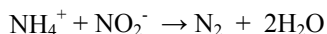


Rate Law Expression



Trial	$[\text{NH}_4^+]$	$[\text{NO}_2^-]$	Initial Rate ($\text{mol L}^{-1} \text{s}^{-1}$)
1	0.100 M	0.0500 M	1.50×10^{-3}
2	0.100 M	0.100 M	3.00×10^{-3}
3	0.200 M	0.100 M	1.20×10^{-2}

$$\text{rate} = k [\text{NH}_4^+]^x [\text{NO}_2^-]^y$$

Trials 1 & 2 hold $[\text{NH}_4^+]$ constant but change $[\text{NO}_2^-]$

Trial	$[\text{NO}_2^-]$	Initial Rate ($\text{mol L}^{-1} \text{s}^{-1}$)
1	0.0500 M	1.50×10^{-3}
2	0.100 M (0.0500 $\times 2$)	3.00×10^{-3} ($1.50 \times 10^{-3} \times 2$)

First order with respect to ammonium concentration

$$\begin{aligned} \text{rate} &= k [\text{NO}_2^-]^1 \\ 1.50 \times 10^{-3} \text{ M s}^{-1} &= k [0.0500 \text{ M}]^1 \\ 3.00 \times 10^{-3} \text{ M s}^{-1} &= k [0.100 \text{ M}]^1 \end{aligned}$$

Trials 2 & 3 hold $[\text{NO}_2^-]$ constant but change $[\text{NH}_4^+]$

Trial	$[\text{NH}_4^+]$	Initial Rate ($\text{mol L}^{-1} \text{s}^{-1}$)
2	0.100 M	3.00×10^{-3}
3	0.200 M (0.100 $\times 2$)	1.20×10^{-2} ($3.00 \times 10^{-3} \times 4$)

Change in $[\text{NH}_4^+]$ changes the Initial Rate by the square of the change in $[\text{NH}_4^+]$

Second order with respect to ammonium concentration

$$\begin{aligned} \text{rate} &= k [\text{NH}_4^+]^2 \\ 3.00 \times 10^{-3} \text{ M s}^{-1} &= k [0.100 \text{ M}]^2 \\ 12.0 \times 10^{-3} \text{ M s}^{-1} &= k [0.200 \text{ M}]^2 \end{aligned}$$

Overall reaction is third order (**2 + 1**)

$$\text{rate} = k [\text{NH}_4^+]^2 [\text{NO}_2^-]^1$$