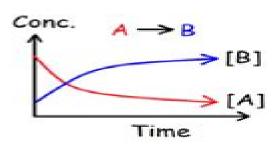
# **Chemical Kinetics:**



#### Instantaneous Rate of Appearance:

$$Rate = + \frac{d[B]}{dt}$$

#### Method of Initial Rates:

Trial	[A]	(B)	[C]	I. Rate
1	0.10 M	0.10 M	0.10 M	0.20 M/s
2	0.20 M	0.10 M	0.10 M	0.40 M/s
3	0.10 M	0.20 M	0.10 M	0.80 M/s
4	0.10 M	0.10 M	0.20 M	0.20 M/s

#### Rate Constant k:

$$k = \frac{Rate}{[A]^{s}[B]^{y}[C]^{s}}$$

Units of k:  $M^{1-n} t^{-1}$  or  $(mol)^{1-n} (L)^{n-1} t^{-1}$ 

Note:  $M = mol * L^{-1}$  and  $t \rightarrow s$ , min, hr, days

#### Unimolecular:

$$A \rightarrow B$$
  $Rate = k[A]$ 

## Bimolecular:

$$A + A \rightarrow B$$
  $Rate = k[A]^2$   
 $A + B \rightarrow C$   $Rate = k[A][B]$ 

## Termolecular:

$$A + B + C \rightarrow D$$
  $A + B + C \rightarrow D$   $A + B \rightarrow C$   $A + B$ 

## Average Rate of Appearance: $A \rightarrow B$

$$Rate = + \frac{\Delta[B]}{\Delta t} = \frac{[B]_F - [B]_0}{t_F - t_0}$$

#### Average Rate of Disappearance:

$$Rate = -\frac{\Delta[A]}{\Delta t}$$

#### Rate of a Chemical Reaction:

$$2A + 3B \rightarrow 4C + 5D$$

$$Rate = -\frac{1}{2}\frac{\Delta[A]}{\Delta t} = -\frac{1}{3}\frac{\Delta[B]}{\Delta t} = +\frac{1}{4}\frac{\Delta[C]}{\Delta t} = +\frac{1}{5}\frac{\Delta[D]}{\Delta t}$$

#### Differential Rate Law Expression:

$$Rate = k[A]^*[B]^*[C]^*$$

#### Finding The Order of a Reactant:

$$\mathbf{x} = \frac{\log\left(\frac{Rate\ 2}{Rate\ 1}\right)}{\log\left(\frac{[A]_2}{[A]_1}\right)} \qquad \mathbf{y} = \frac{\log\left(\frac{Rate\ 3}{Rate\ 1}\right)}{\log\left(\frac{[B]_3}{[B]_1}\right)}$$

## Overall order of the reaction:

$$Order = x + y + z$$

## Factors Affecting the Rate of a Reaction:

- 1. Temperature
- Concentration
- 3. Catalyst
- 4. Surface Area
- 5. The Nature of the Reactants

## Reaction Mechanisms:

$$A + B \rightarrow C + D$$
  $Rate = k_1[A][B]$   
  $D + E \rightarrow F + B$   $Rate = k_2[D][E]$ 

Note: Catalyst → B Intermediate → D

**Terry C. Jones** 

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