

Alternative Activity 5.1

Description

In this activity, the students will use an Excel spreadsheet to explore how the shape of representative rate versus conversion plots vary as the parameters in the corresponding rate expressions are changed.

Objective

The objective is to familiarize the students with power-law and other empirical rate expressions. A secondary objective is to encourage the students to develop a physical understanding for why the rate varies as it does.

Preparation

1. For this activity, the students will need to use a computer running Excel, specifically the spreadsheet provided in the handouts for this unit. Arrangements should be made so this can be done in class (e. g. have the students bring laptops to class, hold the class in a computer lab, etc.)

Lesson Plan

1. Go over the contents of the slide provided with this activity.
2. Optionally, show the students how to use the spreadsheet.
3. Give the students time to “play” with the spreadsheet.
4. Ask what different shapes they observed and discuss how the rate parameters affect the shape of the plot.
5. Have the students examine a power-law rate expression with a negative order for A (the limiting reagent). It will blow up at high conversion as CA approaches zero.
 - a. Point out that power-law rate expressions with negative reaction orders are not uncommon. Initiate a discussion leading to the conclusion that such rate expressions can only be valid over a limited range of environmental variables.

Variations

1. Have the students modify the power-law rate expression to include product concentrations and then explore the effect of a negative product reaction order (infinite rate at zero conversion) and a positive product reaction order (auto-catalysis). This again should lead to the point that these rate expressions would only be valid over a limited range of the environmental variables.