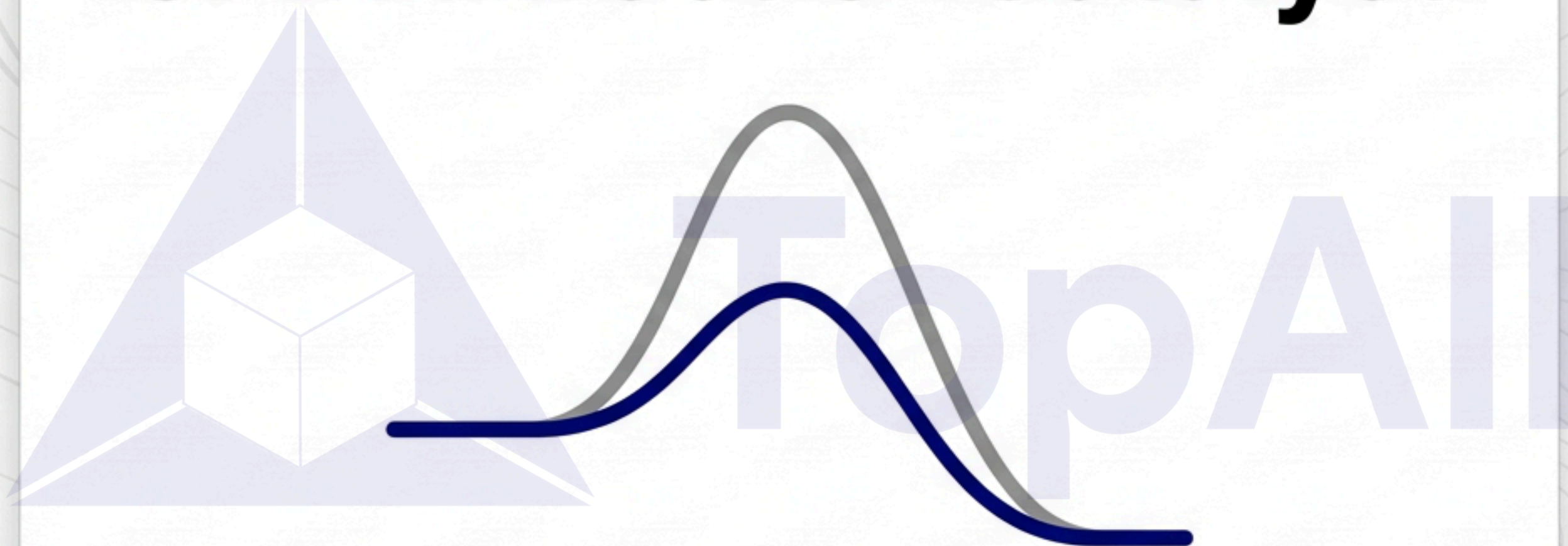


UNIT 3: CHEMICAL KINETICS

3.4.1 Effect of Catalyst



The Alternate Pathway to Chemical Transformation

Terminology

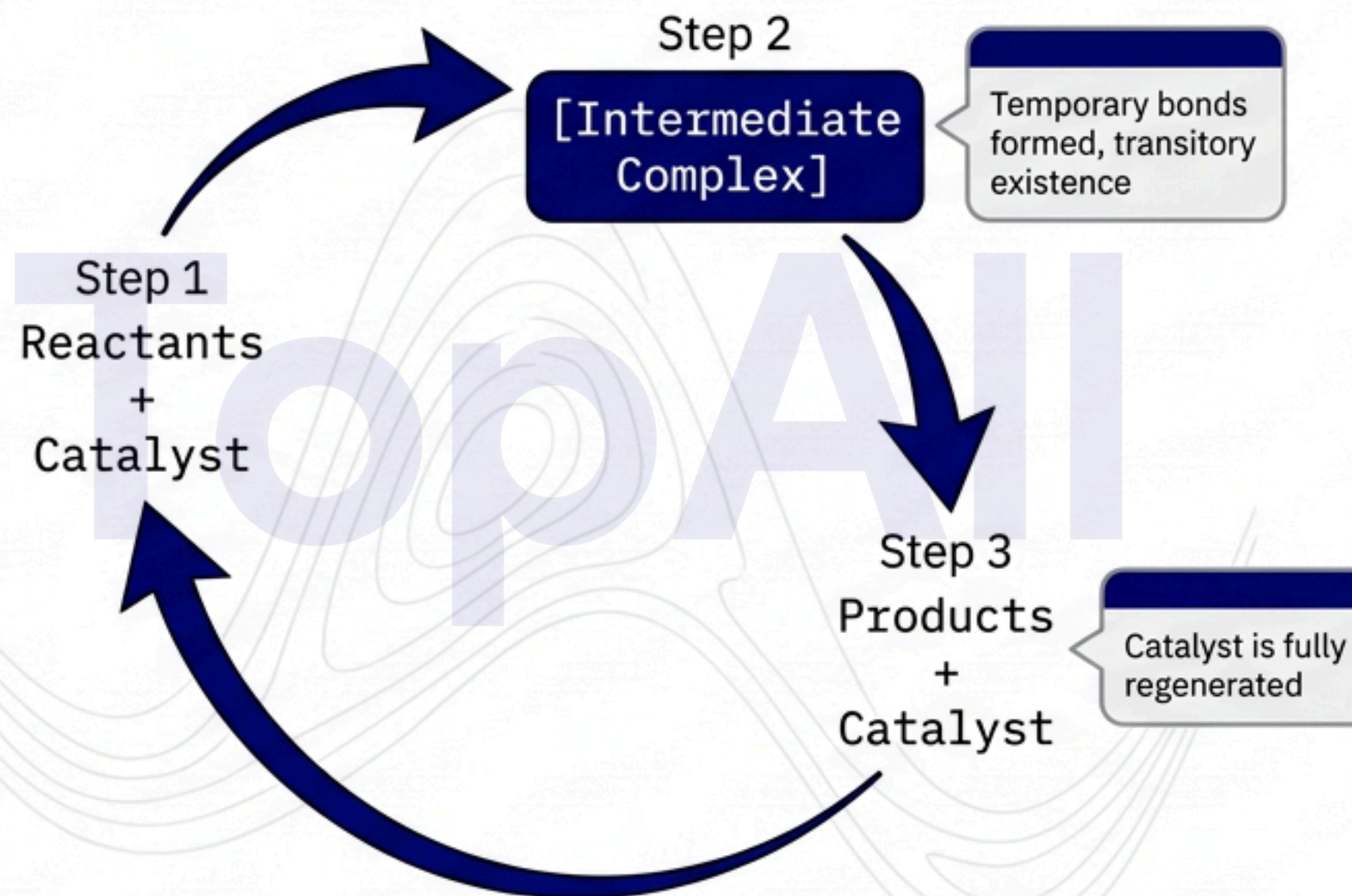
