Collision Theory and Chain Reactions Formulas

List of 8 Collision Theory and Chain Reactions Formulas

Collision Theory and Chain Reactions

1) Concentration of Radical formed during Chain Propagation Step given kw and kg

Open Calculator

fx $$[R]_{CP} = \frac{k_1 \cdot [A]}{k_2 \cdot (1 - \alpha) \cdot [A] + (k_w + k_g)}$$

ex $$0.072233\text{M} = \frac{70\text{L}/(\text{mol*s}) \cdot 60.5\text{M}}{0.00011\text{L}/(\text{mol*s}) \cdot (1 - 2.5) \cdot 60.5\text{M} + (30.75\text{s}^{-1} + 27.89\text{s}^{-1})}$$

2) Concentration of Radical formed in Chain Reaction

Open Calculator

fx $$[R]_{CR} = \frac{k_1 \cdot [A]}{k_2 \cdot (1 - \alpha) \cdot [A] + k_3}$$

ex $$84.67037\text{M} = \frac{70\text{L}/(\text{mol*s}) \cdot 60.5\text{M}}{0.00011\text{L}/(\text{mol*s}) \cdot (1 - 2.5) \cdot 60.5\text{M} + 60\text{L}/(\text{mol*s})}$$

3) Concentration of Radical in Non-Stationary Chain Reactions

Open Calculator

fx $$[R]_{nonCR} = \frac{k_1 \cdot [A]}{-k_2 \cdot (\alpha - 1) \cdot [A] + (k_w + k_g)}$$

ex $$0.072233\text{M} = \frac{70\text{L}/(\text{mol*s}) \cdot 60.5\text{M}}{-0.00011\text{L}/(\text{mol*s}) \cdot (2.5 - 1) \cdot 60.5\text{M} + (30.75\text{s}^{-1} + 27.89\text{s}^{-1})}$$

4) Concentration of Radical in Stationary Chain Reactions

Open Calculator

fx $$[R]_{SCR} = \frac{k_1 \cdot [A]}{k_w + k_g}$$

ex $$0.07222M = \frac{70L/(mol*s) \cdot 60.5M}{30.75s^{-1} + 27.89s^{-1}}$$

5) Number of Collision per Unit Volume per Unit Time between A and B

fx

Open Calculator

$$Z_{NAB} = \left(\pi \cdot \left((\sigma_{AB})^2\right) \cdot Z_{AA} \cdot \left(\frac{\left(\frac{8 \cdot [BoltZ] \cdot T_{Kinetics}}{\pi \cdot \mu}\right)^1}{2}\right)\right)$$

ex $$2.8E\hat{}\text{-}20/(m^3*s) = \left(\pi \cdot \left((2m)^2\right) \cdot 12/(m^3*s) \cdot \left(\frac{\left(\frac{8 \cdot [BoltZ] \cdot 85K}{\pi \cdot 8kg}\right)^1}{2}\right)\right)$$

6) Number of Collision per Unit Volume per Unit Time between Same Molecule

Open Calculator

fx $$Z_A = \frac{1 \cdot \pi \cdot \left((\sigma)^2\right) \cdot V_{avg} \cdot \left(\left(N^*\right)^2\right)}{1.414}$$

ex $$1.3E\hat{}6/(m^3*s) = \frac{1 \cdot \pi \cdot \left((10m)^2\right) \cdot 500m/s \cdot \left((3.4/m^3)^2\right)}{1.414}$$

7) Ratio of Pre-Exponential Factor

Open Calculator

fx $$A12_{ratio} = \frac{\left((D1)^2\right) \cdot \left(\sqrt{\mu\ 2}\right)}{\left((D2)^2\right) \cdot \left(\sqrt{\mu\ 1}\right)}$$

ex $$7.348469 = \frac{\left((9m)^2\right) \cdot \left(\sqrt{4g/mol}\right)}{\left((3m)^2\right) \cdot \left(\sqrt{6g/mol}\right)}$$

8) Ratio of Two Maximum Rate of Biomolecular Reaction

Open Calculator

fx $$rmax12_{ratio} = \frac{\left(\frac{T_1}{T_2}\right)^1}{2}$$

ex $$0.388889 = \frac{\left(\frac{350K}{450K}\right)^1}{2}$$

Variables Used

- **[A]** Concentration of Reactant A *(Molar(M))*
- **$[R]_{CP}$** Concentration of Radical given CP *(Molar(M))*
- **$[R]_{CR}$** Concentration of Radical given CR *(Molar(M))*
- **$[R]_{nonCR}$** Concentration of Radical given nonCR *(Molar(M))*
- **$[R]_{SCR}$** Concentration of Radical given SCR *(Molar(M))*
- **$A12_{ratio}$** Ratio of Pre Exponential Factor
- **D1** Collision Diameter 1 *(Meter)*
- **D2** Collision Diameter 2 *(Meter)*
- **k_1** Reaction Rate Constant for Initiation Step *(Liter per Mole Second)*
- **k_2** Reaction Rate Constant for Propagation Step *(Liter per Mole Second)*
- **k_3** Reaction Rate Constant for Termination Step *(Liter per Mole Second)*
- **k_g** Rate Constant within Gaseous Phase *(1 Per Second)*
- **k_w** Rate Constant at Wall *(1 Per Second)*
- **N^*** Number of A Molecules Per Unit Volume of Vessel *(1 per Cubic Meter)*
- **$rmax12_{ratio}$** Ratio of Two Maximum Rate of Biomolecular Reaction
- **T_1** Temperature 1 *(Kelvin)*
- **T_2** Temperature 2 *(Kelvin)*
- **$T_{Kinetics}$** Temperature_Kinetics *(Kelvin)*
- **V_{avg}** Average Speed of Gas *(Meter per Second)*
- **Z_A** Molecular Collision *(Collisions per Cubic Meter per Second)*
- **Z_{AA}** Molecular Collision per Unit Volume per Unit Time *(Collisions per Cubic Meter per Second)*

- **Z_{NAB}** Number of Collision between A and B *(Collisions per Cubic Meter per Second)*
- **α** No. of Radicals Formed
- **μ** Reduced Mass *(Kilogram)*
- **μ 1** Reduced Mass 1 *(Gram Per Mole)*
- **μ 2** Reduced Mass 2 *(Gram Per Mole)*
- **σ** Diameter of Molecule A *(Meter)*
- **σ_{AB}** Closeness of Approach for Collision *(Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[BoltZ]**, 1.38064852E-23 Joule/Kelvin
  Boltzmann constant
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Molar Concentration** in Molar(M) (M)
  Molar Concentration Unit Conversion
- Measurement: **Molar Mass** in Gram Per Mole (g/mol)
  Molar Mass Unit Conversion
- Measurement: **Carrier Concentration** in 1 per Cubic Meter ($1/m^3$)
  Carrier Concentration Unit Conversion
- Measurement: **First Order Reaction Rate Constant** in 1 Per Second (s^{-1})
  First Order Reaction Rate Constant Unit Conversion
- Measurement: **Second Order Reaction Rate Constant** in Liter per Mole Second (L/(mol*s))
  Second Order Reaction Rate Constant Unit Conversion
- Measurement: **Collision Frequency** in Collisions per Cubic Meter per Second ($1/(m^3*s)$)
  Collision Frequency Unit Conversion

Check other formula lists

- **Collision Theory Formulas**
- **Collision Theory and Chain Reactions Formulas**
- **Enzyme Kinetics Formulas**
- **First Order Reaction Formulas**
- **Important Formulas on Enzyme Kinetics**
- **Important Formulas on Reversible Reaction**
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