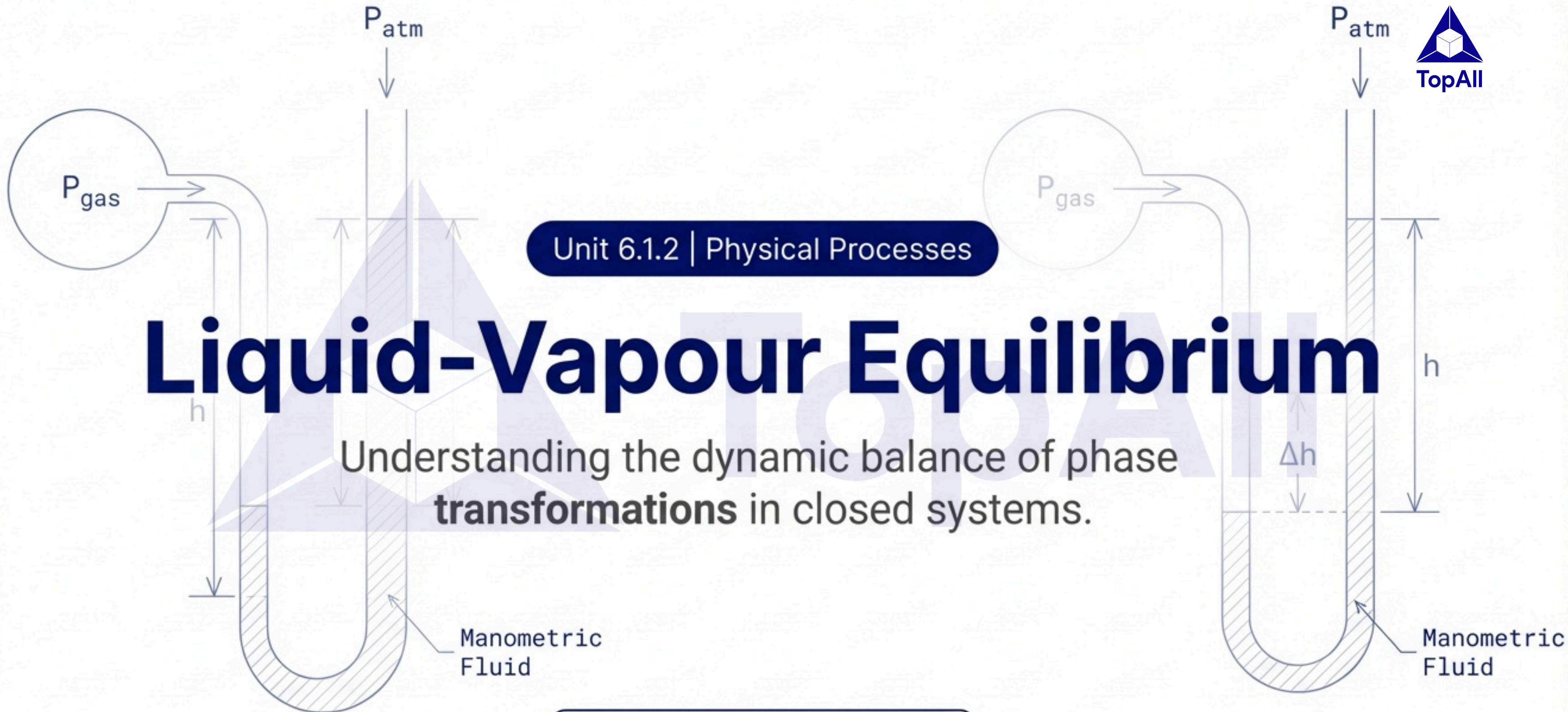


Unit 6.1.2 | Physical Processes

Liquid-Vapour Equilibrium

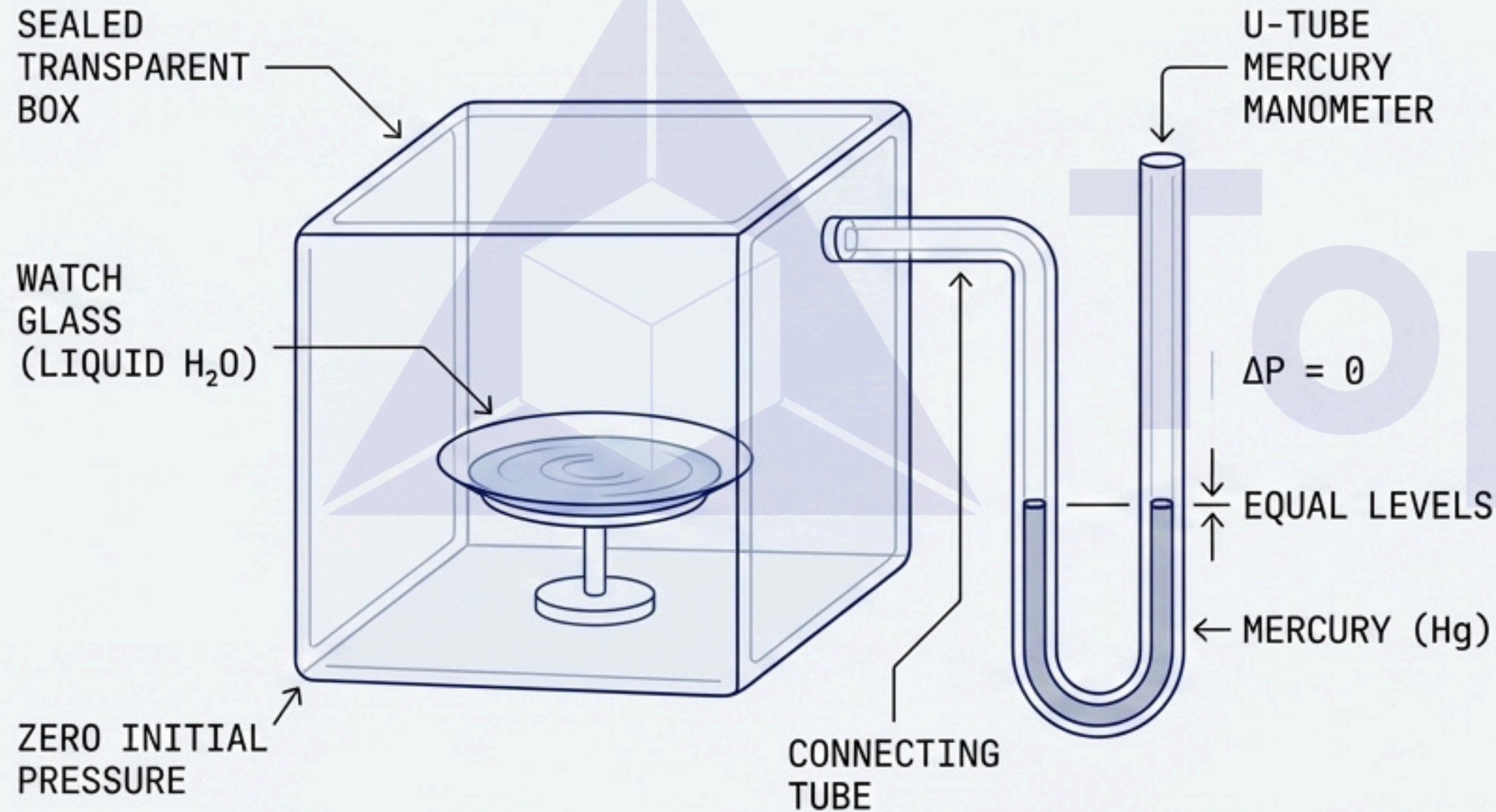
Understanding the dynamic balance of phase transformations in closed systems.



★ Exam-Smart Summary

THE APPARATUS

The Experimental Setup



The Environment



A sealed, transparent box ensures no matter escapes, establishing a strict boundary condition.

