Chemistry 14B
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Ch 15: Chemical Kinetics — Integrated Rate Laws Worksheet

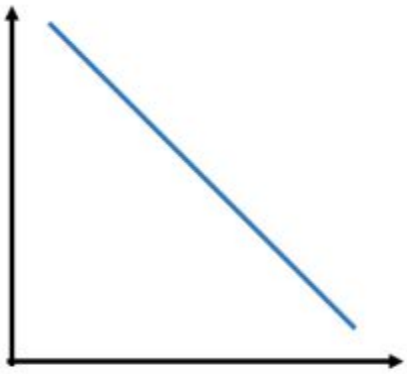
1. Consider the reaction:

   A + B ⇒ C + D rate = $k[A]^2$

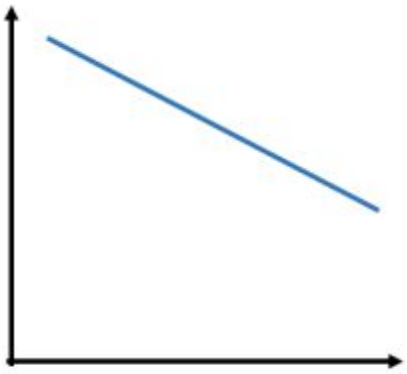
   True or false: The time it takes for [A] to decrease from 1.0 to 0.50M is the same as the time it takes for [A] to decrease from 0.50 to 0.25M.

2. A.) Label the axes for these reactions relating concentration to time. B.) What is the slope of each graph?

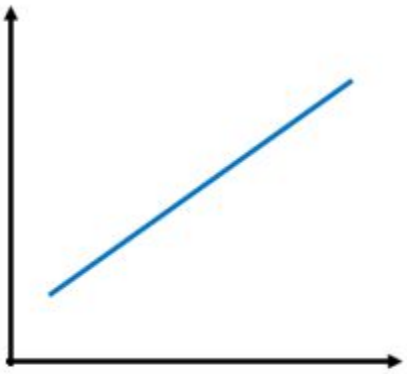
Slope: _____ Slope: _____ Slope: _____



Zeroth-order Reaction



First-order Reaction



Second-order Reaction

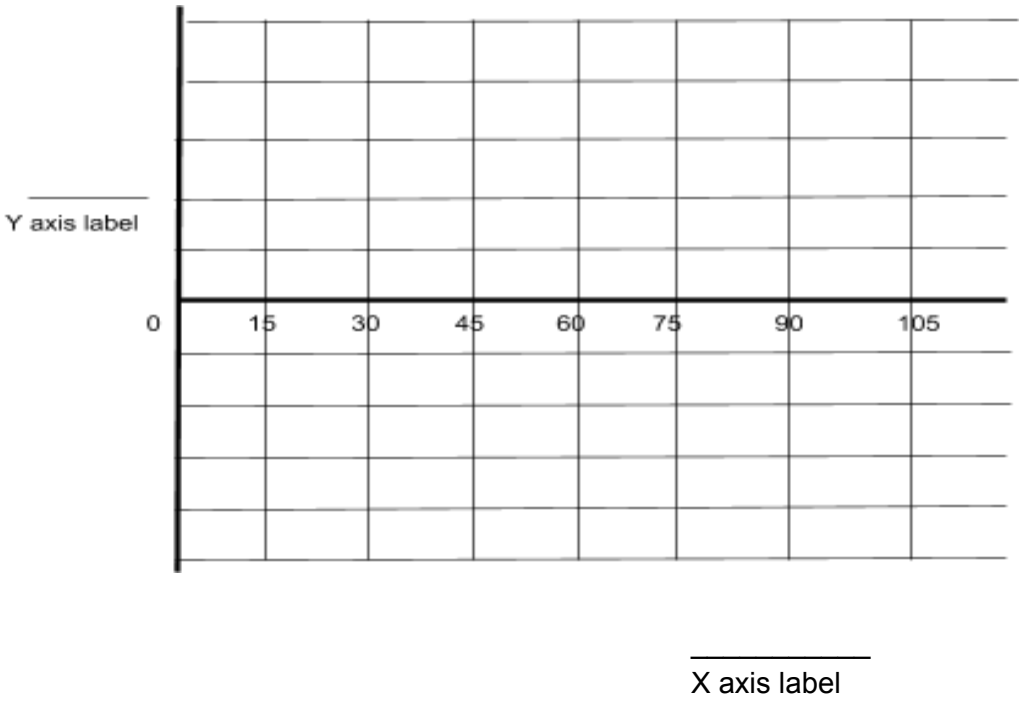
Note: This worksheet may contain problems adapted from Dr. Lavelle's past exams.

3. In the following question, reactant A decomposes into products. The concentration of A can be measured with respect to time. Use the table and graph to show that the reaction is first order with respect to A.

    a. Complete the table labeled with a * that will give the needed information to make a linear plot.

Time (s)	[A] (mol/L)	*
0	3.00	*
15	2.19	*
45	1.17	*
105	0.33	*

    b. Make a plot below to show that the reaction is first order.



4. Derive an expression for the integrated rate law for this third order reaction:

$$rate = -\frac{d[A]}{dt} = k\,[A]^3$$

5. The recombination of iodine atoms to form molecular iodine in the gas phase follows second order kinetics and has a high rate constant of $7.0\,x\,10^9$ M.s at 23^oC

$$I(g) + I\,(g) \rightarrow I_{2\,(g)}$$

   a. If the initial concentration of I was 0.086 M, calculate the concentration after 2.0 minutes.

   b. Calculate the half life of the reaction if the initial concentration of I is 0.60 M versus if the initial concentration is 0.42 M.

6. Mercury (II) is eliminated from the body by a first order process with a 6 day half life. A farmer accidentally ingests Hg (II) by eating contaminated grain. What percentage of the Hg (II) would remain in his body after 30 days if no therapeutic measures are taken?

7. A substance A decomposes in a first order reaction and its half life is 355 seconds. How much time must elapse for the concentration of A to reach 1/8 $[A]_0$?

8. In the first order reaction A ⇒ products, it is found that 99% of the original amount of reactant A decomposed in 137 minutes. What is the half life of this decomposition reaction?