

Summary of Evaluated Kinetic and Photochemical Data for Atmospheric Chemistry

IUPAC Subcommittee on Gas Kinetic Data Evaluation for Atmospheric Chemistry

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Introduction

Since 1980 the **IUPAC Subcommittee on Gas Kinetic Data Evaluation for Atmospheric Chemistry** has published a series of nine evaluations in the *Journal of Physical and Chemical Reference Data*. With the publication of the sixth evaluation (*J. Phys. Chem. Ref. Data*, **26**, pp.521-1011, 1997) the data base had become so extensive that the Subcommittee decided that subsequent evaluations would be limited to dealing in turn with parts of the set of over 700 gas-phase and heterogeneous reactions. Thus the seventh evaluation (*J. Phys. Chem. Ref. Data*, **26**, pp.1329-1499, 1997) dealt with gas-phase O_x, HO_x, NO_x and SO_x reactions ; the eighth evaluation (*J. Phys. Chem. Ref. Data*, **28**, pp.191-393, 1999) with gas-phase organic reactions and the ninth evaluation (*J. Phys. Chem. Ref. Data*, **29**, 167, 2000) with gas-phase halogen reactions. The panel has now updated the evaluations for bimolecular gas-phase Ox, HOx, NOx, and SOx reactions, as well as photochemical reactions of the halogen species. The data sheets for these reactions are now available on this website. Updated evaluations of termolecular gas-phase Ox, HOx, NOx, and SOx reactions, as well as selected organic reactions are currently in preparation by the Subcommittee.

In the desire to communicate the results of these IUPAC Subcommittee recommendations to the atmospheric and kinetic research communities as rapidly as possible, we here present a Summary of the most up-to-date gas-phase kinetic data. The data for O_x, HO_x, NO_x and SO_x reactions are based on a recent evaluation completed by the subcommittee in 2001, which updated the material presented in *J. Phys. Chem. Ref. Data*, **26**, 1329, 1997. Data for organic reactions (including F, Cl and I atom reactions with non halogen-containing organics) are based on those in *J. Phys. Chem. Ref. Data*, **28**, 191, 1999, and for FO_x, ClO_x, BrO_x and IO_x reactions are based on those in *J. Phys. Chem. Ref. Data* **26**, 521, 1997, some of which are updated in *J. Phys. Chem. Ref. Data*, **29**, 167, 2000. Also included in the present Summary are lists of gas-phase photochemical reactions and a list of the heterogeneous atmospheric reactions, which have been considered by the Subcommittee. The tabulated data for heterogeneous reactions was also updated in the last three years. Unfortunately the nature of the data for the atmospheric photochemical and the heterogeneous reactions does not lend itself to a simple summary. At present it is necessary for the user to consult either the data sheets on this website or the original *J. Phys. Chem. Ref. Data* articles for those reactions which have not yet been updated.

Please note that this compilation of summary data must not be disseminated in any way either in hardcopy or electronically without prior consent. It is for personal use only. The most recent compilation of summary data can be found on the subcommittee's website at <http://www.iupac-kinetic.ch.cam.ac.uk/>.

Gas Phase Reactions - Summary of Reactions and Preferred Rate Data

Reaction	k_{298} cm ³ molecule ⁻¹ s ⁻¹	$\Delta \log k_{298}^a$	Temp. dependence of $k/\text{cm}^3 \text{molecule}^{-1} \text{s}^{-1}$	Temp. range/K	Temp. $\Delta(E/R)/\text{K}^a$
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^aThe cited uncertainty is an expanded uncertainty corresponding approximately to a 95% confidence limit.

O_x Reactions - based on data sheets on this website.

$O + O_2 + M \rightarrow O_3 + M$	$6.0 \times 10^{-34} [O_2]$ $5.6 \times 10^{-34} [N_2]$	(k_0)	± 0.05	$6.0 \times 10^{-34}(T/300)^{-2.6}[O_2]$ $5.6 \times 10^{-34}(T/300)^{-2.6}[N_2]$	100-300	$\Delta n = \pm 0.5$
$O + O_3 \rightarrow 2 O_2$	8.0×10^{-15}		± 0.08	$8.0 \times 10^{-12}\exp(-2060/T)$	200-400	± 200
$O(^1D) + O_2 \rightarrow O(^3P) + O_2$	4.0×10^{-11}		± 0.05	$3.2 \times 10^{-11}\exp(67/T)$	200-350	± 100
$O(^1D) + O_3 \rightarrow O_2 + 2 O(^3P)$ $\rightarrow 2 O_2(^3\Sigma_g^-)$	1.2×10^{-10} 1.2×10^{-10}		± 0.1			
Overall	2.4×10^{-10}		± 0.05	2.4×10^{-10}	100-400	
$O_2 + O_3 \rightarrow O + 2 O_2$	See data sheet					
$O_2(^3\Sigma_g^-, v) + M \rightarrow O_2(^3\Sigma_g^-, v') + M$	See data sheet					
$O_2(^1\Delta_g) + M \rightarrow O_2(^3\Sigma_g^-) + M$	1.6×10^{-18} $\leq 1.4 \times 10^{-19}$	(M = O ₂) (M = N ₂)	± 0.2	$3.0 \times 10^{-18}\exp(-200/T)$	100-450	± 200
	5×10^{-18}	(M = H ₂ O)	± 0.3			
	$\leq 2 \times 10^{-20}$	(M = CO ₂)				
$O_2(^1\Delta_g) + O_3 \rightarrow 2O_2 + O$	3.8×10^{-15}		± 0.10	$5.2 \times 10^{-11}\exp(-2840/T)$	280-360	± 500

$O_2(^1\Sigma_g^+) + M \rightarrow O_2(^3\Sigma_g^-) + M$	4.1×10^{-17}	(M = O ₂)	± 0.3			
$\rightarrow O_2(^1\Delta_g) + M$	2.1×10^{-15}	(M = N ₂)	± 0.10	2.1×10^{-15}	200-350	± 200
	8.0×10^{-14}	(M = O(³ P))	± 0.3			
	4.6×10^{-12}	(M = H ₂ O)	± 0.3			
	4.1×10^{-13}	(M = CO ₂)	± 0.10	4.1×10^{-13}	245-360	± 200
$O_2(^1\Sigma_g^+) + O_3 \rightarrow 2O_2 + O$	2.2×10^{-11}					
$\rightarrow O_2(^1\Delta_g) + O_3$			± 0.06	2.2×10^{-11}	295-360	± 300
$O_2 + hv \rightarrow \text{products}$	See data sheet					
$O_3 + hv \rightarrow \text{products}$	See data sheet					

HO_x Reactions - based on data sheets on this website

H + HO ₂ → H ₂ + O ₂	5.6×10^{-12}		± 0.5	5.6×10^{-12}	245-300	$\Delta \log k = \pm 0.5$
→ 2 HO	7.2×10^{-11}		± 0.1	7.2×10^{-11}	245-300	$\Delta \log k = \pm 0.1$
→ H ₂ O + O	2.4×10^{-12}		± 0.5	2.4×10^{-12}	245-300	$\Delta \log k = \pm 0.5$
Overall	8.0×10^{-11}		± 0.1	8.0×10^{-11}	245-300	± 200
H + O ₂ + M → HO ₂ + M	$5.4 \times 10^{-32} [N_2]$	(k ₀)	± 0.1	$5.4 \times 10^{-32} (T/300)^{-1.8} [N_2]$	200-600	$\Delta n = \pm 0.6$
O + HO → O ₂ + H	3.5×10^{-11}		± 0.1	$2.4 \times 10^{-11} \exp(110/T)$	150-500	± 100
O + HO ₂ → HO + O ₂	5.8×10^{-11}		± 0.08	$2.7 \times 10^{-11} \exp(224/T)$	220-400	± 100
O + H ₂ O ₂ → HO + HO ₂	1.7×10^{-15}		± 0.3	$1.4 \times 10^{-12} \exp(-2000/T)$	280-390	± 1000
O(¹ D) + H ₂ → HO + H	1.1×10^{-10}		± 0.1	1.1×10^{-10}	200-350	± 100
O(¹ D) + H ₂ O → 2 HO	2.2×10^{-10}		± 0.1	2.2×10^{-10}	200-350	± 100
HO + H ₂ → H ₂ O + H	6.7×10^{-15}		± 0.1	$7.7 \times 10^{-12} \exp(-2100/T)$	200-450	± 200
HO + HO → H ₂ O + O	1.48×10^{-12}		± 0.15	$6.2 \times 10^{-14} (T/298)^{2.6} \exp(945/T)$	200-350	± 250

$\text{HO} + \text{HO} + \text{M} \rightarrow \text{H}_2\text{O}_2 + \text{M}$	$6.9 \times 10^{-31} [\text{N}_2]$ 2.6×10^{-11} $F_c = 0.50 \pm 0.05$	(k_0) (k_∞)	± 0.1 ± 0.2 ± 0.05	$6.9 \times 10^{-31} (T/300)^{-0.8} [\text{N}_2]$ 2.6×10^{-11} $F_c = 0.50 \pm 0.05$	200-400 200-400 200-400	$\Delta n = \pm 0.5$ $\Delta \log k_\infty = \pm 0.2$
$\text{HO} + \text{HO}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$	1.1×10^{-10}		± 0.1	$4.8 \times 10^{-11} \exp(250/T)$	250-400	± 200
$\text{HO} + \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{HO}_2$	1.7×10^{-12}		± 0.1	$2.9 \times 10^{-12} \exp(-160/T)$	240-460	± 100
$\text{HO} + \text{O}_3 \rightarrow \text{HO}_2 + \text{O}_2$	7.3×10^{-14}		± 0.15	$1.7 \times 10^{-12} \exp(-940/T)$	220-450	± 300
$\text{HO}_2 + \text{HO}_2 \rightarrow \text{H}_2\text{O}_2 + \text{O}_2$	1.6×10^{-12}		± 0.15	$2.2 \times 10^{-13} \exp(600/T)$	230-420	± 200
$\text{HO}_2 + \text{HO}_2 + \text{M} \rightarrow \text{H}_2\text{O}_2 + \text{O}_2 + \text{M}$	$5.2 \times 10^{-32} [\text{N}_2]$ $4.5 \times 10^{-32} [\text{O}_2]$		± 0.15 ± 0.15	$1.9 \times 10^{-33} [\text{N}_2] \exp(980/T)$	230-420	± 300
	See data sheet for effect of H_2O					
$\text{HO}_2 + \text{O}_3 \rightarrow \text{HO} + 2 \text{O}_2$	2.0×10^{-15}		± 0.2	$2.03 \times 10^{-16} (T/300)^{4.57} \exp(693/T)$	250-340	+500/-100
$\text{H}_2\text{O} + \text{hv} \rightarrow \text{HO} + \text{H}$		See data sheets				
$\text{H}_2\text{O}_2 + \text{hv} \rightarrow 2 \text{HO}$		See data sheets				

NO_x Reactions - based on data sheets on this website

$\text{O} + \text{NO} + \text{M} \rightarrow \text{NO}_2 + \text{M}$	$1.0 \times 10^{-31} [\text{N}_2]$ 3.0×10^{-11} $F_c = 0.85$	(k_0) (k_∞)	± 0.1 ± 0.3	$1.0 \times 10^{-31} (T/300)^{-1.6} [\text{N}_2]$ $3.0 \times 10^{-11} (T/300)^{0.3}$ $F_c = 0.85$	200-300 200-300 200-300	$\Delta n = \pm 0.3$ $\Delta n = \pm 0.3$
$\text{O} + \text{NO}_2 \rightarrow \text{O}_2 + \text{NO}$	1.0×10^{-11}		± 0.06	$5.5 \times 10^{-12} \exp(188/T)$	220-420	± 80
$\text{O} + \text{NO}_2 + \text{M} \rightarrow \text{NO}_3 + \text{M}$	$1.3 \times 10^{-31} [\text{N}_2]$ 2.3×10^{-11} $F_c = 0.6$	(k_0) (k_∞)	± 0.30 ± 0.2	$1.3 \times 10^{-31} (T/300)^{-1.5} [\text{N}_2]$ $2.3 \times 10^{-11} (T/300)^{0.24}$ $F_c = 0.6$	200-400 200-400 200-400	$\Delta n = \pm 1$
$\text{O} + \text{NO}_3 \rightarrow \text{O}_2 + \text{NO}_2$	1.7×10^{-11}		± 0.3			

$O(^1D) + N_2 + M \rightarrow N_2O + M$	$2.8 \times 10^{-36} [N_2]$	(k_0)	± 0.5			
$O(^1D) + N_2 \rightarrow O(^3P) + N_2$	2.6×10^{-11}		± 0.1	$1.8 \times 10^{-11} \exp(107/T)$	100-350	± 100
$O(^1D) + N_2O \rightarrow N_2 + O_2$	4.4×10^{-11}		± 0.1	4.4×10^{-11}	200-350	± 100
$\rightarrow 2 NO$	7.2×10^{-11}		± 0.1	7.2×10^{-11}	200-350	± 100
$HO + NH_3 \rightarrow H_2O + NH_2$	1.6×10^{-13}		± 0.1	$3.5 \times 10^{-12} \exp(-925/T)$	230-450	± 200
$HO + HONO \rightarrow H_2O + NO_2$	6.0×10^{-12}		± 0.15	$2.5 \times 10^{-12} \exp(260/T)$	290-380	± 260
$HO + HONO_2 \rightarrow H_2O + NO_3$	1.5×10^{-13}	(1 bar)	± 0.1	See data sheet		
$HO + HO_2NO_2 \rightarrow$ products	3.2×10^{-12}		± 0.15	$3.2 \times 10^{-13} \exp(690/T)$	210-300	± 300
$HO + NO + M \rightarrow HONO + M$	$7.4 \times 10^{-31} [N_2]$	(k_0)	± 0.10	$7.4 \times 10^{-31} (T/300)^{-2.4} [N_2]$	200-400	$\Delta n = \pm 0.5$
	3.3×10^{-11}	(k_∞)	± 0.2	$3.3 \times 10^{-11} (T/300)^{-0.3}$	200-400	$\Delta \log k_\infty = \pm 0.2$
	$F_c = 0.81$					
$HO + NO_2 + M \rightarrow HONO_2 + M$	$3.3 \times 10^{-30} [N_2]$	(k_0)	± 0.1	$3.3 \times 10^{-30} (T/300)^{-3.0} [N_2]$	200-300	$\Delta n = \pm 0.5$
	4.1×10^{-11}	(k_∞)	± 0.3	4.1×10^{-11}	200-400	$\Delta n = \pm 0.5$
	$F_c = 0.4$			$F_c = 0.4$	250-400	
	1.19×10^{-11}	(1 bar)	± 0.3			
$HO + NO_3 \rightarrow HO_2 + NO_2$	2.0×10^{-11}		± 0.3			
$HO_2 + NO \rightarrow HO + NO_2$	8.8×10^{-12}		± 0.1	$3.6 \times 10^{-12} \exp(270/T)$	200-400	± 100
$HO_2 + NO_2 + M \rightarrow HO_2NO_2 + M$	$1.8 \times 10^{-31} [N_2]$	(k_0)	± 0.10	$1.8 \times 10^{-31} (T/300)^{-3.2} [N_2]$	220-360	$\Delta n = \pm 1$
	4.7×10^{-12}	(k_∞)	± 0.2	4.7×10^{-12}	220-360	$\Delta n = \pm 1$
	$F_c = 0.6$			$F_c = 0.6$		

