

SO_2Cl_2 decomposes by first order kinetics and $k = 2.81 \times 10^{-3} \text{ min}^{-1}$ at a given temperature.

The initial concentration of $\text{SO}_2\text{Cl}_2 = 0.015 \text{ M}$.

Determine the half-life of the reaction.

$$t_{1/2} = 0.6931/k \qquad t_{1/2} = 1/(k[A]_0)$$

1. $t_{1/2} = 0.6931/2.81 \times 10^{-3} \text{ min}^{-1} = 246.6 \text{ min}$

2. $t_{1/2} = 0.6931/2.81 \times 10^{-3} \text{ min}^{-1} = 247 \text{ min}$

3. $t_{1/2} = 1/(2.81 \times 10^{-3} \text{ min}^{-1} (0.015)) = 2.37 \times 10^4 \text{ min}$

4. $t_{1/2} = 1/(2.81 \times 10^{-3} \text{ min}^{-1} (0.015)) = 2.4 \times 10^4 \text{ min}$

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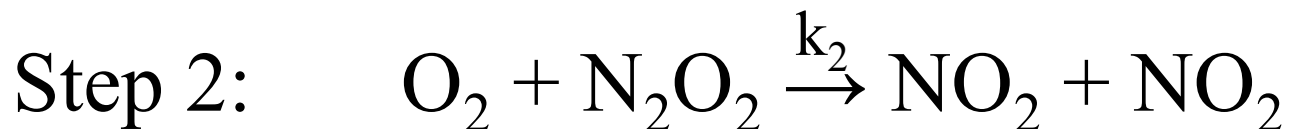
11% 1. $t_{1/2} = 0.6931/2.81 \times 10^{-3} \text{ min}^{-1} = 246.6 \text{ min}$

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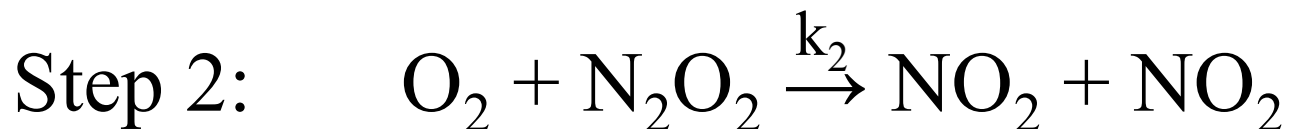
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Select the correct rate law for step 2.



1. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2]$
2. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2]/[\text{NO}_2]^2$
3. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2] k_{-2}[\text{NO}_2]^2$
4. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2]/k_{-2} [\text{NO}_2]^2$

Select the correct rate law for step 2.



71%  1. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2]$

13% 2. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2]/[\text{NO}_2]^2$

6% 3. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2] k_{-2}[\text{NO}_2]^2$

9% 4. $\text{rate} = k_2[\text{O}_2][\text{N}_2\text{O}_2]/k_{-2} [\text{NO}_2]^2$

If the first step is slow and the second step is fast, $k_2[\text{NO}] \gg k_{-1}$.

1. $\text{rate} = k_1[\text{NO}][\text{Br}_2]$

2. $\text{rate} = (k_1k_2k_{-1})[\text{NO}]^2[\text{Br}_2]$

3. $\text{rate} = 2k_1[\text{NO}][\text{Br}_2]$

4. $\text{rate} = (2k_1k_2k_{-1})[\text{NO}]^2[\text{Br}_2]$

If the first step is slow and the second step is fast, $k_2[\text{NO}] \gg k_{-1}$.

16% 1. $\text{rate} = k_1[\text{NO}][\text{Br}_2]$

7% 2. $\text{rate} = (k_1k_2k_{-1})[\text{NO}]^2[\text{Br}_2]$

73% 😊 3. $\text{rate} = 2k_1[\text{NO}][\text{Br}_2]$

4% 4. $\text{rate} = (2k_1k_2k_{-1})[\text{NO}]^2[\text{Br}_2]$

$$\text{rate} = k_{\text{obs}}([\text{O}_3]/[\text{O}_2])$$

Order in O_2 ?

If $[\text{O}_2]$ is doubled/effect on rate?

