CHEM 1032 – Week 13 Questions

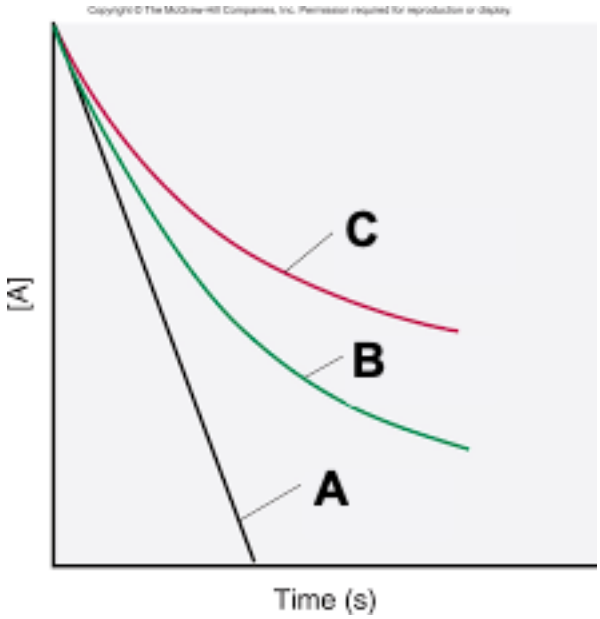
1. What is the definition of dynamic equilibrium?

2. Which of the below is a rate?
   a. 0.0450 M
   b. 55 mph
   c. 0.234 m

3. Can the rate of reaction be negative?

4. Will the rate of reaction be constant throughout the entire reaction?

5. Which line represents a 0^{th} order for the reactant?



6. What is the value of n for A in the reaction below?

A --> Products

[A] (M)	Initial Rate (M/s)
0.10	0.015
0.20	0.030
0.40	0.060

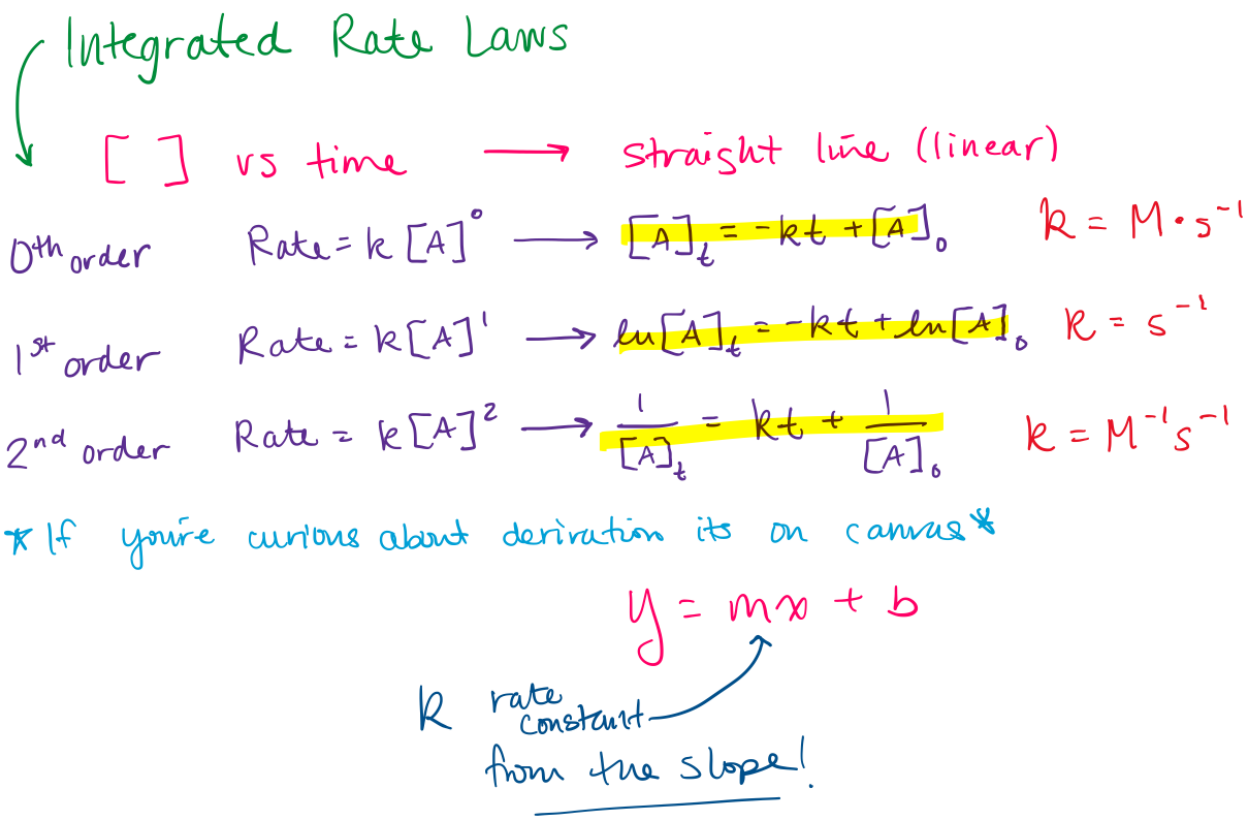
7. For the reaction in Q2, what is the value of k?

