Unit 6 - Week 5

Week 5 Assignment 5

The due date for submitting this assignment has passed. Due on 2018-03-14, 23:59 IST.

Submitted assignment

1) For identical feed composition and flow rate, $M$ plug flow reactors in series with a total volume $V$ give the same conversion as a single.

   - a. Plug flow reactor of volume $V$.
   - b. Plug flow reactor of volume $MV$.
   - c. Plug flow reactor of volume $V/M$.
   - d. CSTR of volume $V$.

   No, the answer is incorrect.

   Score: 0

   Accepted Answers:
   b. Plug flow reactor of volume $MV$.

2) For the following reaction data, where $X_A$: conversion, $F_{A0}$: molar flow rate in for $A$ (mol m$^{-3}$ s$^{-1}$) and $r_A$: rate of reaction (mol m$^{-3}$ s$^{-1}$), find the volume of CSTR necessary (in m$^3$) to achieve 70% conversion.

<table>
<thead>
<tr>
<th>$X_A$</th>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.4</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_{A0}$ = $r_A$</td>
<td>0.89</td>
<td>1.08</td>
<td>1.33</td>
<td>2.05</td>
<td>3.56</td>
<td>5.06</td>
<td>8</td>
</tr>
</tbody>
</table>

No, the answer is incorrect.

Score: 0

Accepted Answers:
(Type: Range) 3.5,3.6

3) Exact same reaction data as question 2. Two PFR’s in series are employed as shown below:

Derive the volume of second PFR (in m$^3$).

No, the answer is incorrect.

Score: 0

Accepted Answers:
(Type: Range) 1.6,1.7

4) Which of the following is the ideal steady state mole balance equation for a CSTR?
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5. The reaction
   \[ \text{aA} + \text{bB} \rightarrow \text{cC} + \text{dD} \]
   follows elementary rate law. Which of the following is true?

- a. \( r_A = k C_A^a C_B^b \)
- b. \( r_A = k C_A^{a/2} C_B^b \)
- c. \( r_A = k C_A \)
- d. \( r_A = k C_A C_B \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.69, 0.7

6. The reaction
   \[ \text{aA} + \text{bB} \rightarrow \text{cC} + \text{dD} \]
   follows elementary rate law. Which of the following is true?

- a. \( r_A = k C_A^a C_B^b \)
- b. \( r_A = k C_A^{a/2} C_B^b \)
- c. \( r_A = k C_A \)
- d. \( r_A = k C_A C_B \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
a. \( r_A = k C_A^a C_B^b \)

7. For the reaction
   \[ \text{aA} + \text{bB} \rightarrow \text{Product} \]
   The rate law, \( r_A = k[A]^m[B]^n \) also given are the following data:

<table>
<thead>
<tr>
<th>Experiment Number</th>
<th>[A] in molL-1</th>
<th>[B] in molL-1</th>
<th>Rate (M/S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.100</td>
<td>0.100</td>
<td>2×10^{-3}</td>
</tr>
<tr>
<td>2</td>
<td>0.200</td>
<td>0.100</td>
<td>4×10^{-3}</td>
</tr>
<tr>
<td>3</td>
<td>0.200</td>
<td>0.200</td>
<td>16×10^{-3}</td>
</tr>
</tbody>
</table>

Which of the following is true?

- a. m=1, n=1
- b. m=1, n=2
- c. m=2, n=1
- d. m=2, n=2

No, the answer is incorrect.
Score: 0
8) For a CSTR operating at steady state, which of the following statements are true? 

- a. Concentration of product in the reactor changes with time.
- b. Concentration of product in the reactor does not change with time.
- c. Concentration of reactants and products both vary spatially inside the reactor.
- d. Concentration of product in the reactor increases continuously with time.

No, the answer is incorrect.
Score: 0

Accepted Answers:
- b. Concentration of product in the reactor does not change with time

9) For a CSTR operating at steady state

- a. Exit stream composition of reaction mixture is different from the reaction mixture composition inside the reactor.
- b. Exit stream composition of reaction mixture is the same as the reaction mixture composition inside the reactor.
- c. Exit stream composition of reaction mixture is the same as the reaction mixture composition of the inlet stream.
- d. None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
- b. Exit stream composition of reaction mixture is the same as the reaction mixture composition inside the reactor.

10) Calculate the PFR volume (in dm³) for the configuration shown below for the reaction data in the table. \( F_{A0} \) is in mol S⁻¹ and \( r_A \) is in mol dm⁻³ S⁻¹.

\[
\begin{array}{cccccccc}
X_A & 0 & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 & 0.8 \\
F_{A0}/r_A & 164 & 167 & 173 & 193 & 217 & 263 & 347 & 482 & 694 \\
\end{array}
\]

No, the answer is incorrect.
Score: 0

Accepted Answers:
- (Type: Range) 51.52

11)
Calculate the CSTR volume (in dm³) for the configuration shown below for the reaction data in the table. F_{A_0} is in molS⁻¹ and r_A is in mol dm⁻³ S⁻¹.

<table>
<thead>
<tr>
<th>X_A</th>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>F_{A_0}/r_A</td>
<td>164</td>
<td>167</td>
<td>173</td>
<td>193</td>
<td>217</td>
<td>263</td>
<td>347</td>
<td>482</td>
<td>694</td>
</tr>
</tbody>
</table>

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 346,348