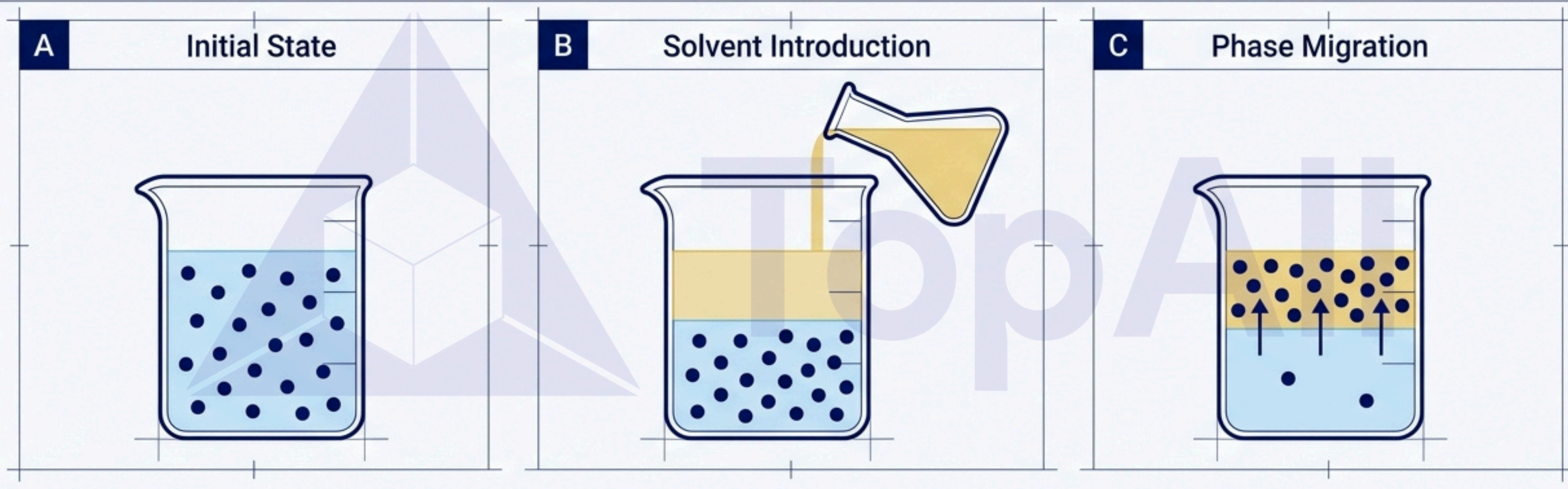


# The Principle of Differential Solubility

Driving molecular migration across liquid boundaries.

## The Migration Metaphor



### Core Principle

An organic compound is extracted from its aqueous solution by shaking it with an organic solvent in which it is highly soluble.

### The Mechanism

The solute 'prefers' the organic environment, driving a spontaneous physical transfer across the phase boundary.

### Key Condition

The aqueous solution and the organic solvent must be completely immiscible (they form distinct layers).

# Selecting the Right Solvents

The precise chemical criteria for a successful extraction.

## Immiscibility

Pass



Perfect phase separation achieved.

Fail



No phase separation; emulsion forms.

### Rule

The organic solvent must not dissolve in the aqueous layer.

## Differential Solubility

Pass



High concentration in organic phase.

Fail



Equal distribution; poor recovery.

### Rule

The target organic compound must be significantly more soluble in the organic solvent than in water.

## Volatility

Pass



Low boiling point; easy removal.

Fail



High boiling point; difficult recovery.

### Rule

The organic solvent should have a low boiling point to allow easy removal and recovery of the compound later.

# Anatomy of a Separatory Funnel

The specialized glassware designed for phase separation.



## Top Component: The Stopper

Seals the funnel for aggressive shaking.  
Crucial: Must be removed before draining to prevent a vacuum lock.

