

Chapter 6: Collision Theory and Transition State Theory

Department of Chemistry

1 Molecular Collisions

Collision theory states that chemical reactions occur only when reactant molecules collide with enough energy and proper orientation.

2 Activation Energy

Not all collisions lead to a reaction. Only collisions with energy exceeding the activation energy (E_a) can break bonds and form products.

3 Transition State Theory

- **Transition State:** An unstable arrangement of atoms at maximum energy—a peak on the reaction profile.
- **Energy Diagram:** Shows the energy change as the reaction proceeds:



4 Effect of Temperature on Collisions

Increasing temperature increases the fraction of molecules with energy greater than E_a , hence more productive collisions.

5 Diagrams

- Reaction coordinate diagrams show reactants, transition state, and products.

Summary

Reactions require effective collisions and sufficient energy to surmount the activation barrier, forming the transition state.

References

1. Laidler, K. J. *Chemical Kinetics* (3rd Ed).
2. Carey, F. *Organic Chemistry*, 9th Ed.