Important Chap 14 eqn

① $\text{Rate} = \dfrac{\Delta\,\text{concentration}}{\Delta\,\text{time}} = \dfrac{M}{\text{sec}}$

② $aA + bB \longrightarrow cC + dD$

$$\text{Rate} = -\frac{1}{a}\frac{\Delta[A]}{\Delta t} = -\frac{1}{b}\frac{\Delta[B]}{\Delta t} = \frac{1}{c}\frac{\Delta[C]}{\Delta t} = \frac{1}{d}\frac{\Delta[D]}{\Delta t}$$

③ $\text{Rate} = K\,[\text{reactant 1}]^m\,[\text{reactant 2}]^n$

m and n are rxn orders

$m + n =$ overall order of rxn

④ Values of K (Rate constant)

Zero order	First order	Second order	Third order
$\dfrac{M}{\text{sec}}$	$\dfrac{1}{\text{sec}}$	$\dfrac{1}{M \cdot \text{sec}}$	$\dfrac{1}{M^2 \cdot \text{sec}}$
$\dfrac{M/\text{sec}}{1}$	$\dfrac{M/\text{sec}}{M}$	$\dfrac{M/\text{sec}}{M^2}$	$\dfrac{M/\text{sec}}{M^3}$
$K = \dfrac{\text{Rate}}{[A]^0}$	$K = \dfrac{\text{Rate}}{[A]^1}$	$K = \dfrac{\text{Rate}}{[A]^2}$	$K = \dfrac{\text{Rate}}{[A]^3}$

$(\text{Rate} = K[A]^1$

⑤ First Order Rxns

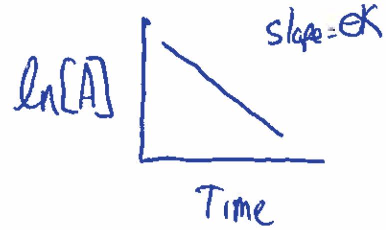
ⓐ Change in concentration with time

$$\ln[A_t] = -Kt + \ln[A_0]$$

$$y = mx + b$$

$[A_t]$ = conc at time t

$[A_0]$ = Initial conc



∴ 1st order

ⓑ Half Life

$$t_{1/2} = \frac{0.693}{K}$$

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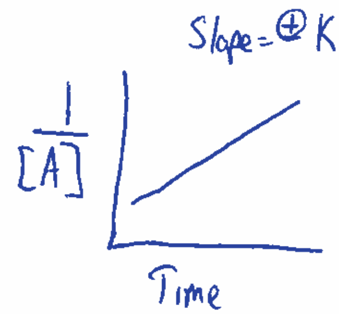
⑥ Second Order Rxn

ⓐ Change in concentration with time

$$\frac{1}{[A_t]} = Kt + \frac{1}{[A_0]}$$

$$y = mx + b$$



∴ 2nd order

ⓑ Half Life

$$t_{1/2} = \frac{1}{K[A_0]}$$

⑦ Arrhenius Equation

$$K = Ae^{-\frac{E_a}{RT}}$$ ← To determine rate constant

A = frequency factor of <u>effective</u> collisions

E_a = Activation energy

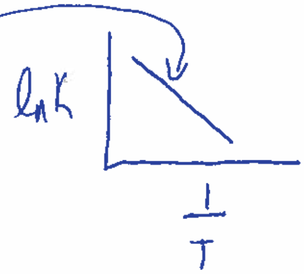
R = 8.314 J/mol-K

T = temp in Kelvin

$$\ln K = -\frac{E_a}{RT} + \ln A$$

$$y = mx + b$$

$$m = \frac{-E_a}{R}$$



⑧ Changing eqn #7 ⇒ What happens to the rate constant when Temp. changes

$$\ln \frac{K_1}{K_2} = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

<u>or</u>

$$\ln K_1 - \ln K_2 = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

* Eqn must add up [illegible]

Chp 14. sec 5

ⓐ Reaction Mechanisms ⇒ Rxn can not go faster than slowest step

ⓐ Rxn 1 (slow) / Rxn 2 (fast) } Rate is determined soley on Rxn 1

Rate = K [reactants of rxn 1]

ⓑ Rxn 1 (fast) / Rxn 2 (slow) } Rxn 2 determines rate but product of Rxn 1 is reactant in rxn 2 and its rate of production is important.

Ex Worksheet #25

Given: $2NO + O_2 \rightarrow 2NO_2$ Rate: $K[O_2][NO]^2$

Ans ⓒ

Rxn 1 $NO + O_2 \leftrightarrow NO_3$ ⇒ Rate $[NO_3] = K[NO][O_2]$

Rxn 2 $NO_3 + NO \rightarrow 2NO_2$ ⇒ Rate $[NO_2] = K[NO_3][NO]$

Substitute Rxn 1 rate into Rxn 2 rate

$$\text{Rate}[NO_2] = K \underbrace{[NO][O_2]}_{[NO_3]} [NO]$$

$$= K[NO]^2[O_2]$$ which matches with given.