$\text{HO}_2\text{NO}_2 + \text{M} \rightarrow \text{HO}_2 + \text{NO}_2 + \text{M}$	$1.3 \times 10^{-20} [\text{N}_2]$ 0.25 $F_c = 0.6$	(k_0/s^{-1}) (k_∞/s^{-1}) $F_c = 0.6$	± 0.3 ± 0.5	$4.1 \times 10^{-5} \exp(-10650/T) [\text{N}_2]$ $4.8 \times 10^{15} \exp(-11170/T)$ $F_c = 0.6$	260-300	± 500
$\text{HO}_2 + \text{NO}_3 \rightarrow \text{products}$	4.0×10^{-12}		± 0.2			
$\text{NH}_2 + \text{O}_2 \rightarrow \text{products}$	$< 6 \times 10^{-21}$					
$\text{NH}_2 + \text{O}_3 \rightarrow \text{products}$	1.7×10^{-13}		± 0.5	$4.9 \times 10^{-12} \exp(-1000/T)$	250-380	± 500
$\text{NH}_2 + \text{NO} \rightarrow \text{products}$	1.6×10^{-11}		± 0.15	$1.6 \times 10^{-11} (T/298)^{-1.4}$	210-500	$\Delta n = \pm 0.5$
$\text{NH}_2 + \text{NO}_2 \rightarrow \text{products}$	2.0×10^{-11}		± 0.2	$2.0 \times 10^{-11} (T/298)^{-1.3}$	250-500	$\Delta n = \pm 0.7$
$2\text{NO} + \text{O}_2 \rightarrow 2 \text{NO}_2$	$2.0 \times 10^{-38} (\text{cm}^6 \text{ molecule}^{-2} \text{ s}^{-1})$		± 0.1	$3.3 \times 10^{-39} \exp(530/T)$	270-600	± 400
$\text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2$	1.8×10^{-14}		± 0.08	$1.4 \times 10^{-12} \exp(-1310/T)$	195-308	± 200
$\text{NO} + \text{NO}_2 + \text{M} \rightarrow \text{N}_2\text{O}_3 + \text{M}$	$3.1 \times 10^{-34} [\text{N}_2]$ 7.9×10^{-12} $F_c = 0.6$	(k_0) (k_∞) $F_c = 0.6$	± 0.3 ± 0.3	$3.1 \times 10^{-34} (T/300)^{-7.7} [\text{N}_2]$ $7.9 \times 10^{-12} (T/300)^{1.4}$	200-300	$\Delta n = \pm 1$
$\text{N}_2\text{O}_3 + \text{M} \rightarrow \text{NO} + \text{NO}_2 + \text{M}$	$1.6 \times 10^{-14} [\text{N}_2]$ 3.6×10^8 $F_c = 0.6$	(k_0/s^{-1}) (k_∞/s^{-1}) $F_c = 0.6$	± 0.4 ± 0.3	$1.9 \times 10^{-7} (T/300)^{-8.7}$ $\exp(-4880/T) [\text{N}_2]$ $4.7 \times 10^{15} (T/300)^{0.4}$ $\exp(-4880/T)$	225-300	± 200
$\text{NO} + \text{NO}_3 \rightarrow 2 \text{NO}_2$	2.6×10^{-11}		± 0.1	$1.8 \times 10^{-11} \exp(110/T)$	220-420	± 100
$\text{NO}_2 + \text{O}_3 \rightarrow \text{NO}_3 + \text{O}_2$	3.5×10^{-17}		± 0.06	$1.4 \times 10^{-13} \exp(-2470/T)$	230-360	± 150
$\text{NO}_2 + \text{NO}_2 + \text{M} \rightarrow \text{N}_2\text{O}_4 + \text{M}$	$1.4 \times 10^{-33} [\text{N}_2]$ 1.0×10^{-12} $F_c = 0.40$	(k_0) (k_∞) $F_c = 0.40$	± 0.3 ± 0.3	$1.4 \times 10^{-33} (T/300)^{-3.8} [\text{N}_2]$ 1.0×10^{-12}	300-500	$\Delta n = \pm 1$
					250-300	$\Delta \log k = \pm 0.3$

$\text{N}_2\text{O}_4 + \text{M} \rightarrow \text{NO}_2 + \text{NO}_2 + \text{M}$	$6.1 \times 10^{-15}[\text{N}_2]$ 4.4×10^6 $F_c = 0.40$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.3 ± 0.4	$1.3 \times 10^{-5}(T/300)^{-3.8} \exp(-6400/T)[\text{N}_2]$ $1.15 \times 10^{16} \exp(-6460/T)$ $F_c = 0.35$	300-500 250-300 200-400	± 500 ± 500 $\Delta n = \pm 0.5$ $\Delta n = \pm 0.6$
$\text{NO}_2 + \text{NO}_3 + \text{M} \rightarrow \text{N}_2\text{O}_5 + \text{M}$	$3.6 \times 10^{-30}[\text{N}_2]$ 1.9×10^{-12} $F_c = 0.35$	(k_0) (k_∞)	± 0.10 ± 0.2	$3.6 \times 10^{-30}(T/300)^{-4.1}[\text{N}_2]$ $1.9 \times 10^{-12}(T/300)^{0.2}$ $F_c = 0.35$	200-300 200-400 200-400	$\Delta n = \pm 0.5$ $\Delta n = \pm 0.6$
$\text{N}_2\text{O}_5 + \text{M} \rightarrow \text{NO}_2 + \text{NO}_3 + \text{M}$	$1.2 \times 10^{-19}[\text{N}_2]$ 6.9×10^{-2} $F_c = 0.35$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.2 ± 0.3	$1.3 \times 10^{-3}(T/300)^{-3.5}$ $\exp(-11000/T)[\text{N}_2]$ $9.7 \times 10^{14}(T/300)^{0.1}$ $\exp(-11080/T)$ $F_c = 0.35$	200-400 200-300 200-300	$\Delta n = \pm 0.5$ $\Delta n = \pm 0.2$
$\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow 2 \text{ HNO}_3$	2.5×10^{-22}			± 0.3 (at 290 K)		
$\text{N}_2\text{O}_5 + 2\text{H}_2\text{O} \rightarrow \text{HNO}_3 + \text{H}_2\text{O}$	1.8×10^{-39} (cm ⁶ molecule ⁻² s ⁻¹)			± 0.3 (at 290 K)		
$\text{HONO} + \text{hv} \rightarrow \text{products}$		see data sheet				
$\text{HONO}_2 + \text{hv} \rightarrow \text{products}$		see data sheet				
$\text{HO}_2\text{NO}_2 + \text{hv} \rightarrow \text{products}$		see data sheet				
$\text{NO}_2 + \text{hv} \rightarrow \text{products}$		see data sheet				
$\text{NO}_3 + \text{hv} \rightarrow \text{products}$		see data sheet				
$\text{N}_2\text{O} + \text{hv} \rightarrow \text{products}$		see data sheet				
$\text{N}_2\text{O}_5 + \text{hv} \rightarrow \text{products}$		see data sheet				

Organic Reactions - based on data sheets on this website

$\text{O} + \text{CH}_3 \rightarrow \text{products}$	1.3×10^{-10}	± 0.1	1.3×10^{-10}	290-900	± 100
$\text{O}^{\text{1D}} + \text{CH}_4 \rightarrow \text{HO} + \text{CH}_3$	1.05×10^{-10}		1.05×10^{-10}	200-350	
$\rightarrow \text{CH}_3\text{O}$ or $\text{CH}_2\text{OH} + \text{H}$	3.45×10^{-11}		3.45×10^{-11}	200-350	
$\rightarrow \text{HCHO} + \text{H}_2$	7.50×10^{-12}		7.50×10^{-12}	200-350	
Overall	1.50×10^{-10}	± 0.10	1.50×10^{-10}	200-350	± 100
$\text{HO} + \text{CH}_4 \rightarrow \text{H}_2\text{O} + \text{CH}_3$	6.4×10^{-15}	± 0.08	$1.85 \times 10^{-12} \exp(-1690/T)$	200-300	± 100
$\text{HO} + \text{C}_2\text{H}_2 + \text{M} \rightarrow \text{C}_2\text{H}_2\text{OH} + \text{M}$	$5.0 \times 10^{-30} [\text{N}_2] \quad (k_0)$ $1.0 \times 10^{-12} \quad (k_\infty)$ $F_c = 0.37$ $7.8 \times 10^{-13} \text{ (1 bar air)}$	± 0.1 ± 0.3 ± 0.15	$5 \times 10^{-30} (T/300)^{-1.5} [\text{N}_2]$	300-800	$\Delta n = \pm 1.5$
$\text{HO} + \text{C}_2\text{H}_4 + \text{M} \rightarrow \text{C}_2\text{H}_4\text{OH} + \text{M}$	$8.6 \times 10^{-29} [\text{N}_2] \quad (k_0)$ $9 \times 10^{-12} \quad (k_\infty)$ $F_c = 0.48$ $7.9 \times 10^{-12} \text{ (1 bar air)}$	± 0.3 ± 0.3 ± 0.15	$8.6 \times 10^{-29} (T/300)^{-3.1} [\text{N}_2]$ $9 \times 10^{-12} (T/300)^{-0.85}$	200-300 100-500	$\Delta n = \pm 2$ $\Delta n = \pm 0.3$
$\text{HO} + \text{C}_2\text{H}_6 \rightarrow \text{H}_2\text{O} + \text{C}_2\text{H}_5$	2.4×10^{-13}	± 0.08	$6.9 \times 10^{-12} \exp(-1000/T)$	200-300	± 100
$\text{HO} + \text{C}_3\text{H}_6 + \text{M} \rightarrow \text{C}_3\text{H}_6\text{OH} + \text{M}$	$8 \times 10^{-27} [\text{N}_2] \quad (k_0)$ $3.0 \times 10^{-11} \quad (k_\infty)$ $F_c = 0.5$ $2.9 \times 10^{-11} \text{ (1 bar air)}$	± 0.5 ± 0.1 ± 0.15	$8 \times 10^{-27} (T/300)^{-3.5} [\text{N}_2]$ $3.0 \times 10^{-11} (T/300)^{-1.0}$	200-300 200-300	$\Delta n = \pm 1$ $\Delta n = \pm 1$
$\text{HO} + \text{C}_3\text{H}_8 \rightarrow \text{H}_2\text{O} + \text{C}_3\text{H}_7$	1.10×10^{-12}	± 0.08	$7.6 \times 10^{-12} \exp(-585/T)$	200-300	± 100
$\text{HO} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \rightarrow \text{products}$	2.3×10^{-12}	± 0.10	$9.1 \times 10^{-12} \exp(-405/T)$	230-300	± 150
$\text{HO} + \text{CH}_2\text{C}(\text{CH}_3)\text{CHCH}_2 \rightarrow \text{products}$	1.0×10^{-10}	± 0.10	$2.7 \times 10^{-11} \exp(390/T)$	240-430	± 100
$\text{HO} + \alpha\text{-pinene} \rightarrow \text{products}$	5.3×10^{-11}	± 0.15	$1.2 \times 10^{-11} \exp(440/T)$	290-430	± 200
$\text{HO} + \text{CO (+M)} \rightarrow \text{products}$	$1.44 \times 10^{-13} (1 + [\text{N}_2] / 4 \times 10^{19})$ (pressure range: 0 – 1 bar)	± 0.05	$1.44 \times 10^{-13} (1 + [\text{N}_2] / 4 \times 10^{19})$ (pressure range: 0 – 1 bar)	200-300	$\Delta \log k = \pm 0.1$

$\text{HO} + \text{HCHO} \rightarrow \text{H}_2\text{O} + \text{HCO}$	8.5×10^{-12}	± 0.08	$5.4 \times 10^{-12} \exp(135/T)$	200-300	± 100
$\text{HO} + \text{CH}_3\text{CHO} \rightarrow \text{H}_2\text{O} + \text{CH}_3\text{CO}$	1.5×10^{-11}	± 0.08	$4.4 \times 10^{-12} \exp(365/T)$	200-350	± 100
$\text{HO} + \text{C}_2\text{H}_5\text{CHO} \rightarrow \text{products}$	2.0×10^{-11}	± 0.10	$5.1 \times 10^{-12} \exp(405/T)$	240-380	± 200
$\text{HO} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO} \rightarrow \text{products}$	2.4×10^{-11}	± 0.10	$6.0 \times 10^{-12} \exp(410/T)$	250-430	± 250
$\text{HO} + \text{CH}_2=\text{C}(\text{CH}_3)\text{CHO} \rightarrow \text{products}$	2.9×10^{-11}	± 0.10	$8.0 \times 10^{-12} \exp(380/T)$	230-380	± 200
$\text{HO} + (\text{CHO})_2 \rightarrow \text{H}_2\text{O} + \text{HC(O)CO}$	1.1×10^{-11}	± 0.3			
$\text{HO} + \text{HOCH}_2\text{CHO} \rightarrow \text{H}_2\text{O} + \text{HOCH}_2\text{CO}$	8.8×10^{-12}	± 0.10			
$\rightarrow \text{H}_2\text{O} + \text{HOCHCHO}$	2.2×10^{-12}	± 0.10			
Overall	1.1×10^{-11}	± 0.15			
$\text{HO} + \text{CH}_3\text{C(O)CHO} \rightarrow \text{H}_2\text{O} + \text{CH}_3\text{C(O)CO}$	1.5×10^{-11}	± 0.2			
$\text{HO} + \text{CH}_3\text{C(O)CH}_3 \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{C(O)CH}_3$	1.8×10^{-13}	± 0.08	$\{8.8 \times 10^{-12} \exp(-1320/T) + 1.7 \times 10^{-14} \exp(423/T)\}$	195-440	$\Delta \log k = \pm 0.08$
$\text{HO} + \text{CH}_3\text{C(O)CH}_2\text{CH}_3 \rightarrow \text{products}$	1.2×10^{-12}	± 0.15	$1.3 \times 10^{-12} \exp(-25/T)$	240-300	± 200
$\text{HO} + \text{CH}_2=\text{CHC(O)CH}_3 \rightarrow \text{products}$	2.0×10^{-11}	± 0.10	$2.6 \times 10^{-12} \exp(610/T)$	230-380	± 200
$\text{HO} + \text{pinonaldehyde} \rightarrow \text{products}$	4.2×10^{-11}	± 0.25			
$\text{HO} + \text{CH}_3\text{OH} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{OH}$	7.65×10^{-13}				
$\rightarrow \text{H}_2\text{O} + \text{CH}_3\text{O}$	1.35×10^{-13}				
Overall	9.0×10^{-13}	± 0.08	$2.85 \times 10^{-12} \exp(-345/T)$	210-300	± 150
$\text{HO} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{CH}_2\text{OH}$	1.6×10^{-13}	$+0.10/-0.05$		298	
$\rightarrow \text{H}_2\text{O} + \text{CH}_3\text{CHOH}$	2.9×10^{-12}			298	
$\rightarrow \text{H}_2\text{O} + \text{CH}_3\text{CH}_2\text{O}$	1.6×10^{-13}	$+0.10/-0.05$		298	
Overall	3.2×10^{-12}	± 0.08	$3.0 \times 10^{-12} \exp(20/T)$	210-300	± 150
$\text{HO} + \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \rightarrow \text{products}$	5.8×10^{-12}	± 0.10	$4.6 \times 10^{-12} \exp(70/T)$	260-380	± 100

