

Name

KEY

gtID#

**ChBE 4300(A) – Kinetics and Reactor Design**

School of Chemical &amp; Biomolecular Engineering

Georgia Institute of Technology

Spring 2014

Quiz #4 – March 7<sup>th</sup>, 2014

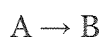
Closed Book, 10 minutes

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

$$\frac{dM_j}{dt} = F_{j0} - F_j + r_j V$$

0 steady state

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



$$r_A = -k$$

in a series of two, steady-state CSTRs of identical volume,  $V$ . The inlet volumetric flow rate,  $v_0$ , is held constant while inlet concentration of A,  $C_{A0}$ , 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 1<sup>st</sup> reactor:

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

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

Outlet of 2<sup>nd</sup> reactor:

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

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

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

$\underbrace{C_{A2}}_y = \underbrace{C_{A0}}_{mx} - \underbrace{2k\tau}_b$

↑  
measured

↑  
varied

