A First Course on Kinetics and Reaction Engineering
Unit 9. Lesson Plan

Before Class

• Provide the redacted slides to the students and tell them to bring them to class

During Class

• Introduce today's topic and where it fits in the course (Slides 1 and 2)
• Review of Unit 9 (5 to 10 minutes)
  - Slides 3 and 4
• Ask whether the students have any questions from their pre-class preparation and answer them
  - Slide 5
• Learning Activity[1] (~20 minutes)
  - Slide 6: Put the slide up
    ‣ form the students into groups and send the groups to the blackboard; give each group a section of blackboard and have them set up their solution (if there is not enough blackboard space, either have some work at their desks using paper or have them assist a group at the board from their seats
    ‣ allow them to talk to other groups, look at their approach, etc. as they work
    ‣ circulate among them, checking their progress, giving hints and answering questions
    ‣ when most have it all set up, send them to their seats
  - Slide 7
    ‣ go through the set up of the solution either using the slide or comparing the slide to some of the groups' work
  - Slide 8
    ‣ go through the substitution of the concentration expression and simplification of the rate expression
    ‣ note that this equation could be put in a linear form by taking its reciprocal
• Learning Activity (20 minutes) - this activity gives them an opportunity to perform a Lineweaver-Burk type analysis and to perform linear least squares with two independent variables
  - Slide 9
    ‣ Put the problem statement up and have them work in groups at their seats to devise a strategy for solution; give them a few minutes to discuss; if they aren't recognizing that the reciprocal of the rate expression is linear, give them a hint
    ‣ Students may get stuck recognizing the linear form OR knowing how to do least squares when there are two independent variables (if your students don't use MATLAB, you

_____

[1] The problem used in this activity is one of the practice problems for the unit. If you assign that problem as homework, you might not want to go over the solution in class.

> may want to prepare slides or a handout showing them how to do it with the software that they use; if they do use MATLAB, you can direct them to Supplemental Unit S3 and/or incorporate some of the slides available there)

- Slides 10: Show them how the model is linear then discuss the fitting process (Note, only one of two residuals plots are shown; the other is included in the solution to be posted after class)

- Slide 11: Show how to calculate the model parameters from the slopes and intercept; many may not be familiar with differential error analysis, you may want to walk them through the process for calculating the uncertainty in a model parameter starting from the slopes and intercept and their uncertainties

• Slide 12: show them what's next and how it relates to what's already been covered

After Class

• Provide the complete slides to the students.
• Provide the written solutions to the activities to the students.