$\text{HO} + \text{CH}_3\text{CH(OH)CH}_3 \rightarrow \text{products}$	5.1×10^{-12}	± 0.08	$2.6 \times 10^{-12} \exp(200/T)$	250-360	± 100
$\text{HO} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \rightarrow \text{products}$	8.5×10^{-12}	± 0.15	$5.3 \times 10^{-12} \exp(140/T)$	260-380	± 200
$\text{HO} + \text{CH}_3\text{CH(OH)CH}_2\text{CH}_3 \rightarrow \text{products}$	8.7×10^{-12}	± 0.15			
$\text{HO} + (\text{CH}_3)_2\text{C(OH)CH=CH}_2 \rightarrow \text{products}$	6.4×10^{-11}	± 0.15	$8.2 \times 10^{-12} \exp(610/T)$	230-300	± 200
$\text{HO} + \text{CH}_3\text{OCH}_3 \rightarrow \text{H}_2\text{O} + \text{CH}_3\text{OCH}_2$	2.8×10^{-12}	± 0.08	$5.7 \times 10^{-12} \exp(-215/T)$	230-300	± 100
$\text{HO} + [-\text{CH}_2\text{CHC(CH}_3\text{)CH}_2\text{O}-] \rightarrow \text{products}$	9.3×10^{-11}	± 0.3			
$\text{HO} + \text{CH}_3\text{C(O)CH}_2\text{OH} \rightarrow \text{products}$	3.0×10^{-12}	± 0.15			
$\text{HO} + (\text{CH}_3)_2\text{C(OH)CHO} \rightarrow \text{products}$	1.5×10^{-11}	± 0.3			
$\text{HO} + \text{CH}_3\text{OOH} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{OOH}$	1.9×10^{-12}			298	
$\rightarrow \text{H}_2\text{O} + \text{CH}_3\text{OO}$	3.6×10^{-12}	± 0.15		298	
Overall	5.5×10^{-12}	± 0.2	$2.9 \times 10^{-12} \exp(190/T)$	220-430	± 150
$\text{HO} + \text{HC(O)OH} \rightarrow \text{products}$	4.5×10^{-13}	± 0.15	4.5×10^{-13}	290-450	± 250
$\text{HO} + \text{CH}_3\text{C(O)OH} \rightarrow \text{products}$	7.4×10^{-13}	± 0.15	$4.2 \times 10^{-14} \exp(855/T)$	220-300	± 400
$\text{HO} + \text{C}_2\text{H}_5\text{C(O)OH} \rightarrow \text{products}$	1.2×10^{-12}	± 0.2	1.2×10^{-12}	290-450	± 300
$\text{HO} + \text{CH}_3\text{ONO}_2 \rightarrow \text{products}$	2.3×10^{-14}	$+0.5_{-0.2}$	$4.0 \times 10^{-13} \exp(-845/T)$	220-300	± 400
$\text{HO} + \text{C}_2\text{H}_5\text{ONO}_2 \rightarrow \text{products}$	1.8×10^{-13}	± 0.3	$6.7 \times 10^{-13} \exp(-395/T)$	230-300	± 400
$\text{HO} + 1\text{-C}_3\text{H}_7\text{ONO}_2 \rightarrow \text{products}$	5.8×10^{-13} (1 bar air)	± 0.3			
$\text{HO} + 2\text{-C}_3\text{H}_7\text{ONO}_2 \rightarrow \text{products}$	2.9×10^{-13}	± 0.2	$6.2 \times 10^{-13} \exp(-230/T)$	230-300	± 300
$\text{HO} + 1\text{-C}_4\text{H}_9\text{ONO}_2 \rightarrow \text{products}$	1.6×10^{-12}	± 0.2			
$\text{HO} + 2\text{-C}_4\text{H}_9\text{ONO}_2 \rightarrow \text{products}$	8.6×10^{-13}	± 0.3			

$\text{HO} + \text{CH}_3\text{C(O)OONO}_2 \rightarrow \text{products}$	$<3 \times 10^{-14}$					
$\text{HO} + \text{CH}_3\text{C(O)CH}_2\text{ONO}_2 \rightarrow \text{products}$	$<1 \times 10^{-12}$					
$\text{HO} + \text{CH}_3\text{CH}_2\text{C(O)CH}_2\text{ONO}_2 \rightarrow \text{products}$	8.2×10^{-13}	± 0.3				
$\text{HO} + \text{CH}_3\text{CH(ONO}_2\text{)C(O)CH}_3 \rightarrow \text{products}$	1.2×10^{-12}	± 0.3				
$\text{HO} + \text{CH}_2=\text{C(CH}_3\text{)C(O)OONO}_2 \rightarrow \text{products}$	2.9×10^{-11}	$+0.2/-0.5$				
$\text{HO} + \text{HCN} \rightarrow \text{products}$	3.0×10^{-14} (1 bar)	± 0.5	$1.2 \times 10^{-13}(-400/T)$ (1 bar)	290-440	± 300	
$\text{HO} + \text{CH}_3\text{CN} \rightarrow \text{products}$	2.2×10^{-14} (1 bar)	± 0.15	$8.1 \times 10^{-13}\exp(-1080/T)$ (1 bar)	250-390	± 200	
$\text{HO}_2 + \text{CH}_3\text{O}_2 \rightarrow \text{O}_2 + \text{CH}_3\text{OOH}$ $\rightarrow \text{O}_2 + \text{HCHO} + \text{H}_2\text{O}$	4.7×10^{-12} 5.2×10^{-13}	± 0.1		298		
Overall	5.2×10^{-12}	± 0.3	$3.8 \times 10^{-13}\exp(780/T)$	225-580	± 500	
$\text{HO}_2 + \text{HOCH}_2\text{O}_2 \rightarrow \text{O}_2 + \text{HOCH}_2\text{O}_2\text{H}$ $\rightarrow \text{O}_2 + \text{HC(O)OH} + \text{H}_2\text{O}$	7.2×10^{-12} 4.8×10^{-12}	± 0.4		298		
Overall	1.2×10^{-11}	± 0.3	$5.6 \times 10^{-15}\exp(2300/T)$	275-335	± 1500	
$\text{HO}_2 + \text{C}_2\text{H}_5\text{O}_2 \rightarrow \text{O}_2 + \text{C}_2\text{H}_5\text{OOH}$	7.8×10^{-12}	± 0.2	$3.8 \times 10^{-13}\exp(900/T)$	200-500	± 400	
$\text{HO}_2 + \text{CH}_3\text{C(O)OO} \rightarrow \text{products}$	1.4×10^{-11}	± 0.3	$5.2 \times 10^{-13}\exp(980/T)$	250-400	± 500	
$\text{HO}_2 + \text{HOCH}_2\text{CH}_2\text{O}_2 \rightarrow \text{products}$	1.2×10^{-11}	± 0.2				
$\text{HO}_2 + \text{CH}_3\text{OCH}_2\text{O}_2 \rightarrow \text{O}_2 + \text{CH}_3\text{OCH}_2\text{OOH}$ $\rightarrow \text{O}_2 + \text{CH}_3\text{OCHO} + \text{H}_2\text{O}$	See data sheet					
$\text{HO}_2 + \text{CH}_3\text{C(O)CH}_2\text{O}_2 \rightarrow \text{products}$	9.0×10^{-12}	± 0.3				
$\text{HO}_2 + \text{HCHO} \rightarrow \text{HOCH}_2\text{OO}$	7.9×10^{-14}	± 0.3	$9.7 \times 10^{-15}\exp(625/T)$	275-333	± 600	
$\text{HOCH}_2\text{OO} \rightarrow \text{HO}_2 + \text{HCHO}$	1.5×10^2 (k/s^{-1}) ± 0.3		$2.4 \times 10^{12}\exp(-7000/T)$	275-330	± 2000	

$\text{NO}_3 + \text{CH}_4 \rightarrow \text{HNO}_3 + \text{CH}_3$	$<1 \times 10^{-18}$					
$\text{NO}_3 + \text{C}_2\text{H}_2 \rightarrow \text{products}$	$<1 \times 10^{-16}$					
$\text{NO}_3 + \text{C}_2\text{H}_4 \rightarrow \text{products}$	2.1×10^{-16}	± 0.2	$3.3 \times 10^{-12} \exp(-2880/T)$	270-340	± 500	
$\text{NO}_3 + \text{C}_2\text{H}_6 \rightarrow \text{HNO}_3 + \text{C}_2\text{H}_5$	$<1 \times 10^{-17}$					
$\text{NO}_3 + \text{C}_3\text{H}_6 \rightarrow \text{products}$	9.5×10^{-15}	± 0.2	$4.6 \times 10^{-13} \exp(-1155/T)$	290-430	± 300	
$\text{NO}_3 + \text{C}_3\text{H}_8 \rightarrow \text{HNO}_3 + \text{C}_3\text{H}_7$	$<7 \times 10^{-17}$					
$\text{NO}_3 + n\text{-C}_4\text{H}_{10} \rightarrow \text{products}$	4.6×10^{-17}	± 0.2	$2.8 \times 10^{-12} \exp(-3280/T)$	290-430	± 400	
$\text{NO}_3 + \text{CH}_2=\text{C}(\text{CH}_3)\text{CH}=\text{CH}_2 \rightarrow \text{products}$	7.0×10^{-13}	± 0.2	$3.15 \times 10^{-12} \exp(-450/T)$	250-390	± 200	
$\text{NO}_3 + \alpha\text{-pinene} \rightarrow \text{products}$	6.2×10^{-12}	± 0.1	$1.2 \times 10^{-12} \exp(490/T)$	260-390	± 300	
$\text{NO}_3 + \text{HCHO} \rightarrow \text{HNO}_3 + \text{HCO}$	5.6×10^{-16}	± 0.3				
$\text{NO}_3 + \text{CH}_3\text{CHO} \rightarrow \text{HNO}_3 + \text{CH}_3\text{CO}$	2.7×10^{-15}	± 0.2	$1.4 \times 10^{-12} \exp(-1860/T)$	260-380	± 500	
$\text{NO}_3 + \text{C}_2\text{H}_5\text{CHO} \rightarrow \text{HNO}_3 + \text{C}_2\text{H}_5\text{CO}$	6.5×10^{-15}	± 0.2				
$\text{NO}_3 + \text{CH}_3\text{C}(\text{O})\text{CH}_3 \rightarrow \text{HNO}_3 + \text{CH}_3\text{C}(\text{O})\text{CH}_2$	$<3 \times 10^{-17}$					
$\text{NO}_3 + \text{C}_3\text{H}_7\text{CHO} \rightarrow \text{HNO}_3 + \text{C}_3\text{H}_7\text{CO}$	1.1×10^{-14}	± 0.15	$1.70 \times 10^{-12} \exp(-1500/T)$	260-340	± 500	
$\text{NO}_3 + (\text{CH}_3)_2\text{CHCHO} \rightarrow \text{products}$	1.25×10^{-14}	± 0.20	$1.67 \times 10^{-12} \exp(-1460/T)$	260-420	± 300	
$\text{NO}_3 + \text{CH}_2=\text{C}(\text{CH}_3)\text{CHO} \rightarrow \text{products}$	3.4×10^{-15}	± 0.15				
$\text{NO}_3 + \text{CH}_2=\text{CHC}(\text{O})\text{CH}_3 \rightarrow \text{products}$	$<6.0 \times 10^{-16}$					
$\text{NO}_3 + \text{pinonaldehyde} \rightarrow \text{products}$	2×10^{-14}	± 0.25				
$\text{NO}_3 + [-\text{CH}_2\text{CHC}(\text{CH}_3)\text{CH}_2\text{O}-] \rightarrow \text{products}$	1.9×10^{-11}	± 0.5				

