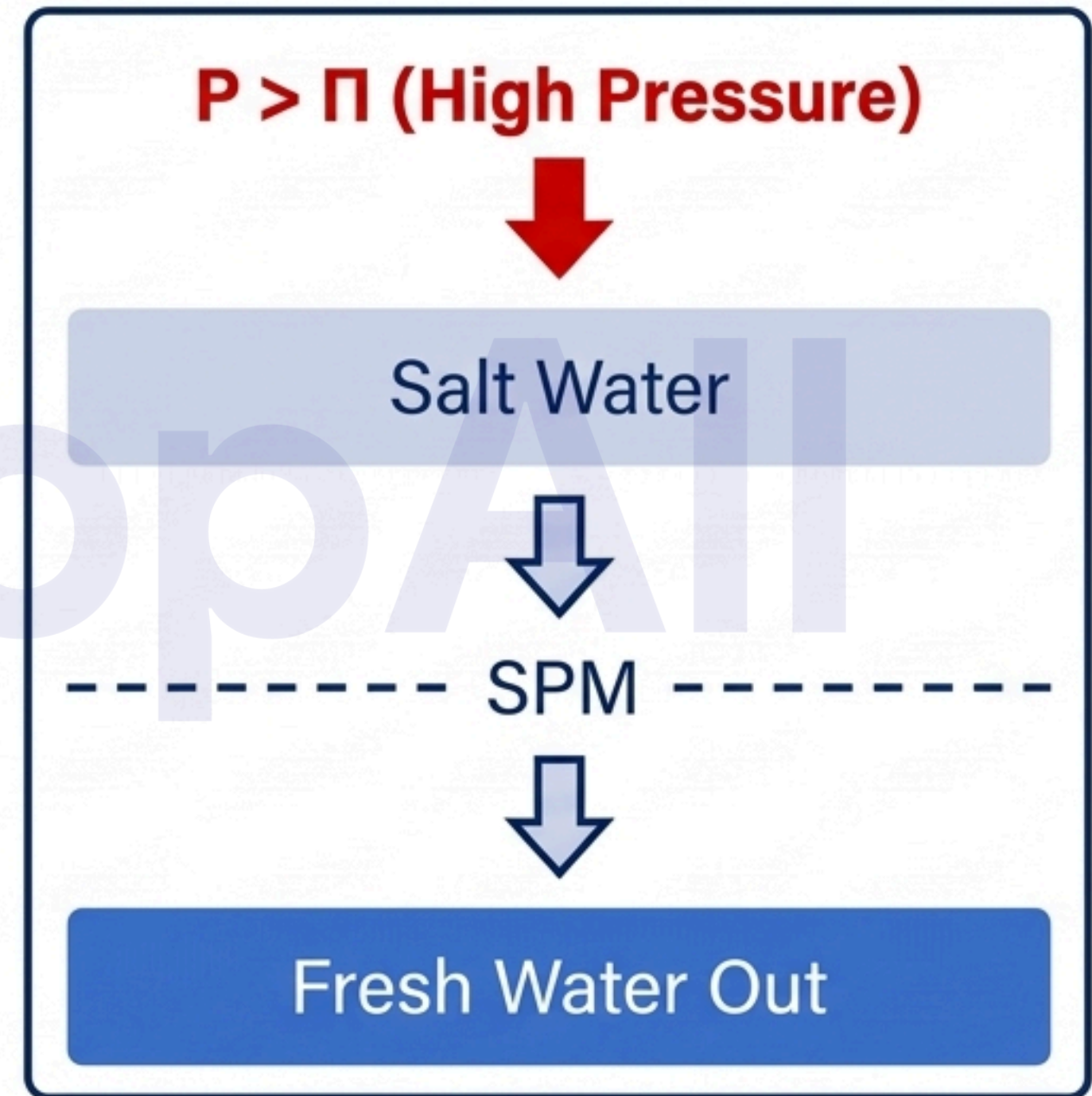
< 0.9% NaCl. Water flows into the cell. Cell swells.

Reverse Osmosis (RO)

If a pressure larger than the osmotic pressure ($P > \Pi$) is applied to the solution side, the natural direction of osmosis is reversed.

Used in seawater desalination.

Pure water is squeezed out of salt water through a polymer membrane (e.g., cellulose acetate).



Key Takeaways

- Apply $\Pi = CRT$ for molar mass determination, especially advantageous for large biomolecules/polymers because it is measured at room temperature using molarity.
- Keep volume strictly in litres and ensure you match the gas constant (R) units to the given pressure unit.
- Distinguish isotonic (stable), hypertonic (shrinking), and hypotonic (swelling) states by tracing the direction of net water flow.



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis