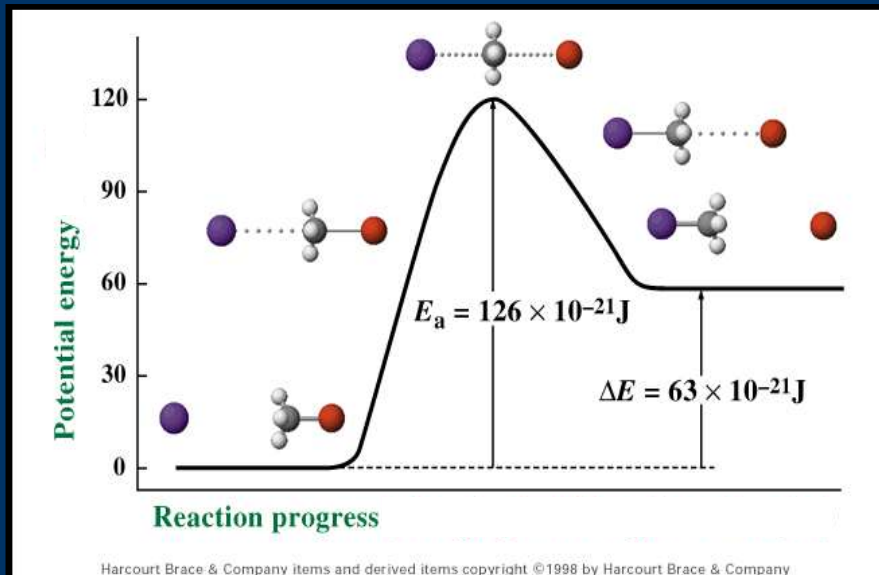


# Chemical Reactions

## *V. Reaction Rate*



(p. 532 - 541)

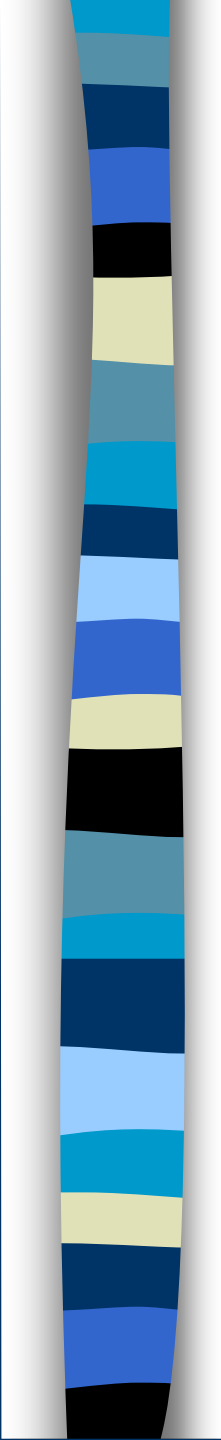
I

II

III

IV

V



## Standard 7. Solutions, Rates of Reaction, and Equilibrium

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- 7.5 Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, and catalyst).



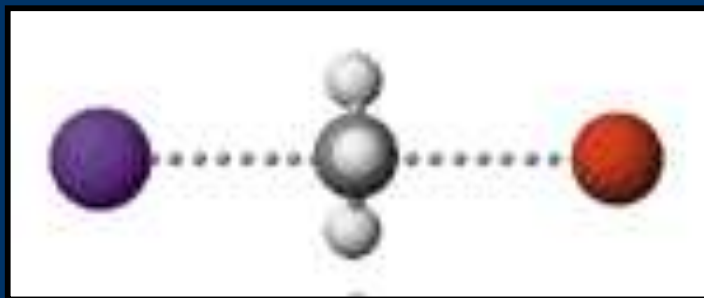
# A. Collision Theory

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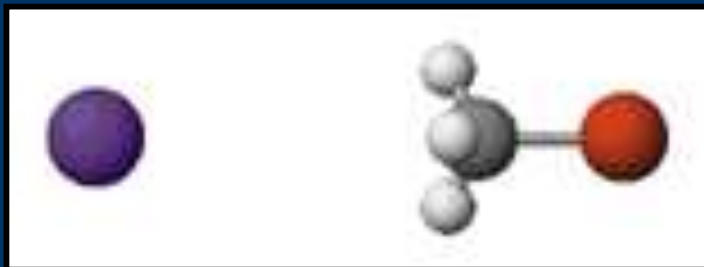
- Reaction rate depends on the collisions between reacting particles.
- Successful collisions occur if the particles...
  - collide with each other
  - have the correct orientation
  - have enough kinetic energy to break bonds

