N11 – Collision Theory and More

|  |  |  |
| --- | --- | --- |
| **Elementary Step** | **Molecularity** | **Rate Law** |
| A → products | Unimolecular | Rate = k[A] |
| A + A → products (2A → products) |  Bimolecular | Rate = k[A]2 |
| A + B → products | Rate = k[A][B] |
| A + A + B → products (2A + B → products) | Termolecular | Rate = k[A]2[B] |
| A + B + C → products | Rate = k[A][B][C] |

$k=Ae^{\left(\frac{-E\_{a}}{RT}\right)}$ $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{E\_{a}}{R}\left(\frac{1}{T\_{1}}-\frac{1}{T\_{2}}\right)$ or...
 $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{-E\_{a}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)$

$ln⁡(k)=-\frac{E\_{a}}{R}\left(\frac{1}{T}\right)+ln⁡(A)$

* *-Ea / R* is the slope when graphing ln(*k*) vs. (1/T)
* ln(*A*) is the y-intercept
* *Ea = -R(slope)*
* Graphing ln(*k*) vs (1/T) and taking line of best fit
can quickly yield a slope

N11 – Collision Theory and More

|  |  |  |
| --- | --- | --- |
| **Elementary Step** | **Molecularity** | **Rate Law** |
| A → products | Unimolecular | Rate = k[A] |
| A + A → products (2A → products) |  Bimolecular | Rate = k[A]2 |
| A + B → products | Rate = k[A][B] |
| A + A + B → products (2A + B → products) | Termolecular | Rate = k[A]2[B] |
| A + B + C → products | Rate = k[A][B][C] |

$k=Ae^{\left(\frac{-E\_{a}}{RT}\right)}$ $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{E\_{a}}{R}\left(\frac{1}{T\_{1}}-\frac{1}{T\_{2}}\right)$ or...
 $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{-E\_{a}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)$

$ln⁡(k)=-\frac{E\_{a}}{R}\left(\frac{1}{T}\right)+ln⁡(A)$

* *-Ea / R* is the slope when graphing ln(*k*) vs. (1/T)
* ln(*A*) is the y-intercept
* *Ea = -R(slope)*
* Graphing ln(*k*) vs (1/T) and taking line of best fit
can quickly yield a slope

N11 – Collision Theory and More

|  |  |  |
| --- | --- | --- |
| **Elementary Step** | **Molecularity** | **Rate Law** |
| A → products | Unimolecular | Rate = k[A] |
| A + A → products (2A → products) |  Bimolecular | Rate = k[A]2 |
| A + B → products | Rate = k[A][B] |
| A + A + B → products (2A + B → products) | Termolecular | Rate = k[A]2[B] |
| A + B + C → products | Rate = k[A][B][C] |

$k=Ae^{\left(\frac{-E\_{a}}{RT}\right)}$ $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{E\_{a}}{R}\left(\frac{1}{T\_{1}}-\frac{1}{T\_{2}}\right)$ or...
 $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{-E\_{a}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)$

$ln⁡(k)=-\frac{E\_{a}}{R}\left(\frac{1}{T}\right)+ln⁡(A)$

* *-Ea / R* is the slope when graphing ln(*k*) vs. (1/T)
* ln(*A*) is the y-intercept
* *Ea = -R(slope)*
* Graphing ln(*k*) vs (1/T) and taking line of best fit
can quickly yield a slope

N11 – Collision Theory and More

|  |  |  |
| --- | --- | --- |
| **Elementary Step** | **Molecularity** | **Rate Law** |
| A → products | Unimolecular | Rate = k[A] |
| A + A → products (2A → products) |  Bimolecular | Rate = k[A]2 |
| A + B → products | Rate = k[A][B] |
| A + A + B → products (2A + B → products) | Termolecular | Rate = k[A]2[B] |
| A + B + C → products | Rate = k[A][B][C] |

$k=Ae^{\left(\frac{-E\_{a}}{RT}\right)}$ $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{E\_{a}}{R}\left(\frac{1}{T\_{1}}-\frac{1}{T\_{2}}\right)$ or...
 $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{-E\_{a}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)$

$ln⁡(k)=-\frac{E\_{a}}{R}\left(\frac{1}{T}\right)+ln⁡(A)$

* *-Ea / R* is the slope when graphing ln(*k*) vs. (1/T)
* ln(*A*) is the y-intercept
* *Ea = -R(slope)*
* Graphing ln(*k*) vs (1/T) and taking line of best fit
can quickly yield a slope

N11 – Collision Theory and More

|  |  |  |
| --- | --- | --- |
| **Elementary Step** | **Molecularity** | **Rate Law** |
| A → products | Unimolecular | Rate = k[A] |
| A + A → products (2A → products) |  Bimolecular | Rate = k[A]2 |
| A + B → products | Rate = k[A][B] |
| A + A + B → products (2A + B → products) | Termolecular | Rate = k[A]2[B] |
| A + B + C → products | Rate = k[A][B][C] |

$k=Ae^{\left(\frac{-E\_{a}}{RT}\right)}$ $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{E\_{a}}{R}\left(\frac{1}{T\_{1}}-\frac{1}{T\_{2}}\right)$ or...
 $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{-E\_{a}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)$

$ln⁡(k)=-\frac{E\_{a}}{R}\left(\frac{1}{T}\right)+ln⁡(A)$

* *-Ea / R* is the slope when graphing ln(*k*) vs. (1/T)
* ln(*A*) is the y-intercept
* *Ea = -R(slope)*
* Graphing ln(*k*) vs (1/T) and taking line of best fit
can quickly yield a slope

N11 – Collision Theory and More

|  |  |  |
| --- | --- | --- |
| **Elementary Step** | **Molecularity** | **Rate Law** |
| A → products | Unimolecular | Rate = k[A] |
| A + A → products (2A → products) |  Bimolecular | Rate = k[A]2 |
| A + B → products | Rate = k[A][B] |
| A + A + B → products (2A + B → products) | Termolecular | Rate = k[A]2[B] |
| A + B + C → products | Rate = k[A][B][C] |

$k=Ae^{\left(\frac{-E\_{a}}{RT}\right)}$ $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{E\_{a}}{R}\left(\frac{1}{T\_{1}}-\frac{1}{T\_{2}}\right)$ or...
 $ln\left(\frac{k\_{2}}{k\_{1}}\right)=\frac{-E\_{a}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)$

$ln⁡(k)=-\frac{E\_{a}}{R}\left(\frac{1}{T}\right)+ln⁡(A)$

* *-Ea / R* is the slope when graphing ln(*k*) vs. (1/T)
* ln(*A*) is the y-intercept
* *Ea = -R(slope)*
* Graphing ln(*k*) vs (1/T) and taking line of best fit
can quickly yield a slope