CHG 3127
Assignment#1
(Due date: 01/25/2011 by 13:00)

<u>Problem1</u>

The reaction

$$\mathrm{A} \rightarrow \mathrm{B}$$

is to be carried out isothermally in a continuous-flow reactor. Calculate both the CSTR and PFR reactor volumes necessary to consume 99% of A when the entering molar flow rate is 5 mol/h, assuming the reaction rate $-r_A$ is:

(a) $-r_A = k$ with $k = 0.05\dfrac{mol}{h.dm^3}$

(b) $-r_A = kC_A$ with $k = 0.0001\ s^{-1}$

(c) $-r_A = kC_A^2$ with $k = 3\ \dfrac{dm^3}{mol.h}$

The entering volumetric flow rate is $10\,dm^3/h$.

<u>Problem 2</u>

(a) A noval reactor used in special processing operations is the foam (liquid +gas) reactor. Assuming that the reaction occurs only in liquid phase, derive the differential general mole balance Equation in terms of

$$-r_A = \text{rate of reaction,g mol A per cm}^3 \text{ of liquid per second}$$

$$\mathrm{e} = \text{volume fraction of gas}$$

$$F_A = \text{molar flow rate of A, gmol/s}$$

$$\mathrm{V} = \text{volume of reactor}$$

(b) If the volume of constant-pressure batch reactor varied in a manner like, $V = V_0 + V_1 \sin \omega t$, write mole balance for this reactor.

<u>Problem 3</u>

The gas-phase reaction

$$A \rightarrow B + C$$

is carried out isothermally in a 20-dm^3 constant-volume batch reactor. Twenty moles of pure A is initially placed in the reactor. The reactor is well mixed.

(a) If the reaction is first order:

$$-r_A = kC_A \qquad \text{with } k = 0.865\,\mathrm{min}^{-1}$$

calculate the time necessary to reduce the number of moles of A in the reactor to 0.2 mol.

(b) If the reaction is second order:

$$-r_A = kC_A^2 \qquad \text{with } k = \frac{2dm^3}{mol.\mathrm{min}}$$

calculate the time necessary to consume 19.0 mol of A.

(c) If the temperature is 127ºC , what is the initial total pressure? What is the final total pressure assuming the reaction goes to completion?