**Elimination Kinetics: Measuring the Rate and Yield of E2 Eliminations**

*Substrate: Bromoethane (Trial 1)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  | |  |  | | **Volume** | | **Volume** | |  | | |
| **R (L\*atm / K\*mol)** | | 0.08206 | |  | **Time** | | **Reading** | | **Produced** | | **Ln** | | |
| **Ambient Temperature (K)** | | 295.15 | |  | **(s)** | | **(mL)** | | **(mL)** | | **(Vf/(Vf-Vt))** | | |
| **Ambient Pressure (atm)** | | 0.826 | |  | 0 | | 31.0 | | 0.0 | | 0.000 | | |
| **Substrate Name** | | Bromoethane | |  | 30 | | 36.2 | | 5.2 | | 2.434 | | |
| **Substrate MW (g/mol)** | | 108.97 | |  | 60 | | 36.3 | | 5.3 | | 2.539 | | |
| **Mass KOH (g)** | | 0.7351 | |  | 90 | | 36.4 | | 5.4 | | 2.944 | | |
| **Volume of solvent (mL)** | | 2.50 | |  | 120 | | 36.4 | | 5.4 | | 2.944 | | |
| **Mass syringe + substrate (g)** | | 4.0960 | |  | 150 | | 36.5 | | 5.5 | | 3.127 | | |
| **Mass empty syringe (g)** | | 3.8700 | |  | 180 | | 36.5 | | 5.5 | | 3.127 | | |
| **Mass substrate (g)** | | 0.2260 | |  | 210 | | 36.5 | | 5.5 | | 3.350 | | |
| **Theoretical Yield (mol)** | | 0.00207 | |  | 240 | | 36.5 | | 5.5 | | 3.350 | | |
| **Theoretical Yield (mL)** | | 60.8 | |  | 270 | | 36.6 | | 5.6 | | 3.638 | | |
| **Actual Yield (mL)** | | 5.7 | |  | 300 | | 36.6 | | 5.6 | | 4.043 | | |
| **Percent Yield** | | 9.4% | |  | 330 | | 36.7 | | 5.7 | | - | | |
| **SN2:E2 Ratio** | | 9.67 | |  | 360 | | 36.7 | | 5.7 | | - | | |
| **KOH Concentration (mol/L)** | | 5.24 | |  | 390 | | 36.7 | | 5.7 | | - | | |
|  | |  | |  | 420 | | 36.7 | | 5.7 | | - | | |
|  | |  | |  |  | |  | |  | |  | | |
| **Slope of Trendline (1/s)** | | 0.00862 | |  |  | |  | |  | |  | | |
| **Pseudo-first-order k1 overall (1/s)** | | 0.00862 | |  |  | |  | |  | |  | | |
| **Second-order k2 overall (L/mol s)** | | 0.00165 | |  |  | |  | |  | |  | | |
| **Second-order k2subs (L/mol s)** | | 0.00149 | |  |  | |  | |  | |  | | |
| **Second-order k2elim (L/mol s)** | | 0.00015 | |  |  | |  | |  | |  | | |
|  |  | |  | | |  | |  | |  | |  |  | |

