The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min.

\[
A \rightleftharpoons B + C \quad r'_{IC} = k_{1C} \left( C_A - \frac{C_B C_C}{K_{1C}} \right)
\]

\[
A \rightarrow D \quad r'_{2D} = k_{2D} C_A
\]

\[
2C + D \rightarrow 2E \quad r'_{3E} = k_{3E} C_C^2 C_D
\]

Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at \( W = \) ___________

(b) the concentration of C is a maximum at \( W = \) ___________

(c) Explain why the curves look the way they do.

(d) Vary \( k_{1C} \) (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

Additional Information

Overall mass transfer coefficient \( k_B = 1.0 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)

\[
k_{1C} = 2 \text{ dm}^3/\text{kg cat} \cdot \text{min} \\
K_{1C} = 0.2 \text{ mol/dm}^3 \\
k_{2D} = 0.4 \text{ dm}^3/\text{kg cat} \cdot \text{min} \\
k_{3E} = 5 \text{ dm}^9/\text{mol}^2 \cdot \text{kg cat} \cdot \text{min} \\
W_f = 100 \text{ kg}
\]
Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at \( W = \) 

(b) the concentration of C is a maximum at \( W = \) 

(c) Explain why the curves look the way they do.

(d) Vary \( k_{1C} \) (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

**Additional Information**

Overall mass transfer coefficient \( k_B = 0.2 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)
- \( k_{1C} = 2 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)
- \( K_{1C} = 0.2 \text{ mol/dm}^3 \)
- \( k_{2D} = 0.4 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)
- \( k_{3E} = 5 \text{ dm}^9/\text{mol}^2 \cdot \text{kg cat} \cdot \text{min} \)
- \( W_f = 100 \text{ kg} \)

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[
A \rightarrow B + C \quad r'_{IC} = k_{1C} \left[ C_A - \frac{C_B C_C}{K_{1C}} \right]
\]
\[ A \rightarrow D \quad r_{2D}^* = k_{2D} C_A \]

\[ 2C + D \rightarrow 2E \quad r_{3E}^* = k_{3E} C_C^2 C_D \]

Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at \( W = \) 
(b) the concentration of C is a maximum at \( W = \) 
(c) Explain why the curves look the way they do.

(d) Vary \( k_{1C} \) (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

**Additional Information**

Overall mass transfer coefficient \( k_B = 5.0 \text{ dm}^3 / \text{kg cat} \cdot \text{min} \)

\( k_{1C} = 2 \text{ dm}^3 / \text{kg cat} \cdot \text{min} \)

\( K_{1C} = 0.2 \text{ mol/dm}^3 \)

\( k_{2D} = 0.4 \text{ dm}^3 / \text{kg cat} \cdot \text{min} \)

\( k_{3E} = 5 \text{ dm}^9 / \text{mol}^2 \cdot \text{kg cat} \cdot \text{min} \)

\( W_f = 100 \text{ kg} \)

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[ A \leftrightarrow B + C \quad r_{1C}^* = k_{1C} \left[ C_A - \frac{C_B C_C}{K_{1C}} \right] \]

\[ A \rightarrow D \quad r_{2D}^* = k_{2D} C_A \]
Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at \( W = \) ________________

(b) the concentration of C is a maximum at \( W = \) ________________

(c) Explain why the curves look the way they do.

