Chapter #14 – Chemical Kinetics

1. Use the following table to calculate the rate of disappearance for X_2 at different times.

$$X_2 + 3Y \rightarrow Y_3X$$

Time (s)	$[X_2]$
0.00 s	1.30 M
15.0 s	1.10 M
30.0 s	0.80 M
60.0 s	0.20 M
120.0 s	0.50 M

a. 0 s → 120 s

b. 0 s → 60 s

c. 15 s → 60 s

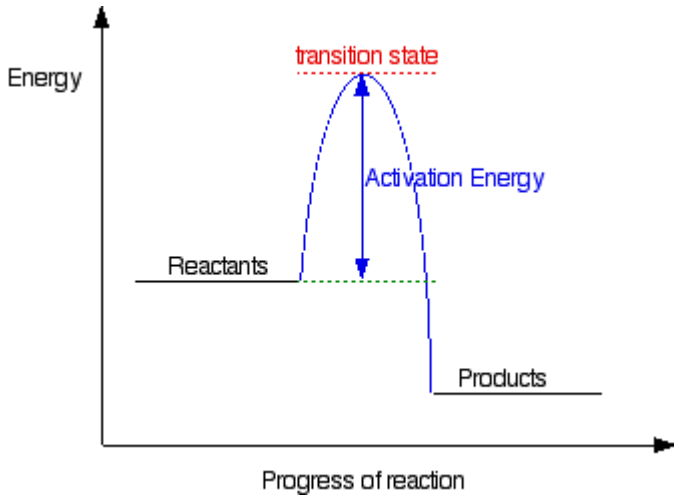
d. What would the rate of disappearance be for Y at these time intervals?

2. Give the $t_{1/2}$ equation.

3. What effect does temperature have on the rate constant (k)?

4. How does the activation energy affect the rate constant (k)?

5. Label the following graph:



1st order reaction:

2nd order reaction:

1. Consider the data for hydrogen concentration [H_2], iodine concentration [I_2] and the rate of reaction (moles per liter per second or mol·L^{-1}/s) for this reaction:

$$H_2\,(g) + I_2\,(g) \rightarrow 2\,HI\,(g)$$

Trial	[H_2] (mol/L)	[I_2] (mol/L)	Rate (mol·L^{-1}/s)
1	0.01	0.05	0.04
2	0.02	0.05	0.08
3	0.05	0.01	0.02
4	0.05	0.03	0.54

What is the overall reaction order?

2. Consider a hypothetical reaction:

$$A + B \rightarrow C + D$$

Doubling the concentration of A causes the reaction rate to increase by a factor of four. This is done while the concentration of B is held constant. Tripling the concentration of B, while the concentration of A is held constant, causes the reaction rate to increase by a factor of nine. What is the rate law expression for this reaction?

3. Consider the reaction:

$$NO_2^- (aq) + NH_4^+ (aq) \rightarrow N_2 (g) + 2\ H_2O (l)$$

Trial	$[NO_2^-]$ (mol/L)	$[NH_4^+]$ (mol/L)	Rate (mol·L-1/s x 10^{-7})
1	0.0100	0.200	5.4
2	0.0200	0.200	10.8
3	0.0400	0.200	21.6
4	0.200	0.200	10.8
5	0.200	0.400	21.6
6	0.200	0.600	32.4

Determine the rate law expression for this reaction:

4. In a reaction involving only one reactant, A, the rate of the reaction increases by a factor of 27 when the concentration of A is tripled. What is the rate law expression for this reaction?