$\text{NO}_3 + \text{CH}_2=\text{C}(\text{CH}_3)\text{C}(\text{O})\text{OOONO}_2 \rightarrow \text{products}$	1.6×10^{-16}	± 0.7				
$\text{NO}_3 + \text{CH}_3\text{OH} \rightarrow \text{products}$	1.3×10^{-16}	± 0.5	$9.4 \times 10^{-13} \exp(-2650/T)$	250-370	± 700	
$\text{NO}_3 + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{products}$	$< 2 \times 10^{-15}$					
$\text{NO}_3 + \text{CH}_3\text{CH}(\text{OH})\text{CH}_3 \rightarrow \text{products}$	1.4×10^{-15}	± 0.3				
$\text{NO}_3 + \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3 \rightarrow \text{products}$	2.1×10^{-15}	± 0.3				
$\text{NO}_3 + (\text{CH}_3)_2\text{C}(\text{OH})\text{CH}=\text{CH}_2 \rightarrow \text{products}$	1.2×10^{-14}	± 0.2	$4.6 \times 10^{-14} \exp(-400/T)$	260-400	± 200	
$\text{CH}_3 + \text{O}_2 + \text{M} \rightarrow \text{CH}_3\text{O}_2 + \text{M}$	$1.0 \times 10^{-30} [\text{N}_2] \quad (k_0)$	± 0.2	$1.0 \times 10^{-30} (T/300)^{-3.3} [\text{N}_2]$	200-300	$\Delta n = \pm 1$	
	$1.8 \times 10^{-12} \quad (k_\infty)$	± 0.3	$1.8 \times 10^{-12} (T/300)^{1.1}$	200-300	$\Delta n = \pm 1$	
	$F_c = 0.27$					
	$9.5 \times 10^{-13} \text{ (1 bar air)}$					
$\text{CH}_3 + \text{O}_3 \rightarrow \text{products}$	2.3×10^{-12}	± 0.3	$4.7 \times 10^{-12} \exp(-210/T)$	240-400	± 200	
$\text{C}_2\text{H}_5 + \text{O}_2 \rightarrow \text{C}_2\text{H}_4 + \text{HO}_2$	$3.8 \times 10^{-15} \quad (1 \text{ bar air})$	± 0.5				
	$1.9 \times 10^{-14} \quad (0.133 \text{ bar air})$	± 0.5				
$\text{C}_2\text{H}_5 + \text{O}_2 + \text{M} \rightarrow \text{C}_2\text{H}_5\text{O}_2 + \text{M}$	$5.9 \times 10^{-29} [\text{N}_2] \quad (k_0)$	± 0.3	$5.9 \times 10^{-29} (T/300)^{-3.8} [\text{N}_2]$	200-300	$\Delta n = \pm 1$	
	$7.8 \times 10^{-12} \quad (k_\infty)$	± 0.2	7.8×10^{-12}	200-300		
	$F_c = \{0.58 \exp(-T/1250) + 0.42 \exp(-T/183)\}$			200-300		
	$7.0 \times 10^{-12} \text{ (1 bar air)}$					
$n\text{-C}_3\text{H}_7 + \text{O}_2 + \text{M} \rightarrow n\text{-C}_3\text{H}_7\text{O}_2 + \text{M}$	$8 \times 10^{-12} \quad (k_\infty)$	± 0.2	8×10^{-12}	200-300	$\Delta \log k_\infty = \pm 0.2$	
$i\text{-C}_3\text{H}_7 + \text{O}_2 + \text{M} \rightarrow i\text{-C}_3\text{H}_7\text{O}_2 + \text{M}$	$1.1 \times 10^{-11} \quad (k_\infty)$	± 0.3	1.1×10^{-11}	200-300	$\Delta \log k_\infty = \pm 0.3$	
$1\text{-C}_4\text{H}_9 + \text{O}_2 + \text{M} \rightarrow 1\text{-C}_4\text{H}_9\text{O}_2 + \text{M}$	$7.5 \times 10^{-12} \quad (k_\infty)$	± 0.5				
$2\text{-C}_4\text{H}_9 + \text{O}_2 + \text{M} \rightarrow 2\text{-C}_4\text{H}_9\text{O}_2 + \text{M}$	$1.7 \times 10^{-11} \quad (k_\infty)$	± 0.5				

$\text{CH}_3\text{COCH}_2 + \text{O}_2 + \text{M} \rightarrow$ $\text{CH}_3\text{COCH}_2\text{O}_2 + \text{M}$	1.5×10^{-12}	(k_∞)	± 0.5			
$\text{HCO} + \text{O}_2 \rightarrow \text{CO} + \text{HO}_2$	5.1×10^{-12}		± 0.15	5.1×10^{-12}	200-300	± 150
$\text{CH}_3\text{C(O)} + \text{O}_2 + \text{M} \rightarrow \text{CH}_3\text{C(O)OO} + \text{M}$	5.1×10^{-12}	(k_∞)	± 0.2	5.1×10^{-12}	220-300	
$\text{CH}_2\text{OH} + \text{O}_2 \rightarrow \text{HCHO} + \text{HO}_2$	9.7×10^{-12}		± 0.12			
$\text{CH}_3\text{CHOH} + \text{O}_2 \rightarrow \text{CH}_3\text{CHO} + \text{HO}_2$	1.9×10^{-11}		± 0.3			
$\text{CH}_2\text{CH}_2\text{OH} + \text{O}_2 \rightarrow \text{products}$	3.0×10^{-12}		± 0.3			
$\text{CH}_3\text{O} + \text{O}_2 \rightarrow \text{HCHO} + \text{HO}_2$	1.9×10^{-15}		± 0.2	$7.2 \times 10^{-14} \exp(-1080/T)$	290-610	± 300
$\text{C}_2\text{H}_5\text{O} + \text{O}_2 \rightarrow \text{CH}_3\text{CHO} + \text{HO}_2$	8.1×10^{-15}		± 0.2	$2.4 \times 10^{-14} \exp(-325/T)$	295-354	± 300
$1\text{-C}_3\text{H}_7\text{O} + \text{O}_2 \rightarrow \text{C}_2\text{H}_5\text{CHO} + \text{HO}_2$	1.0×10^{-14}		± 0.2	$2.6 \times 10^{-14} \exp(-253/T)$	220-380	± 500
$2\text{-C}_3\text{H}_7\text{O} + \text{O}_2 \rightarrow \text{CH}_3\text{COCH}_3 + \text{HO}_2$	7.0×10^{-15}		± 0.2	$1.9 \times 10^{-14} \exp(-300/T)$	218-364	± 200
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O} + \text{O}_2 \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ $+ \text{HO}_2$	1.4×10^{-14}		± 0.3	$8.9 \times 10^{-14} \exp(-550/T)$	270-340	± 300
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O} + \text{M} \rightarrow$ $\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + \text{M}$	2.9×10^5	$(\text{s}^{-1}) (1 \text{ bar})$	± 0.2	$4.6 \times 10^{10} \exp(-3570/T) (1 \text{ bar})$	250-350	± 300
$\text{CH}_3\text{OCH}_2\text{O} + \text{O}_2 \rightarrow \text{CH}_3\text{OCHO} + \text{HO}_2$	}	see data sheet				
$\text{CH}_3\text{OCH}_2\text{O} + \text{M} \rightarrow \text{CH}_3\text{OCHO} + \text{H} + \text{M}$						
$\text{CH}_3\text{COCH}_2\text{O} + \text{O}_2 \rightarrow \text{CH}_3\text{COCHO} + \text{HO}_2$	}	see data sheet				
$\text{CH}_3\text{COCH}_2\text{O} + \text{M} \rightarrow \text{CH}_3\text{CO} + \text{HCHO} + \text{M}$						
$\text{CH}_3\text{CH(O)CH}_2\text{CH}_3 + \text{O}_2 \rightarrow$ $\text{CH}_3\text{C(O)CH}_2\text{CH}_3 + \text{HO}_2$	7.6×10^{-15}		± 0.3	$1.5 \times 10^{-14} \exp(-200/T)$	250-350	± 300

$\text{CH}_3\text{CH}(\text{O})\text{CH}_2\text{CH}_3 + \text{M} \rightarrow \text{products}$	2.0 x 10 ⁴	(s ⁻¹) (1 bar)	±0.3	7.2 x 10 ¹² exp(-5780/T) (1 bar)	240-340	±500
$\text{CH}_3\text{O} + \text{NO} + \text{M} \rightarrow \text{CH}_3\text{ONO} + \text{M}$	2.6 x 10 ⁻²⁹ [N ₂] (k ₀) 3.3 x 10 ⁻¹¹ (k _∞) $F_c = \exp(-T/900)$ see data sheet	±0.1	2.6 x 10 ⁻²⁹ (T/300) ^{-2.8} [N ₂]	200-400	Δn = ±0.5	
$\text{CH}_3\text{O} + \text{NO} \rightarrow \text{HCHO} + \text{HNO}$		±0.5	3.3 x 10 ⁻¹¹ (T/300) ^{-0.6}	200-400	Δn = ±0.5	
$\text{C}_2\text{H}_5\text{O} + \text{NO} + \text{M} \rightarrow \text{C}_2\text{H}_5\text{ONO} + \text{M}$		2.2 x 10 ⁻²⁸ [N ₂] (k ₀) 4.4 x 10 ⁻¹¹ (k _∞) $F_c = 0.6$ see data sheet	±0.3	4.4 x 10 ⁻¹¹	200-400	Δn = ±0.5
$\text{C}_2\text{H}_5\text{O} + \text{NO} \rightarrow \text{CH}_3\text{CHO} + \text{HNO}$	$n\text{-C}_3\text{H}_7\text{O} + \text{NO} + \text{M} \rightarrow n\text{-C}_3\text{H}_7\text{ONO} + \text{M}$ $i\text{-C}_3\text{H}_7\text{O} + \text{NO} + \text{M} \rightarrow i\text{-C}_3\text{H}_7\text{ONO} + \text{M}$ $(\text{CH}_3)_3\text{CO} + \text{NO} + \text{M} \rightarrow (\text{CH}_3)_3\text{CONO} + \text{M}$	3.8 x 10 ⁻¹¹ (k _∞)	±0.3			
$2\text{-C}_4\text{H}_9\text{O} + \text{NO} + \text{M} \rightarrow 2\text{-C}_4\text{H}_9\text{ONO} + \text{M}$		2.5 x 10 ⁻¹¹ (k _∞)	±0.5			Δn = ±1
$\text{CH}_3\text{O} + \text{NO}_2 + \text{M} \rightarrow \text{CH}_3\text{ONO}_2 + \text{M}$		8.1 x 10 ⁻²⁹ [N ₂] (k ₀) 2.1 x 10 ⁻¹¹ (k _∞) (1 bar) $F_c = 0.44$ 1.5 x 10 ⁻¹¹ (1 bar air) see data sheet	±0.3 ±0.3	8.1 x 10 ⁻²⁹ (T/300) ^{-4.5} [N ₂] 2.1 x 10 ⁻¹¹	200-400 200-400	Δn = ±1 Δn = ±0.5
$\text{CH}_3\text{O} + \text{NO}_2 \rightarrow \text{HCHO} + \text{HONO}$	$\text{C}_2\text{H}_5\text{O} + \text{NO}_2 + \text{M} \rightarrow \text{C}_2\text{H}_5\text{ONO}_2 + \text{M}$ $\text{C}_2\text{H}_5\text{O} + \text{NO}_2 \rightarrow \text{CH}_3\text{CHO} + \text{HONO}$	2.8 x 10 ⁻¹¹ (k _∞) see data sheet	±0.3	2.8 x 10 ⁻¹¹	200-300	Δn = ±0.5
$1\text{-C}_3\text{H}_7\text{O} + \text{NO}_2 + \text{M} \rightarrow 1\text{-C}_3\text{H}_7\text{ONO}_2 + \text{M}$		3.6 x 10 ⁻¹¹ (k _∞)	±0.3			
$2\text{-C}_3\text{H}_7\text{O} + \text{NO}_2 + \text{M} \rightarrow 2\text{-C}_3\text{H}_7\text{ONO}_2 + \text{M}$		3.4 x 10 ⁻¹¹ (k _∞)	±0.2	3.4 x 10 ⁻¹¹	200-300	
$\text{CH}_3\text{O}_2 + \text{NO} \rightarrow \text{CH}_3\text{O} + \text{NO}_2$	7.7 x 10 ⁻¹²		±0.05	2.3 x 10 ⁻¹² exp(360/T)	200-430	±100
$\text{C}_2\text{H}_5\text{O}_2 + \text{NO} \rightarrow \text{products}$	9.1 x 10 ⁻¹²		±0.1	2.6 x 10 ⁻¹² exp(380/T)	200-410	±50

$\text{HOCH}_2\text{CH}_2\text{O}_2 + \text{NO} \rightarrow \text{HOCH}_2\text{CH}_2\text{O} + \text{NO}_2$	9×10^{-12}	± 0.5				
$\text{n-C}_3\text{H}_7\text{O}_2 + \text{NO} \rightarrow \text{n-C}_3\text{H}_7\text{O} + \text{NO}_2$	9.4×10^{-12}	± 0.2	$2.9 \times 10^{-12} \exp(350/T)$	200-410	± 100	
$\text{i-C}_3\text{H}_7\text{O}_2 + \text{NO} \rightarrow \text{i-C}_3\text{H}_7\text{O} + \text{NO}_2$	9.0×10^{-12}	± 0.1	$2.7 \times 10^{-12} \exp(360/T)$	200-410	± 100	
$\text{CH}_3\text{C(O)CH}_2\text{O}_2 + \text{NO} \rightarrow \text{CH}_3\text{C(O)CH}_2\text{O} + \text{NO}_2$	8.0×10^{-12}	± 0.2				
$\text{CH}_3\text{C(O)OO} + \text{NO} \rightarrow \text{CH}_3\text{C(O)O} + \text{NO}_2$	2.0×10^{-11}	± 0.15	$7.5 \times 10^{-12} \exp(290/T)$	200-350	± 250	
$\text{C}_2\text{H}_5\text{C(O)OO} + \text{NO} \rightarrow \text{C}_2\text{H}_5\text{C(O)O} + \text{NO}_2$	2.1×10^{-11}	± 0.15	$6.7 \times 10^{-12} \exp(340/T)$	220-410	± 200	
$\text{CH}_3\text{O}_2 + \text{NO}_2 + \text{M} \rightarrow \text{CH}_3\text{O}_2\text{NO}_2 + \text{M}$	$2.5 \times 10^{-30} [\text{N}_2] \quad (k_0)$ $1.8 \times 10^{-11} \quad (k_\infty)$ $F_c = 0.36$ $4.0 \times 10^{-12} \text{ (1 bar air)}$	± 0.3 ± 0.3	$2.5 \times 10^{-30} (T/300)^{-5.5} [\text{N}_2]$ 1.8×10^{-11}	250-350	$\Delta n = \pm 1$	
$\text{CH}_3\text{O}_2\text{NO}_2 + \text{M} \rightarrow \text{CH}_3\text{O}_2 + \text{NO}_2 + \text{M}$	$6.8 \times 10^{-19} [\text{N}_2] \quad (k_0/s^{-1})$ $4.5 \quad (k_\infty/s^{-1})$ $F_c = 0.60$ 1.8 (1 bar air)	± 0.3 ± 0.3	$9 \times 10^{-5} \exp(-9690/T) [\text{N}_2]$ $1.1 \times 10^{16} \exp(-10560/T)$	250-300	± 500	
$\text{C}_2\text{H}_5\text{O}_2 + \text{NO}_2 + \text{M} \rightarrow \text{C}_2\text{H}_5\text{O}_2\text{NO}_2 + \text{M}$	$1.3 \times 10^{-29} [\text{N}_2] \quad (k_0)$ $8.8 \times 10^{-12} \quad (k_\infty)$ $F_c = 0.31$ $6.1 \times 10^{-12} \text{ (1 bar air)}$	± 0.3 ± 0.3	$1.3 \times 10^{-29} (T/300)^{-6.2} [\text{N}_2]$ 8.8×10^{-12}	200-300	$\Delta n = \pm 1$	
$\text{C}_2\text{H}_5\text{O}_2\text{NO}_2 + \text{M} \rightarrow \text{C}_2\text{H}_5\text{O}_2 + \text{NO}_2 + \text{M}$	$1.4 \times 10^{-17} [\text{N}_2] \quad (k_0/s^{-1})$ $5.4 \quad (k_\infty/s^{-1})$ $F_c = 0.31$ 4.0 (1 bar air)	± 0.5 ± 0.5	$4.8 \times 10^{-4} \exp(-9285/T) [\text{N}_2]$ $8.8 \times 10^{15} \exp(-10440/T)$	250-300	± 1000	
$\text{CH}_3\text{C(O)OO} + \text{NO}_2 + \text{M} \rightarrow \text{CH}_3\text{C(O)OONO}_2 + \text{M}$	$2.7 \times 10^{-28} [\text{N}_2] \quad (k_0)$ $1.2 \times 10^{-11} \quad (k_\infty)$ $F_c = 0.3$ $1.0 \times 10^{-11} \text{ (1 bar air)}$	± 0.4 ± 0.2	$2.7 \times 10^{-28} (T/300)^{-7.1} [\text{N}_2]$ $1.2 \times 10^{-11} (T/300)^{-0.9}$	250-300	$\Delta n = \pm 2$	
				250-300	$\Delta n = \pm 1$	

