Name:_____Date:_____Block:____

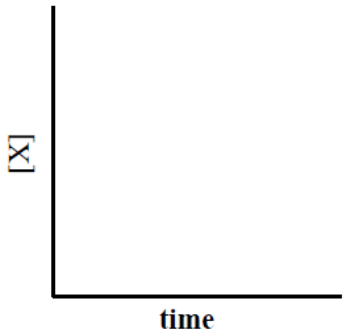
Chapter 8 – Kinetics: Integrated Rates

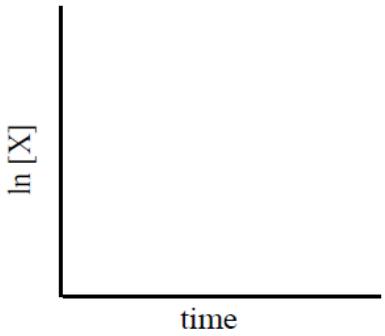
Super Problem

$$X(g) + 2\,Y(g) \rightarrow Z(g)$$

The decomposition of substance X was experimentally observed at 25°C and shown to be first order with respect to X. Data from the experiment are shown below.

[X] *M*	Time (min)
0.100	0
0.088	2
0.069	6
0.054	10
0.043	14
0.030	???





(a) For each of the graphs above

(i) Sketch the expected curve based on the labeled axes. You do not need to plot the exact data.

(ii) Write the rate law for the decomposition of substance X.

(iii) Explain how one of the two graphs above can be used to determine the rate constant, *k*. Be sure to specify which graph.

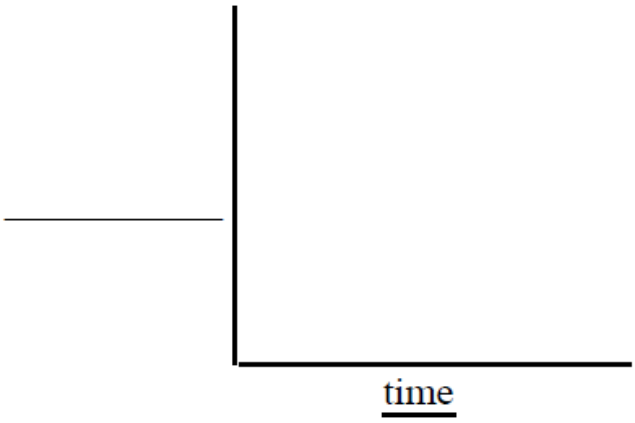
(b) Based on the above data

(i) Calculate the rate constant for this reaction. Be sure to include units.

(ii) How many minutes will it take for [X] to become 0.030 M?

In a different experiment, the decomposition of substance Y at 50°C was determine to have the following rate law.

$$\text{Rate} = k\,[\text{Y}]^2$$



(c) On the axes above

(i) Sketch the graph that is expected to provide a liner relationship when plotted against time. Be sure to label the y-axis.

(ii) What does the slope of this line represent?

(d) The temperature of this reaction was increased from 50°C to 100°C. Predict the effect this would have on each of the following.

(i) Rate of the reaction

(ii) Rate constant, *k*

(e) Sketch the graph of the reaction at 100°C on the plot in part (c).