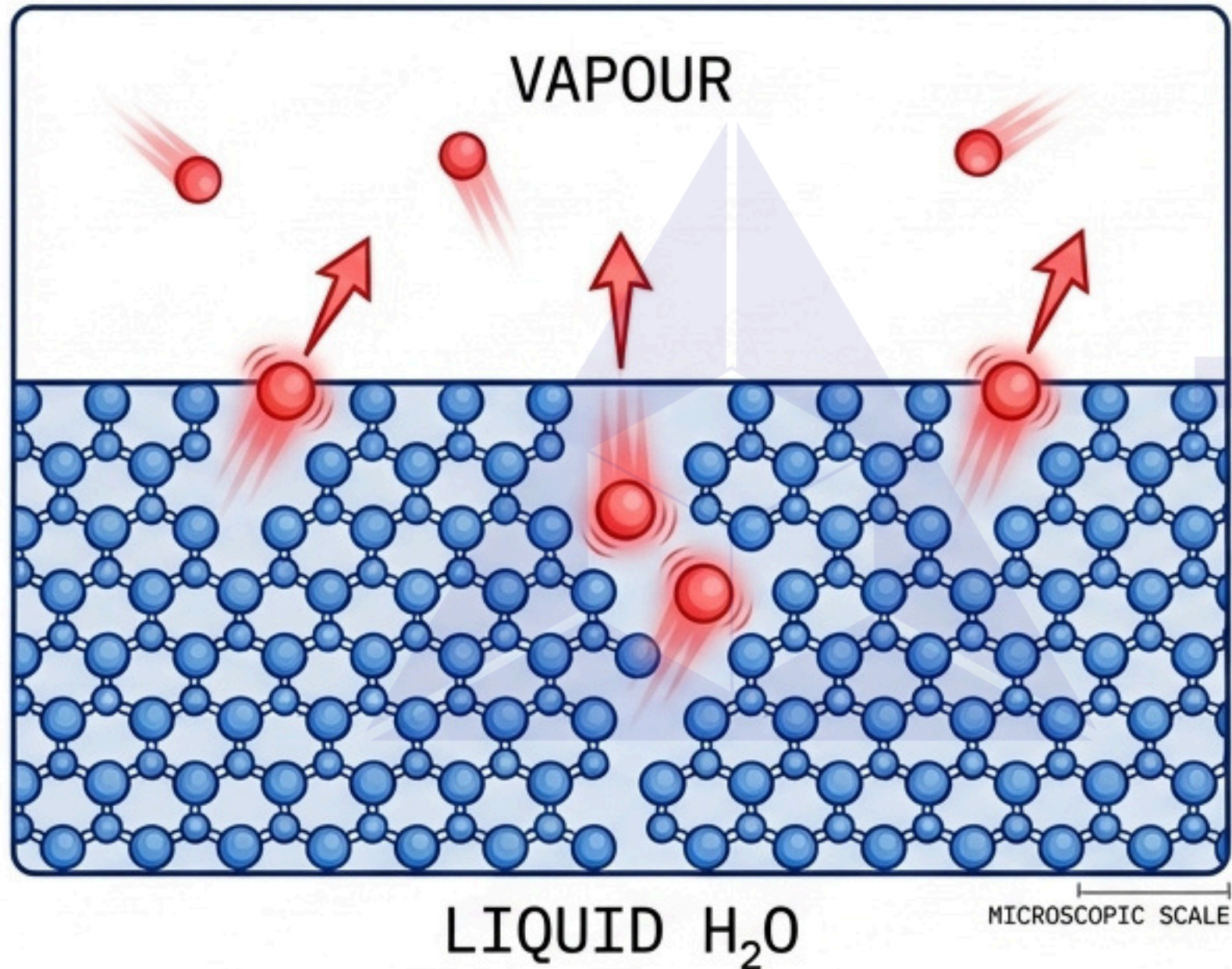
The Agent

Anhydrous calcium chloride is placed inside initially to absorb ambient moisture, ensuring the experiment starts with zero water vapour.

The Indicator

A mercury U-tube manometer acts as the primary gauge, tracking internal pressure changes over time.