## Bottom Component: The Stopcock

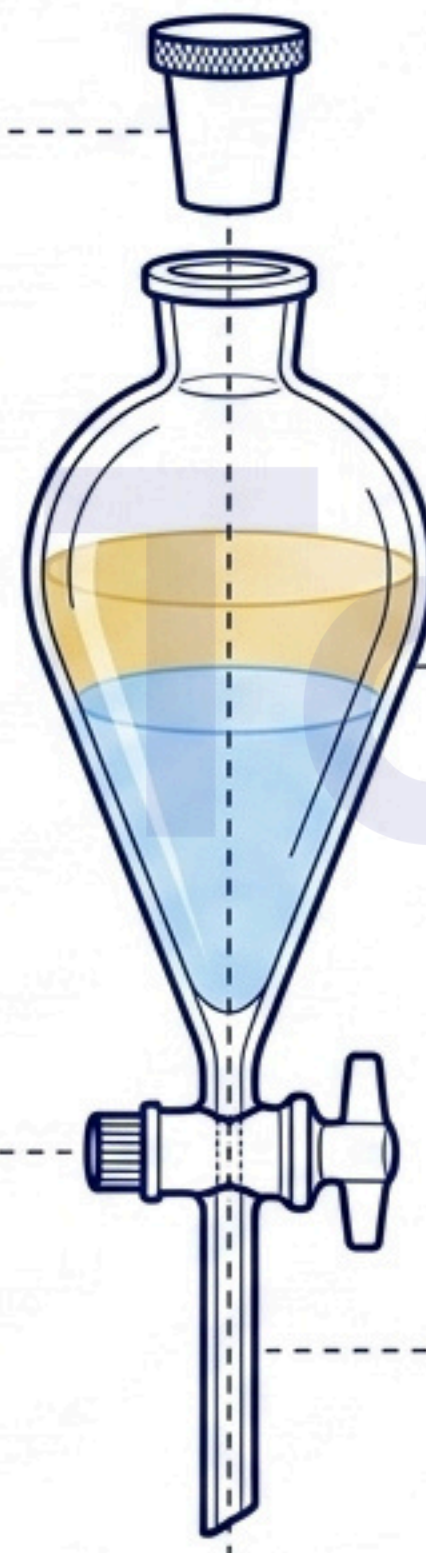
The precision valve. Controls the outward flow of the heavier bottom layer. Vented regularly during shaking to release gas pressure.

## Middle Component: The Body

Pear-shaped design maximizes the surface area for phase-transfer during shaking, while tapering perfectly to a narrow boundary for precise layer separation.

## Exit: The Stem

Narrow tube directing the isolated liquid into the receiving flask.





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# The Extraction Sequence

Transferring the solute through physical agitation.



## State 1: Pre-Shake (Layered)



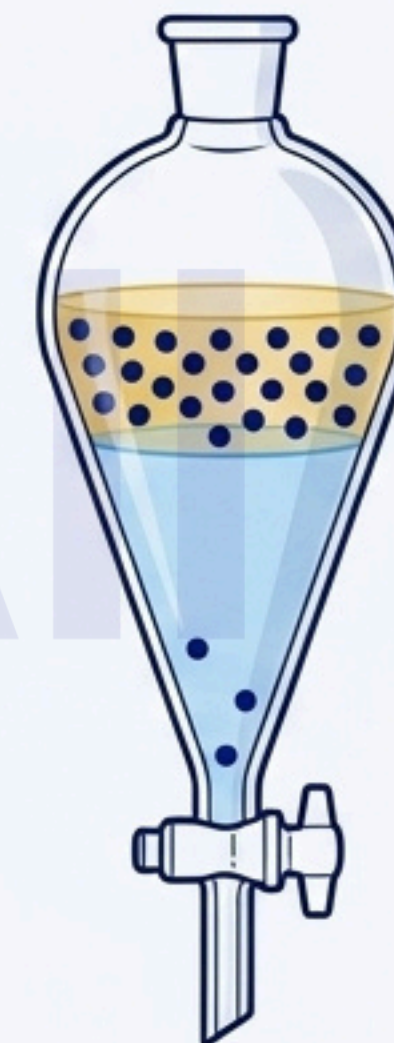
Initial State. Layers are stacked by density. No transfer occurring.

## State 2: Shaking & Venting (Emulsion)



Agitation maximizes surface area contact. Solute rapidly transfers. Stopcock is periodically opened to vent vapor pressure.

