General Chemistry w/ Doc M

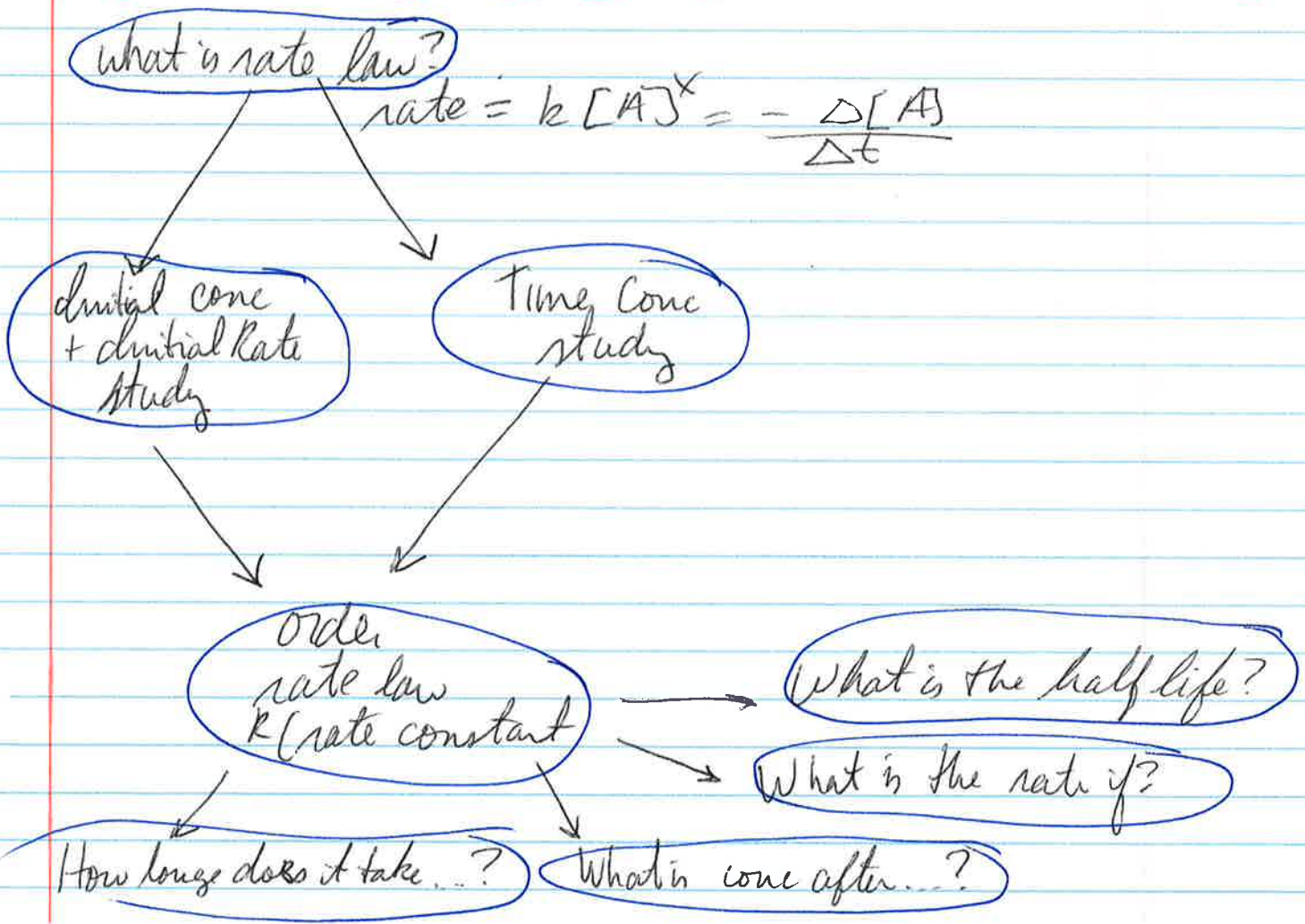
Today
Wednesday 1/25 Last content day for Celebration of Knowledge #1

Lab tomorrow Quiz
Youtube video before lab

Friday 1/27 Finish Chp 13
Exam Q+A
Exam details

Monday 1/29 Review session in HTTC 108
5-6:30 w/ Monika

Monday 1/30 Celebration of Knowledge #1 (Exam)



A → products

time	[A]
0 hr	1.00 mol/L
40	0.66
80	0.43
120	0.28
160	0.19

(Example from last class)

So it's first order!

