

Chemical Kinetics



CA Standards

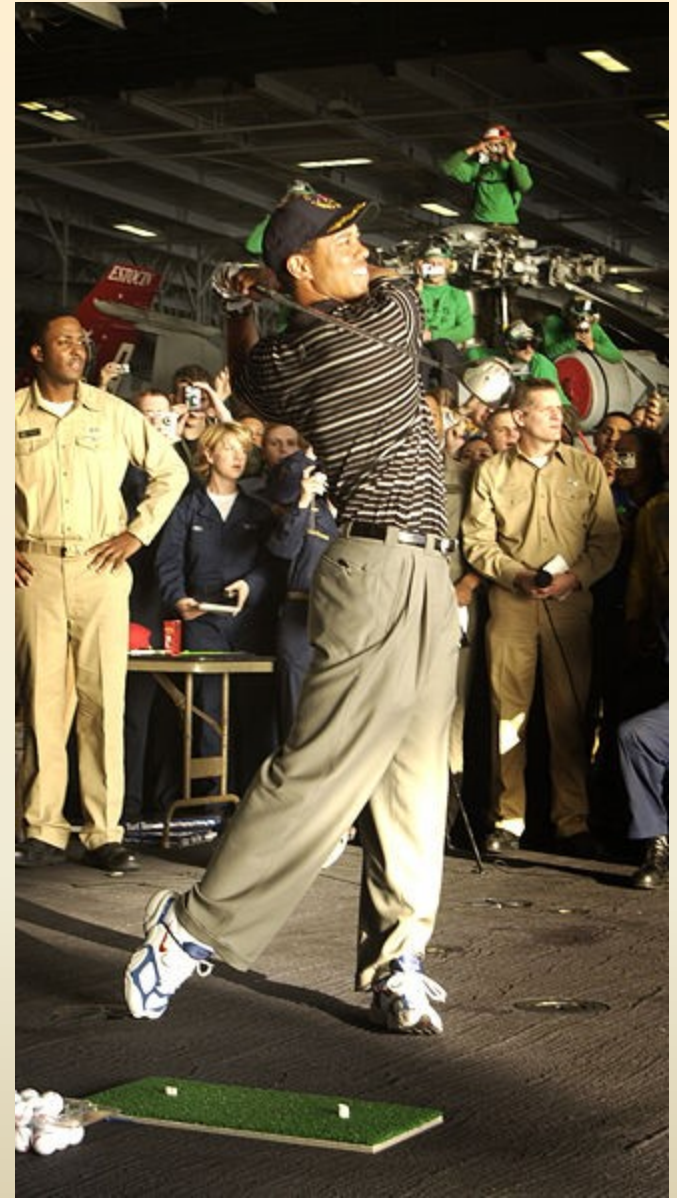
Students know the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.

Students know how reaction rates depend on such factors as concentration, temperature, and pressure.

Students know the role a catalyst plays in increasing the reaction rate.

Collision Model

- Collisions must have enough energy to produce the reaction (must equal or exceed the activation energy).
- Reactants must have proper orientation to allow the formation of new bonds.



