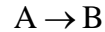


**CHG 3127**  
**Assignment #1**  
(Due date: 01/25/2011 by 13:00)

**Problem 1**

The reaction



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  $k = 0.05 \frac{\text{mol}}{\text{h.dm}^3}$
- (b)  $-r_A = kC_A$  with  $k = 0.0001 \text{ s}^{-1}$
- (c)  $-r_A = kC_A^2$  with  $k = 3 \frac{\text{dm}^3}{\text{mol.h}}$

The entering volumetric flow rate is  $10 \text{ dm}^3/\text{h}$ .

**Problem 2**

- (a) A novel 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

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

$e$  = volume fraction of gas

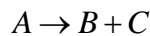
$F_A$  = molar flow rate of A, gmol/s

$V$  = 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.

**Problem 3**

The gas-phase reaction



is carried out isothermally in a  $20\text{-dm}^3$  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:

$$-r_A = kC_A \quad \text{with } k = 0.865 \text{ min}^{-1}$$

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:

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

calculate the time necessary to consume 19.0 mol of A.

- (c) If the temperature is  $127^\circ\text{C}$ , what is the initial total pressure? What is the final total pressure assuming the reaction goes to completion?