

Chemical Reaction Engineering I

Quiz 5

by
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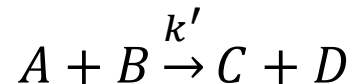
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QUESTION 1

Chemical C can be synthesized via a gaseous reaction at 131°C as follows;



The reaction follows elementary rate law when using catalyst 1 and catalyst 2. The reaction kinetics and side reaction are shown below:

Catalyst 1	Catalyst 2
$k'_1 = 20 \text{ L}^2 \text{kgcat}^{-1} \text{mol}^{-1} \text{min}^{-1}$	$k'_1 = 73 \text{ L}^2 \text{kgat}^{-1} \text{mol}^{-1} \text{min}^{-1}$
$E_1 = 42.3 \text{ kJmol}^{-1}$	$E_1 = 23 \text{ kJmol}^{-1}$
No side reaction	Elementary side reaction
	$2A \xrightarrow{k'_2} E$
	$k'_2 = 150 \text{ L}^2 \text{kgat}^{-1} \text{mol}^{-1} \text{min}^{-1}$
	$E_2 = 23 \text{ kJmol}^{-1}$

Estimate the residence time for a constant-volume reactor for each catalyst converting 90% of A at 150°C. Initial concentration of A and B are 1 mol/L respectively. (catalyst 1; $t = 0.25 \text{ min}$ catalyst 2 = 0.09 min)



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