Catalysis

Chemistry · Kinetics (Unit 5, Topic 5.11)

The Teaching Analogy

"Picture a mountain range. Reactants sit at the base — they need enough energy to climb the peak to become products. Most molecules can't make it. But a catalyst digs a tunnel through the mountain. Same start, same destination, just a lower path."

Key Concept

A **catalyst** is a substance that speeds up a chemical reaction by providing an alternative reaction pathway with a lower activation energy (E_a). The catalyst is not consumed in the reaction — it participates in the mechanism but is regenerated by the end. Crucially, a catalyst lowers E_a but does **not** change the overall enthalpy change (ΔH) of the reaction.

Guided Practice

1. **Using the mountain analogy:** If the "mountain peak" represents activation energy, what does "digging a tunnel" represent in terms of the potential energy diagram? Draw both pathways (with and without catalyst) and label E_a for each.
2. **Real-world connection:** A car's catalytic converter uses platinum to convert toxic carbon monoxide (CO) into carbon dioxide (CO_2). Explain why the platinum is still there after 100,000 miles of driving, using the definition of a catalyst.
3. **Diagram analysis:** Two potential energy diagrams show the same reaction — one with a catalyst, one without. Both have identical ΔH values but different peak heights. Explain why the reaction rate increases with the catalyst even though the overall energy change is the same.

Extension Activity

Tunnel vs. Mountain Challenge: Research one biological catalyst (enzyme) and one industrial catalyst. For each, identify: (1) the reaction it catalyzes, (2) the "mountain" it helps molecules get past, and (3) why it matters that the catalyst isn't used up. Present your findings as a labeled potential energy diagram with the "tunnel" drawn in for each catalyst.