University of Kentucky
Chemical & Materials Engineering Department
CME 550: Chemical Reactor Design
Homework 6

Due at *beginning* of class on Wednesday, October 19, 2005
Partial credit will be given in ½-point increments.

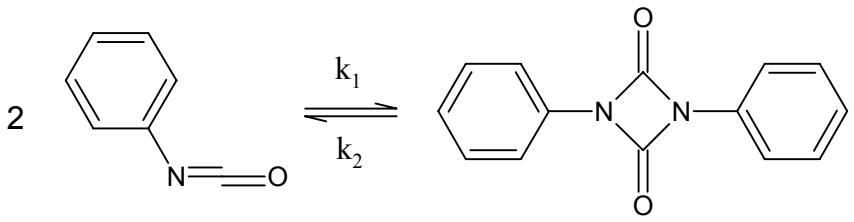
1) [2 pt] Levenspiel 6.9 (Clarification – the question is asking you to keep the same conversion and to assume that the same reactor is used, so the volumetric flowrate of feed needs to change.)

2) [2 pt] Levenspiel 6.16

3) [2 pt] Levenspiel 6.20

4) [2 pt] (adapted from C. Hill, "An Introduction to Chemical Engineering Kinetics and Reactor Design," Wiley, 1977.)

   Buckles and McGrew [*J. Am. Chem. Soc.* 88, 1966] have studied the dimerization of phenyl isocyanate in liquid solution in the presence of a catalyst.



   The forward reaction is third-order (second-order with respect to monomer and first-order with respect to catalyst). The reverse reaction is second-order overall (first-order with respect to both catalyst and dimer). The reaction is catalyzed by tributylphosphine at a concentration of 0.05 moles/liter. The following data relative to the reaction at 25 C are available:

   $K_c = 0.178$
   $k_1 = 1.15 \times 10^{-3}\ L^2 / (mol*s)$
   $E_1 = 1.12$ kcal/mol
   $E_2 = 11.6$ kcal/mol

   If a monomer solution at a concentration of 1 mol/L is fed to a MFR at 0 C, determine the space time necessary to achieve a conversion corresponding to 90% of the equilibrium value. If the reactor volume is 100 L, what is the corresponding volumetric flowrate?

5) Levenspiel 7.2 and 7.4 [1 pt]

6) Levenspiel 7.8 [1 pt]