The Drive to Escape



High Kinetic Energy

Only molecules with above-average kinetic energy can overcome intermolecular forces to escape the liquid surface.



Phase Shift

Liquid molecules transition into the vapour phase, rapidly filling the empty space in the closed box.



Pressure Rises

As water vapour molecules accumulate, the manometer begins to register an initial increase in internal pressure.

At this initial stage, the rate of evaporation is at its maximum and the rate of condensation is strictly zero.



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

$$E=mc^2$$



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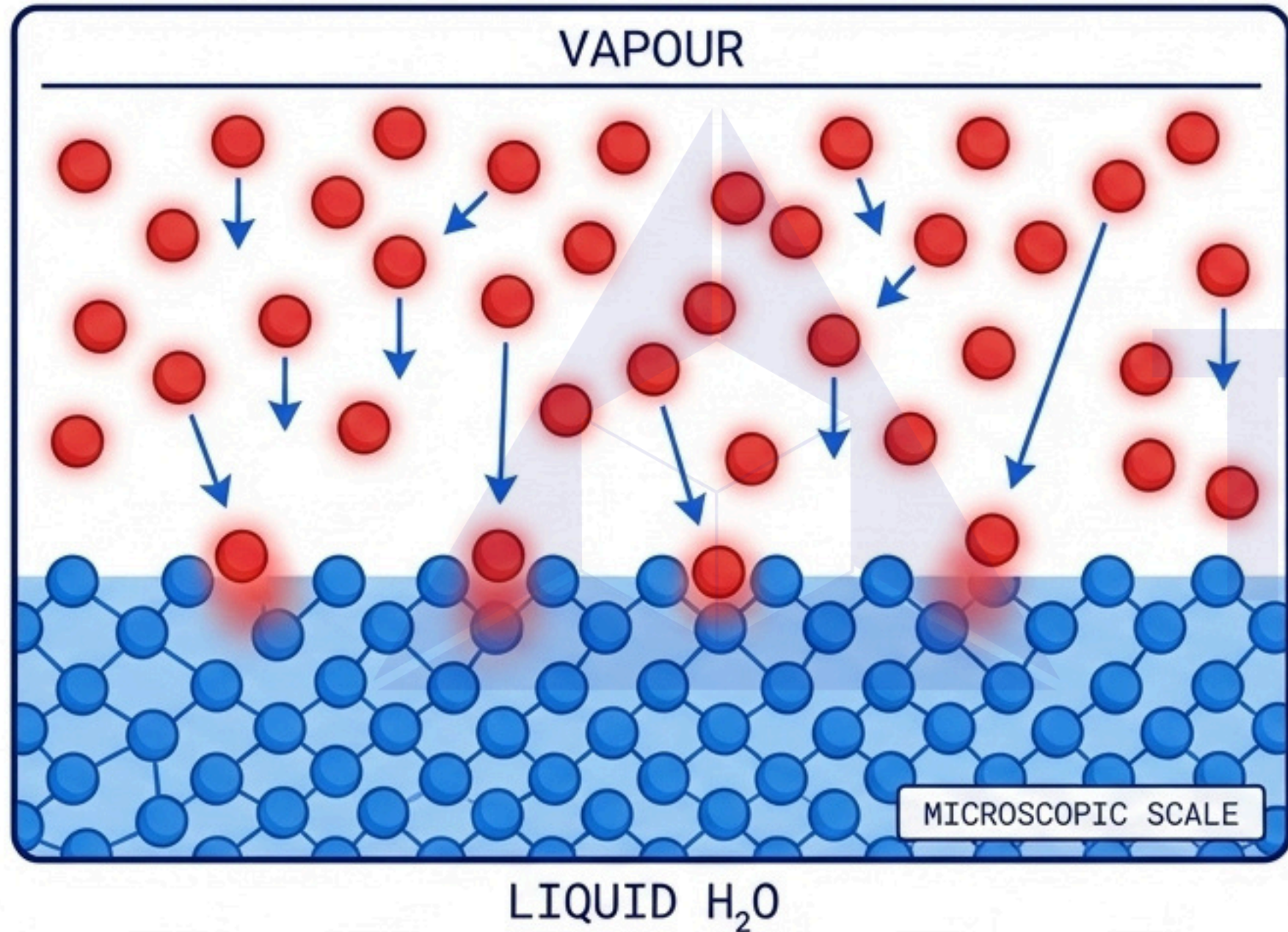
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- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



