Assignment 3

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2019-02-20, 23:59 IST.

The assignment 3 of CRE-II is from the topics covered in Week 3 lectures.

1) The rate parameters for the proposed mechanism of butanol dehydrogenation were determined by linear regression of experimental data. Using the following rate law, find the approximate weight of the catalyst required for 90% conversion in packed bed reactor (PBR).

Given that \( P_{A0} = 10 \text{ atm}, \ F_{A0} = 10 \text{ mol/min}, \) and assume isobaric and isothermal condition, and rate law as given below.

\[
\frac{r_A}{k} = \frac{0.56P_A}{(1+2.04P_A)^2} \text{ mol/h/gram of catalyst and } P_A = P_{A0}^{(1-X)/(1+X)} \text{ atm.}
\]

- 0.36 kg
- 1.87 kg
- 112 kg
- 21.4 kg

No, the answer is incorrect.
Score: 0

Accepted Answers:

21.4 kg

2) Repeat the previous question to find weight of catalyst required in case of ideal CSTR (instead of packed bed reactor).

- 37.0 kg
- 7.88 kg
- 0.13 kg
- None of the above

No, the answer is incorrect.
Score: 0
I. $S \rightarrow TiO_2 + P$

where “TTIP” is titanium tetraisopropoxide, “I” is an intermediate, “P1” and “P2” are by-products of respective reactions. Assume homogeneous gas phase reaction of TTIP to be in equilibrium. Note: $k_s$ and $K_I$ is a rate constant and equilibrium constant for the 2nd reaction, respectively, while $k$ and $K$ are lumped parameters. Which of the following is a correct rate law? Assume third reaction to be rate controlling. Hint: Apply PSSH for the other reactions.

$$r_{TiO_2} = \frac{k_{P2}^{TTIP}}{P_{P1} + K_{P2}^{TTIP}}$$

$$r_{TiO_2} = \frac{k_{P2}^{TTIP}}{P_{P1} + K_{P2}^{TTIP}}$$

$$r_{TiO_2} = \frac{k_{P2}^{TTIP}}{(P_{P1} + K_{P2}^{TTIP})^2}$$

$$r_{TiO_2} = \frac{k_{P2}^{TTIP}}{P_{P1}^2 + K_{P2}^{TTIP}}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$r_{TiO_2} = \frac{k_{P2}^{TTIP}}{P_{P1} + K_{P2}^{TTIP}}$

4) For the rate law derived in previous question, which of the following statement is false? 1 point

- Reaction is first order in TTIP at high partial pressure of TTIP.
- Reaction is second order in TTIP at low partial pressure of TTIP.
- Reaction is zero order in TTIP at a very low partial pressure of P1.
- Reaction is zero order in TTIP at high partial pressure of TTIP.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Reaction is first order in TTIP at high partial pressure of TTIP.

5) w3q3_match 1 point

From the above, identify the correct match for the deactivation of catalysts.

- A-2, B-1, C-2, D-3, E-2
- A-2, B-2, C-3, D-3, E-1
- A-2, B-3, C-2, D-3, E-1
- A-2, B-1, C-3, D-3, E-2

No, the answer is incorrect.

Score: 0

Accepted Answers:

A-2, B-3, C-2, D-3, E-1

6) Which of the following captures the deactivation dynamics in packed bed reactor of length $L$ and maximum weight of catalyst $W_{max}$ at exit? 1 point

- w3q4_a
- w3q4_b
- w3q4_c
Limiting reactant in a multi-molecular chemical reaction decides the ________.  
- rate constant  
- conversion  
- reaction speed  
- equilibrium constant

For Non-dissociative adsorption of species A & B, if $C_T$ is total active sites, $C_{A,S}$ and $C_{B,S}$ are adsorbed species concentration, and $C_V$ is vacant sites, then

$C_T = C_V + C_{A,S} + C_{B,S}$  
$C_T < C_{A,S} + C_{B,S}$  
$C_T > C_{A,S} + C_{B,S}$  
$C_T = C_V$

$C_T = C_V + C_{A,S} + C_{B,S}$  
$C_T > C_{A,S} + C_{B,S}$