$\text{CH}_3\text{C(O)OONO}_2 + \text{M} \rightarrow \text{CH}_3\text{C(O)OO} + \text{NO}_2 + \text{M}$	$1.1 \times 10^{-20}[\text{N}_2] \quad (k_0/\text{s}^{-1})$ $3.8 \times 10^{-4} \quad (k_\infty/\text{s}^{-1})$ $F_c = 0.3$ $3.3 \times 10^{-4} \text{ (1 bar air)}$	± 0.3	$4.9 \times 10^{-3} \exp(-12100/T)[\text{N}_2]$ $5.4 \times 10^{16} \exp(-13830/T)$	300-330	± 1000 ± 300
$\text{C}_2\text{H}_5\text{C(O)OONO}_2 + \text{M} \rightarrow \text{C}_2\text{H}_5\text{C(O)OO} + \text{NO}_2 + \text{M}$	$6.2 \times 10^{-20}[\text{N}_2] \quad (k_0/\text{s}^{-1})$ $4.0 \times 10^{-4} \quad (k_\infty/\text{s}^{-1})$ $F_c = 0.36$ $3.6 \times 10^{-4} \text{ (1 bar air)}$	± 0.5 ± 0.2	$1.7 \times 10^{-3} \exp(-11280/T)[\text{N}_2]$ $8.3 \times 10^{16} \exp(-13940/T)$	290-320	± 2000 ± 1000
$\text{CH}_3\text{C(O)CH}_2\text{O}_2\text{NO}_2 + \text{M} \rightarrow \text{CH}_3\text{C(O)CH}_2\text{O}_2 + \text{NO}_2 + \text{M}$	$3.2 \text{ (s}^{-1}\text{)}$	$\pm 0.3 \text{ (250K)}$	$1.4 \times 10^{16} \exp(-10730/T) \text{ (1 bar)}$	240-260	± 200
$\text{CH}_2\text{C(CH}_3\text{)C(O)OONO}_2 + \text{M} \rightarrow \text{CH}_2\text{C(CH}_3\text{)C(O)OO} + \text{NO}_2$	$3.5 \times 10^{-4} \text{ (s}^{-1}\text{) (1 bar)}$	± 0.3	$1.6 \times 10^{16} \exp(-13500/T) \text{ (1 bar)}$	290-330	± 1000
$\text{CH}_3\text{O}_2 + \text{NO}_3 \rightarrow \text{CH}_3\text{O} + \text{NO}_2 + \text{O}_2$	1.3×10^{-12}	± 0.3			
$\text{C}_2\text{H}_5\text{O}_2 + \text{NO}_3 \rightarrow \text{C}_2\text{H}_5\text{O} + \text{NO}_2 + \text{O}_2$	2.3×10^{-12}	± 0.2			
$\text{CH}_3\text{O}_2 + \text{CH}_3\text{O}_2 \rightarrow \text{CH}_3\text{OH} + \text{HCHO} + \text{O}_2$ $\rightarrow 2 \text{ CH}_3\text{O} + \text{O}_2$ $\rightarrow \text{CH}_3\text{OOCH}_3 + \text{O}_2$	1.3×10^{-13}	± 0.15	$7.4 \times 10^{-13} \exp(-520/T)$	220-330	± 300
Overall	3.5×10^{-13}	± 0.12	$1.0 \times 10^{-13} \exp(365/T)$	200-400	± 200
$\text{CH}_3\text{O}_2 + \text{CH}_3\text{C(O)OO}$ $\rightarrow \text{CH}_3\text{O} + \text{CH}_3\text{C(O)O} + \text{O}_2$ $\rightarrow \text{CH}_3\text{C(O)OH} + \text{HCHO} + \text{O}_2$	9.9×10^{-12} 1.1×10^{-12}				
Overall	1.1×10^{-11}	± 0.15	$2.0 \times 10^{-12} \exp(500/T)$	200-350	± 250
$\text{CH}_3\text{O}_2 + \text{CH}_3\text{COCH}_2\text{O}_2$ $\rightarrow \text{CH}_3\text{OH} + \text{CH}_3\text{COCHO} + \text{O}_2$ $\rightarrow \text{HCHO} + \text{CH}_3\text{COCH}_2\text{OH} + \text{O}_2$ $\rightarrow \text{CH}_3\text{O} + \text{CH}_3\text{COCH}_2\text{O} + \text{O}_2$	1.9×10^{-12} 7.6×10^{-13} 1.1×10^{-12}				
Overall	3.8×10^{-12}	± 0.3			

$\text{HOCH}_2\text{O}_2 + \text{HOCH}_2\text{O}_2$						
	$\rightarrow \text{HC(O)OH} + \text{CH}_2(\text{OH})_2 + \text{O}_2$	7.0×10^{-13}	± 0.3	$5.7 \times 10^{-14} \exp(750/T)$	270-330	± 750
	$\rightarrow 2 \text{HOCH}_2\text{O} + \text{O}_2$	5.5×10^{-12}	± 0.3			
$\text{C}_2\text{H}_5\text{O}_2 + \text{C}_2\text{H}_5\text{O}_2 \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{CHO} + \text{O}_2$	2.4×10^{-14}					
	$\rightarrow 2 \text{C}_2\text{H}_5\text{O} + \text{O}_2$	4.0×10^{-14}	± 0.1			
Overall		6.4×10^{-14}	± 0.12	6.4×10^{-14}	250-450	$+300/-100$
$\text{C}_2\text{H}_5\text{O}_2 + \text{CH}_3\text{C(O)OO}$						
	$\rightarrow \text{C}_2\text{H}_5\text{O} + \text{CH}_3\text{C(O)O} + \text{O}_2$					
	$\rightarrow \text{CH}_3\text{CHO} + \text{CH}_3\text{C(O)OH} + \text{O}_2$					
Overall		1.6×10^{-11}	± 0.5	$4.4 \times 10^{-13} \exp(1070/T)$	220-440	± 500
$\text{CH}_3\text{OCH}_2\text{O}_2 + \text{CH}_3\text{OCH}_2\text{O}_2$						
	$\rightarrow \text{CH}_3\text{OCH}_2\text{OH} + \text{CH}_3\text{OCHO} + \text{O}_2$					
	$\rightarrow 2 \text{CH}_3\text{OCH}_2\text{O} + \text{O}_2$	1.4×10^{-12}				
Overall		2.1×10^{-12}	± 0.3			
$\text{CH}_3\text{C(O)OO} + \text{CH}_3\text{C(O)OO} \rightarrow 2 \text{CH}_3\text{C(O)O} + \text{O}_2$	1.6×10^{-11}		± 0.1	$2.9 \times 10^{-12} \exp(500/T)$	200-370	± 200
$\text{CH}_3\text{C(O)OO} + \text{CH}_3\text{C(O)CH}_2\text{O}_2$						
	$\rightarrow \text{CH}_3\text{COOH} + \text{CH}_3\text{COCHO} + \text{O}_2$	2.5×10^{-12}				
	$\rightarrow \text{CH}_3\text{C(O)O} + \text{CH}_3\text{COCH}_2\text{O} + \text{O}_2$	2.5×10^{-12}				
Overall		5.0×10^{-12}	± 0.3			
$\text{HOCH}_2\text{CH}_2\text{O}_2 + \text{HOCH}_2\text{CH}_2\text{O}_2$						
	$\rightarrow \text{HOCH}_2\text{CH}_2\text{OH} + \text{HOCH}_2\text{CHO} + \text{O}_2$	1.1×10^{-12}				
	$\rightarrow 2 \text{HOCH}_2\text{CH}_2\text{O} + \text{O}_2$	1.1×10^{-12}				
Overall		2.2×10^{-12}	± 0.1	$7.8 \times 10^{-14} \exp(1000/T)$	250-450	± 300
$n\text{-C}_3\text{H}_7\text{O}_2 + n\text{-C}_3\text{H}_7\text{O}_2$						
	$\rightarrow n\text{-C}_3\text{H}_7\text{OH} + \text{C}_2\text{H}_5\text{CHO} + \text{O}_2$					
	$\rightarrow 2 n\text{-C}_3\text{H}_7\text{O} + \text{O}_2$					
Overall		3×10^{-13}	± 0.5			

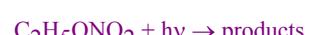
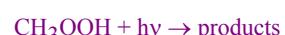
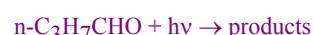
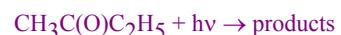
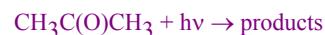
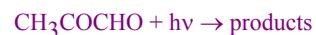
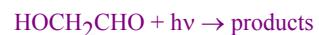
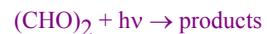
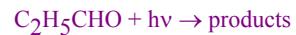
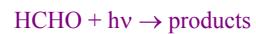
i-C ₃ H ₇ O ₂ + i-C ₃ H ₇ O ₂						
→ i-C ₃ H ₇ OH + CH ₃ COCH ₃ + O ₂	4.4 x 10 ⁻¹⁶					
→ 2 i-C ₃ H ₇ O + O ₂	5.6 x 10 ⁻¹⁶					
Overall	1.0 x 10 ⁻¹⁵	±0.30	1.6 x 10 ⁻¹² exp(-2200/T)	300-400	±300	
CH ₃ COCH ₂ O ₂ + CH ₃ COCH ₂ O ₂						
→ CH ₃ COCH ₂ OH + CH ₃ COCHO + O ₂	3.0 x 10 ⁻¹²					
→ 2 CH ₃ COCH ₂ O + O ₂	5.0 x 10 ⁻¹²					
Overall	8.0 x 10 ⁻¹²	±0.3				
RCHOO + O ₃ → RCHO + 2O ₂						
RCHOO + H ₂ O → products						
RCHOO + CO → products						
RCHOO + HCHO → products						
RCHOO + C ₂ H ₄ → products			No recommendations (See data sheet)			
RCHOO + NO → RCHO + NO ₂						
RCHOO + NO ₂ → RCHO + NO ₃						
RCHOO + SO ₂ → products						
RCHOO + HCOOH → products						
O ₃ + alkene → OH + products	see data sheet					
O ₃ + C ₂ H ₂ → products	1 x 10 ⁻²⁰	±1.0				
O ₃ + C ₂ H ₄ → products	1.6 x 10 ⁻¹⁸	±0.10	9.1 x 10 ⁻¹⁵ exp(-2580/T)	180-360	±100	
O ₃ + C ₃ H ₆ → products	1.0 x 10 ⁻¹⁷	±0.10	5.5 x 10 ⁻¹⁵ exp(-1880/T)	230-370	±200	
O ₃ + CH ₂ C(CH ₃)CHCH ₂ → products	1.27 x 10 ⁻¹⁷	±0.10	1.03x 10 ⁻¹⁴ exp(-1995/T)	240-360	±200	
O ₃ + α-pinene → products	9.0 x 10 ⁻¹⁷	±0.20	6.3 x 10 ⁻¹⁶ exp(-580/T)	270-370	±300	
O ₃ + CH ₂ =C(CH ₃)CHO → products	1.2 x 10 ⁻¹⁸	±0.20	1.4 x 10 ⁻¹⁵ exp(-2100/T)	240-330	±300	
O ₃ + CH ₂ =CHC(O)CH ₃ → products	5.2 x 10 ⁻¹⁸	±0.20	8.5 x 10 ⁻¹⁶ exp(-1520/T)	240-330	±200	
O ₃ + pinonaldehyde → products	<2 x 10 ⁻²⁰					