8. What is the value of k for the reaction below?

$NO_2\ (g) + CO\ (g) \rightarrow NO\ (g) + CO_2\ (g)$

$[NO_2]$ (M)	[CO] (M)	Initial Rate (M/s)
0.10	0.10	0.0021
0.20	0.10	0.0082
0.20	0.20	0.0083
0.40	0.10	0.0330

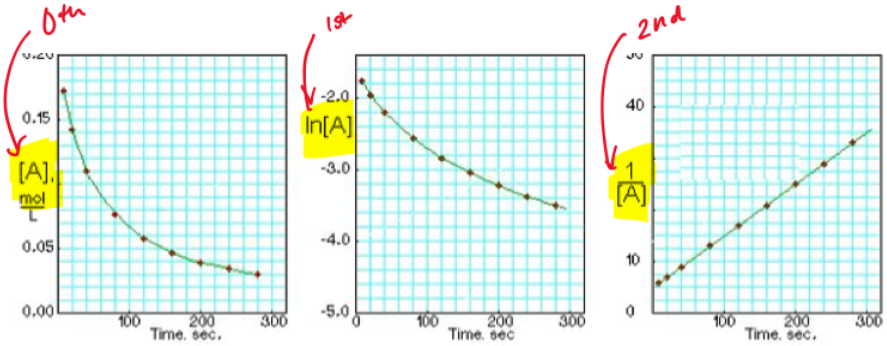
NOTES FROM FRIDAY 4/21



Based on the plots below, what is the reaction order for A?

A --> Products

0th 1st 2nd ~~X~~



$Rate = k[A]^2$

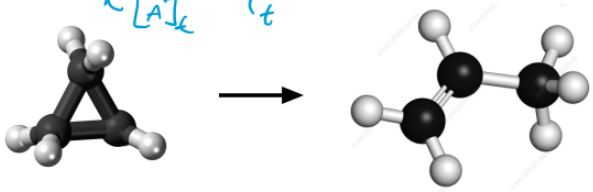
Straight line, the rate law is valid.

$n = 2$

Cyclopropane can rearrange to propene with a rate constant of $3.36 \times 10^{-5}\ s^{-1}$ at 720 K. If the initial concentration if 0.0445 M, what is the concentration after 235.0 minutes?

$[A]_0$ $[A]_t$ t

1st



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

$$\ln[A]_t = -3.36\times10^{-5}\,s^{-1}\,(1.41\times10^{4}\,s) + \ln(0.0445\,M)$$

$$e^{\ln[A]_t} = e^{-3.586}$$

$$[A]_t = 0.0277\ M$$

Integrated rate laws also enable us to determine the half-life of a reaction.
- how long it takes for [ ] to decrease by 50%

0th $t_{1/2} = \dfrac{[A]_0}{2k}$

1st $t_{1/2} = \dfrac{0.693}{k}$ ← independent of conc.

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

Data for the reaction below yields a straight line when ln[A] is plotted versus time and has a slope of -0.0105 s^{-1}. What is the half life of the reaction?

A --> B + C

1st

slope = ⊖

$k \neq \ominus$

$0.0105\ s^{-1}$

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

$$t_{1/2} = \frac{0.693}{0.0105\ s^{-1}}$$

$$t_{1/2} = 66\ s$$

Would you expect rate to increase or decrease with increased temp?

Increase!

Increase T → Increase KE

So more speed!

↑ T → ↑ Rate → ↑ rate constant

(proportional to one another)

Reaction order does not change.

We can quantify this relationship between T & k.

$$k = A e^{\left(\frac{-E_a}{RT}\right)}$$

E_a: Activation Energy

R: 8.314 J/mol·K

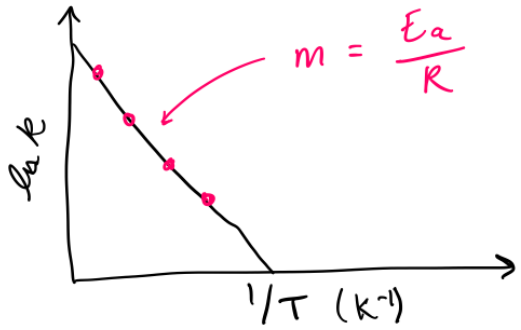
k: rate constant

A: Frequency Factor

$$\ln k = \frac{-E_a}{R}\left(\frac{1}{T}\right) + \ln A$$

$$y = m x + b$$

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

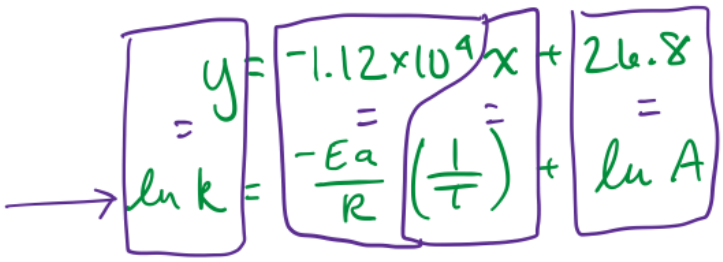


The 2nd order reaction

$$O_{3(g)} \rightarrow O_{2(g)} + O_{(g)}$$

has an equation of $y = -1.12\times10^{4}x + 26.8$

What is k when temperature is 900 K?



$$y = -1.12\times10^{4}\left(\frac{1}{900}\right) + 26.8$$

$$y = 14.36 = \ln k$$

$$e^{y} = k$$

$$k = 1.7\times10^{6}\ M^{-1}s^{-1}$$