# A. Collision Theory

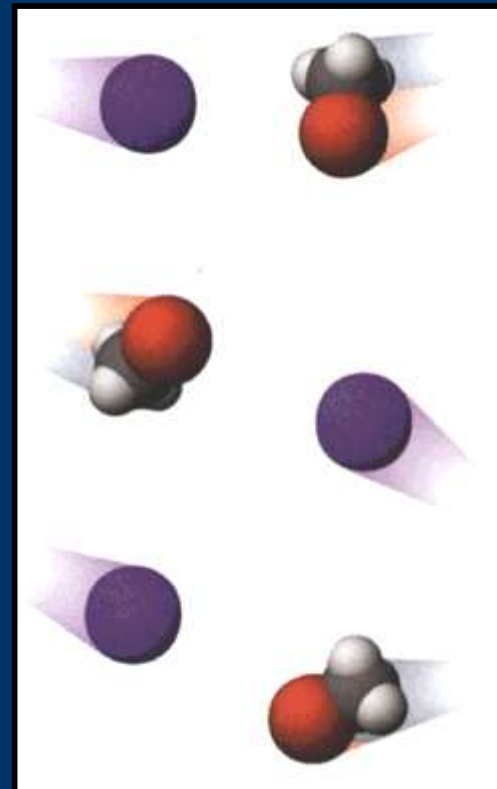
## ■ Particle Orientation



Required Orientation



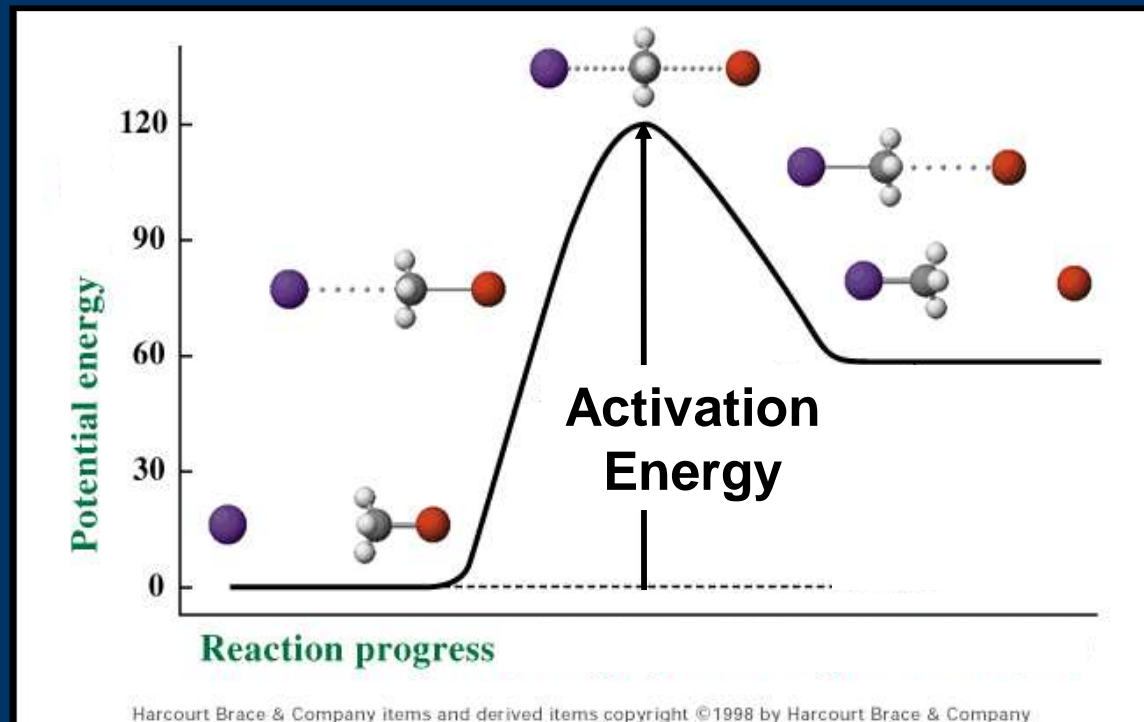
Successful Collision



Unsuccessful  
Collisions

# A. Collision Theory

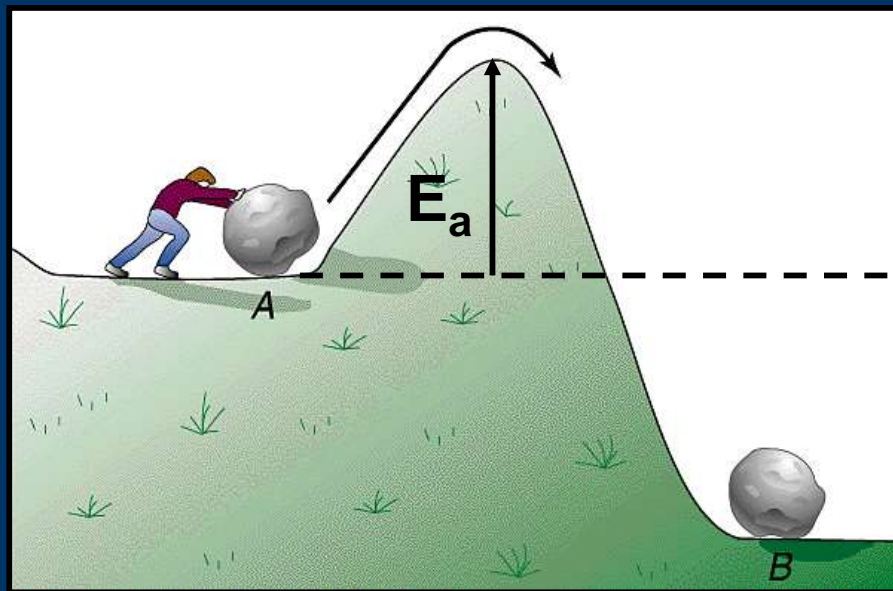
- **Activation Energy ( $E_a$ )**
  - minimum energy required for a reaction to occur