(d) Vary \( k_{1C} \) (0.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

**Additional Information**

Overall mass transfer coefficient \( k_B = 1.0 \text{ dm}^3 / \text{kg cat\text*\text{min}} \)

\( k_{1C} = 0.2 \text{ dm}^3 / \text{kg cat\text*\text{min}} \)

\( K_{1C} = 0.2 \text{ mol/dm}^3 \)

\( k_{2D} = 0.4 \text{ dm}^3 / \text{kg cat\text*\text{min}} \)

\( k_{3E} = 5 \text{ dm}^9 / \text{mol}^2 \cdot \text{kg cat\text*\text{min}} \)

\( W_f = 100 \text{ kg} \)

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[
\begin{align*}
A \rightleftharpoons &B + C & r'_{1C} = k_{1C} \left[ C_A - \frac{C_B C_C}{K_{1C}} \right] \\
A &\rightarrow D & r'_{2D} = k_{2D} C_A \\
2C + D &\rightarrow 2E & r'_{3E} = k_{3E} C_C^2 C_D
\end{align*}
\]
Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at \( W = \) 

(b) the concentration of C is a maximum at \( W = \) 

(c) Explain why the curves look the way they do.

(d) Vary \( k_{IC} \) (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

Additional Information

Overall mass transfer coefficient \( k_B = 1.0 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)

\( k_{1C} = 10 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)

\( K_{1C} = 0.2 \text{ mol/dm}^3 \)

\( k_{2D} = 0.4 \text{ dm}^3/\text{kg cat} \cdot \text{min} \)

\( k_{3E} = 5 \text{ dm}^9/\text{mol}^2 \cdot \text{kg cat} \cdot \text{min} \)

\( W_f = 100 \text{ kg} \)

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[
A \rightarrow B + C \quad \quad \quad r'_C = k_{1C} \left[ C_A - \frac{C_B C_C}{K_{1C}} \right]
\]

\[
A \rightarrow D \quad \quad \quad r'_2D = k_{2D} C_A
\]

\[
2C + D \rightarrow 2E \quad \quad \quad r'_3E = k_{3E} C_C^2 C_D
\]

Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the
(a) the concentration of B is a maximum at $W =$ ________________

(b) the concentration of C is a maximum at $W =$ ________________

(c) Explain why the curves look the way they do.

(d) Vary $k_{1C}$ (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

Additional Information

Overall mass transfer coefficient $k_B = 1.0 \text{ dm}^3/\text{kg cat} \cdot \text{min}$

$k_{1C} = 2 \text{ dm}^3/\text{kg cat} \cdot \text{min}$

$K_{1C} = 0.2 \text{ mol/dm}^3$

$k_{2D} = 0.4 \text{ dm}^3/\text{kg cat} \cdot \text{min}$

$k_{3E} = 20 \text{ dm}^9/\text{mol}^2 \cdot \text{kg cat} \cdot \text{min}$

$W_f = 100 \text{ kg}$

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[
\begin{align*}
A &\rightarrow B + C & r'_1 &= k_{1C}[C_A - \frac{C_B C_C}{K_{1C}}] \\
A &\rightarrow D & r'_2 &= k_{2D} C_A \\
2C + D &\rightarrow 2E & r'_3 &= k_{3E} C_C^2 C_D
\end{align*}
\]

Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at $W =$ ________________

(b) the concentration of C is a maximum at $W =$ ________________
(c) Explain why the curves look the way they do.

(d) Vary \( k_{1C} \) (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

**Additional Information**

Overall mass transfer coefficient \( k_B = 1.0 \text{ dm}^3/\text{kg cat}\times\text{min} \)

\[ k_{1C} = 2 \text{ dm}^3/\text{kg cat}\times\text{min} \]
\[ K_{1C} = 0.2 \text{ mol/dm}^3 \]
\[ k_{2D} = 0.4 \text{ dm}^3/\text{kg cat}\times\text{min} \]
\[ k_{3E} = 10 \text{ dm}^9/\text{mol}^2\times\text{kg cat}\times\text{min} \]
\[ W_f = 100 \text{ kg} \]

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The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[ \text{A} \rightleftharpoons \text{B} + \text{C} \quad r'_{1C} = k_{1C} \left( C_A - \frac{C_B C_C}{K_{1C}} \right) \]
\[ \text{A} \rightarrow \text{D} \quad r'_{2D} = k_{2D} C_A \]
\[ 2\text{C} + \text{D} \rightarrow 2\text{E} \quad r'_{3E} = k_{3E} C_C^2 C_D \]

Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at \( W = \) ____________

(b) the concentration of C is a maximum at \( W = \) ____________

(c) Explain why the curves look the way they do.
(d) Vary $k_{1C}$ (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.