rate $= k[A]^1$

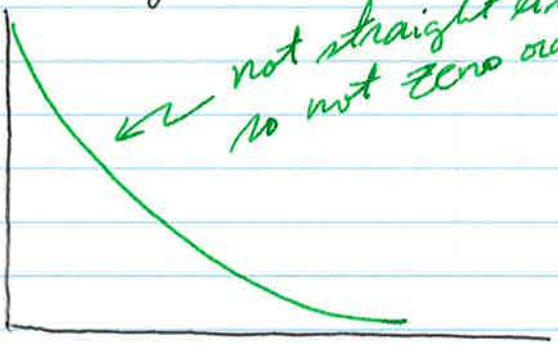
$\ln \frac{[A]_0}{[A]_t} = kt$

$k = 0.0105\ 1/hr$

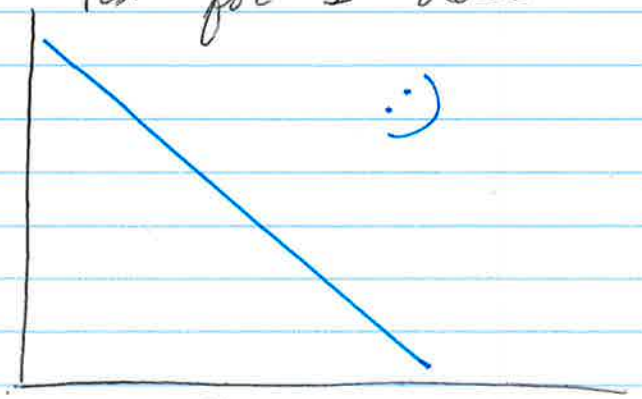
$t_{1/2} = \frac{0.693}{k} = 66\ hr$

↳ half-life equation for 1st order rxn

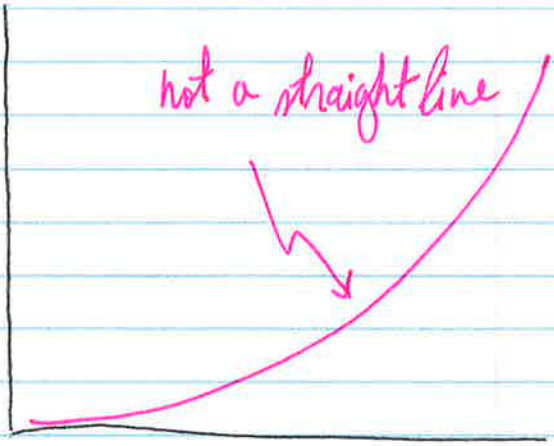
Test for Zero Order

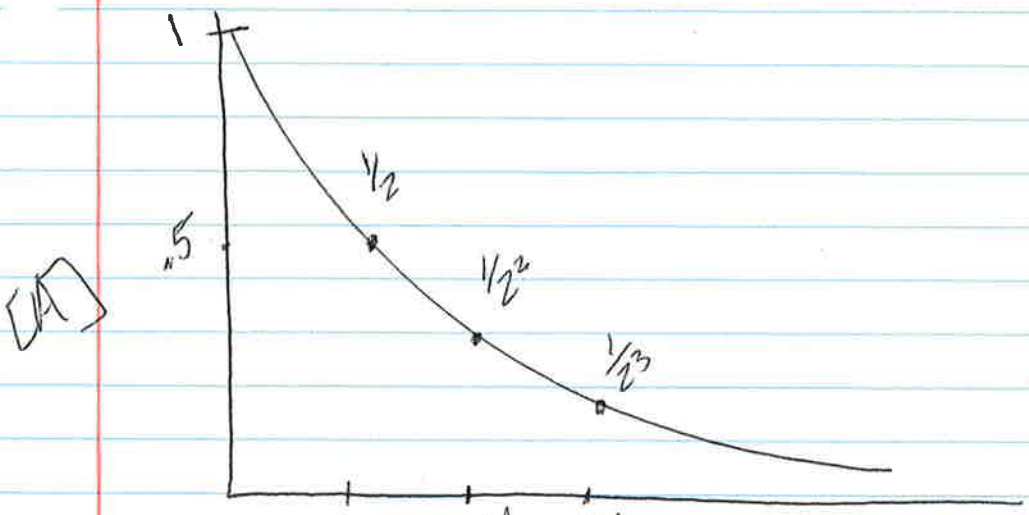


Test for 1st order



Test for second order





1 half-life → 66 hr
2 half-lives → 132 hr
3 half-lives → 198 hr

After 5 $t_{1/2}$, there would be $\left(\frac{1}{2}\right)^5 = \frac{1}{2^5} \times [A]$ left.