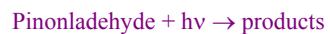
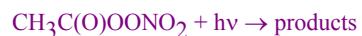
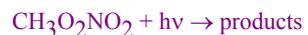
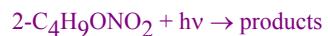
$O_3 + [-CH_2CHC(CH_3)CH_2O^-] \rightarrow$ products	2.0×10^{-17}	± 0.3				
$O_3 + CH_2=C(CH_3)C(O)OONO_2 \rightarrow$ products	8.2×10^{-18}	± 0.3				
$O_3 + (CH_3)_2C(OH)CH=CH_2 \rightarrow$ products	1.0×10^{-17}	± 0.2				
$F + CH_4 \rightarrow HF + CH_3$	6.3×10^{-11}	± 0.15	$1.3 \times 10^{-10} \exp(-215/T)$	180-410	± 200	
$Cl + CH_4 \rightarrow HCl + CH_3$	1.0×10^{-13}	± 0.06	$6.6 \times 10^{-12} \exp(-1240/T)$	200-300	± 200	
$Cl + C_2H_2 + M \rightarrow C_2H_2Cl + M$	$6.1 \times 10^{-30} [N_2] (k_0)$ $2.0 \times 10^{-10} (k_\infty)$ $F_c = 0.6$ $5.2 \times 10^{-11} (1 \text{ bar air})$	± 0.3 ± 0.3	$6.1 \times 10^{-30} (T/300)^{-3} [N_2]$ 2.0×10^{-10}	200-300	$\Delta n = \pm 1$	
$Cl + C_2H_4 + M \rightarrow C_2H_4Cl + M$	$1.85 \times 10^{-29} [air] (k_0)$ $6 \times 10^{-10} (k_\infty)$ $F_c = 0.4$ $1.1 \times 10^{-10} (1 \text{ bar air})$	± 0.5 ± 0.3	$1.85 \times 10^{-29} (T/300)^{-3.3} [air]$ 6×10^{-10}	250-300	$\Delta n = \pm 1$	
$Cl + C_2H_6 \rightarrow HCl + C_2H_5$	5.9×10^{-11}	± 0.06	$8.3 \times 10^{-11} \exp(-100/T)$	220-600	± 100	
$Cl + C_3H_6 + M \rightarrow C_3H_6Cl + M$	$4.0 \times 10^{-28} [N_2] (k_0)$ $2.8 \times 10^{-10} (k_\infty)$ $2.3 \times 10^{-10} (1 \text{ bar air})$	± 0.5 ± 0.3				
$Cl + C_3H_8 \rightarrow HCl + n-C_3H_7$ $\rightarrow HCl + i-C_3H_7$						
Overall	1.4×10^{-10}	± 0.06	1.4×10^{-10}	200-700	± 100	
$Cl + n-C_4H_{10} \rightarrow HCl + C_4H_9$	2.05×10^{-10}	± 0.06	2.05×10^{-10}	290-600	± 100	
$Cl + HCHO \rightarrow HCl + HCO$	7.2×10^{-11}	± 0.06	$8.1 \times 10^{-11} \exp(-34/T)$	200-500	± 100	
$Cl + CH_3CHO \rightarrow HCl + CH_3CO$	8.0×10^{-11}	± 0.07	8.0×10^{-11}	210-340	± 300	
$Cl + C_2H_5CHO \rightarrow$ products	1.3×10^{-10}	± 0.2				

$\text{Cl} + \text{CH}_3\text{C(O)CH}_3 \rightarrow \text{HCl} + \text{CH}_3\text{COCH}_2$	2.1×10^{-12}	± 0.15	$3.2 \times 10^{-11} \exp(-815/T)$	215-300	± 300
$\text{Cl} + \text{CH}_3\text{C(O)CH}_2\text{CH}_3 \rightarrow \text{products}$	3.6×10^{-11}	± 0.15			
$\text{Cl} + \text{CH}_3\text{OH} \rightarrow \text{HCl} + \text{CH}_2\text{OH}$	5.5×10^{-11}	± 0.07	5.5×10^{-11}	200-580	± 200
$\text{Cl} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{products}$	1.0×10^{-10}	± 0.08	$8.6 \times 10^{-11} \exp(45/T)$	295-600	± 100
$\text{Cl} + \text{n-C}_3\text{H}_7\text{OH} \rightarrow \text{products}$	1.6×10^{-10}	± 0.15	$2.5 \times 10^{-11} \exp(-130/T)$	270-350	± 100
$\text{Cl} + \text{i-C}_3\text{H}_7\text{OH} \rightarrow \text{products}$	8.6×10^{-11}	± 0.1			
$\text{Cl} + \text{CH}_3\text{OOH} \rightarrow \text{products}$	5.9×10^{-11}	± 0.5			
$\text{Cl} + \text{HC(O)OH} \rightarrow \text{products}$	1.9×10^{-13}	± 0.15			
$\text{Cl} + \text{CH}_3\text{C(O)OH} \rightarrow \text{products}$	2.65×10^{-14}	± 0.2			
$\text{Cl} + \text{CH}_3\text{ONO}_2 \rightarrow \text{products}$	2.4×10^{-13}	± 0.15			
$\text{Cl} + \text{C}_2\text{H}_5\text{ONO}_2 \rightarrow \text{products}$	4.7×10^{-12}	± 0.2			
$\text{Cl} + \text{n-C}_3\text{H}_7\text{ONO}_2 \rightarrow \text{products}$	2.2×10^{-11}	± 0.2			
$\text{Cl} + \text{i-C}_3\text{H}_7\text{ONO}_2 \rightarrow \text{products}$	3.8×10^{-12}	± 0.3			
$\text{Cl} + \text{1-C}_4\text{H}_9\text{ONO}_2 \rightarrow \text{products}$	8.5×10^{-11}	± 0.3			
$\text{Cl} + \text{CH}_3\text{C(O)OONO}_2 \rightarrow \text{products}$	$< 2 \times 10^{-14}$				
$\text{Cl} + \text{CH}_3\text{CN} \rightarrow \text{products}$	1.2×10^{-14}	± 0.3	$1.6 \times 10^{-11} \exp(-2140/T)$	270-350	± 300
$\text{Br} + \text{C}_2\text{H}_2 + \text{M} \rightarrow \text{products}$	2.6×10^{-14} (1 bar air)	± 0.2	$6.35 \times 10^{-15} \exp(440/T)$	230-300	± 200
$\text{Br} + \text{C}_2\text{H}_4 + \text{M} \rightarrow \text{products}$	1.3×10^{-13} (1 bar air)	± 0.15			
$\text{Br} + \text{C}_3\text{H}_6 \rightarrow \text{products}$	3.6×10^{-12} (1 bar air and 296 K)	± 0.2			

$\text{Br} + \text{HCHO} \rightarrow \text{HBr} + \text{HCO}$	1.1×10^{-12}	± 0.15	$7.7 \times 10^{-12} \exp(-580/T)$	220-300	± 200
$\text{Br} + \text{CH}_3\text{CHO} \rightarrow \text{HBr} + \text{CH}_3\text{CO}$	3.9×10^{-12}	± 0.2	$1.8 \times 10^{-11} \exp(-460/T)$	250-400	± 200

Data for the following Photochemical Reactions are based on data sheets on this website





SO_x Reactions - based on data sheets on this website

$\text{O} + \text{CS} \rightarrow \text{CO} + \text{S}$	2.1×10^{-11}	± 0.1	$2.7 \times 10^{-10} \exp(-760/T)$	150-300	± 250	
$\text{O} + \text{CH}_3\text{SCH}_3 \rightarrow \text{CH}_3\text{SO} + \text{CH}_3$	5.0×10^{-11}	± 0.1	$1.3 \times 10^{-11} \exp(409/T)$	270-560	± 100	
$\text{O} + \text{CS}_2 \rightarrow \text{products}$	3.7×10^{-12}	± 0.2	$3.3 \times 10^{-11} \exp(-650/T)$	210-500	± 100	
$\text{O} + \text{CH}_3\text{SSCH}_3 \rightarrow \text{CH}_3\text{SO} + \text{CH}_3\text{S}$	1.5×10^{-10}	± 0.3	$6.5 \times 10^{-11} \exp(250/T)$	290-570	± 100	
$\text{O} + \text{OCS} \rightarrow \text{SO} + \text{CO}$	1.2×10^{-14}	± 0.2	$1.6 \times 10^{-11} \exp(-2150/T)$	230-500	± 150	
$\text{O} + \text{SO}_2 + \text{M} \rightarrow \text{SO}_3 + \text{M}$	$1.4 \times 10^{-33} [\text{N}_2]$	(k_0)	± 0.3	$4.0 \times 10^{-32} \exp(-1000/T) [\text{N}_2]$	200-400	± 200
$\text{S} + \text{O}_2 \rightarrow \text{SO} + \text{O}$	2.1×10^{-12}	± 0.2	2.1×10^{-12}	250-430	± 200	
$\text{S} + \text{O}_3 \rightarrow \text{SO} + \text{O}_2$	1.2×10^{-11}	± 0.3				
$\text{Cl} + \text{H}_2\text{S} \rightarrow \text{HCl} + \text{HS}$	7.4×10^{-11}	± 0.1	$3.7 \times 10^{-11} \exp(208/T)$	200-430	± 100	
$\text{Cl} + \text{OCS} \rightarrow \text{SCl} + \text{CO}$	$< 1.0 \times 10^{-16}$					
$\text{Cl} + \text{CS}_2 + \text{O}_2 \rightarrow \text{products}$	$\leq 4 \times 10^{-15}$	(1 bar air)				
$\text{Cl} + \text{CH}_3\text{SH} \rightarrow \text{products}$	2.0×10^{-10}	± 0.1	$1.2 \times 10^{-10} \exp(150/T)$	190-430	± 100	
$\text{Cl} + \text{CH}_3\text{SCH}_3 \rightarrow \text{products}$	3.4×10^{-10}	(1 bar N ₂)	± 0.2			
$\text{HO} + \text{H}_2\text{S} \rightarrow \text{H}_2\text{O} + \text{HS}$	4.7×10^{-12}	± 0.08	$6.1 \times 10^{-12} \exp(-80/T)$	220-520	± 80	

$\text{HO} + \text{SO}_2 + \text{M} \rightarrow \text{HOSO}_2 + \text{M}$	$4.5 \times 10^{-31}[\text{N}_2]$ 1.3×10^{-12} $F_c = 0.525$	(k_0) (k_∞)	± 0.3 ± 0.3	$4.5 \times 10^{-31}(T/300)^{-3.9}[\text{N}_2]$ $1.3 \times 10^{-12} (T/300)^{-0.7}$ $F_c = 0.525$	200-300 200-300 200-300	$\Delta n = \pm 1$ $\Delta \log k = \pm 0.3$
$\text{HOSO}_2 + \text{O}_2 \rightarrow \text{HO}_2 + \text{SO}_3$	4.3×10^{-13}		± 0.10	$1.3 \times 10^{-12} \exp(-330/T)$	290-420	± 200
$\text{HO} + \text{OCS} \rightarrow \text{products}$	2.0×10^{-15}		± 0.3	$1.1 \times 10^{-13} \exp(-1200/T)$	250-500	± 500
$\text{HO} + \text{CS}_2 + \text{M} \rightarrow \text{HOCS}_2 + \text{M}$	$1 \times 10^{-30}[\text{N}_2]$ 2.5×10^{-11} $F_c = 0.44$	(k_0) (k_∞)	± 0.5 ± 0.5	$1 \times 10^{-30}[\text{N}_2]$ 2.5×10^{-11}	250-320 250-300	$\Delta \log k = \pm 0.5$ $\Delta \log k = \pm 0.5$
$\text{HOCS}_2 + \text{M} \rightarrow \text{HO} + \text{CS}_2 + \text{M}$	$4.8 \times 10^{-14}[\text{N}_2]$ 4.8×10^5 $F_c = 0.8$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.5 ± 0.5	$1.6 \times 10^{-6} \exp(-5160/T)[\text{N}_2]$ $1.6 \times 10^{13} \exp(-5160/T)$	250-300 250-300	± 500 ± 500
$\text{HOCS}_2 + \text{O}_2 \rightarrow \text{products}$	2.8×10^{-14}		± 0.15	2.8×10^{-14}	240-350	$\Delta \log k = \pm 0.15$
$\text{HO} + \text{CH}_3\text{SH} \rightarrow \text{products}$	3.3×10^{-11}		± 0.10	$9.9 \times 10^{-12} \exp(356/T)$	240-430	± 100
$\text{HO} + \text{CH}_3\text{SCH}_3 \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{SCH}_3$ $\rightarrow \text{CH}_3\text{S(OH)CH}_3$	4.8×10^{-12} 1.5×10^{-12}		± 0.10 ± 0.30	$1.13 \times 10^{-11} \exp(-253/T)$ $1.0 \times 10^{-39} [\text{O}_2] \exp(5820/T) /$ $\{1 + 5.0 \times 10^{-30} [\text{O}_2] \exp(6280/T)\}$	240-400 240-360	± 150 ± 150
$\text{HO} + \text{CH}_3\text{SSCH}_3 \rightarrow \text{products}$	2.3×10^{-10}		± 0.10	$7.0 \times 10^{-11} \exp(350/T)$	250-370	± 200
$\text{HO}_2 + \text{H}_2\text{S} \rightarrow \text{products}$	$< 3 \times 10^{-15}$					
$\text{HO}_2 + \text{SO}_2 \rightarrow \text{products}$	$< 1 \times 10^{-18}$					
$\text{HO}_2 + \text{CH}_3\text{SH} \rightarrow \text{products}$	$< 4 \times 10^{-15}$					
$\text{HO}_2 + \text{CH}_3\text{SCH}_3 \rightarrow \text{products}$	$< 5 \times 10^{-15}$					
$\text{NO}_3 + \text{H}_2\text{S} \rightarrow \text{products}$	$< 1 \times 10^{-15}$					
$\text{NO}_3 + \text{CS}_2 \rightarrow \text{products}$	$< 4 \times 10^{-16}$					

