

Participation Assignment

CHEM 1100-General Chemistry II

Name:

#6

Section: 31, TR

Due Date: Tuesday 4/17/2018

Half-Life:

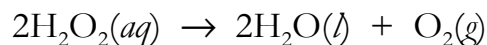
First Order

$$\ln[A]_t = -kt + \ln[A]_0$$

Second Order

$$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$$

1. In a dilute sodium hydroxide solution, the decomposition of hydrogen peroxide is a first order process:



At 20 °C, the rate constant for this process is $1.8 \times 10^{-5} \text{ 1/s}$. If the concentration of hydrogen peroxide is initially 0.300 M, how many hours will it take until the concentration drops to 0.150 M?

Rate constant: McMurry, J., Fay, R., *Chemistry*, 5th ed., Pearson Education, 2008, p452.

2. The decomposition of hydrogen iodide is a second order reaction:



The rate constant for this process is $5.13 \times 10^{-4} \text{ M}^{-1} \text{ s}^{-1}$ at $410 \text{ }^\circ\text{C}$. If the initial concentration of hydrogen iodide is 0.400 M , how many hours will it take until the concentration is 0.200 M ?

Rate constant: McMurry, J., Fay, R., *Chemistry*, 5th ed., Pearson Education, 2008, p460 (units for the rate constant modified).

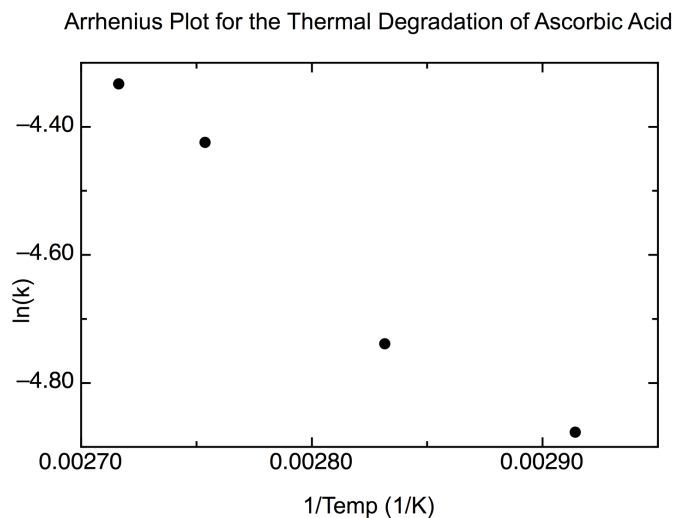
Arrhenius equation: $k = Ae^{-E_a/RT}$

$$\ln(k) = \ln(A) + \ln(e^{-E_a/RT})$$

3. Determine the activation energy, in kJ/mol, for the thermal degradation of ascorbic acid in rose hips:

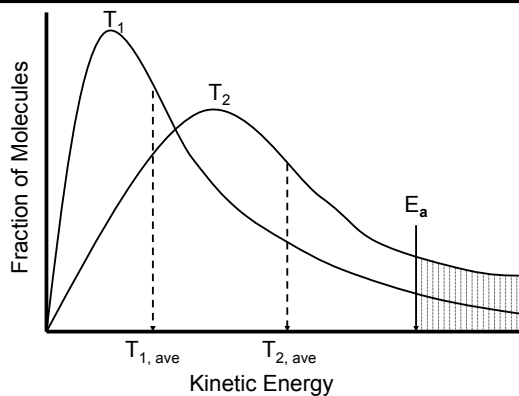
Temp($^\circ\text{C}$)	1/T (1/K)	k (1/min)	ln(k)
70	0.002914	0.00762	-4.877
80	0.002832	0.00875	-4.739
90	0.002754	0.01198	-4.425
95	0.002716	0.01313	-4.333

Karhan, M., Aksu, M., Tetik, N., Turhan, I., "Kinetic Modeling of Anaerobic Thermal Degradation of Ascorbic Acid in Rose Hip (*Rosa Canina* L) Pulp", *Journal of Food Quality*, 2004, 27, p311.



