Important Kinetics for Set of Three Parallel Reactions Formulas PDF

Formulas
Examples
with Units

List of 13
Important Kinetics for Set of Three Parallel Reactions Formulas

1) Average Life-Time for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$t_{1/2av} = \frac{0.693}{k_1 + k_2 + k_3}$$

Example with Units

$$5377.5122\,s = \frac{0.693}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}}$$

2) Concentration of Product B in Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$R_b = \frac{k_1}{k_1 + k_2 + k_3} \cdot A_0 \cdot \left(1 - \exp\left(-\left(k_1 + k_2 + k_3\right) \cdot t\right)\right)$$

Example with Units

$$1.6332\,mol/L = \frac{0.00000567\,s^{-1}}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot 100\,mol/L \cdot \left(1 - \exp\left(-\left(0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}\right) \cdot 3600\,s\right)\right)$$

3) Concentration of Product C in Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$C = \frac{k_2}{k_1 + k_2 + k_3} \cdot A_0 \cdot \left(1 - \exp\left(-\left(k_1 + k_2 + k_3\right) \cdot t\right)\right)$$

Example with Units

$$25.5489\,mol/L = \frac{0.0000887\,s^{-1}}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot 100\,mol/L \cdot \left(1 - \exp\left(-\left(0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}\right) \cdot 3600\,s\right)\right)$$

4) Concentration of Product D in Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$R_d = \frac{k_3}{k_1 + k_2 + k_3} \cdot A_0 \cdot \left(1 - \exp\left(-\left(k_1 + k_2 + k_3\right) \cdot t\right)\right)$$

Example with Units

$$9.9373\,mol/L = \frac{0.0000345\,s^{-1}}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot 100\,mol/L \cdot \left(1 - \exp\left(-\left(0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}\right) \cdot 3600\,s\right)\right)$$

5) Concentration of Reactant A at Time t for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$R_A = A_0 \cdot \exp\left(-\left(k_1 + k_2 + k_3\right) \cdot t\right)$$

Example with Units

$$62.8806\,mol/L = 100\,mol/L \cdot \exp\left(-\left(0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}\right) \cdot 3600\,s\right)$$

6) Initial Concentration of Reactant A for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$A_0 = R_A \cdot \exp\left(\left(k_1 + k_2 + k_3\right) \cdot t\right)$$

Example with Units

$$96.214\,mol/L = 60.5\,mol/L \cdot \exp\left(\left(0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}\right) \cdot 3600\,s\right)$$

7) Rate Constant for Reaction A to B for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$k_1 = \frac{1}{t} \cdot \ln\left(\frac{A_0}{R_A}\right) - \left(k_2 + k_3\right)$$

Example with Units

$$1.6\text{E-}5\,s^{-1} = \frac{1}{3600\,s} \cdot \ln\left(\frac{100\,mol/L}{60.5\,mol/L}\right) - \left(0.0000887\,s^{-1} + 0.0000345\,s^{-1}\right)$$

8) Rate Constant for Reaction A to C for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$k_2 = \frac{1}{t} \cdot \ln\left(\frac{A_0}{R_A}\right) - \left(k_1 + k_3\right)$$

Example with Units

$$9.9\text{E-}5\,s^{-1} = \frac{1}{3600\,s} \cdot \ln\left(\frac{100\,mol/L}{60.5\,mol/L}\right) - \left(0.00000567\,s^{-1} + 0.0000345\,s^{-1}\right)$$

9) Rate Constant for Reaction A to D for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$k_3 = \frac{1}{t} \cdot \ln\left(\frac{A_0}{R_A}\right) - \left(k_1 + k_2\right)$$

Example with Units

$$4.5\text{E-}5\,s^{-1} = \frac{1}{3600\,s} \cdot \ln\left(\frac{100\,mol/L}{60.5\,mol/L}\right) - \left(0.00000567\,s^{-1} + 0.0000887\,s^{-1}\right)$$

10) Time taken for Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$t = \frac{1}{k_1 + k_2 + k_3} \cdot \ln\left(\frac{A_0}{R_A}\right)$$

Example with Units

$$3899.4865\,s = \frac{1}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot \ln\left(\frac{100\,mol/L}{60.5\,mol/L}\right)$$

11) Time taken to form Product B from Reactant A in Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$t = \frac{k_1}{k_1 + k_2 + k_3} \cdot A_0$$

Example with Units

$$4399.7827\,s = \frac{0.00000567\,s^{-1}}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot 100\,mol/L$$

12) Time taken to form Product C from Reactant A in Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$T_{CtoA\_3} = \frac{k_2}{k_1 + k_2 + k_3} \cdot A_0$$

Example with Units

$$68829.0525\,s = \frac{0.0000887\,s^{-1}}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot 100\,mol/L$$

13) Time taken to form Product D from Reactant A in Set of Three Parallel Reactions Formula

Evaluate Formula

Formula

$$T_{DtoA} = \frac{k_3}{k_1 + k_2 + k_3} \cdot A_0$$

Example with Units

$$26771.1647\,s = \frac{0.0000345\,s^{-1}}{0.00000567\,s^{-1} + 0.0000887\,s^{-1} + 0.0000345\,s^{-1}} \cdot 100\,mol/L$$

Variables used in list of Kinetics for Set of Three Parallel Reactions Formulas above

- A_0 Initial Concentration of Reactant A *(Mole per Liter)*
- **C** Concentration of C at time t *(Mole per Liter)*
- k_1 Reaction Rate Constant 1 *(1 Per Second)*
- k_2 Reaction Rate Constant 2 *(1 Per Second)*
- k_3 Rate Constant of Reaction 3 *(1 Per Second)*
- R_A Reactant A Concentration *(Mole per Liter)*
- R_b Concentration of Reactant B *(Mole per Liter)*
- R_d Concentration of reactant D *(Mole per Liter)*
- **t** Time *(Second)*
- $t_{1/2av}$ Life Time for Parallel Reaction *(Second)*
- T_{CtoA_3} Time C to A for 3 Parallel Reaction *(Second)*
- T_{DtoA} Time D to A for 3 Parallel Reaction *(Second)*

Constants, Functions, Measurements used in list of Kinetics for Set of Three Parallel Reactions Formulas above

- Functions: **exp**, exp(Number)
  n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.
- Functions: **ln**, ln(Number)
  The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Molar Concentration** in Mole per Liter (mol/L)
  Molar Concentration Unit Conversion
- Measurement: **First Order Reaction Rate Constant** in 1 Per Second (s^{-1})
  First Order Reaction Rate Constant Unit Conversion

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