Today 1/28 Sections 13.6 - 13.8
Tuesday 1/29 experiment 2
[redacted]: Problem club with Ali 6-7:30 epply 107
Wednesday: Sections 13.9 - 13.11

Warm up: $2N_2O(g) \rightarrow 2N_2(g) + O_2(g)$

expt	$[N_2O]_0$	Rate
1	0.053 mol/L	0.63 mol/L hr
2	0.074	0.63
3	0.092	0.63

What is the order and rate expression? What is the value of rate constant and units?

$$\frac{0.63\ mol/L\cdot hr}{0.63\ mol/L\cdot hr} = \left(\frac{k\ 0.053\ mol/L}{k\ 0.074\ mol/L}\right)^{0,1,or\ 2}$$

$1\ mol/L\cdot hr = [redacted]\ (0.72\ mol/L)^{0,1,or\ 2}$

$1 = [0.72]^0$

Zero order reaction

$rate = k[N_2O]_0^0$

$0.63 = k(0.092)^0$

$0.63\ mol/L\cdot hr = k(0.092\ mol/L)^0$

$0.63\ mol/L\cdot hr = k(1)$

$\boxed{0.63\ mol/L\cdot hr = k}$

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what is the rate law

- initial conc and initial rate study
- time-conc study

→ $rate = k[A]^{0,1,2}$

↓

k

↙ 1 ↘

$2NO(g) + H_2(g) \rightarrow N_2O(g) + H_2O(g)$

	$[NO]_0$	$[H_2]_0$	initial rate
expt 1	0.60 mol/L	0.37 mol/L	0.181 mol/L·min
expt 2	1.00	0.37	0.503 mol/L·min
expt 3	0.60	.94	0.181 mol/L·min

do not have to be the same number

rate $= k[NO]^{0,1,\text{or }2}[H_2]^{0,1,\text{or }2}$

$\frac{0.181}{0.503} = \left(\frac{k\ 0.60}{k\ 1.00}\right)^{0,1,2}$ $\qquad$ $\frac{.181}{.181} = \left(\frac{k(.37)}{k(.94)}\right)^{0,1,2}$

$0.36 = (0.6)^{0,1,\text{or }2}$ $\qquad$ $1 = \left(\frac{.37}{.94}\right)^{0,1,2}$

$0.36 = (0.6)^2$ $\qquad$ $1 = 1$

2^{nd} order for $NO(g)$ $\qquad$ 0 order for H_2

rate $= k[NO]^2[H_2]^0$

$0.181\ mol/L\cdot min = k(0.60\ mol/L)^2(0.37\ mol/L)^0$

$0.181\ mol/L\cdot min = k(0.36\ mol^2/L^2)$

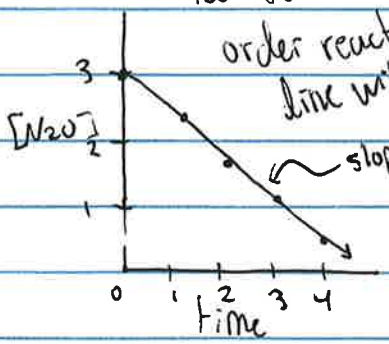
$0.50\ \frac{L}{mol\cdot min} = k$

Time - Conc study

$2N_2O(g) \rightarrow 2N_2(g) + O_2(g)$

time (hr)	$[N_2O]$
0.00 hr	3.00 mol/L
1.00 hr	2.37 mol/L
2.00 hr	1.74 mol/L
3.00 hr	1.11 mol/L
4.00 hr	0.48 mol/L

test for zero order reaction: line will be linear



$y = mx + b$

$[N_2O]_t = -k(t) + [N_2O]_0$

time-conc expression

finding rate constant:

$1.74 = -k(2) + 3.00$

$k = 0.63\ mol/L\cdot hr$

finding half life

$t_{1/2} = \frac{[A]_0}{2k}$

$t_{1/2} = 2.4\ hr$

What is $[N_2O]$ after 90 minutes?

$[N_2O]_t = -kt + [N_2O]_0$

$[N_2O]_{1.5hr} = (-0.63)(1.5hr) + 3.00 mol/L$

$[N_2O]_{1.5hr} = 2.06 mol/L$

How long does it take until 75% of the N_2O is gone

$[N_2O]_t = -kt + [N_2O]_0$

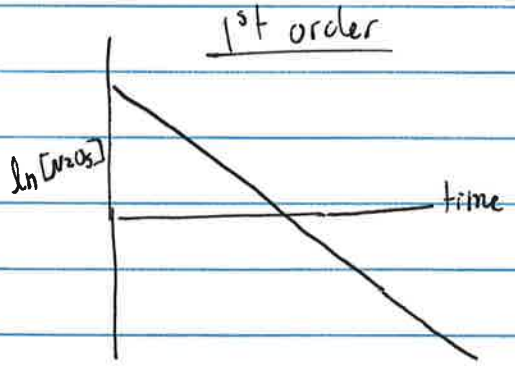
$0.75 = -(0.63)(t) + 3.00 mol/L$

$-2.25 mol/L = (-0.63)(t)$

$t = 3.57 hr$

$2N_2O_5 \rightarrow 4NO_2 + O_2$

time	$[N_2O_5]$	$\ln[N_2O_5]$
0_s	2.330 mol/L	0.846
1000_s	1.260 mol/L	0.231
2000_s	0.681 mol/L	-0.384
3000_s	0.369 mol/L	-0.997
4000_s	0.199 mol/L	-1.614



$\ln\left(\frac{[A]_0}{[A]_t}\right) = kt$

$\ln\left(\frac{2.33 mol/L}{1.260 mol/L}\right) = k(1000_s)$

$k = 6.15 \times 10^{-4} s^{-1}$

- How long does it take until $[N_2O_5] = 0.500M$?

$\ln\left(\frac{2.330 mol/L}{0.500 mol/L}\right) = (6.15 \times 10^{-4} s^{-1})(t)$

$t = 2503_s$

- What is $[N_2O_5]$ after 5000_s?

$\ln\left(\frac{2.330 mol/L}{[N_2O_5]}\right) = (6.15 \times 10^{-4} s^{-1})(5000_s)$

$[N_2O_5] = 0.108 mol/L$

$CH_3CHO \longrightarrow CH_4 + CO$

time	$[CH_3CHO]$	
0 hr	0.4 mol/L	2nd order
3.00 hr	0.118	
6.00 hr	0.069	
9.00 hr	0.049	
12.00 hr	0.038	

look at excel for Wednesday