


Slide 1

Chemistry: A Molecular Approach, 1st Ed.
Nivaldo Tro

Chapter 13
Chemical Kinetics



Roy Kennedy
Massachusetts Bay Community College
Wellesley Hills, MA
2008, Prentice Hall

Slide 2

Catalysts

- catalysts are substances that affect the rate of a reaction without being consumed
- catalysts work by providing an alternative mechanism for the reaction
 - ✓ with a lower activation energy
- catalysts are consumed in an early mechanism step, then made in a later step

mechanism without catalyst mechanism with catalyst


$O_3(g) + O(g) \rightarrow 2 O_2(g)$ V. Slow $Cl(g) + O_3(g) \rightleftharpoons O_2(g) + ClO(g)$ Fast

$ClO(g) + O_3(g) \rightarrow O_2(g) + Cl(g)$ Slow

Tro, Chemistry: A Molecular Approach 2

Slide 3

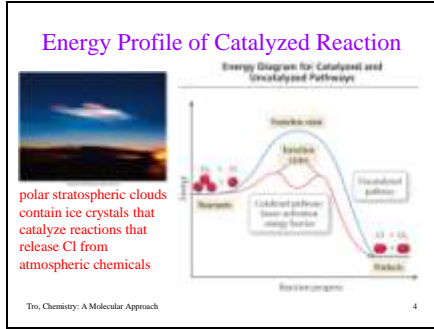
Ozone Depletion over the Antarctic



Copyright © 2008 Pearson Education, Inc.

Tro, Chemistry: A Molecular Approach 3

Slide 4



Slide 5

Catalysts

- **homogeneous catalysts** are in the same phase as the reactant particles
✓ $\text{Cl}_{(g)}$ in the destruction of $\text{O}_{3(g)}$
- **heterogeneous catalysts** are in a different phase than the reactant particles
✓ solid catalytic converter in a car's exhaust system

Tro, Chemistry: A Molecular Approach 5

Slide 6

Types of Catalysts

Tro, Chemistry: A Molecular Approach 6

Slide 7

Catalytic Hydrogenation
$$\text{H}_2\text{C}=\text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{CH}_3$$

Hydrogenation Catalyst

The diagram illustrates the catalytic hydrogenation of ethene on a metal surface. It is divided into four stages: 1. Adsorption: Ethene and hydrogen molecules adsorb onto the metal surface. 2. Surface Reaction: The adsorbed ethene and hydrogen react on the surface. 3. Desorption: The resulting ethane molecule desorbs from the surface. 4. Regeneration: The metal surface is regenerated for the next cycle.

Tro, Chemistry: A Molecular Approach 7

Slide 8

Enzymes

- because many of the molecules are large and complex, most biological reactions require a catalyst to proceed at a reasonable rate
- protein molecules that catalyze biological reactions are called **enzymes**
- enzymes work by adsorbing the substrate reactant onto an active site that orients it for reaction

Tro, Chemistry: A Molecular Approach 8

Slide 9

Enzyme-Substrate Binding
Lock and Key Mechanism

The diagram shows the lock and key mechanism. An enzyme is represented as a lock with a specific shape. A substrate is represented as a key that fits perfectly into the lock's active site. The binding of the substrate to the enzyme is shown, leading to the formation of a product.

Tro, Chemistry: A Molecular Approach 9

Slide 10

