Unit 6 - Week 4: Interpretation of Batch Reactor Data

Assignment 4

The data for this assignment has been passed. As per our records you have not submitted this assignment.

1. What will be the rate expression for the following diagram?

   ![Diagram](image)

   \[
   \frac{d[X]}{dt} = k_1 [X] [Y] \]

   \[
   \frac{d[Y]}{dt} = k_2 [X] [Y] \]

   \[
   \frac{d[Z]}{dt} = k_3 [X] [Y] \]

   \[
   \frac{d[W]}{dt} = k_4 [X] [Y] \]

   a. \frac{d[Y]}{dt} = k_2 [X] [Y] \]

   b. \frac{d[Z]}{dt} = k_3 [X] [Y] \]

   c. \frac{d[W]}{dt} = k_4 [X] [Y] \]

   d. \frac{d[X]}{dt} = k_1 [X] [Y] \]

   No, the answer is incorrect.

   Accepted Answer:
   \[
   \frac{d[Y]}{dt} = k_2 [X] [Y] \]

   2. The rate equation for a reaction \( \ce{A + B \rightarrow C} \) is \( \frac{d[C]}{dt} = k_1 [A] [B] \). A plot of \( \frac{d[C]}{dt} \) versus \( [C] \) gives a

   a. straight line with a steep \( \text{slope} \)

   b. straight line with a shallow \( \text{slope} \)

   c. parabola

   d. hyperbola

   No, the answer is incorrect.

   Accepted Answer:
   c. parabola

   3. If the following consecutive, irreversible, first-order, liquid phase reaction in a reactor involves a batch reactor \( \ce{A -> B -> C} \), where \( k_1 \) is in the reaction rate constant for first reaction and \( k_2 \) be the reaction rate constant for the second-order reaction. The rate of reaction of \( B \) can be written as

   a. \( \frac{d[B]}{dt} = k_1 [A] \]

   b. \( \frac{d[B]}{dt} = k_2 [B] \]

   c. \( \frac{d[B]}{dt} = k_1 [A] [B] \]

   d. \( \frac{d[B]}{dt} = k_2 [A] [B] \]

   No, the answer is incorrect.

   Accepted Answer:
   c. \( \frac{d[B]}{dt} = k_1 [A] [B] \)

   4. Consider the reversible reaction \( \ce{A \rightleftharpoons B} \). Both reactions are 1st order. If the equilibrium constant for the reaction at any temperature is \( K \), the equilibrium conversion is equal to

   a. \( \frac{K}{1+K} \]

   b. \( \frac{1}{K} \]

   c. \( \frac{K}{1} \]

   d. \( \frac{1}{K} \]

   No, the answer is incorrect.

   Accepted Answer:
   a. \( \frac{K}{1+K} \)

   5. Consider the reaction \( \ce{A \rightleftharpoons B} \) with \( \frac{d[A]}{dt} = k_2 [A] \). If the concentration of \( A \) is very high, then the reaction order and the rate constant will be

   a. \( 2, k_2 \)

   b. \( 1, k_1 \)

   c. \( 1, k_2 \)

   d. \( 3, k_2 \)

   No, the answer is incorrect.

   Accepted Answer:
   b. \( 1, k_1 \)

   6. The following liquid phase reaction is taking place in an isothermal batch reactor

   \[
   \frac{d[B]}{dt} = k \]

   Feed concentration = 1 and after \( t_1 \) and after \( t_2 \) the rate of change of reaction from \( [B]_0 \) is given by.

   a. \( \max(\text{rounded off to decimal places}) \)

   b. \( \min(\text{rounded off to decimal places}) \)

   No, the answer is incorrect.

   Accepted Answer:
   a. \( \max(\text{rounded off to decimal places}) \)

   7. A series reaction \( \ce{A \rightarrow B \rightarrow C} \) occurs in a batch reactor. Both the rate constants are equal i.e. \( k_1 = k_2 \). Initial concentration of \( A \) is 5 mol. The minimum concentration of \( B \) will be

   a. \( 2.5 \text{ mol} \)

   b. \( 3.5 \text{ mol} \)

   c. \( 4.5 \text{ mol} \)

   d. \( 5.5 \text{ mol} \)

   No, the answer is incorrect.

   Accepted Answer:
   c. \( 4.5 \text{ mol} \)