

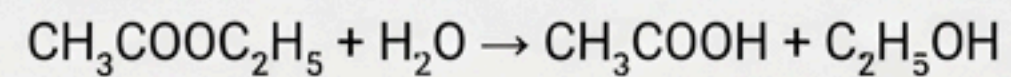
Pseudo First Reactions Order

When a higher-order chemical reaction wears a first-order disguise.

Truly 2nd order + one
reactant in **huge excess**
= behaves as 1st order

The concentration of the excess reactant **barely** changes, so it gets absorbed into the rate constant.

The Scale of "Excess": Ethyl Acetate Hydrolysis



	Phase	Ester	Water
1	Time = 0	0.01 mol	10 mol
2	Time = t	0 mol	9.99 mol

The water bar barely moves.
 $9.99 \approx 10$. Because its
concentration remains
effectively constant, it cannot
dictate the rate of change.





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$$E=mc^2$$



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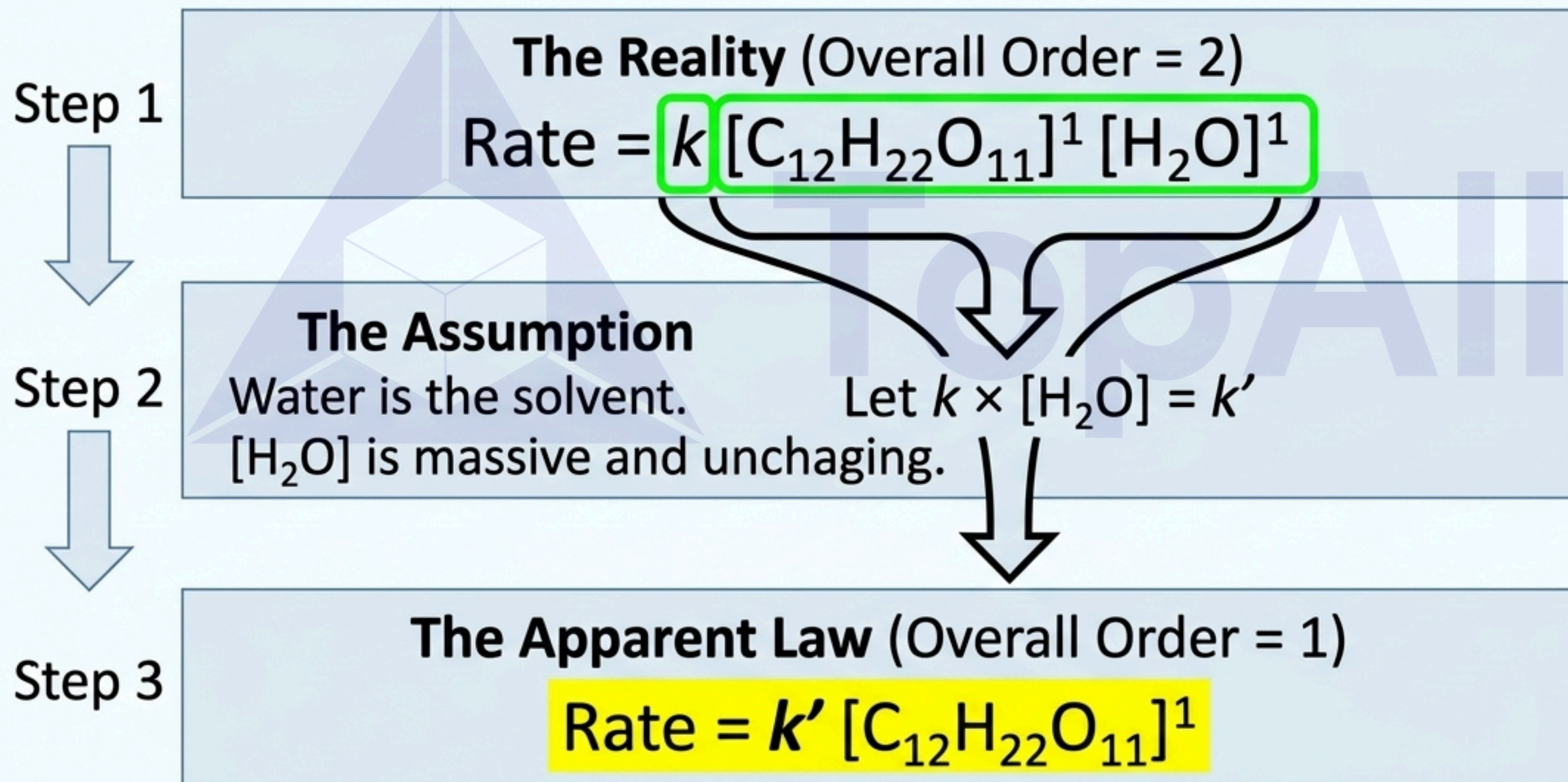
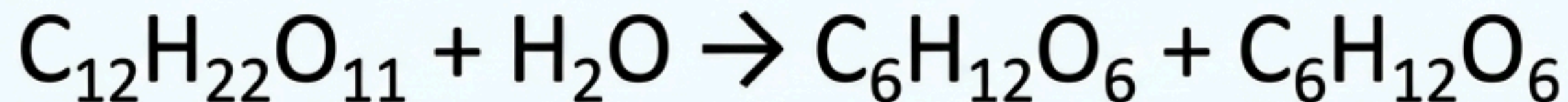
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Rate Law Collapse: Inversion of Cane Sugar



Examiner's Playbook

Decoding the trap in chemical kinetics questions.

**"In large excess" is
your signal word.**

The Trap

Assuming a two-reactant reaction must show second-order-in-both kinetics based purely on the balanced chemical equation.

The Reality

The moment an examiner states a reactant is "in excess", "abundant", or "acts as the solvent", its order becomes zero in the practical rate law. Cross it out immediately.

...if reactant B is taken in large excess, what is the order...



Test Your Instincts

For the reaction $A + B \rightarrow \text{Products}$, the rate law is given as **Rate = $k[A][B]$** . If reactant **B** is taken in large excess, what is the order of the reaction and what are the units of the new rate constant k' ?

[A] Order = 2, Units = $\text{mol}^{-1} \text{L s}^{-1}$



[B] Order = 1, Units = s^{-1}

[C] Order = 1, Units = $\text{mol}^{-1} \text{L s}^{-1}$

[D] Order = 0, Units = $\text{mol L}^{-1} \text{s}^{-1}$

Solution Reveal

Success Green
Correct Answer: **B**

The reaction becomes pseudo-first order (Order = 1). Because the new rate constant k' governs a first-order equation (**Rate = $k'[A]$**), its units must be **Time⁻¹** (e.g., **s⁻¹**).

Concept Summary: Pseudo First Order Reactions



1. Definition

A higher-order reaction that mathematically behaves as a 1st-order reaction under specific conditions.



2. The Cause

One reactant is present in such **massive excess** that its concentration change is negligible, treating it as a constant.



3. The Math

$$k_{true} \times [\text{Excess Reactant}] = k_{pseudo}$$



4. Classic Examples

- Hydrolysis of Ester (ethyl acetate)
- Inversion of Cane Sugar in aqueous solution



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