Chem 10123, Quiz 5 **Answer Key**
March 4, 2020

1. The simple reaction, A $\longrightarrow$ B + C, is thought to be a ***first order*** process. In one kinetics experiment, the following data was obtained.

[A]	0.300	0.222	0.150	0.108	0.0750	0.0521	0.0375
Time (sec)	0	20	40	60	80	100	120

(a) (2 points) How would you plot this data to confirm that the reaction is actually first order?

Plot **ln[A] vs time**. It should be a straight line for a 1st order reaction.

(b) (5 points) Determine the instantaneous rate of this reaction in units of mole/L·sec at time t = 30 seconds. ***Show a calculation.***

rate = Δ conc / Δ time (use 2 points around the t = 30 sec point)

= (0.222 – 0.150) mole/L] / [(40 – 20) sec

= 3.60×10^{-3} mole / L·sec

(b) (3 points) Assuming that it is first order, the half-life of this reaction is 40 sec and the rate constant (k) is 0.0173 sec^{-1}.

2. (10 points) A kinetic study of the following gas-phase reaction gave the concentration *vs* initial rate data summarized below. $2\,A + B_2 \longrightarrow 2\,AB$

Expt	**[A]**	**[B_2]**	**initial rate** (mole/L·sec)
(1)	0.250	0.100	1.375×10^{-4}
(2)	0.650	0.450	1.972×10^{-3}
(3)	1.250	0.450	7.291×10^{-3}
(4)	1.250	0.100	3.438×10^{-3}

Determine the **rate law** for this reaction. **Clearly SHOW how you arrive at your answer**. (It is not necessary to determine the rate constant, k.)

rate = $k[A]^x[B_2]^y$

Expts 1 and 4 -- constant $[B_2]$, use to determine x

$(3.438 \times 10^{-3}) / (1.375 \times 10^{-4}) = (1.25 / 0.25)^x$

$25 = (5)^x$ $\therefore$ x = 2

Expts 3 and 4 -- constant [A], use to determine y

$(7.291 \times 10^{-3}) / (3.438 \times 10^{-3}) = (0.450 / 0.100)^y$

$2.121 = (4.50)^y$ $\therefore$ y = 1/2

rate = $k\,[A]^2\,[B_2]^{1/2}$