Catalyst

Increases the rate of a reaction without undergoing any permanent chemical change.

Inhibitor

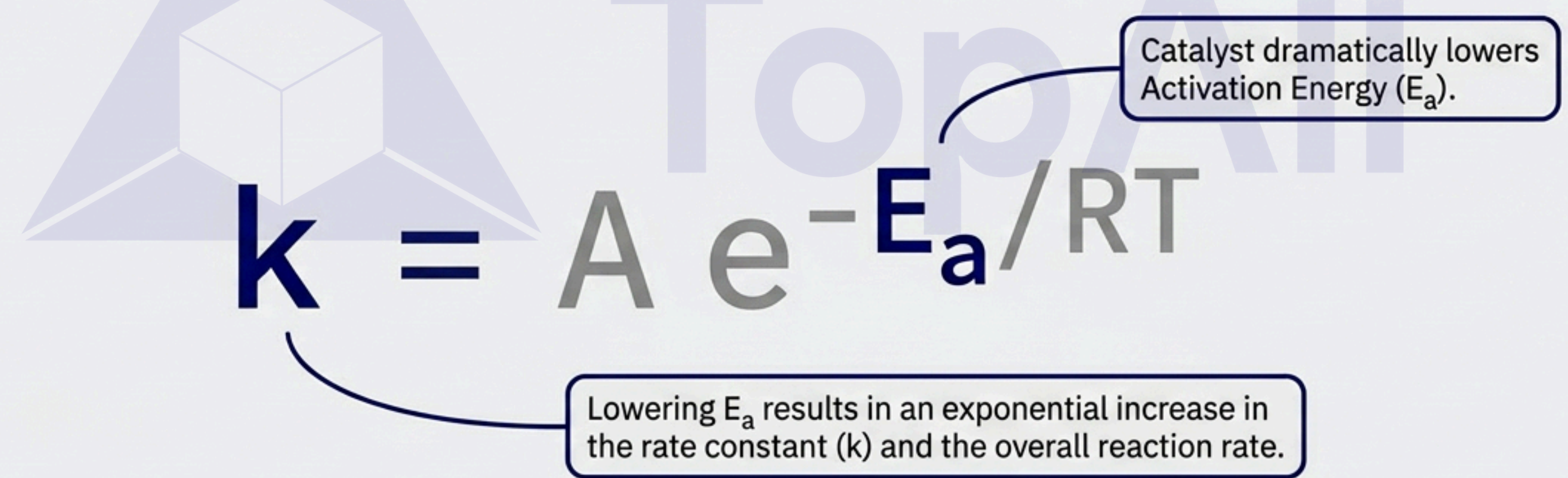
A substance added that reduces the rate of reaction.

