Name **KEY** gtID# _____

ChBE 4300(A) – Kinetics and Reactor Design
School of Chemical & Biomolecular Engineering
Georgia Institute of Technology
Spring 2014

Quiz #3 – February 28th, 2014
Closed Book, 10 minutes

The mass balance for species j in any well-mixed reactor can be written as:

$$\frac{dN_j}{dt} = F_{jo} - F_j + r_j V$$

The space time necessary to achieve 50 percent conversion in a steady-state CSTR is 1 hr. Determine the reactor volume required to process 1 ft³-hr⁻¹ at this conversion.

A is limiting reactant

$$F_{A0} - F_{A0}(1-x) + r_A U = 0$$

$$C_{A0} U_0 X = -r_A V$$

$$\frac{C_{A0}}{-r_A} = \frac{\tau}{X} = \frac{1\,hr}{0.5} = 2\,hr$$

Solve for V:

$$V = \left(\frac{C_{A0}}{-r_A}\right) U_0 X$$

$$= (2\,hr)(1\,\frac{ft^3}{hr})(0.5)$$

$$\boxed{V = 1\,ft^3}$$