$\text{NO}_3 + \text{OCS} \rightarrow \text{products}$	$<1 \times 10^{-16}$					
$\text{NO}_3 + \text{SO}_2 \rightarrow \text{products}$	$<1 \times 10^{-19}$					
$\text{NO}_3 + \text{CH}_3\text{SH} \rightarrow \text{products}$	9.2×10^{-13}		± 0.15	9.2×10^{-13}	250-370	± 400
$\text{NO}_3 + \text{CH}_3\text{SCH}_3 \rightarrow \text{CH}_3\text{SCH}_2 + \text{HNO}_3$	1.1×10^{-12}		± 0.15	$1.9 \times 10^{-13} \exp(520/T)$	250-380	± 200
$\text{NO}_3 + \text{CH}_3\text{SSCH}_3 \rightarrow \text{products}$	7×10^{-13}		± 0.3	7×10^{-13}	300-380	± 500
$\text{HS} + \text{O}_2 \rightarrow \text{products}$	$<4 \times 10^{-19}$					
$\text{HS} + \text{O}_3 \rightarrow \text{HSO} + \text{O}_2$	3.7×10^{-12}		± 0.2	$9.5 \times 10^{-12} \exp(-280/T)$	290-440	± 250
$\text{HS} + \text{NO} + \text{M} \rightarrow \text{HSNO} + \text{M}$	$2.4 \times 10^{-31} [\text{N}_2]$	(k_0)	± 0.3	$2.4 \times 10^{-31} (T/300)^{-2.5} [\text{N}_2]$	250-300	$\Delta n = \pm 1$
	2.7×10^{-11}	(k_∞)	± 0.5	2.7×10^{-11}	250-300	$\Delta \log k = \pm 0.5$
	$F_c = 0.6$					
$\text{HS} + \text{NO}_2 \rightarrow \text{HSO} + \text{NO}$	6.7×10^{-11}		± 0.3	$2.9 \times 10^{-11} \exp(240/T)$	220-420	± 100
$\text{HSO} + \text{O}_2 \rightarrow \text{products}$	$\leq 2.0 \times 10^{-17}$					
$\text{HSO} + \text{O}_3 \rightarrow \text{products}$	1.1×10^{-13}		± 0.2			
$\text{HSO} + \text{NO} \rightarrow \text{products}$	$<1.0 \times 10^{-15}$					
$\text{HSO} + \text{NO}_2 \rightarrow \text{products}$	9.6×10^{-12}		± 0.3			
$\text{HSO}_2 + \text{O}_2 \rightarrow \text{products}$	3.0×10^{-13}		± 0.8			
$\text{SO} + \text{O}_2 \rightarrow \text{SO}_2 + \text{O}$	7.6×10^{-17}		± 0.15	$1.6 \times 10^{-13} \exp(-2280/T)$	230-420	± 500
$\text{SO} + \text{O}_3 \rightarrow \text{SO}_2 + \text{O}_2$	8.9×10^{-14}		± 0.1	$4.5 \times 10^{-12} \exp(-1170/T)$	230-420	± 150
$\text{SO} + \text{NO}_2 \rightarrow \text{SO}_2 + \text{NO}$	1.4×10^{-11}		± 0.1	1.4×10^{-11}	210-360	± 100
$\text{SO}_3 (+ \text{H}_2\text{O}) \rightarrow \text{H}_2\text{SO}_4$	$5.7 \times 10^4 \text{ s}^{-1}$ (at 50% relative humidity)					

$\text{SO}_3 + \text{NH}_3 \rightarrow \text{products}$	2.0×10^{-11} (1 atm)	± 0.2				
$\text{CS} + \text{O}_2 \rightarrow \text{products}$	2.9×10^{-19}	± 0.6				
$\text{CS} + \text{O}_3 \rightarrow \text{OCS} + \text{O}_2$	3.0×10^{-16}	± 0.5				
$\text{CS} + \text{NO}_2 \rightarrow \text{OCS} + \text{NO}$	7.6×10^{-17}	± 0.5				
$\text{CH}_2\text{SH} + \text{O}_2 \rightarrow \text{products}$	6.6×10^{-12}	± 0.3				
$\text{CH}_2\text{SH} + \text{O}_3 \rightarrow \text{products}$	3.5×10^{-11}	± 0.3				
$\text{CH}_2\text{SH} + \text{NO} \rightarrow \text{products}$	1.5×10^{-11}	± 0.3				
$\text{CH}_2\text{SH} + \text{NO}_2 \rightarrow \text{products}$	4.4×10^{-11}	± 0.5				
$\text{CH}_3\text{S} + \text{O}_2 + \text{M} \rightarrow \text{CH}_3\text{SOO} + \text{M}$	see data sheet.					
$\text{CH}_3\text{SOO} + \text{M} \rightarrow \text{CH}_3\text{S} + \text{O}_2 + \text{M}$	see data sheet					
$\text{CH}_3\text{S} + \text{O}_3 \rightarrow \text{products}$	4.9×10^{-12}	± 0.2	$1.15 \times 10^{-12} \exp(432/T)$	259-381	± 100	
$\text{CH}_3\text{S} + \text{NO} + \text{M} \rightarrow \text{CH}_3\text{SNO} + \text{M}$	$3.3 \times 10^{-29} [\text{N}_2]$	(k_0)	± 0.3	$3.3 \times 10^{-29} (T/300)^{-4} [\text{N}_2]$	290-450	$\Delta n = \pm 2$
	4×10^{-11}	(k_∞)	± 0.5	4×10^{-11}	290-450	$\Delta \log k = \pm 0.5$
	$F_c = 0.54$					
$\text{CH}_3\text{S} + \text{NO}_2 \rightarrow \text{CH}_3\text{SO} + \text{NO}$	6.0×10^{-11}	± 0.15	$3.0 \times 10^{-11} \exp(210/T)$	240-350	± 200	
$\text{CH}_3\text{SO} + \text{O}_3 \rightarrow \text{products}$	6.0×10^{-13}	± 0.3				
$\text{CH}_3\text{SO} + \text{NO}_2 \rightarrow \text{products}$	1.2×10^{-11}	± 0.2				
$\text{CH}_3\text{SOO} + \text{O}_3 \rightarrow \text{products}$	$< 8 \times 10^{-13}$	(227 K)				
$\text{CH}_3\text{SOO} + \text{NO} \rightarrow \text{products}$			1.1×10^{-11}	227-256	$\Delta \log k = \pm 0.3$	
$\text{CH}_3\text{SOO} + \text{NO}_2 \rightarrow \text{products}$			2.2×10^{-11}	227-246	$\Delta \log k = \pm 0.3$	

$\text{CH}_3\text{SO}_2 + \text{NO}_2 \rightarrow \text{products}$	$\leq 1 \times 10^{-15}$					
$\text{CH}_3\text{SCH}_2 + \text{O}_2 \rightarrow \text{CH}_3\text{SCH}_2\text{O}_2$	5.7×10^{-12}	(1 bar)	± 0.4			
$\text{CH}_3\text{SCH}_2\text{O}_2 + \text{NO} \rightarrow \text{CH}_3\text{SCH}_2\text{O} + \text{NO}_2$	1.2×10^{-11}		± 0.2	$4.9 \times 10^{-12} \exp(260/T)$	260-400	± 300
$\text{CH}_3\text{SCH}_2\text{O}_2 + \text{NO}_2 + \text{M} \rightarrow \text{CH}_3\text{SCH}_2\text{O}_2\text{NO}_2 + \text{M}$	9×10^{-12}	(1 bar)	± 0.5			
$\text{CH}_3\text{SCH}_2\text{O}_2 + \text{CH}_3\text{SCH}_2\text{O}_2 \rightarrow 2\text{CH}_3\text{SCH}_2\text{O} + \text{O}_2$	1.0×10^{-11}		± 0.3			
$\text{CH}_3\text{SS} + \text{O}_3 \rightarrow \text{products}$	4.6×10^{-13}		± 0.3			
$\text{CH}_3\text{SS} + \text{NO}_2 \rightarrow \text{products}$	1.8×10^{-11}		± 0.3			
$\text{CH}_3\text{SSO} + \text{NO}_2 \rightarrow \text{products}$	4.5×10^{-12}		± 0.3			
$\text{O}_3 + \text{CH}_3\text{SCH}_3 \rightarrow \text{products}$	$< 1 \times 10^{-18}$					
$\text{ClO} + \text{CH}_3\text{SCH}_3 \rightarrow \text{products}$	5.3×10^{-15}		± 0.5	$1.7 \times 10^{-15} \exp(340/T)$	250-340	± 400
$\text{BrO} + \text{CH}_3\text{SCH}_3 \rightarrow \text{products}$	4.3×10^{-13}		± 0.3	$1.5 \times 10^{-14} \exp(1000/T)$	270-340	± 500
$\text{IO} + \text{CH}_3\text{SCH}_3 \rightarrow \text{products}$	1.5×10^{-14}		± 0.2	$6.3 \times 10^{-12} \exp(1800/T)$	290-470	± 500

Data for the following Photochemical Reactions based on data sheets on this website

$\text{OCS} + \text{hv} \rightarrow \text{products}$	See data sheet
$\text{CS}_2 + \text{hv} \rightarrow \text{products}$	See data sheet
$\text{CH}_3\text{SSCH}_3 + \text{hv} \rightarrow \text{products}$	See data sheet
$\text{CH}_3\text{SNO} + \text{hv} \rightarrow \text{products}$	See data sheet

FO_x Reactions - based on data sheets on this website

O + FO → O ₂ + F	2.7 x 10 ⁻¹¹	±0.3
O + FO ₂ → O ₂ + FO	5 x 10 ⁻¹¹	±0.7
O(¹ D) + HF → HO + F	1.5 x 10 ⁻¹¹	±0.1
→ O(³ P) + HF	3.6 x 10 ⁻¹¹	±0.1
overall	5.1 x 10 ⁻¹¹	±0.2
O(¹ D) + COF ₂ → O(³ P) + COF ₂	5.2 x 10 ⁻¹¹	
→ other products	2.2 x 10 ⁻¹¹	
overall	7.4 x 10 ⁻¹¹	±0.3
O(¹ D) + CH ₃ F → O(³ P) + CH ₃ F	2.7 x 10 ⁻¹¹	
→ other products	1.2 x 10 ⁻¹⁰	
overall	1.5 x 10 ⁻¹⁰	±0.15
O(¹ D) + CH ₂ F ₂ → O(³ P) + CH ₂ F ₂	3.6 x 10 ⁻¹¹	
→ other products	1.5 x 10 ⁻¹¹	
overall	5.1 x 10 ⁻¹¹	±0.3
O(¹ D) + CHF ₃ → O(³ P) + CHF ₃	8.2 x 10 ⁻¹²	
→ other products	9.1 x 10 ⁻¹³	
overall	9.1 x 10 ⁻¹²	±0.15
O(¹ D) + CH ₃ CH ₂ F → O(³ P) + CH ₃ CH ₂ F	4.7 x 10 ⁻¹¹	
→ other products	2.1 x 10 ⁻¹⁰	
overall	2.6 x 10 ⁻¹⁰	±0.3
O(¹ D) + CH ₃ CHF ₂ → O(³ P) + CH ₃ CHF ₂	1.1 x 10 ⁻¹⁰	
→ other products	9.2 x 10 ⁻¹¹	
overall	2.0 x 10 ⁻¹⁰	±0.3
O(¹ D) + CH ₃ CF ₃ → O(³ P) + CH ₃ CF ₃	5.8 x 10 ⁻¹¹	
→ other products		±0.5

$O(^1D) + CH_2FCF_3 \rightarrow O(^3P) + CH_2FCF_3$	4.6×10^{-11}					
→ other products	3.0×10^{-12}					
overall	4.9×10^{-11}		± 0.3			
$O(^1D) + CHF_2CF_3 \rightarrow O(^3P) + CHF_2CF_3$	1.0×10^{-10}					
→ other products	1.8×10^{-11}					
overall	1.2×10^{-10}		± 0.3			
$F + H_2 \rightarrow HF + H$	2.4×10^{-11}		± 0.1	$1.1 \times 10^{-10} \exp(-450/T)$	190-380	± 100
$F + H_2O \rightarrow HF + HO$	1.4×10^{-11}		± 0.1	1.4×10^{-11}	240-380	± 200
$F + O_2 + M \rightarrow FO_2 + M$	$5.8 \times 10^{-33} [N_2]$	(k_0)	± 0.3	$5.8 \times 10^{-33} (T/300)^{-1.7} [N_2]$	100-380	$\Delta n = \pm 0.5$
	1.2×10^{-10}	(k_∞)	± 0.3	1.2×10^{-10}	100-380	$\Delta \log k_\infty = \pm 0.3$
	$F_c \approx 0.5$			$F_c \approx 0.5$		
$FO_2 + M \rightarrow F + O_2 + M$	$1.5 \times 10^{-17} [N_2]$	(k_0/s^{-1})	± 0.3	$8.4 \times 10^{-9} (T/300)^{-1.25}$	310-420	± 500
	3.1×10^5	(k_∞/s^{-1})	± 0.3	$\exp(-5990/T) [N_2]$		$\Delta n = \pm 0.5$
	$F_c \approx 0.5$			$1.7 \times 10^{14} (T/300)^{0.45}$	310-420	± 500
				$\exp(-5990/T)$		$\Delta n = \pm 0.5$
				$F_c \approx 0.5$		
$F + O_3 \rightarrow FO + O_2$	1.0×10^{-11}		± 0.25	$2.2 \times 10^{-11} \exp(-230/T)$	250-370	± 200
$F + HONO_2 \rightarrow HF + NO_3$	2.3×10^{-11}		± 0.1	$6.0 \times 10^{-12} \exp(400/T)$	260-320	± 200
$HO + CH_3F \rightarrow H_2O + CH_2F$	2.1×10^{-14}		± 0.15	$1.9 \times 10^{-12} \exp(-1350/T)$	240-300	± 400
$HO + CH_2F_2 \rightarrow H_2O + CHF_2$	1.1×10^{-14}		± 0.10	$2.3 \times 10^{-12} \exp(-1590/T)$	220-300	± 200
$HO + CHF_3 \rightarrow H_2O + CF_3$	2.7×10^{-16}		± 0.2	$6.9 \times 10^{-13} \exp(-2340/T)$	250-300	± 300
$HO + CF_4 \rightarrow HO + CF_3$	$< 2 \times 10^{-18}$					
$HO + CH_3CH_2F \rightarrow \text{products}$	2.1×10^{-13}		± 0.2	$2.7 \times 10^{-12} \exp(-765/T)$	210-300	± 300
$HO + CH_3CHF_2 \rightarrow \text{products}$	3.6×10^{-14}		$+0.10$ -0.20	$1.25 \times 10^{-12} \exp(-1070/T)$	210-300	$+200$ -400