Activation Energy

The minimum energy required to transform reactants into the activated complex

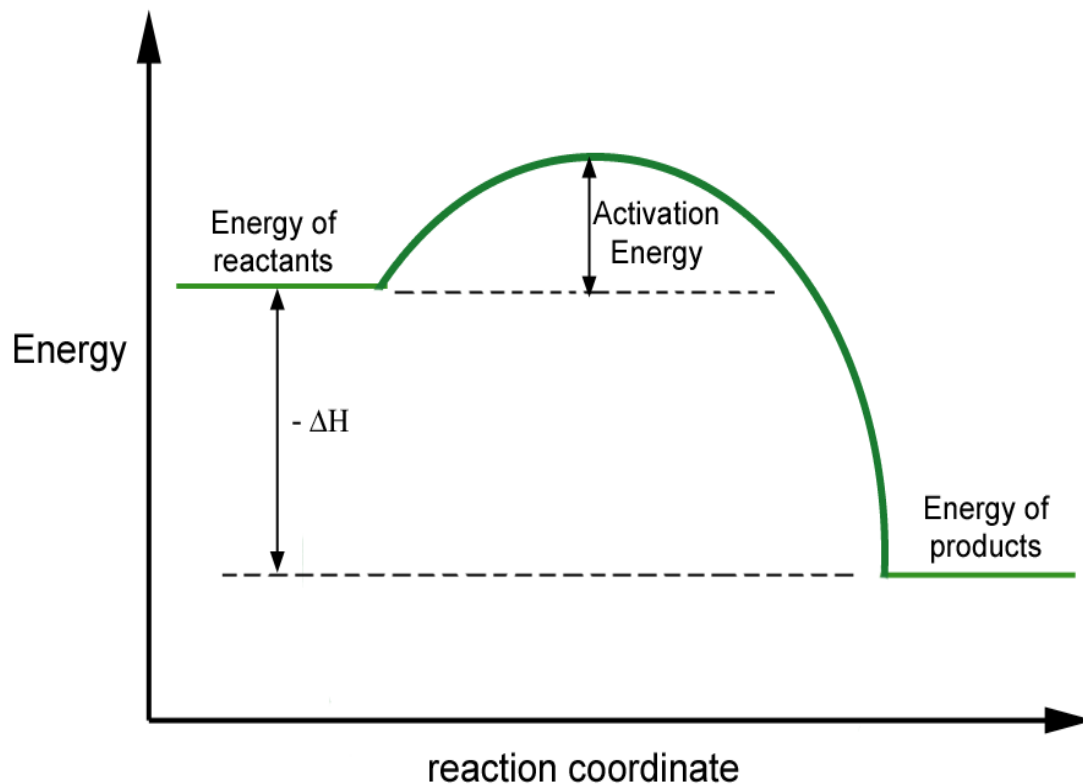
(The minimum energy required to produce an effective collision)



Flame, spark, high temperature, radiation are all sources of activation energy

Exothermic Processes

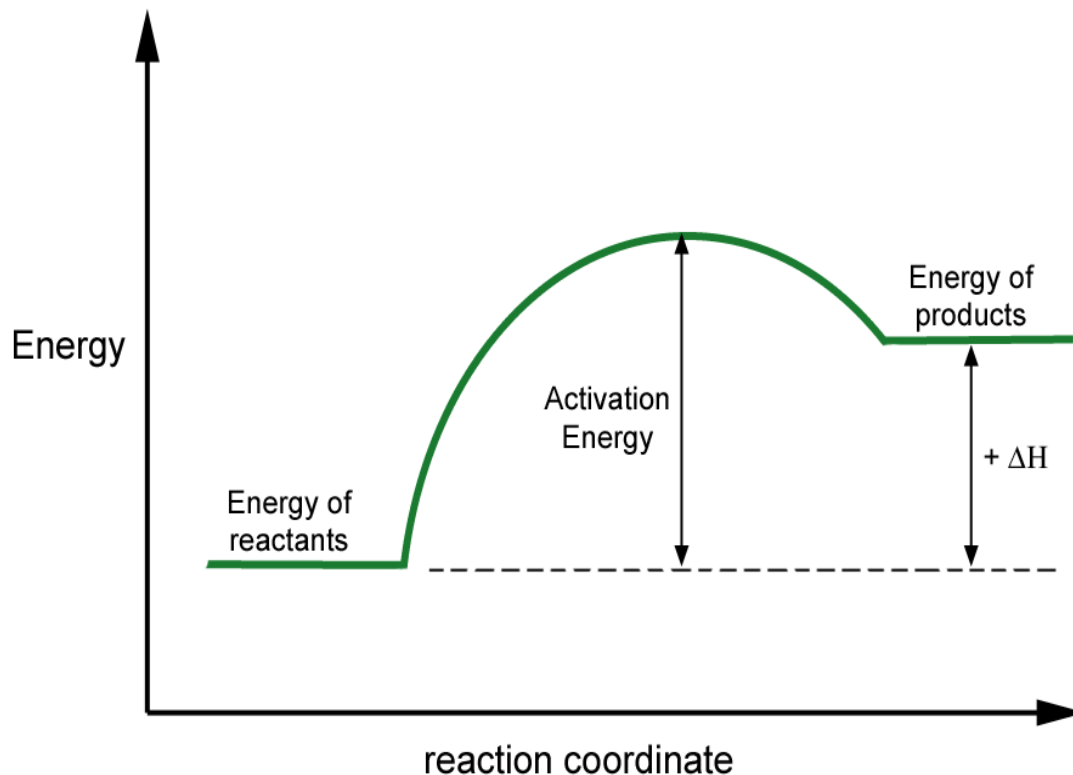
Processes in which energy is released as it proceeds, and surroundings become warmer



