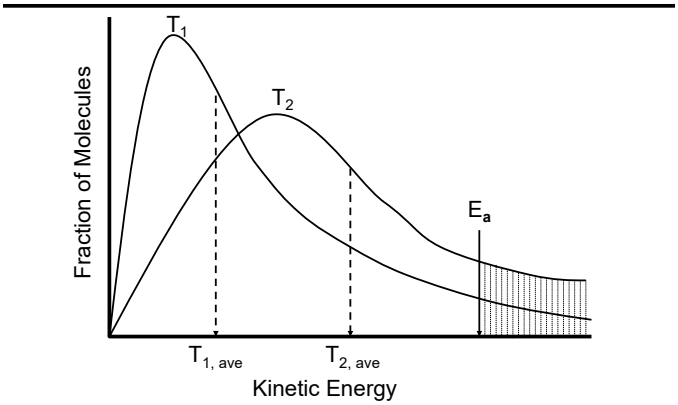
Participation Assignment
CHEM 1100-General Chemistry II

Name: **#8**

Section: 31, TR **Due Date: Tuesday 2/11/2020**

Chemical Kinetics
Theoretical Models-Collision Theory



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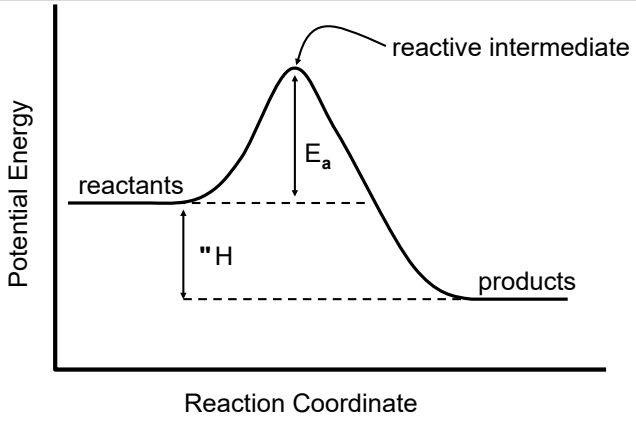
Theoretical Models-Collision Theory



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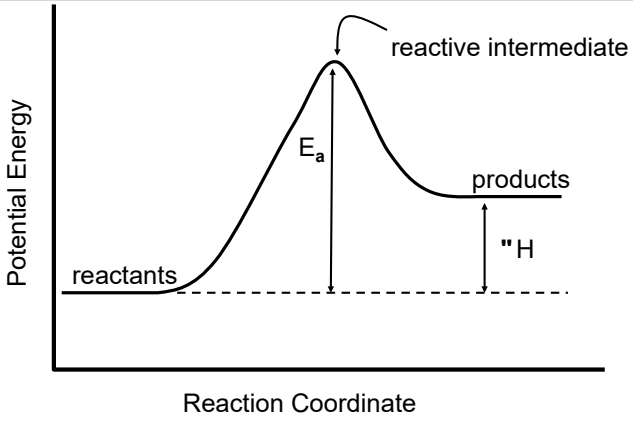
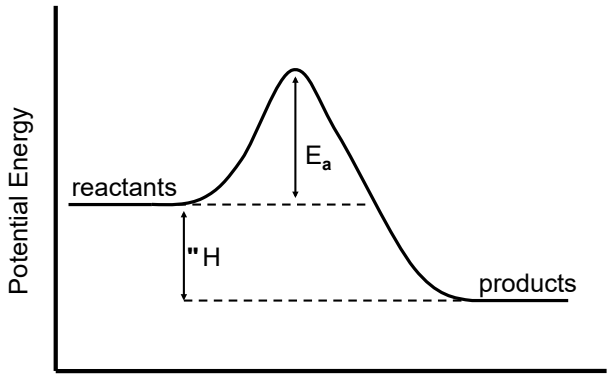


Chemical Kinetics
Catalysts-Energy Diagram



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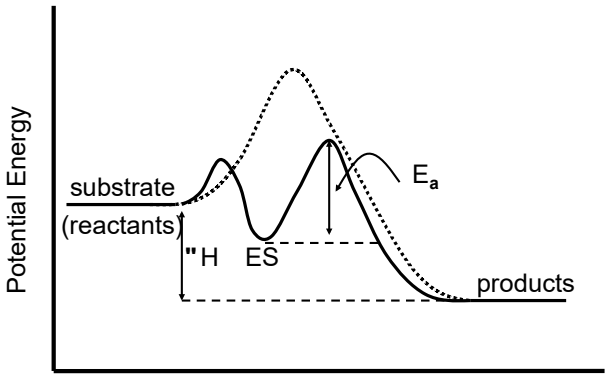

Formation of Ozone

$$O_2(g) \rightarrow O(g) + O(g)$$
$$O_2(g) + O(g) + M \rightarrow O_3(g) + M$$
$$O_2(g) + O(g) + M \rightarrow O_3(g) + M$$

$$3O_2(g) \rightarrow 2O_3(g)$$

Decomposition of Ozone

$$O_3(g) \rightarrow O_2(g) + O(g)$$
$$O_3(g) + O(g) \rightarrow 2O_2(g)$$

$$2O_3(g) \rightarrow 3O_2(g)$$

Catalyzed Decomposition of Ozone

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

$$2O_3(g) \rightarrow 3O_2(g)$$

Unimolecular Step:

$A \rightarrow$ products

rate = k[A]

Bimolecular Step:

$A + A \rightarrow$ products

rate = $k[A]^2$

$A + B \rightarrow$ products

rate = k[A][B]

Termolecular Step:

$A + A + A \rightarrow$ products

rate = $k[A]^3$

$A + B + C \rightarrow$ products

rate = k[A][B][C]

etc.

Decomposition of Hydrogen Peroxide

Uncatalyzed

$$H_2O_2(aq) \rightarrow H_2O(l) + O(g)$$
$$O(g) + H_2O_2(aq) \rightarrow H_2O(l) + O_2(g)$$

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

Catalyzed (I^{1-})

$$H_2O_2(aq) + I^-(aq) \rightarrow H_2O(l) + IO^-(aq)$$
$$H_2O_2(aq) + IO^-(aq) \rightarrow H_2O(l) + O_2(g) + I^-(aq)$$

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

Catalyzed (Catalase)

$$[\text{catalase-Fe(III)}] + H_2O_2(aq) + 2H^+(aq) \rightarrow H_2O(l) + [\text{complex I-}H_2O\text{-Fe(V)}]^{2+}$$
$$[\text{complex I-}H_2O\text{-Fe(V)}]^{2+} + H_2O_2(aq) \rightarrow H_2O(l) + O_2(g) + 2H^+(aq) + [\text{catalase-Fe(III)}]$$

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

1. The overall reaction between nitrogen dioxide and carbon monoxide may be written as follows:

$$NO_2(g) + CO(g) \rightarrow NO(g) + CO_2(g)$$

Below 225 °C, the rate law is:

$$\text{rate} = k[NO_2]^2$$

Verify that the following mechanism is consistent with the rate law:

Step 1 (slow): $2NO_2(g) \rightarrow NO_3(g) + NO(g)$

Step 2 (fast): $NO_3(g) + CO(g) \rightarrow NO_2(g) + CO_2(g)$