*Substrate: Bromoethane (Trial 2)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **Volume** | **Volume** |  |
| **R (L\*atm / K\*mol)** | 0.08206 |  | **Time** | **Reading** | **Produced** | **Ln** |
| **Ambient Temperature (K)** | 295.15 |  | **(s)** | **(mL)** | **(mL)** | **(Vf/(Vf-Vt))** |
| **Ambient Pressure (atm)** | 0.826 |  | 0 | 30.0 | 0.0 | 0.000 |
| **Substrate Name** | Bromoethane |  | 30 | 36.1 | 6.1 | 2.051 |
| **Substrate MW (g/mol)** | 108.97 |  | 60 | 36.2 | 6.2 | 2.108 |
| **Mass KOH (g)** | 0.7334 |  | 90 | 36.3 | 6.3 | 2.234 |
| **Volume of solvent (mL)** | 2.50 |  | 120 | 36.4 | 6.4 | 2.457 |
| **Mass syringe + substrate (g)** | 4.0586 |  | 150 | 36.5 | 6.5 | 2.544 |
| **Mass empty syringe (g)** | 3.8650 |  | 180 | 36.6 | 6.6 | 2.862 |
| **Mass substrate (g)** | 0.1936 |  | 210 | 36.7 | 6.7 | 2.996 |
| **Theoretical Yield (mol)** | 0.00178 |  | 240 | 36.7 | 6.7 | 2.996 |
| **Theoretical Yield (mL)** | 52.1 |  | 270 | 36.7 | 6.7 | 3.150 |
| **Actual Yield (mL)** | 7.0 |  | 300 | 36.8 | 6.8 | 3.332 |
| **Percent Yield** | 13.4% |  | 330 | 36.9 | 6.9 | - |
| **SN2:E2 Ratio** | 6.44 |  | 360 | 37.0 | 7.0 | - |
| **KOH Concentration (mol/L)** | 5.23 |  | 390 | 37.0 | 7.0 | - |
|  |  |  | 420 | 37.0 | 7.0 | - |
|  |  |  |  |  |  |  |
| **Slope of Trendline (1/s)** | 0.00777 |  |  |  |  |  |
| **Pseudo-first-order k1 overall (1/s)** | 0.00777 |  |  |  |  |  |
| **Second-order k2 overall (L/mol s)** | 0.00149 |  |  |  |  |  |
| **Second-order k2subs (L/mol s)** | 0.00129 |  |  |  |  |  |
| **Second-order k2elim (L/mol s)** | 0.00020 |  |  |  |  |  |

*Substrate: 1-Bromobutane (Trial 1)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **Volume** | **Volume** |  |
| **R (L\*atm / K\*mol)** | 0.08206 |  | **Time** | **Reading** | **Produced** | **Ln** |
| **Ambient Temperature (K)** | 295.15 |  | **(s)** | **(mL)** | **(mL)** | **(Vf/(Vf-Vt))** |
| **Ambient Pressure (atm)** | 0.826 |  | 0 | 34.9 | 0.0 | 0.000 |
| **Substrate Name** | 1-Bromobutane | | 30 | 37.2 | 2.3 | 0.616 |
| **Substrate MW (g/mol)** | 137.02 |  | 60 | 37.8 | 2.9 | 0.868 |
| **Mass KOH (g)** | 0.7044 |  | 90 | 38.2 | 3.3 | 1.079 |
| **Volume of solvent (mL)** | 2.50 |  | 120 | 38.6 | 3.7 | 1.309 |
| **Mass syringe + substrate (g)** | 3.9456 |  | 150 | 38.9 | 4.0 | 1.561 |
| **Mass empty syringe (g)** | 3.8043 |  | 180 | 39.2 | 4.3 | 1.966 |
| **Mass substrate (g)** | 0.1413 |  | 210 | 39.4 | 4.5 | 2.303 |
| **Theoretical Yield (mol)** | 0.00103 |  | 240 | 39.5 | 4.6 | 2.526 |
| **Theoretical Yield (mL)** | 30.2 |  | 270 | 39.5 | 4.6 | 2.526 |
| **Actual Yield (mL)** | 5.0 |  | 300 | 39.6 | 4.7 | 2.813 |
| **Percent Yield** | 16.5% |  | 330 | 39.7 | 4.8 | 2.996 |
| **SN2:E2 Ratio** | 5.05 |  | 360 | 39.7 | 4.8 | 3.219 |
| **KOH Concentration (mol/L)** | 5.02 |  | 390 | 39.8 | 4.9 | 3.507 |
|  |  |  | 420 | 39.8 | 4.9 | 3.912 |
|  |  |  | 450 | 39.9 | 5.0 | 4.605 |
| **Slope of Trendline (1/s)** | 0.00883 |  | 480 | 39.9 | 5.0 | - |
| **Pseudo-first-order k1 overall (1/s)** | 0.00883 |  | 510 | 39.9 | 5.0 | - |
| **Second-order k2 overall (L/mol s)** | 0.00176 |  | 540 | 39.9 | 5.0 | - |
| **Second-order k2subs (L/mol s)** | 0.00147 |  |  |  |  |  |
| **Second-order k2elim (L/mol s)** | 0.00029 |  |  |  |  |  |