Consecutive Reactions Formulas

List of 9 Consecutive Reactions Formulas

Consecutive Reactions

1) Conc. of Intermediate B provided Reactant A Conc. at time t given k2 much greater than k1

Open Calculator

fx $$[B] = A \cdot \left(\frac{k_1}{k_2 - k_1} \right)$$

ex $$0.064386\text{mol/L} = 101\text{mol/L} \cdot \left(\frac{0.00000567\text{s}^{-1}}{0.0089\text{s}^{-1} - 0.00000567\text{s}^{-1}} \right)$$

2) Concentration of Intermediate B in First Order Consecutive Reaction

Open Calculator

fx $$[B] = A_0 \cdot \left(\frac{k_1}{k_2 - k_1} \right) \cdot (\exp(-k_1 \cdot t) - \exp(-k_2 \cdot t))$$

ex $$0.06246\text{mol/L} = 100\text{mol/L} \cdot \left(\frac{0.00000567\text{s}^{-1}}{0.0089\text{s}^{-1} - 0.00000567\text{s}^{-1}} \right) \cdot (\exp(-0.00000567\text{s}^{-1} \cdot 3600\text{s}) - \exp(-0.0089\text{s}^{-1} \cdot$$

3) Concentration of Product C in First Order Consecutive Reaction

Open Calculator

fx $$[C] = A_0 \cdot \left(1 - \left(\frac{1}{k_2 - k_1} \cdot (k_2 \cdot (\exp(-k_1 \cdot t) - k_1 \cdot \exp(-k_2 \cdot t))) \right)\right)$$

ex $$1.958048\text{mol/L} = 100\text{mol/L} \cdot \left(1 - \left(\frac{1}{0.0089\text{s}^{-1} - 0.00000567\text{s}^{-1}} \cdot (0.0089\text{s}^{-1} \cdot (\exp(-0.00000567\text{s}^{-1} \cdot 3600\text{s}) -$$

4) Concentration of Product C when k2 much greater than k1 in 1st Order Consecutive Reaction

Open Calculator

fx $$[C] = A_0 \cdot (1 - \exp(-k_1 \cdot t))$$

ex $$2.020509\text{mol/L} = 100\text{mol/L} \cdot (1 - \exp(-0.00000567\text{s}^{-1} \cdot 3600\text{s}))$$

5) Concentration of Reactant A in First Order Consecutive Reaction

Open Calculator

fx $$A = A_0 \cdot \exp(-k_1 \cdot t)$$

ex $$97.97949\text{mol/L} = 100\text{mol/L} \cdot \exp(-0.00000567\text{s}^{-1} \cdot 3600\text{s})$$

6) Maximum Concentration of Intermediate B in First Order Consecutive Reaction

Open Calculator

fx $$[B] = A_0 \cdot \left(\frac{k_2}{k_1}\right)^{\frac{k_2}{k_1 - k_2}}$$

ex $$0.06341\text{mol/L} = 100\text{mol/L} \cdot \left(\frac{0.0089\text{s}^{-1}}{0.00000567\text{s}^{-1}}\right)^{\frac{0.0089\text{s}^{-1}}{0.00000567\text{s}^{-1} - 0.0089\text{s}^{-1}}}$$

7) Secular Eqm- Ratio of Conc. of A to B given of half-lives provided k2 much greater than k1

Open Calculator

fx $$R_{A:B} = \frac{t_{1/2,B}}{t_{1/2,A}}$$

ex $$0.8 = \frac{800\text{s}}{1000\text{s}}$$

8) Time required to form Maximum Concentration of Intermediate B in First Order Consecutive Reaction

Open Calculator

fx $$t_{maxB} = \frac{1}{k_1 - k_2} \cdot \ln\left(\frac{k_1}{k_2}\right)$$

ex $$827.338\text{s} = \frac{1}{0.00000567\text{s}^{-1} - 0.0089\text{s}^{-1}} \cdot \ln\left(\frac{0.00000567\text{s}^{-1}}{0.0089\text{s}^{-1}}\right)$$

9) Transient Eqm- Ratio of B by A when k2 much greater than k1 for 1st Order Consecutive Rxn

Open Calculator

fx $$R_{B:A} = \frac{k_1}{k_2 - k_1}$$

ex $$0.000637 = \frac{0.00000567\text{s}^{-1}}{0.0089\text{s}^{-1} - 0.00000567\text{s}^{-1}}$$

Variables Used

- **[B]** Concentration of B at Time t *(Mole per Liter)*
- **[C]** Concentration of C at Time t *(Mole per Liter)*
- **A** Concentration of A at Time t *(Mole per Liter)*
- $\mathbf{A_0}$ Initial Concentration of Reactant A *(Mole per Liter)*
- $\mathbf{k_1}$ Reaction Rate Constant 1 *(1 Per Second)*
- $\mathbf{k_2}$ Rate Constant of Reaction 2 *(1 Per Second)*
- $\mathbf{R_{A:B}}$ A to B Ratio
- $\mathbf{R_{B:A}}$ B to A Ratio
- **t** Time *(Second)*
- $\mathbf{t_{1/2,A}}$ Half life of A *(Second)*
- $\mathbf{t_{1/2,B}}$ Half life of B *(Second)*
- $\mathbf{t_{maxB}}$ Time at maxB *(Second)*

Constants, Functions, Measurements used

- Function: **exp**, exp(Number)
  Exponential function
- Function: **ln**, ln(Number)
  Natural logarithm function (base e)
- 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

Check other formula lists

- **Consecutive Reactions Formulas**

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