- | | | |
|----|----|---------------------------|
| 1. | 0 | no effect |
| 2. | 0 | double |
| 3. | 1 | double |
| 4. | 1 | multiply by $\frac{1}{2}$ |
| 5. | -1 | double |
| 6. | -1 | multiply by $\frac{1}{2}$ |
| 7. | -1 | multiply by -1 |

$$\text{rate} = k_{\text{obs}}([\text{O}_3]/[\text{O}_2])$$

Order in O_2 ?

If $[\text{O}_2]$ is doubled/effect on rate?

2%	1.	0	no effect
2%	2.	0	double
10%	3.	1	double
6%	4.	1	multiply by $\frac{1}{2}$
3%	5.	-1	double
73%	6.	-1	multiply by $\frac{1}{2}$
4%	7.	-1	multiply by -1

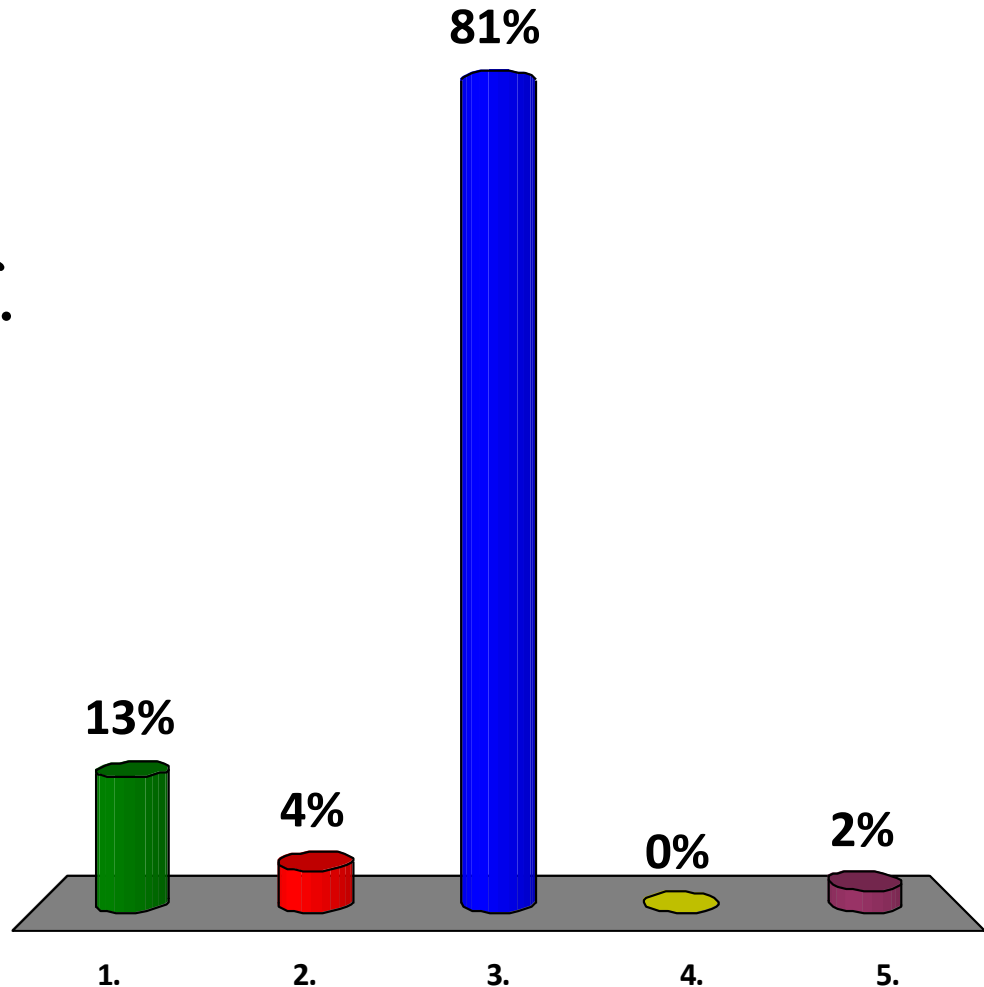


If you double both $[O_3]$ and $[O_2]$, the rate will

1. not change.
2. decrease by half.
3. double.
4. triple.
5. quadruple.

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2. decrease by half.
- 😊 3. double.
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5.111 Principles of Chemical Science
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