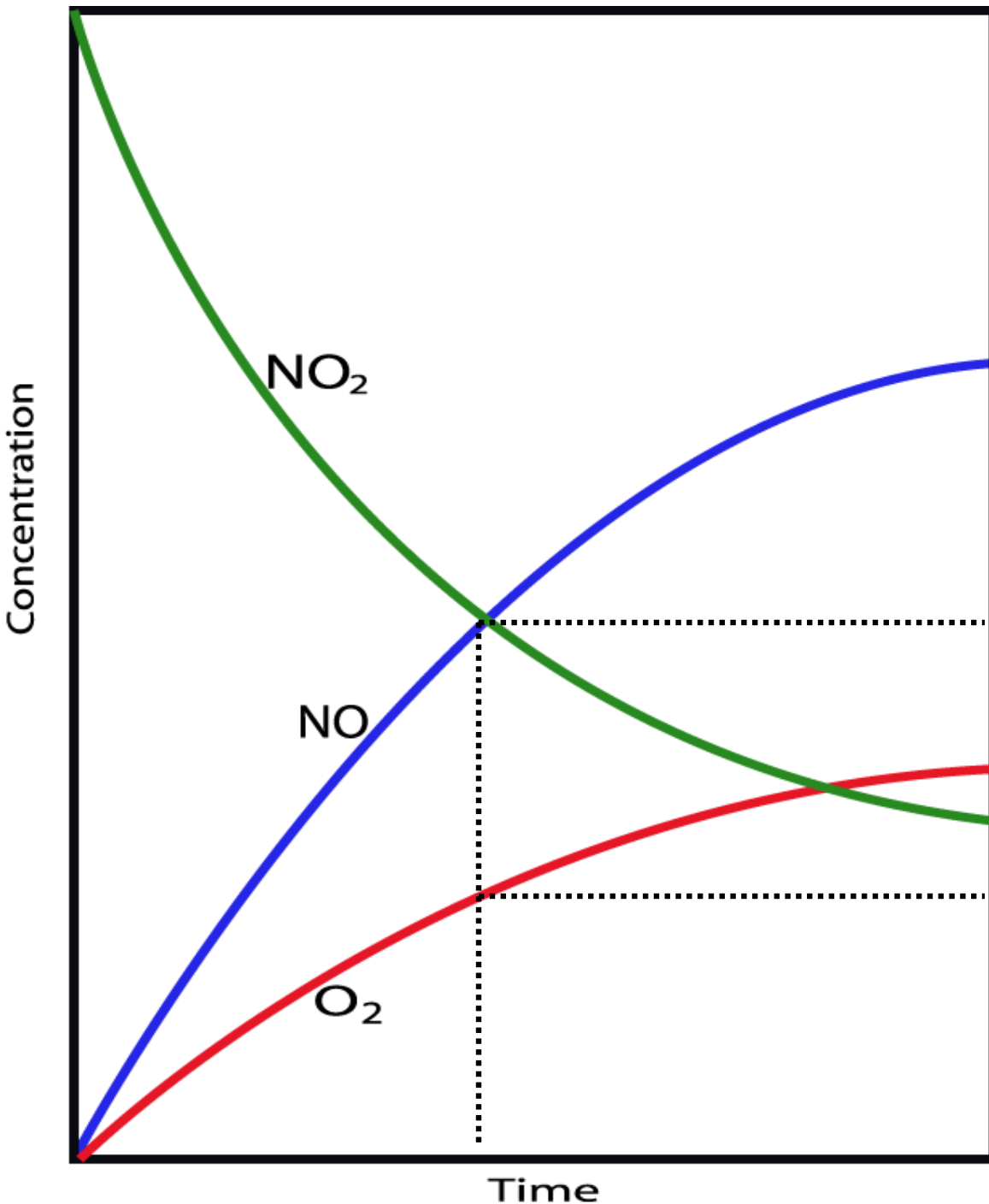
Reactants → Products + energy

Endothermic Processes

Processes in which energy is absorbed as it proceeds, and surroundings become colder



Reactants + energy → Products



Reaction Rates:

1. Can measure disappearance of reactants
2. Can measure appearance of products
3. Are proportional stoichiometrically

The Reaction Mechanism

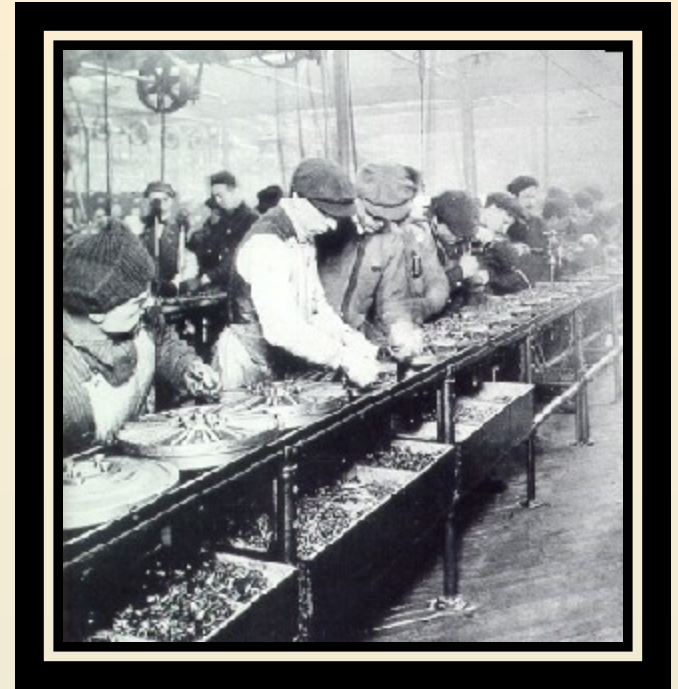
- The reaction mechanism is the series of steps by which a chemical reaction occurs.
- A chemical equation does not tell us how reactants become products; it is a summary of the overall process.

Reactants → Products

The → sign has represents the reaction mechanism, but gives no indication of the steps in the mechanism

The Rate-Determining Step

In a multi-step reaction, the slowest step is the rate-determining step. It therefore determines the rate of reaction.



Factors Affecting Rate

❖ Temperature

Increasing temperature always increases the rate of a reaction.