# A. Collision Theory

## ■ Activation Energy

- depends on reactants
- low  $E_a$  = fast *reaction rate*





## B. Factors Affecting *Rxn. Rate*

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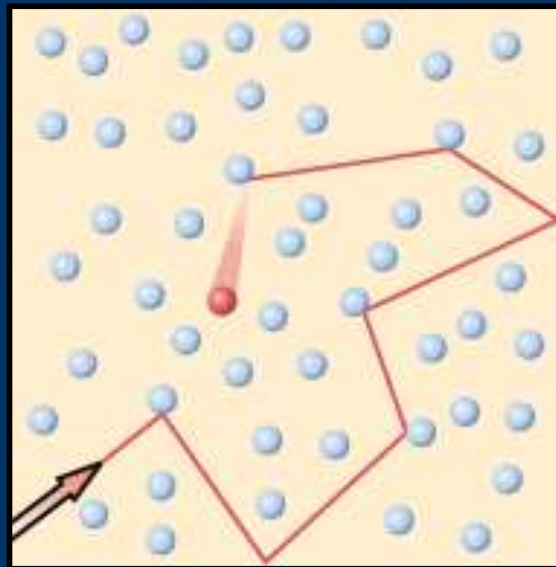
### ■ Surface Area

- high SA = fast *reaction rate*
- more opportunities for collisions
- **Increase surface area by...**
  - using smaller particles (crushing)
  - dissolving in water