5 × 66 hr

Expt	$[A]_0$	initial rate
1	1.00 m/L	0.0105 mol/L·hr
2	2.00	0.0211
3	3.00	0.0316

$$\frac{\text{rate}_2}{\text{rate}_3} = \frac{0.0211}{0.0316} = \left(\frac{2.00}{3.00}\right)^x$$

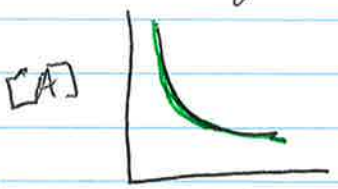
$$0.67 = (0.67)^x$$

$x = 1 \Rightarrow$ 1st order rxn

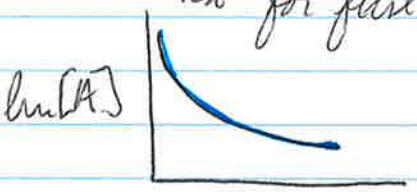
$$\text{rate} = k[A] \Rightarrow 0.0105 \text{ mol/L·hr} = k[1.00] \Rightarrow k = 0.0105 \text{ 1/hr}$$

time	$[CH_3CHO]$	([A])
0 min	0.400	
3.00	0.118	
6.00	0.069	
9.00	0.049	
12.00	0.038	

test for 0 zero order



test for first order



it's 2nd order!

test for second order

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

$$\frac{1}{0.118} = k \times 3\,\text{min} + \frac{1}{.400}$$

$$k = 1.991$$

13.67 $NO_2 + Cl_2 \rightarrow$

Ext	$[NO_2]_0$	$[Cl_2]_0$	initial rate
1	0.24	0.10	7.2×10^{-6} mol/L·time
2	0.12	0.10	3.6×10^{-6}
3	0.12	0.15	5.4×10^{-6}

$$\text{rate} = k[NO_2]^{?}[Cl_2]^{?}$$

to compare: "hold" one [reactant] constant and change the other

$$\frac{rate_1}{rate_2} = \frac{7.2}{3.6} = \frac{k[NO_2]_1^x[Cl_2]_1^y}{k[NO_2^x]_2[Cl_2]_2^y} = \left(\frac{0.24}{0.12}\right)^x \left(\frac{0.10}{0.10}\right)^y$$

$$2.00 = 2.00^x$$

$$x = 1$$

$$rate = k[NO_2]^1[Cl_2]^y$$

now do it a gain to find y

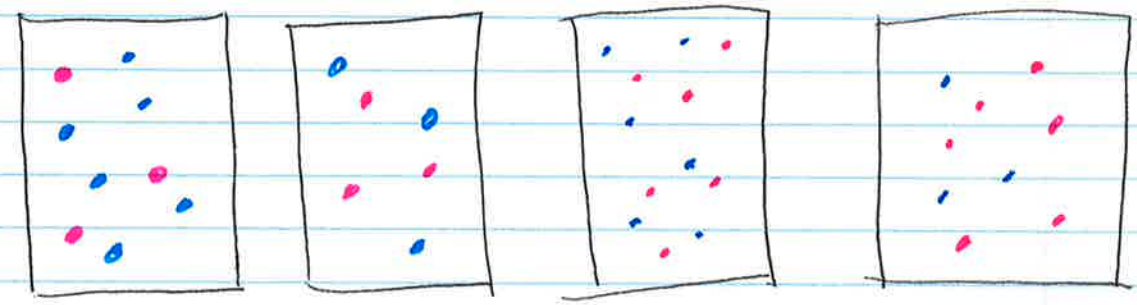
$$\frac{rate_2}{rate_3} = \frac{3.6}{5.4} = \left(\frac{0.12}{0.12}\right)^1 \left(\frac{0.10}{0.15}\right)^y$$

$$(2/3) = (2/3)^y$$

$$y = 1$$

$$rate = k[NO_2]^1[Cl_2]^1$$

13.40



red + Blue →

$rate = k[Red]^x[Blue]^y$

Given: Reaction is 1st order in Red and 1st order in Blue, what are the relative rates?