Additional Information

Overall mass transfer coefficient $k_B = 15 \text{ dm}^3/\text{kg cat} \cdot \text{min}$
\[ k_{1C} = 2 \text{ dm}^3/\text{kg cat} \cdot \text{min} \]
\[ K_{1C} = 0.2 \text{ mol/dm}^3 \]
\[ k_{2D} = 0.4 \text{ dm}^3/\text{kg cat} \cdot \text{min} \]
\[ k_{3E} = 5 \text{ dm}^9/\text{mol}^2 \cdot \text{kg cat} \cdot \text{min} \]
\[ W_f = 100 \text{ kg} \]

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure $A$ enters the reactor at 24.6 atm and 500K and a flow rate of $A$ of 10 mol/min

\[ \begin{align*}
A &\rightarrow B + C & r'_{1C} = k_{1C} \left[ C_A - \frac{C_B C_C}{K_{1C}} \right] \\
A &\rightarrow D & r'_{2D} = k_{2D} C_A \\
2C + D &\rightarrow 2E & r'_{3E} = k_{3E} C_C^2 C_D
\end{align*} \]

Only species $B$ diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of $B$ is a maximum at \[ W = \] 
(b) the concentration of $C$ is a maximum at \[ W = \] 

(c) Explain why the curves look the way they do.

(d) Vary $k_{1C}$ (.1 to 1000) and write a paragraph describing what you observe. Explain whether or not what you observe is reasonable.
Additional Information

Overall mass transfer coefficient $k_B = 1.0 \text{ dm}^3/\text{kg cat} \cdot \text{min}$

- $k_{1C} = 2 \text{ dm}^3/\text{kg cat} \cdot \text{min}$
- $K_{1C} = 0.2 \text{ mol/dm}^3$
- $k_{2D} = 0.8 \text{ dm}^3/\text{kg cat} \cdot \text{min}$
- $k_{3E} = 5 \text{ dm}^9/\text{mol}^2 \cdot \text{kg cat} \cdot \text{min}$
- $W_f = 100 \text{ kg}$

The gas phase reactions take place isothermally in a membrane reactor packed with catalyst. Pure A enters the reactor at 24.6 atm and 500K and a flow rate of A of 10 mol/min

\[ \begin{align*}
A &\xleftarrow{} B + C & r'_{1C} = k_{1C} \left[ C_A - \frac{C_B C_C}{K_{1C}} \right] \\
A &\rightarrow D & r'_{2D} = k_{2D} C_A \\
2C + D &\rightarrow 2E & r'_{3E} = k_{3E} C_C^2 C_D
\end{align*} \]

Only species B diffuses out of the reactor through the membrane. At what point in the reactor is the

(a) the concentration of B is a maximum at $W =$ ____________
(b) the concentration of C is a maximum at $W =$ ____________
(c) Explain why the curves look the way they do.
(d) Vary $k_{1C}$ (.1 to 1000) and write a paragraph describing what you. Explain whether or not what you observe is reasonable.
Additional Information

Overall mass transfer coefficient $k_B = 1.0 \text{ dm}^3 / \text{kg cat} \cdot \text{min}$

$k_{1C} = 2 \text{ dm}^3 / \text{kg cat} \cdot \text{min}$

$K_{1C} = 0.2 \text{ mol/dm}^3$

$k_{2D} = 2 \text{ dm}^3 / \text{kg cat} \cdot \text{min}$

$k_{3E} = 5 \text{ dm}^9 / \text{mol}^2 \cdot \text{kg cat} \cdot \text{min}$

$W_f = 100 \text{ kg}$