The Vapour Strikes Back



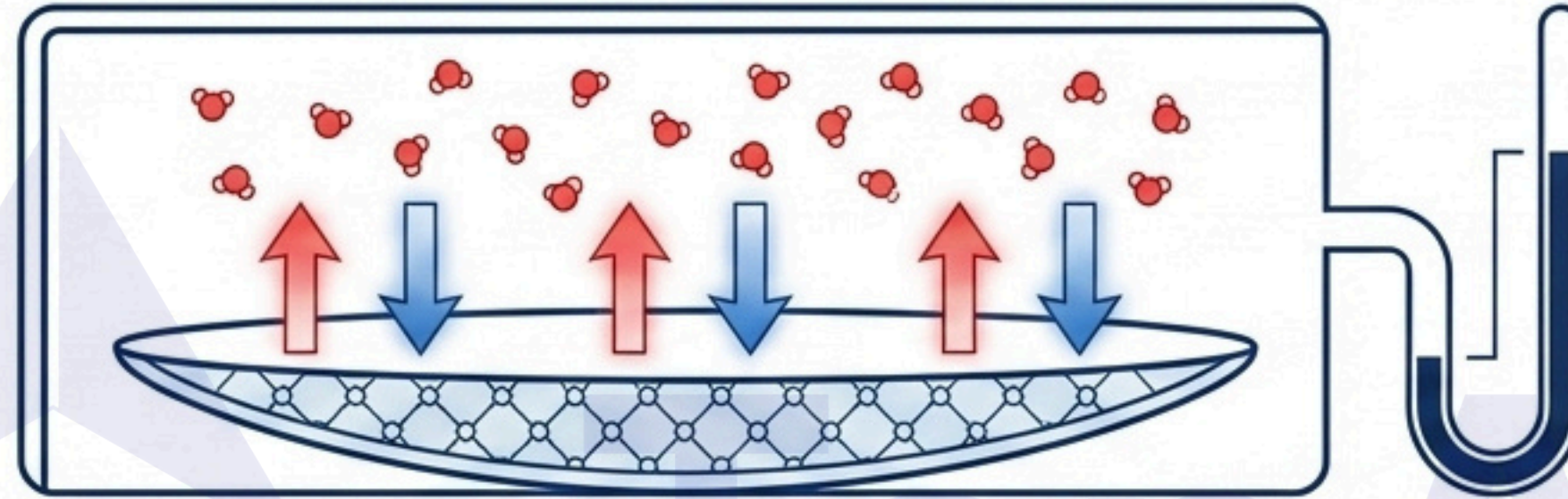
Vapour Accumulation: As evaporation continues unchecked, the concentration of gaseous molecules in the box steadily increases.

Surface Collisions: Random kinetic motion causes these trapped vapour molecules to continually strike the liquid surface.

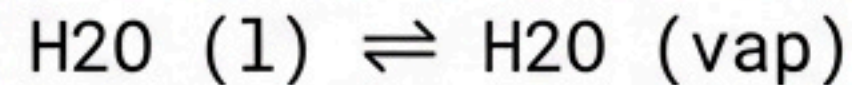
Capture: Molecules striking the surface lose energy upon impact and are retained back into the liquid phase.

As the number of vapour molecules grows, the opposing rate of condensation steadily increases.