How It Works



The Alternate Pathway

A catalyst does not magically create energy; it circumvents the high-energy barrier by providing an alternate reaction mechanism with a lower potential energy requirement.


$$k = A e^{-E_a/RT}$$

The diagram features the Arrhenius equation $k = A e^{-E_a/RT}$ in a large, light blue font. A callout box points to the E_a term, stating 'Catalyst dramatically lowers Activation Energy (E_a).'. Another callout box points to the k term, stating 'Lowering E_a results in an exponential increase in the rate constant (k) and the overall reaction rate.'.

Catalyst dramatically lowers Activation Energy (E_a).

Lowering E_a results in an exponential increase in the rate constant (k) and the overall reaction rate.



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$$E=mc^2$$



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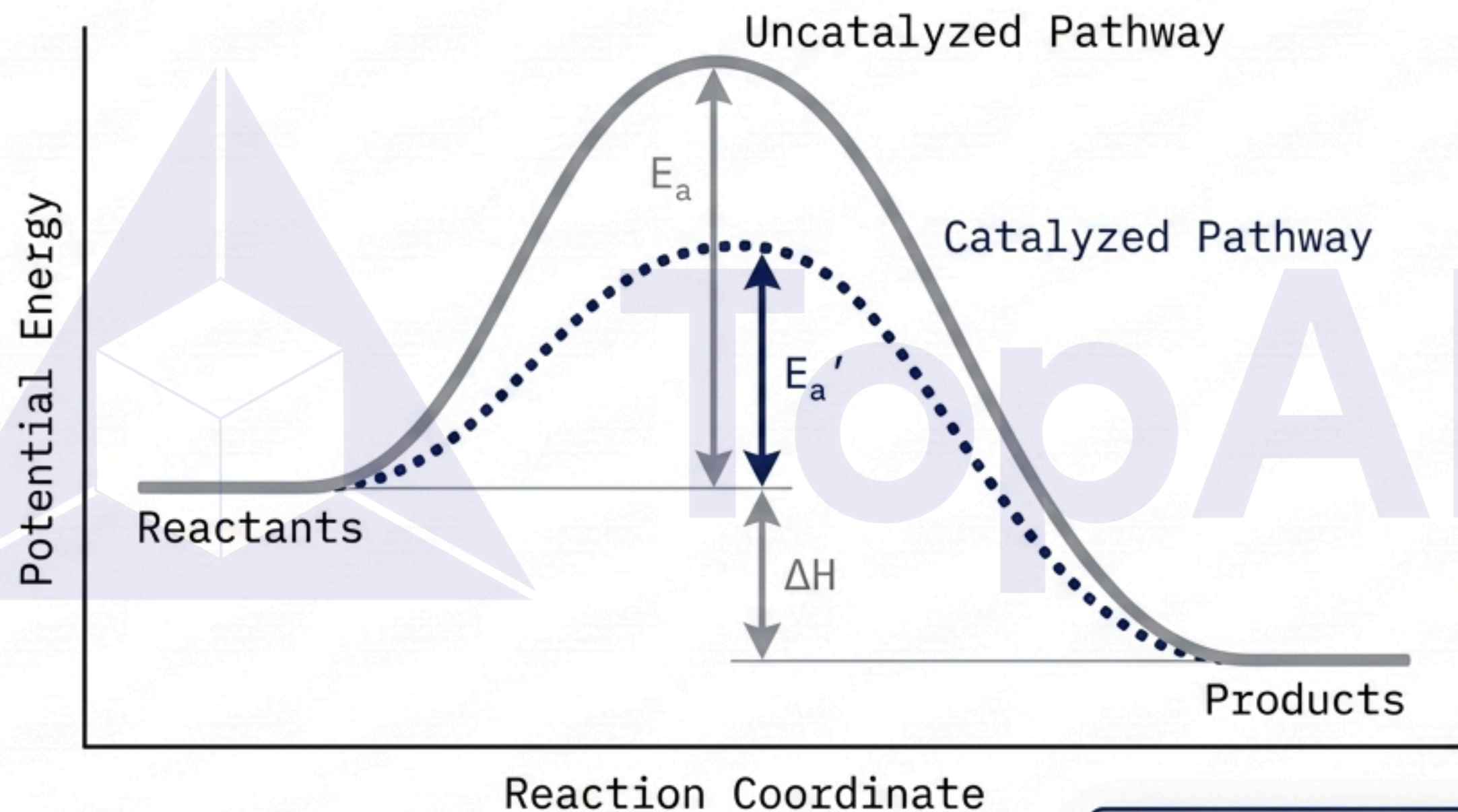
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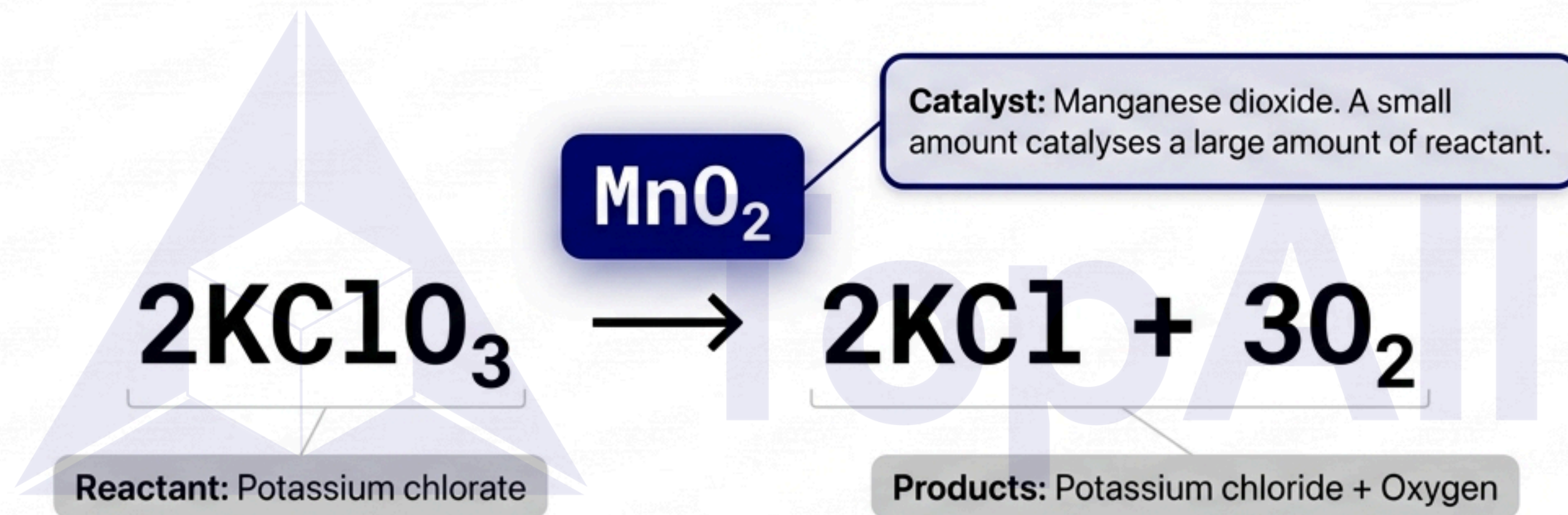
Catalysis & Reaction Pathways



Key-Takeaway Box: The gap between reactants and products (ΔH) remains unchanged, proving the overall energy of the reaction is conserved.

SYLLABUS APPLICATION

Potassium Chlorate Decomposition



Without MnO₂, this decomposition is extremely slow. The catalyst provides an alternate pathway, speeding it up considerably.

Catalyst Boundaries: Kinetics vs. Thermodynamics

What a Catalyst ALTERS ✓

- Reaction Path / Mechanism
- Activation Energy (E_a)
- Reaction Rate (Speeds up forward AND backward reactions equally)
- Time required to reach equilibrium

What a Catalyst DOES NOT ALTER 🔒

- Gibbs Free Energy (ΔG)
- Spontaneity (Cannot force a non-spontaneous reaction to occur)
- Equilibrium Position
- Equilibrium Constant (K)

Catalysts change the speed of the journey, but they cannot change the ultimate destination of the reaction.



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