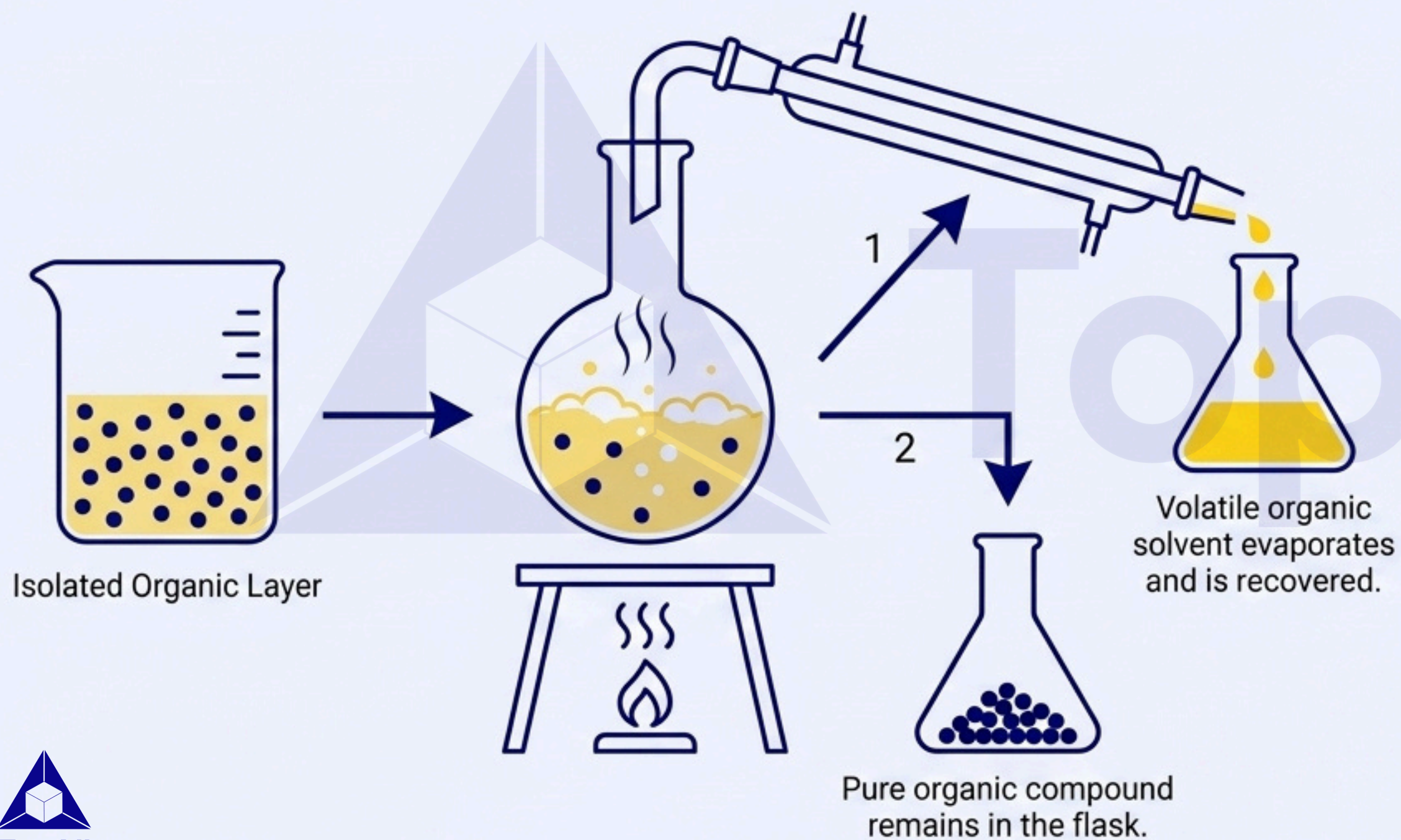
## State 3: Post-Shake (Settled)



Phases separate based on density. The target compound is now safely trapped in the organic phase.

# Product Recovery & Edge Cases

Isolating the pure compound from the organic phase.



## Continuous Extraction (Low Solubility Edge Case)

If the target compound is only slightly soluble in the organic solvent, a single shake is insufficient. A specialized continuous extraction apparatus is used, which automatically boils, condenses, and recycles the organic solvent through the aqueous layer repeatedly until extraction is complete.



# Revision Matrix: Differential Extraction

High-yield summary and common conceptual pitfalls.

## Visual Element 1: 4-Step Timeline Mini-map



1. Add Immiscible Solvent



2. Shake & Vent



3. Settle & Drain



4. Distill Organic Layer



## Visual Element 2: Exam Traps Diagnostic Table

| Procedural Error                                   | Chemical Consequence                                                                                         |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Forgetting to remove the stopper before draining.  | Creates a <b>vacuum lock</b> ; liquid stops flowing out of the stopcock.                                     |
| Failing to vent the stopcock during shaking.       | Vaporization of the volatile organic solvent builds dangerous pressure, potentially blowing the stopper off. |
| Using Ethanol and Water as the two solvents.       | <b>Fails completely (Miscible)</b> . Ethanol dissolves in water; no distinct layers will form.               |
| Target compound is equally soluble in both layers. | Extremely poor yield. <b>Requires continuous extraction</b> to overcome the low partition coefficient.       |



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