The Equilibrium Condition



Rate of Evaporation = Rate of Condensation



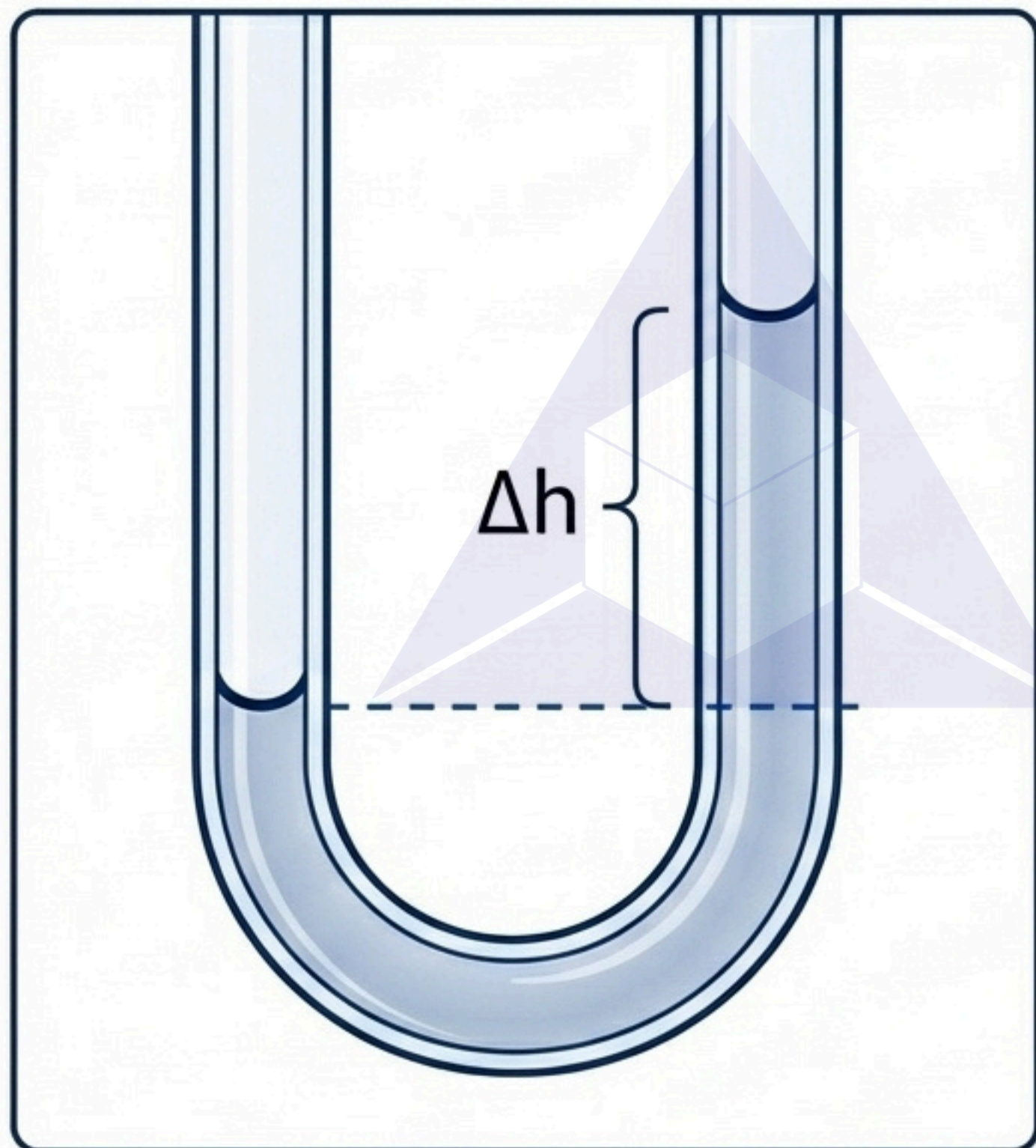
Dynamic, Not Static

Activity hasn't stopped. Intense transfer occurs at the phase boundary, but the opposing rates are identical, resulting in zero net change.

Constant Properties

Because the exact same number of molecules leave and return, the total mass of liquid and mass of vapour remain perfectly constant.

Equilibrium Vapour Pressure



Equilibrium Vapour Pressure is defined as the constant pressure exerted by vapour molecules on the liquid surface when the system is at equilibrium at a given temperature.

