Ch En 386

**Winter 2014 Homework**

**Homework #4 (20 points)**

**Due Friday, January 31**

*Conditioning Problems (0.5 points each- you may not work with other students):*

1. For the reaction 2A + B 🡪 C in a flow reactor, write FB = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in terms of XA and inlet molar flow rates of A and B.
2. For any reactor, is CA= CA0\* (1-XA) under all circumstances? Explain your answer.
3. For the reaction 2A + B 🡪C in a flow reactor, what is XB if XA = 0.4 and the molar feed rates of A and B are equal? You must show the math.
4. For ideal gas phase reactions, when would *v* = *v0*?

Magnitude and Reasonableness Problems *(0.5 points each)*

1. For the reaction A + 2B 🡪 C, can XA ever be 0.6 if you have equal molar feed rates in a steady state flow reactor? Explain your reasoning.
2. For a gas phase irreversible reaction A + B 🡪 C in a plug flow reactor, can the concentration of A increase down the length of the reactor? Assume an equimolar feed. Explain your reasoning.

*Lesson 8: Building Blocks: Rate laws as a function of conversion*

1. (3 points) Fogler P3-11 a. For this problem, set up the table like we did in class. Do not use the  and Θ notation. Then express the concentration of each species and the rate law as a function of conversion. Finally, answer any additional questions.
2. (4 points) Fogler P3-13 a-f
3. (3 points) Fogler P3-16a

*Lesson 9: Building Blocks: Rate laws as a function of conversion*

1. (4 points) Fogler P3-11 b-d. For this problem, set up the table like we did in class. Do not use the  and Θ notation. Then express the concentration of each species and the rate law as a function of conversion. Finally, answer any additional questions.
2. (3 points) Using –rA you derived in Fogler P3-11 a (problem 7 above), plot -1/rA vs XA at constant T=300K up to XA = 0.9 where A is ethylene oxide. You may assume that the inlet volumetric flow rate is 10 ft3/min. How would your graph change if the inlet volumetric flow rate was tripled but the inlet concentrations stayed the same? What are the units of -1/rA? Now you know where the -1/rA curves come from that were used in Chapter 2. Note that if CA0 and/or CB0 changes, then the graph changes. Thus, the graphs can be dependent upon inlet conditions.