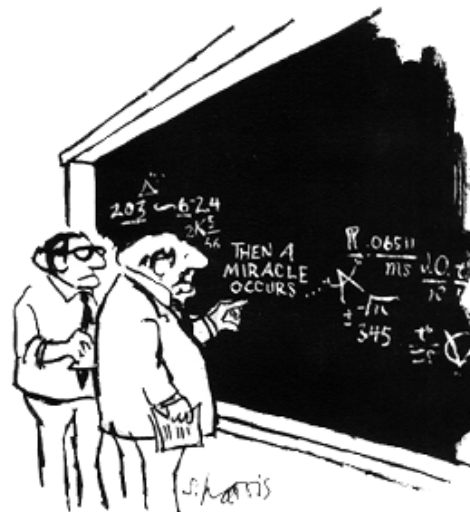


Chemistry in Action

Experimental Determination of a Kinetic Rate Law

Background

Like many other topics in chemistry, chemical kinetics is deeply rooted in experimentation. Thus, a theoretical consideration of its rate laws was made only after the progress of a chemical reaction could be followed. Today, you will be examining a physical system, which is analogous to a chemical reaction.



"I think you should be more explicit here in step two."

Objective

The objectives of this laboratory are for you to experimentally derive a rate law by observing the change in a physical system over time, fit a rate law to existing kinetic data, and subsequently analyze the significance of your results.

Experimental Method

- Obtain a buret setup, a computer and a timing device.
- Fill the buret with 50 ml water, and ready the timing device
- Begin timing when the stopcock is fully opened.
- Record the time point for each 10 ml drop. (Buret is calibrated.)
- Obtain time points for the entire 50 ml volume.

Things to note:

- The drop will proceed rapidly, so be sure to watch the buret for the entire duration of the experiment to obtain the 10 ml timepoints!
- Repeat the experiment 2 times to obtain replicate data.

Data Analysis

- Record volume and time data and enter it into an Excel spreadsheet
- Transform your data in a manner that represents what you would expect for a zeroth, first and second order kinetic reaction
- Using the chart wizard, plot volume as a function of time for each of three rate laws that you have studied in class and obtain a slope for the data
- Determine which rate law applies to this data
- Also determine which rate law applies to the experimental data given on the board via the graphical method

Translation of Physical System into Chemical System

Gathering your results and observations...

Which rate law applies to the experimental data?

Why does this rate law fit the data? Write the differential form of the rate law and use your observations and understanding of the system to fill in the table below.

<i>VARIABLE</i>	<i>Physical Significance</i>	<i>Mathematical Expression</i>	<i>Qualitative Assessment (relative rate)</i>	
			<i>begin</i>	<i>end</i>
<i>rate</i>				
<i>V</i>				
<i>k</i>				

Why was it necessary to transform the data? Write an equation that expresses volume as a function of time (the integrated rate law).

References

http://quiz2.chem.arizona.edu/preproom/Demo%20Files/kinetics_with_a_buret.htm