① Rate disappearance = Rate appearance
Reactants Products.

$\frac{M}{sec}$

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

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

② Rate on Concentration of REACTANTS

$$Rate = K[react1]^m[react2]^n$$

← rxn order, $\uparrow A \uparrow \Delta$, $\uparrow A \uparrow B \uparrow K$

Jan 31-7:26 AM

(14.16)

Time	Moles A	(a) Moles B	Δ A	(b) $\frac{\Delta[A]}{\Delta t}$
0	0.1	0		
40	0.067	0.033	0.033	8.25×10^{-4} M/sec
80	0.045	0.055	0.022	5.5×10^{-4} M/sec
120	0.030	0.070	0.015	3.75×10^{-4} M/sec
160	0.020	0.080	0.01	2.5×10^{-4} M/sec

.033, .022

$\Delta 40$ sec

$A \rightarrow B$
(g) (g)

$\Sigma = 0.1$

$\frac{0.01}{40}$

Jan 31-7:55 AM

14.22 a

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

0.050 M/sec   0.050 M/sec

$\frac{\Delta[\,]}{\Delta t}$ $\frac{0.025M}{sec}$

$\frac{\Delta[\,]}{\Delta t}$

$$\boxed{\frac{-\Delta[C_2H_4]}{\Delta t} = -\frac{1}{3}\frac{\Delta[O_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[CO_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[H_2O]}{\Delta t}}$$

$$2 * \frac{\Delta[C_2H_4]}{\Delta t} = \frac{1}{2}\frac{\Delta[CO_2]}{\Delta t} * 2$$

$2(0.025) =$

Jan 31-8:04 AM

14.22 b

$N_2H_4 + H_2 \rightarrow 2NH_3$

63   63   126

ΔS

$126 - (63 + 63)$

0

$\frac{\Delta}{\Delta t}$ $\frac{63\,torr}{hr}$

$$\boxed{\frac{-\Delta[N_2H_4]}{\Delta t} = \frac{-\Delta[H_2]}{\Delta t} = +\frac{1}{2}\frac{\Delta[NH_3]}{\Delta t}}$$

$$2 * \frac{\Delta[N_2H_4]}{\Delta t} = \frac{1}{2}\frac{\Delta[NH_3]}{\Delta t} * 2$$

63   126 torr/h

Jan 31-8:10 AM

Units for Rate Constant $\boxed{K}$

First order Rxn

$A \rightarrow$ Products

$$Rate = K[A]^1$$

$$\frac{\frac{M}{sec}}{M} = \frac{K \; M^1}{M}$$

$$\boxed{K = \frac{1}{sec} \text{ or } sec^{-1}} \quad \frac{1}{M^0 \cdot sec}$$

First order rxn

Second order rxn

$A + A \rightarrow$ Products.

$2A \rightarrow$ Prod.

$A + B \rightarrow$ Prod.

$$Rate = K[A]^2$$

$$\frac{\frac{M}{Sec}}{M^2} = \frac{K \; M^2}{M^2}$$

$$K = \frac{1}{M^1 \cdot sec}$$

Jan 31-8:16 AM

Third order

$$Rate = K[A]^3$$

$$\frac{\frac{M}{sec}}{M^3} = \frac{K \; M^3}{M^3}$$

$$K = \frac{1}{M^2 \, sec}$$

Zero order

$$Rate = K[A]^0$$

$$\frac{M}{sec} = K \; (1)$$

$$\frac{1}{M^{-1} \cdot sec} = K$$

Jan 31-8:25 AM

$$K = \frac{1}{M^{(\text{rxn order} - 1)} \times \text{sec}}$$

Jan 31-8:28 AM

DD

Sochan + J. DAlo

$$\text{Rate} = K\,[\text{Sochan}]^{\square}\,[\text{J Dalo}]^{\square}$$

Dalo remains unchanged

Unchanged

Sochan on break

Jan 31-8:30 AM

$NH_4^+ + NO_2^- \Rightarrow N_2 + H_2O$

$Rate = K[NH_4^+]^{\boxed{1}}[NO_2^-]^{\boxed{1}}$

$K = \frac{1}{M \cdot sec}$

2^{nd} order rxn

$\frac{NH_4}{\Delta(NH_4)}$ Δrate

$2^{\boxed{1}} = 2$

double doubled

Pick 2 experiment lines

Overall order of rxn
Add up rxn orders

Jan 31-8:43 AM

p584 14.6

$A + B \Rightarrow C$

$Rate = K[A]^{\boxed{2}}[B]^{\boxed{0}}$

Expt 1+3

$\frac{A}{2^{\boxed{2}}} = \frac{rate}{4}$

Expt 1+2

$\frac{B}{2^{\boxed{0}}} = \frac{rate}{1}$

Jan 31-8:49 AM

14.6 Practice
p585

$2NO + 2H_2 \rightarrow N_2 + 2H_2O$

$$\text{Rate} = K[NO]^{\boxed{2}}[H_2]^{\boxed{1}}$$

H_2 constant

(1+3)

NO	Rate
$2^{\boxed{2}}$ =	4

NO constant

(1+2)

H_2	rate
2^1 =	2

Jan 31-8:55 AM

Δ[react] Δrate

doubled tripled

$$2^x = 3$$

$$\log 2^x = \log 3$$

$$x \log 2 = \log 3$$

$$x = \frac{\log 3}{\log 2} = 1.58$$

Jan 31-8:58 AM

Log Rulz

$$\log x^y = y \log x$$

$$\log xy = \log x + \log y$$

$$\log \frac{x}{y} = \log x - \log y$$

Jan 31-9:00 AM

① disapp = app.

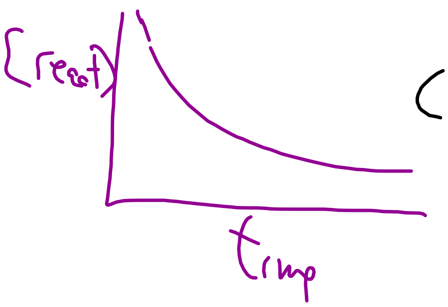
$$-\frac{1}{a}\frac{\Delta[A]}{\Delta t} = \frac{1}{b}\frac{\Delta[B]}{\Delta t} \ldots$$

② Rate law
Δ concentration

$$\text{Rate} = k[A]^m[B]^n$$

m+n rxn orders → DATA TABLE

③ Rate
Δ time



curved line → straight line

$y = mx + b$

Jan 31-9:02 AM

1°

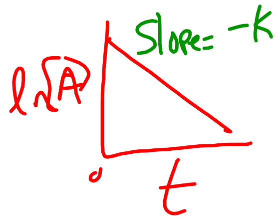
$[A_0]$ = initial amount at time = 0

$[A_t]$ = amount at some $\underline{time}$ along the way

Jan 31-9:07 AM

$$y = mx + b$$

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



6/1/17 5×10^{-7} g/cm^3

$K = 1.45\ \text{yr}^{-1}$

6/1/18 = ? g/cm^3

$$\ln A_t = (-1.45)(1) + \ln(5\times10^{-7})$$

$$e \quad \ln A_t = -15.96$$

$$\boxed{A_t = 1.17\times10^{-7}\ \text{g/cm}^3}$$

Jan 31-9:08 AM

14 / 32 + 40

Jan 31-9:16 AM