SO_2Cl_2 decomposes by first order kinetics and $k = 2.81 \times 10^{-3}\ min^{-1}$ at a given temperature. The initial concentration of $SO_2Cl_2 = 0.015$ M. Determine the half-life of the reaction.

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

1. $t_{1/2} = 0.6931/2.81 \times 10^{-3}\ min^{-1} = 246.6$ min
2. $t_{1/2} = 0.6931/2.81 \times 10^{-3}\ min^{-1} = 247$ min
3. $t_{1/2} = 1/(2.81 \times 10^{-3}\ min^{-1}\ (0.015))= 2.37 \times 10^4$ min
4. $t_{1/2} = 1/(2.81 \times 10^{-3}\ min^{-1}\ (0.015))= 2.4 \times 10^4$ min

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

69% 2. ✓ $t_{1/2} = 0.6931/2.81 \times 10^{-3}\ min^{-1} = 247$ min

12% 3. $t_{1/2} = 1/(2.81 \times 10^{-3}\ min^{-1}\ (0.015)) = 2.37 \times 10^{4}$ min

9% 4. $t_{1/2} = 1/(2.81 \times 10^{-3}\ min^{-1}\ (0.015)) = 2.4 \times 10^{4}$ min

Select the correct rate law for step 2.

Step 2: $O_2 + N_2O_2 \xrightarrow{k_2} NO_2 + NO_2$

1. rate = $k_2[O_2][N_2O_2]$
2. rate = $k_2[O_2][N_2O_2]/[NO_2]^2$
3. rate = $k_2[O_2][N_2O_2]\ k_{-2}[NO_2]^2$
4. rate = $k_2[O_2][N_2O_2]/k_{-2}\ [NO_2]^2$

Select the correct rate law for step 2.

Step 2: $O_2 + N_2O_2 \xrightarrow{k_2} NO_2 + NO_2$

71% ✓ 1. rate = $k_2[O_2][N_2O_2]$

13% 2. rate = $k_2[O_2][N_2O_2]/[NO_2]^2$

6% 3. rate = $k_2[O_2][N_2O_2]\ k_{-2}[NO_2]^2$

9% 4. rate = $k_2[O_2][N_2O_2]/k_{-2}\ [NO_2]^2$

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

1. $\text{rate} = k_1[NO][Br_2]$
2. $\text{rate} = (k_1 k_2 k_{-1})[NO]^2[Br_2]$
3. $\text{rate} = 2k_1[NO][Br_2]$
4. $\text{rate} = (2k_1 k_2 k_{-1})[NO]^2[Br_2]$

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

16% 1. rate = $k_1[NO][Br_2]$

7% 2. rate = $(k_1 k_2 k_{-1})[NO]^2[Br_2]$

73% 3. rate = $2k_1[NO][Br_2]$

4% 4. rate = $(2k_1 k_2 k_{-1})[NO]^2[Br_2]$

$$rate = k_{obs}([O_3]/[O_2])$$

Order in O_2?	If $[O_2]$ is doubled/effect on rate?
1. 0	no effect
2. 0	double
3. 1	double
4. 1	multiply by ½
5. -1	double
6. -1	multiply by ½
7. -1	multiply by -1

$$\text{rate} = k_{obs}([O_3]/[O_2])$$

Responses		Order in O_2?	If $[O_2]$ is doubled/effect on rate?
2%	1.	0	no effect
2%	2.	0	double
10%	3.	1	double
6%	4.	1	multiply by ½
3%	5.	-1	double
73% ✓	6.	-1	multiply by ½
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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