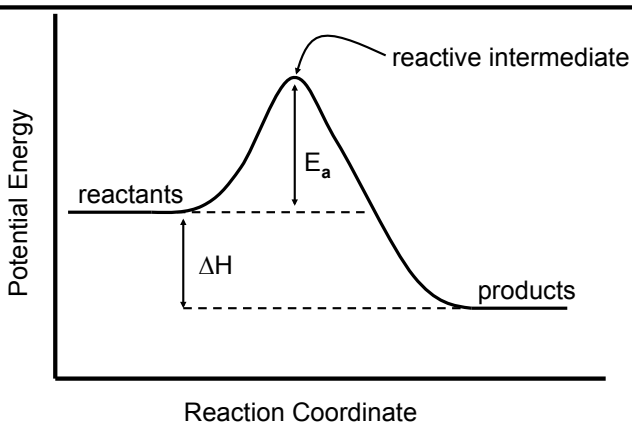
Chemical Kinetics

Theoretical Models-Collision Theory



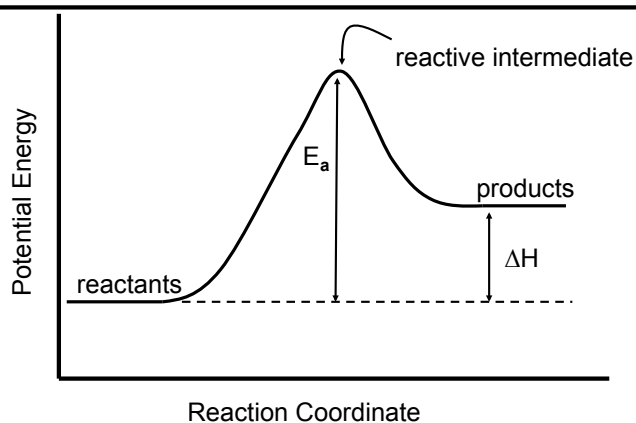
Chemical Kinetics

Theoretical Models-Collision Theory



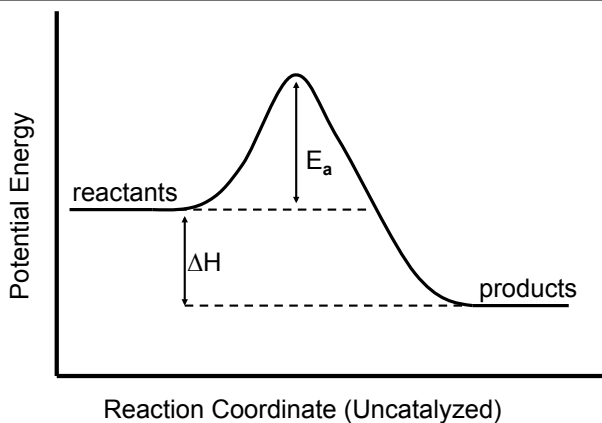
Chemical Kinetics

Theoretical Models-Collision Theory



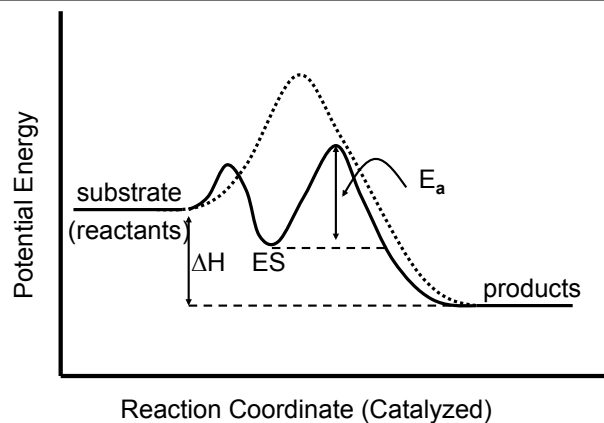
Chemical Kinetics

Catalysts-Energy Diagram



Chemical Kinetics

Catalysts-Energy Diagram



4. Define each of the following:

a. Reaction mechanism

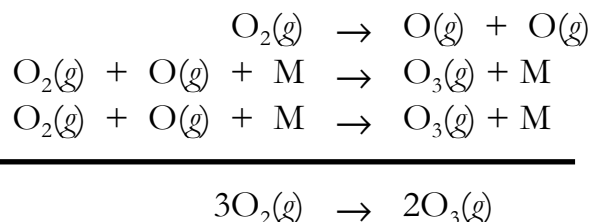
b. Elementary step

c. Rate-determining step

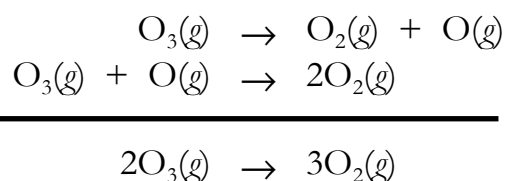
d. Reaction (reactive) intermediate

e. Catalyst

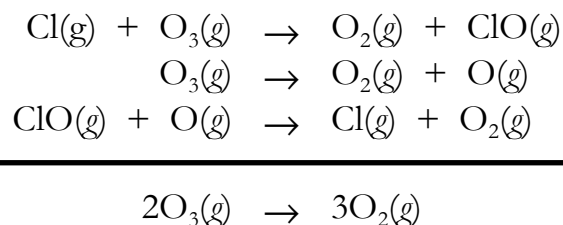
Formation of Ozone



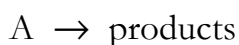
Decomposition of Ozone



Catalyzed Decomposition of Ozone

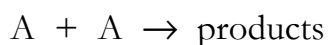


Unimolecular Step:

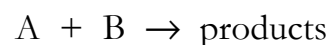


$$\text{rate} = k[\text{A}]$$

Bimolecular Step:



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



$$\text{rate} = k[\text{A}][\text{B}]$$

Termolecular Step:



$$\text{rate} = k[\text{A}]^3$$

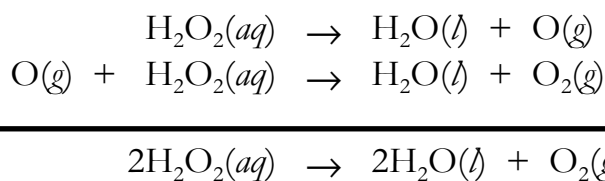


$$\text{rate} = k[\text{A}][\text{B}][\text{C}]$$

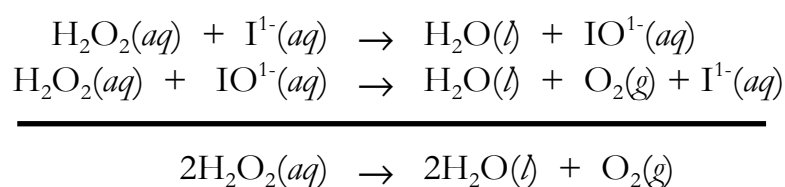
etc.

Decomposition of Hydrogen Peroxide

Uncatalyzed



Catalyzed (I¹⁻)



Catalyzed (Catalase)