Temperature ↑

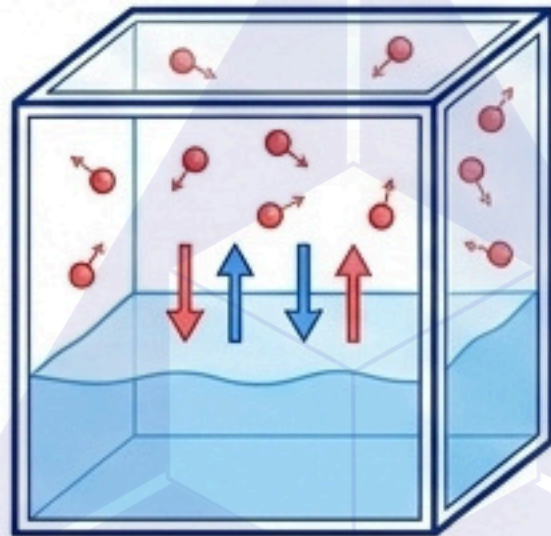
Kinetic
Energy ↑

Vapour
Pressure ↑

Different liquids exhibit different vapour pressures.
Higher vapour pressure = more volatile liquid = lower boiling point.

Why Open Systems Never Balance

Closed System (The Box)

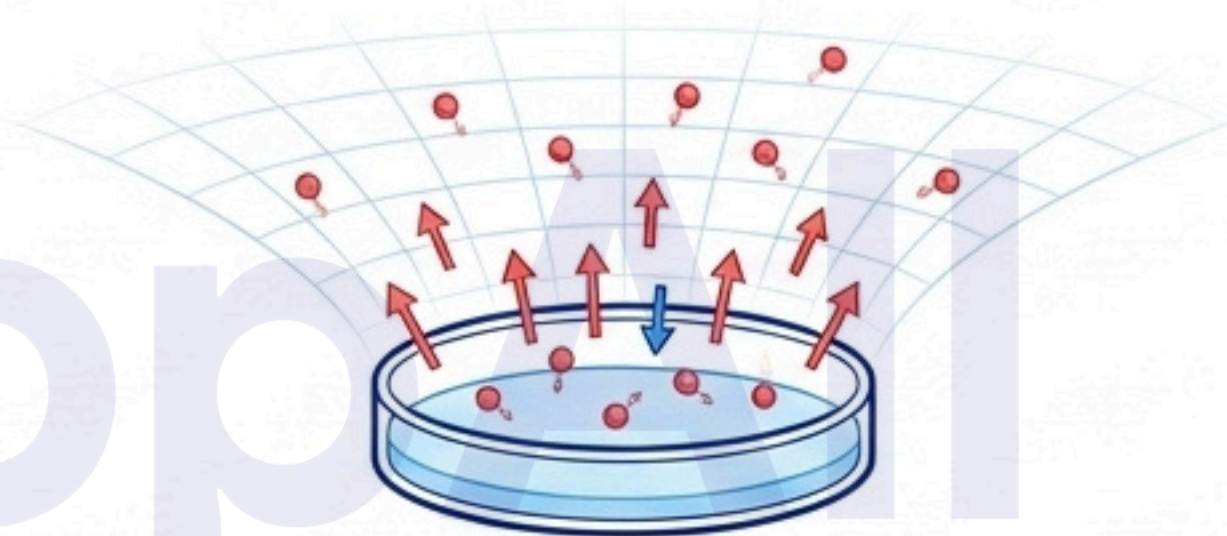


Molecule Fate: Vapour is trapped inside the boundaries. Concentration builds.

Rates: Rate of Condensation catches up to Rate of Evaporation.

Equilibrium Attained. Liquid volume completely stabilizes.

Open System (The Room)



Molecule Fate: Molecules disperse into a massive, effectively infinite volume.

Rates: Rate of Condensation remains much less than Rate of Evaporation forever.

No Equilibrium. Liquid eventually disappears completely.



You've Learned the Theory.

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