Assignment 1

(Submission deadline-31 Aug 2021, 5 PM)

1. The exothermic reaction of stillbene (A) to form the economically important trospophene (B) and methane (C),

$$A \rightarrow B + C$$

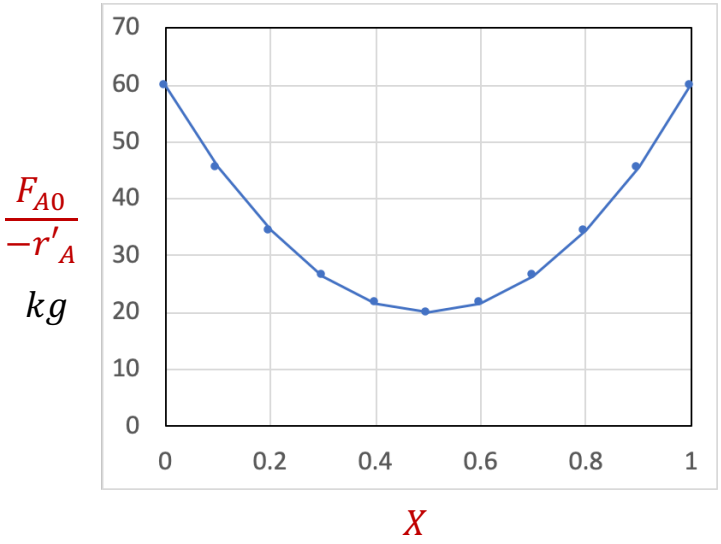
was carried out adiabatically and the following data recorded:

X	0	0.2	0.4	0.45	0.5	0.6	0.8	0.9
$-r_A$ mol/(L.min)	1.0	1.67	5.0	5.0	5.0	5.0	1.25	0.91

The entering molar flow rate of A was 300 mol/min.

(a) What are the PFR and CSTR volumes necessary to achieve 40% conversion?
(b) Over what range of conversions would the CSTR and PFR reactor volumes be identical?
(c) What is the maximum conversion that can be achieved in a 105L CSTR?
(d) What conversion can be achieved if a 72L PFR is followed in series by a 24L CSTR?
(e) What conversion can be achieved if a 24L CSTR is followed in a series by a 72L PFR?

2. The curve shown below is typical of a gas-solid catalytic exothermic reaction carried out adiabatically.



The curve can be approximated to $\frac{F_{A0}}{-r'_A} = 20 + 160(X - 0.5)^2$

For F_{A0} = 2 mol/s,

(a) Assuming that you have a fluidized CSTR and a PBR containing equal weights of catalyst, how should they be arranged for this adiabatic reaction? Use the smallest amount of catalyst weight to achieve 80% conversion of A.
(b) What is the catalyst weight necessary to achieve 80% conversion in a fluidized CSTR?
(c) What is the catalyst weight necessary to achieve 40% conversion in a fluidized CSTR?
(d) What is the catalyst weight necessary to achieve 80% conversion in a fluidized PBR?
(e) What is the catalyst weight necessary to achieve 40% conversion in a fluidized PBR?