❖ Surface Area

Increasing surface area increases the rate of a reaction

❖ Concentration

Increasing concentration **USUALLY** increases the rate of a reaction

❖ Presence of Catalysts

Catalysis

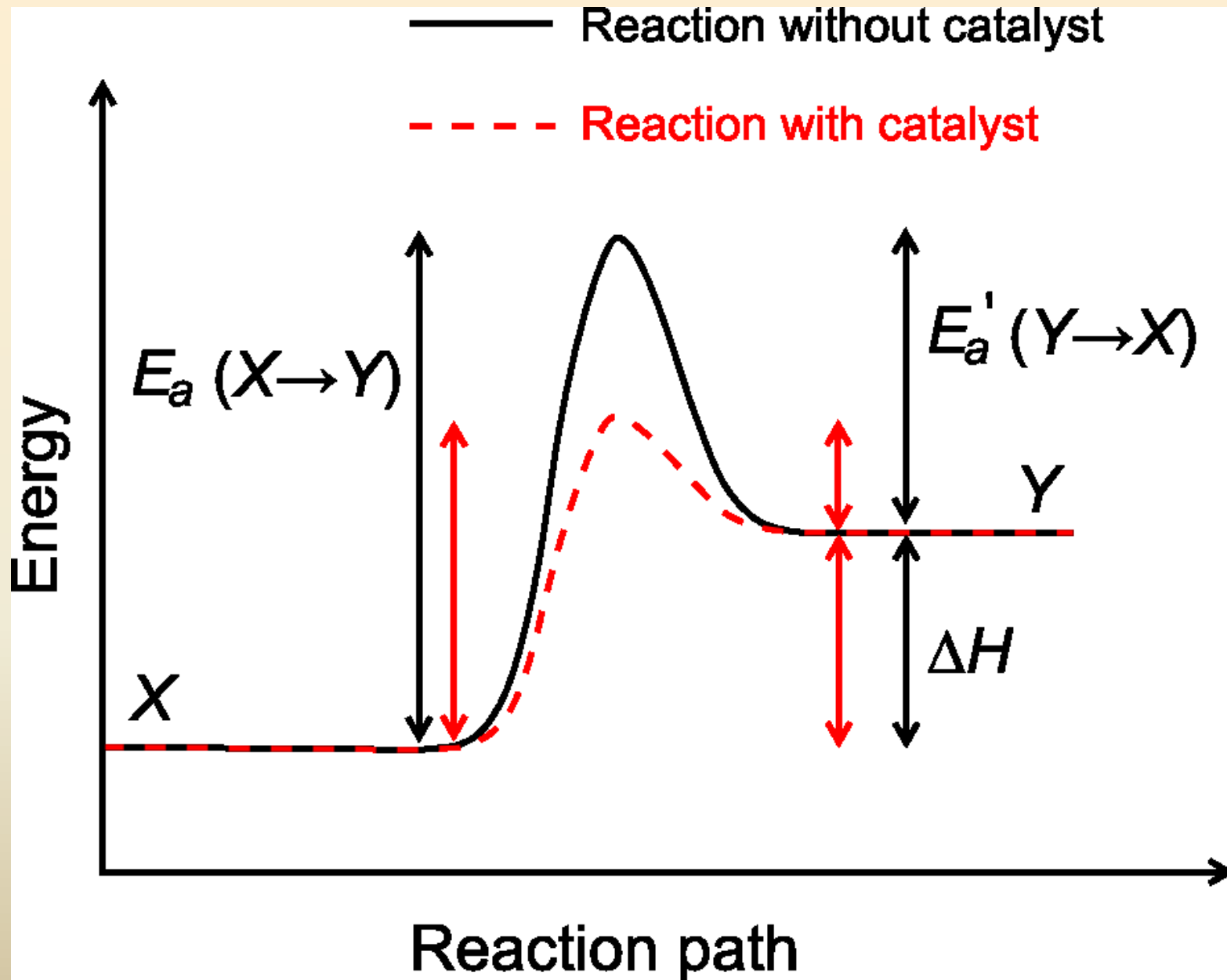
• Catalyst: A substance that speeds up a reaction by lowering activation energy

• Enzyme: A large molecule (usually a protein) that catalyzes biological reactions.

• Homogeneous catalyst: Present in the same phase as the reacting molecules.

• Heterogeneous catalyst: Present in a different phase than the reacting molecules.

Endothermic Reaction w/Catalyst



Exothermic Reaction w/Catalyst

