

A First Course on Kinetics and Reaction Engineering

Unit 33. Lesson Plan

Before Class

- Provide the redacted slides to the students
- Tell the students to print the worksheet for Activity 33.1 and bring it to class
- Tell the students to print the equations from Unit 17 or, preferably, the AFCoKaRE Exam Handout and bring it to class
- You may wish to modify the lesson plan so that instead of writing the memo at the end, you spend time going over how to solve the equations numerically (especially if your class uses software other than MATLAB and your students haven't already taken a numerical methods class where they learned how to solve mixed-boundary ODEs).

During Class

- Introduce today's topic and where it fits in the course
 - Slides 1 and 2
- Review of Unit 33 (5 minutes)
 - Slides 3
 - emphasize that while it looks like a diffusion term, the axial dispersion term is different because there is only one dispersion coefficient and it is the same for all species
 - note that it is rarely necessary to include the axial dispersion term to accurately model a plug flow reactor, but that the axial dispersion model can be useful empirically because the amount of mixing can be dialed in from zero (PFR) to infinite (CSTR)
 - Slide 4
 - Point out that there are other boundary conditions besides the Danckwerts boundary conditions
 - Note that because different numerical methods are needed to solve the ODEs for a tubular reactor with axial dispersion than were needed for a PFR
 - Slide 5: ask whether the students have any questions from their pre-class preparation and answer them
- Learning Activity 33.1 (~40 minutes)
 - Slides 6 and 7: Read through the problem statement and the instructions and then give them a few minutes to write out the known constants, then go over the results
 - Slides 8 and 9: Read the instructions and then tell them to find the appropriate mole balance on the exam handout. Ask someone how they can distinguish this equation from the others and note that on an exam they will have to do so. Note that they should be able to write out the Danckwerts boundary conditions. Then give them some time to use the general equation to write the necessary mole balance design equations. Circulate and answer questions as they work. Use slide 9 to go over the results. Discuss how they could also

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use a balance on B, but in this problem it isn't necessary because the balance on A can be solved independently.

- Slides 11 through 13: Proceed in the same manner as above: put up a slide with a task, give them time to answer on their worksheet (circulate as they do), then use the next slide to review and show the next task.
- Slide 14: Show them the results and discuss briefly, then tell them to write a memo as directed on the worksheet. After some time have a few volunteers share their memos and discuss.
- Summary
 - Slide 15: Put the material covered in this class into the overall context of the course.

After Class

- Make the complete slides and the MATLAB code for Activity 33.1 available to the students