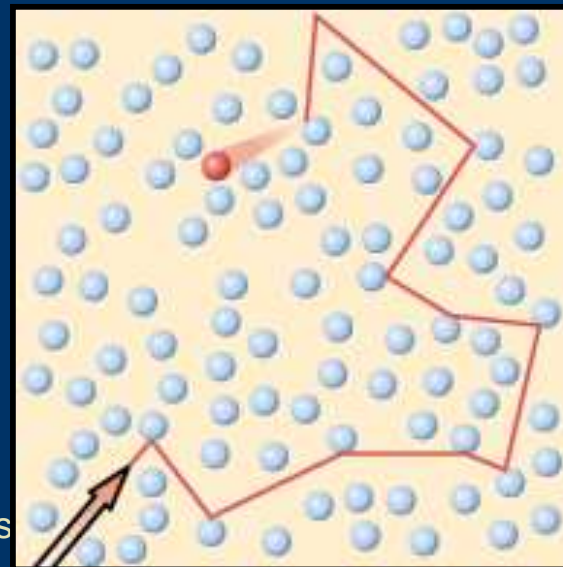
# B. Factors Affecting Rxn Rate

## ■ Concentration

- high concentration = fast *reaction rate*
- more opportunities for collisions



annes







## B. Factors Affecting *Rxn. Rate*

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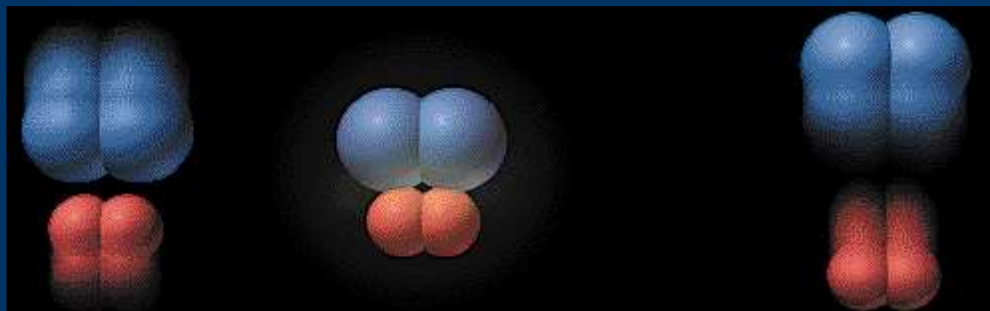
### ■ Temperature

- high temp = fast *reaction rate*
- high KE
  - fast-moving particles
  - more likely to reach activation energy

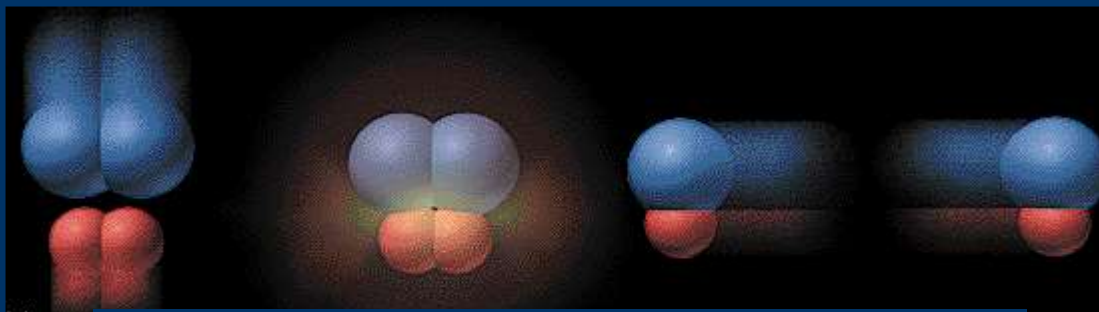
## B. Factors Affecting *Rxn. Rate*

### ■ Temperature

**Analogy: 2-car collision**



5 mph “fender bender”

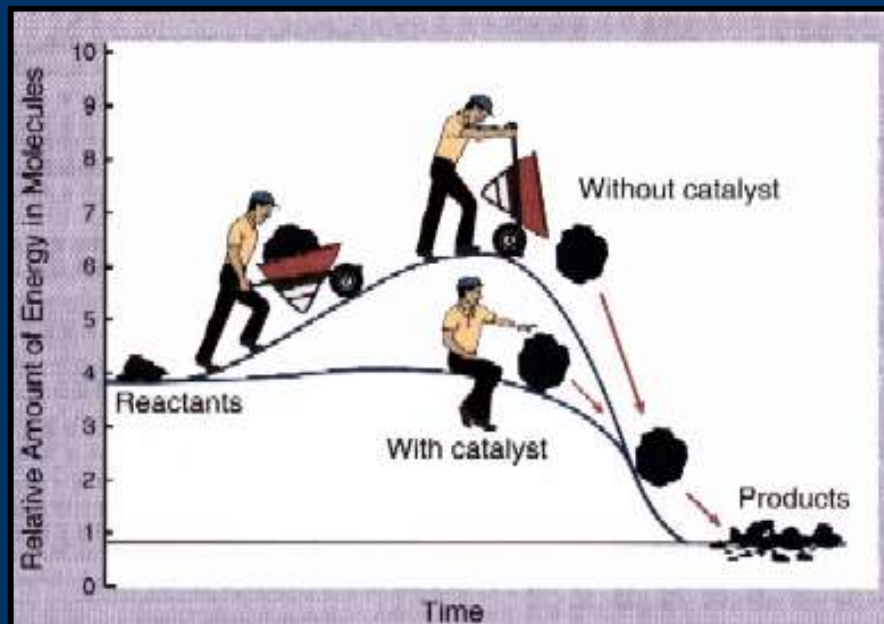


50 mph “high-speed crash”

## B. Factors Affecting *Rxn. Rate*

### ■ Catalyst

- substance that increases *rxn. rate* without being consumed in the rxn.
- lowers the activation energy



# B. Factors Affecting *Rxn Rate*

## ■ Enzyme Catalysis

