Name KEY gtID# _____

ChBE 4300(A) – Kinetics and Reactor Design

School of Chemical & Biomolecular Engineering
Georgia Institute of Technology
Spring 2014

Quiz #4 – March 7th, 2014
Closed Book, 10 minutes

The mass balance for species j in a CSTR can be written as:

$$\frac{dN_j}{dt} = F_{jo} - F_j + r_j V \qquad 0 \text{ steady state}$$

You are trying to determine the rate constant, k, for a zeroth order, liquid phase reaction

$$A \rightarrow B \qquad r_A = -k$$

in a series of two, steady-state CSTRs of identical volume, V. The inlet volumetric flow rate, v_o, is held constant while inlet concentration of A, C_{Ao}, is varied. You measure the outlet concentration of A, C_{A2}, after the second reactor.

How would you plot your experimental data so that the value of k can be extracted? Clearly indicate what aspect of the curve (e.g. its slope, y-intercept, etc.) yields the value of k.

Outlet of 1st reactor:

$$C_{A0}v_0 - C_{A1}v_0 - kV = 0$$

$$C_{A1} = C_{A0} - k\tau$$

Outlet of 2nd reactor:

$$(C_{A0} - k\tau)v_0 - C_{A2}v_0 - kV = 0$$

$$C_{A0} - k\tau - C_{A2} - k\tau = 0$$

$$C_{A2} = C_{A0} - 2k\tau$$

C_{A2} = y (measured), C_{A0} = mx (varied), $-2k\tau$ = b