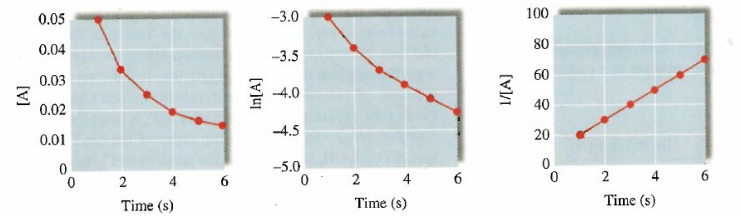
Unit 13 – Chapter 12: Kinetics **Name _____**

Assignment #2: Rate Law Determination and Half-Life Calculations **Period _____**

1) 1. A certain reaction has the following general form: aA → bB
At a particular temperature and $[A]_0 = 2.00 \times 10^{-2}$ *M*, concentration versus time data were collected for this reaction, and a plot of ln [A] versus time resulted in a straight line with a slope value of -2.97×10^{-2} min^{-1}.
    a. Determine the rate law, the integrated rate law, and the value of the rate constant for this reaction.
    b. Calculate the half-life for this reaction.
    c. How much time is required for the concentration of A to decrease to 2.50×10^{-3}?

2) A certain reaction has the following general form: aA → bB
At a particular temperature and $[A]_0 = 2.80 \times 10^{-3}$ *M*, concentration versus time data were collected for this reaction, and a plot of 1/[A] versus time resulted in a straight line with a slope value of $+3.60 \times 10^{-2}$ L/mol · sec.
    a. Determine the rate law, the integrated rate law, and the value of the rate constant for this reaction.
    b. Calculate the half-life for this reaction.
    c. How much time is required for the concentration of A to decrease to 7.00×10^{-4} *M*?

3) Experimental data for the reaction: A → 2 B + C
have been plotted in the following three ways (with concentration units in mol/L):



    a. What is the concentration of A after 9 seconds?
    b. What are the first three half-lives for this experiment?

4) The radioactive isotope ^{32}P decays by first-order kinetics and has a half-life of 14.3 days. How long does it take for 95.0% of a sample of ^{32}P to decay?

5) The rate law for the decomposition of phosphine (PH_3) is

$$\text{Rate} = -\frac{\Delta[PH_3]}{\Delta t} = k\,[PH_3]$$

It takes 120.0 seconds for 1.00 *M* PH_3 to decrease to 0.250 *M*. How much time is required for 2.00 *M* PH_3 to decrease to a concentration of 0.350 *M*?

6) The rate law for the reaction: $2\ NOBr_{(g)} \rightarrow 2\ NO_{(g)} + Br_{2(g)}$
at some temperature is

$$\text{Rate} = -\frac{\Delta[NOBr]}{\Delta t} = k\,[NOBr]^2$$

a. If the half-life for this reaction is 2.00 s when $[NOBr]_0 = 0.900\ M$, calculate the value of *k* for this reaction.
b. How much time is required for the concentration of NOBr to decrease to 0.100 *M*?