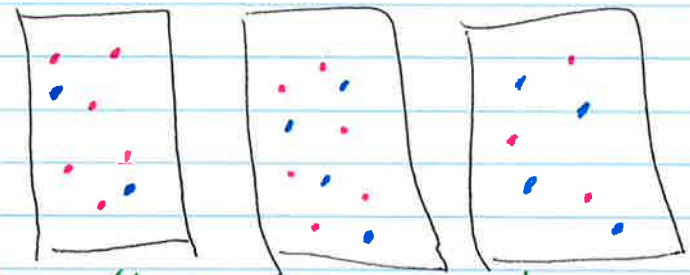
Expt	Red	Blue	Relative Rate
1	3	6	$\propto 18/9 = 2$
2	3	3	$\propto 9/9 = 1$
3	6	6	$\propto 36/9 = 4$
4	6	3	$\propto 18/9 = 2$

Relative rates are 2 : 1 : 4 : 2

What if it was 2nd order in Red and 0th order in Blue?

relative rate
$\propto 9/9 = 1$
$\propto 9/9 = 1$
$\propto 36/9 = 4$
$\propto 36/9 = 4$

13.46



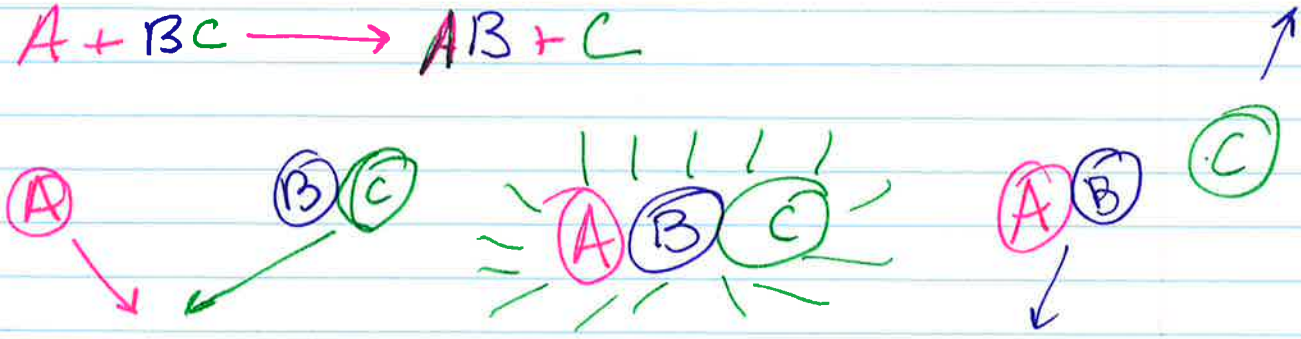
relative rate 4 : 4 : 1

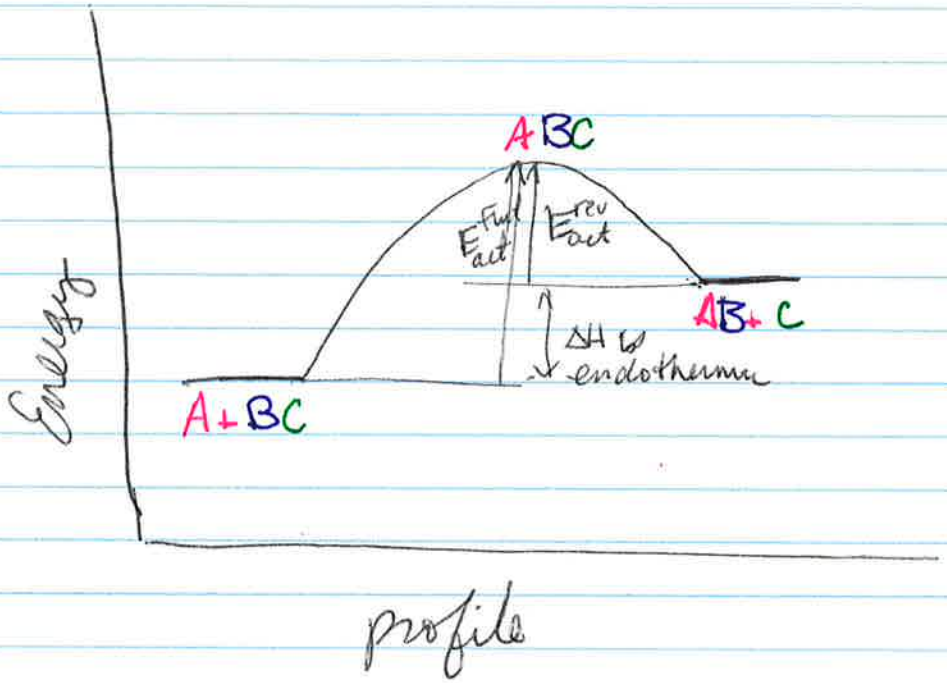
Expt	$[Red]_0$	$[Blue]_0$	Initial Relative Rate
1	6	2	4
2	6	4	4
3	3	4	1
4	9	5	? = 9

rate $\propto [Red]^x [Blue]^y$ $x = 2, y = 0$

End of Exam #1 material →

$A + BC \longrightarrow AB + C$





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