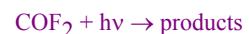
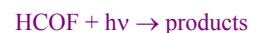
$\text{HO} + \text{CH}_3\text{CF}_3 \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{CF}_3$	1.2×10^{-15}	± 0.15	$9.2 \times 10^{-13} \exp(-1970/T)$	220-300	± 300
$\text{HO} + \text{CH}_2\text{FCH}_2\text{F} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{FCHF}$	1.0×10^{-13}	± 0.3	$1.5 \times 10^{-12} \exp(-800/T)$	210-300	± 200
$\text{HO} + \text{CH}_2\text{FCHF}_2 \rightarrow \text{products}$	1.5×10^{-14}	± 0.2	$3.3 \times 10^{-12} \exp(-1610/T)$	270-330	± 300
$\text{HO} + \text{CH}_2\text{FCF}_3 \rightarrow \text{H}_2\text{O} + \text{CHFCF}_3$	4.6×10^{-15}	± 0.2	$4.9 \times 10^{-13} \exp(-1395/T)$	220-300	± 300
$\text{HO} + \text{CHF}_2\text{CHF}_2 \rightarrow \text{H}_2\text{O} + \text{CF}_2\text{CHF}_2$	6.1×10^{-15}	± 0.2	$1.4 \times 10^{-12} \exp(-1620/T)$	290-360	± 300
$\text{HO} + \text{CHF}_2\text{CF}_3 \rightarrow \text{H}_2\text{O} + \text{CF}_2\text{CF}_3$	1.9×10^{-15}	± 0.2	$4.4 \times 10^{-13} \exp(-1630/T)$	220-300	± 300
$\text{HO} + \text{CHF}_2\text{CF}_2\text{CH}_2\text{F} \rightarrow \text{products}$	7.7×10^{-15}	± 0.3	$2.2 \times 10^{-12} \exp(-1685/T)$	285-365	± 300
$\text{HO} + \text{CF}_3\text{CF}_2\text{CH}_2\text{F} \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CF}_2\text{CHF}$	6.5×10^{-15}	± 0.3	$2.6 \times 10^{-13} \exp(-1100/T)$	250-320	± 400
$\text{HO} + \text{CF}_3\text{CHFCHF}_2 \rightarrow \text{products}$	5.0×10^{-15}	± 0.3	$1.4 \times 10^{-12} \exp(-1680/T)$	290-380	± 300
$\text{HO} + \text{CF}_3\text{CH}_2\text{CF}_3 \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CHCF}_3$	3.3×10^{-16}	± 0.3	$1.3 \times 10^{-12} \exp(-2465/T)$	270-340	± 400
$\text{HO} + \text{CF}_3\text{CHFCF}_3 \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CFCF}_3$	1.9×10^{-15}	± 0.2	$2.9 \times 10^{-13} \exp(-1500/T)$	270-380	± 300
$\text{HO} + \text{CHF}_2\text{OCHF}_2 \rightarrow \text{H}_2\text{O} + \text{CHF}_2\text{OCF}_2$	2.2×10^{-15}	± 0.1	$1.9 \times 10^{-12} \exp(-2020/T)$	273-460	± 300
$\text{HO} + \text{HCOF} \rightarrow \text{H}_2\text{O} + \text{FCO}$	$< 1 \times 10^{-14}$				
$\text{HO} + \text{CHF}_2\text{CHO} \rightarrow \text{products}$	1.6×10^{-12}	± 0.2			
$\text{HO} + \text{CF}_3\text{CHO} \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CO}$	5.7×10^{-13}	± 0.2			
$\text{HO} + \text{CF}_3\text{COOH} \rightarrow \text{products}$	1.3×10^{-13}	± 0.1	1.3×10^{-13}	280-350	$\Delta \log k = \pm 0.1$
$\text{HO}_2 + \text{CH}_2\text{FO}_2 \rightarrow \text{O}_2 + \text{CH}_2\text{FO}_2\text{H}$ $\rightarrow \text{O}_2 + \text{HCOF} + \text{H}_2\text{O}$		See data sheet			

$\text{HO}_2 + \text{CF}_3\text{O}_2 \rightarrow \text{CF}_3\text{O}_2\text{H} + \text{O}_2$	See data sheet					
$\rightarrow \text{C(O)F}_2 + \text{HOF} + \text{O}_2$						
$\text{HO}_2 + \text{CF}_3\text{CHFO}_2 \rightarrow \text{products}$	4.3×10^{-12}	± 0.2	$2.0 \times 10^{-13} \exp(910/T)$	210-365	± 300	
$\text{HO}_2 + \text{CF}_3\text{CF}_2\text{O}_2 \rightarrow \text{products}$	1.2×10^{-12}	± 0.5				
$\text{FO} + \text{O}_3 \rightarrow \text{products}$	$< 1 \times 10^{-14}$					
$\text{FO} + \text{NO} \rightarrow \text{F} + \text{NO}_2$	2.2×10^{-11}	± 0.15	$8.2 \times 10^{-12} \exp(300/T)$	290-850	± 200	
$\text{FO} + \text{FO} \rightarrow \text{products}$	1.0×10^{-11}	± 0.2	1.0×10^{-11}	290-440	± 250	
$\text{FO}_2 + \text{O}_3 \rightarrow \text{products}$	$< 4 \times 10^{-16}$					
$\text{FO}_2 + \text{NO} \rightarrow \text{FNO} + \text{O}_2$	7.5×10^{-13}	± 0.3	$7.5 \times 10^{-12} \exp(-690/T)$	190-300	± 400	
$\text{FO}_2 + \text{NO}_2 \rightarrow \text{products}$	4.0×10^{-14}	± 0.3	$3.8 \times 10^{-11} \exp(-2040/T)$	260-320	± 500	
$\text{FO}_2 + \text{CO} \rightarrow \text{products}$	$< 6 \times 10^{-16}$					
$\text{FO}_2 + \text{CH}_4 \rightarrow \text{products}$	$< 4.1 \times 10^{-15}$					
$\text{CF}_3 + \text{O}_2 + \text{M} \rightarrow \text{CF}_3\text{O}_2 + \text{M}$	$2.2 \times 10^{-29} [\text{N}_2]$	(k_0)	± 0.1	$2.2 \times 10^{-29} (T/300)^{-4.7} [\text{N}_2]$	230-380	$\Delta n = \pm 1.5$
	4.0×10^{-12}	(k_∞)	± 0.3	4.0×10^{-12}	200-300	$\Delta n = \pm 1.5$
	$F_c = 0.39$					
$\text{CF}_3\text{O} + \text{O}_2 \rightarrow \text{COF}_2 + \text{FO}_2$	$< 1 \times 10^{-18}$		$< 1 \times 10^{-10} \exp(-5600/T)$	250-370		
$\text{CF}_3\text{O} + \text{O}_3 \rightarrow \text{CF}_3\text{O}_2 + \text{O}_2$	1.8×10^{-14}	± 1	$2 \times 10^{-12} \exp(-1400/T)$	250-370	± 600	
$\text{CF}_3\text{O} + \text{H}_2\text{O} \rightarrow \text{CF}_3\text{OH} + \text{HO}$	$< 2 \times 10^{-17}$		$< 3 \times 10^{-12} \exp(-3600/T)$	250-380		
$\text{CF}_3\text{O} + \text{NO} \rightarrow \text{COF}_2 + \text{FNO}$	5.4×10^{-11}	± 0.1	$3.7 \times 10^{-11} \exp(110/T)$	230-390	± 100	
$\text{CF}_3\text{O} + \text{CH}_4 \rightarrow \text{CF}_3\text{OH} + \text{CH}_3$	2.2×10^{-14}	± 0.1	$2.6 \times 10^{-12} \exp(-1420/T)$	230-380	± 200	

$\text{CF}_3\text{O} + \text{C}_2\text{H}_6 \rightarrow \text{CF}_3\text{OH} + \text{C}_2\text{H}_5$	1.3×10^{-12}	± 0.1	$4.9 \times 10^{-12} \exp(-400/T)$	230-360	± 200
$\text{CH}_2\text{FO} + \text{O}_2 \rightarrow \text{HCOF} + \text{HO}_2$					
$\text{CH}_2\text{FO} + \text{M} \rightarrow \text{HCOF} + \text{H} + \text{M}$					
$\text{CH}_3\text{CF}_2\text{O} + \text{O}_2 \rightarrow \text{products}$					
$\text{CH}_3\text{CF}_2\text{O} + \text{M} \rightarrow \text{CH}_3 + \text{COF}_2 + \text{M}$					
$\text{CH}_2\text{FCHFO} + \text{O}_2 \rightarrow \text{CH}_2\text{FCOF} + \text{HO}_2$					
$\text{CH}_2\text{FCHFO} + \text{M} \rightarrow \text{CH}_2\text{F} + \text{HCOF} + \text{M}$					
$\text{CF}_3\text{CHFO} + \text{O}_2 \rightarrow \text{CF}_3\text{COF} + \text{HO}_2$					
$\text{CF}_3\text{CHFO} + \text{M} \rightarrow \text{CF}_3 + \text{HCOF} + \text{M}$					
$\text{CF}_3\text{CF}_2\text{O} + \text{O}_2 \rightarrow \text{products}$					
$\text{CF}_3\text{CF}_2\text{O} + \text{M} \rightarrow \text{CF}_3 + \text{COF}_2 + \text{M}$					
$\text{CH}_2\text{FO}_2 + \text{NO} \rightarrow \text{CH}_2\text{FO} + \text{NO}_2$	1.3×10^{-11}	± 0.3			
$\text{CHF}_2\text{O}_2 + \text{NO} \rightarrow \text{CHF}_2\text{O} + \text{NO}_2$	1.3×10^{-11}	± 0.3			
$\text{CF}_3\text{O}_2 + \text{O}_3 \rightarrow \text{CF}_3\text{O} + 2\text{O}_2$	$< 3 \times 10^{-15}$				
$\text{CF}_3\text{O}_2 + \text{NO} \rightarrow \text{CF}_3\text{O} + \text{NO}_2$	1.6×10^{-11}	± 0.15	$1.6 \times 10^{-11} (T/298)^{-1.2}$	230-430	$\Delta \log k = \pm 0.15$
$\text{CH}_2\text{FCHFO}_2 + \text{NO} \rightarrow \text{CH}_2\text{FCHFO} + \text{NO}_2$	$> 9 \times 10^{-12}$				
$\text{CHF}_2\text{CF}_2\text{O}_2 + \text{NO} \rightarrow \text{CHF}_2\text{CF}_2\text{O} + \text{NO}_2$	$> 1 \times 10^{-11}$				
$\text{CF}_3\text{CHFO}_2 + \text{NO} \rightarrow \text{CF}_3\text{CHFO} + \text{NO}_2$	1.3×10^{-11}	± 0.3			
$\text{CF}_3\text{CF}_2\text{O}_2 + \text{NO} \rightarrow \text{CF}_3\text{CF}_2\text{O} + \text{NO}_2$	$> 1 \times 10^{-11}$				

$\text{CF}_3\text{O}_2 + \text{NO}_2 + \text{M} \rightarrow \text{CF}_3\text{O}_2\text{NO}_2 + \text{M}$	$5.6 \times 10^{-29}[\text{N}_2]$ 7.7×10^{-12} $F_c = 0.31$	(k_0) (k_∞)	± 0.2 ± 0.2	$5.6 \times 10^{-29} (T/298)^{-9}[\text{N}_2]$ $7.7 \times 10^{-12} (T/298)^{-0.67}$ $F_c = 0.31$	260-300 260-300 260-300	$\Delta n = \pm 3$ $\Delta n = \pm 0.5$
$\text{CF}_3\text{O}_2\text{NO}_2 + \text{M} \rightarrow \text{CF}_3\text{O}_2 + \text{NO}_2 + \text{M}$	$4.5 \times 10^{-19}[\text{N}_2]$ 6.0×10^{-2} $F_c = 0.31$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.3 ± 0.3	$2.5 \times 10^{-5} \exp(-9430/T)[\text{N}_2]$ $1.5 \times 10^{16} \exp(-11940/T)$ $F_c = 0.31$	260-300 260-300 260-300	± 250 ± 250
$\text{CH}_2\text{FO}_2 + \text{CH}_2\text{FO}_2 \rightarrow \text{products}$	2.6×10^{-12}		± 0.3	$2.5 \times 10^{-13} \exp(700/T)$	220-380	± 300
$\text{CHF}_2\text{O}_2 + \text{CHF}_2\text{O}_2 \rightarrow \text{products}$	$(2.5-5) \times 10^{-12}$					
$\text{CF}_3\text{O}_2 + \text{CF}_3\text{O}_2 \rightarrow 2 \text{ CF}_3\text{O} + \text{O}_2$	1.5×10^{-12}		± 0.3			
$\text{CF}_3\text{O}_2 + \text{CF}_3\text{CHFO}_2 \rightarrow \text{products}$	8×10^{-12}		± 0.5			
$\text{CHF}_2\text{CF}_2\text{O}_2 + \text{CHF}_2\text{CF}_2\text{O}_2 \rightarrow \text{products}$		no recommendation				
$\text{CF}_3\text{CHFO}_2 + \text{CF}_3\text{CHFO}_2 \rightarrow \text{products}$	4.7×10^{-12}		± 0.3	$6.2 \times 10^{-13} \exp(605/T)$	210-375	± 200
$\text{CF}_3\text{CF}_2\text{O}_2 + \text{CF}_3\text{CF}_2\text{O}_2 \rightarrow 2 \text{ CF}_3\text{CF}_2\text{O} + \text{O}_2$		no recommendation				

Data for the following Photochemical Reactions is based on data sheets on this website



ClO_x Reactions- based on data contained in J. Phys. Chem. Ref. Data 26, 521, 1997, and updated () in J. Phys. Chem. Ref. Data, 29, 167, 2000*

O + HOCl → HO + ClO	1.7x 10 ⁻¹³	±0.5	1.7x 10 ⁻¹³	210-300	±300
O + ClO → Cl + O ₂	3.7 x 10 ⁻¹¹	±0.06	2.5 x 10 ⁻¹¹ exp(110/T)	220-390	±50
O + OCLO → O ₂ + ClO	1.0 x 10 ⁻¹³	±0.3	2.4 x 10 ⁻¹² exp(-960/T)	240-400	±300
O + OCLO + M → ClO ₃ + M	1.8 x 10 ⁻³¹ [N ₂] (k ₀) 2.8 x 10 ⁻¹¹ (k _∞) F _C = 0.5	±0.3	1.8 x 10 ⁻³¹ (T/298) ⁻¹ [N ₂] 2.8 x 10 ⁻¹¹	240-320	Δn = ±0.5 Δn = ±1
O + Cl ₂ O → ClO + ClO	4.5 x 10 ⁻¹²	±0.15	2.7 x 10 ⁻¹¹ exp(-530/T)	230-380	±200
O + ClONO ₂ → products	2.2 x 10 ⁻¹³	±0.08	4.5 x 10 ⁻¹² exp(-900/T)	200-330	±150
O(¹ D) + CHF ₂ Cl → O(³ P) + CHF ₂ Cl → ClO + CHF ₂ → other products	2.8 x 10 ⁻¹¹ 5.5 x 10 ⁻¹¹ 1.7 x 10 ⁻¹¹				
overall	1.0 x 10 ⁻¹⁰	±0.1	1.0 x 10 ⁻¹⁰	170-350	Δlog k = ±0.1
O(¹ D) + CHFCl ₂ → ClO + CHFCl ₂ → other products	1.4 x 10 ⁻¹⁰ 5.0 x 10 ⁻¹¹				
overall	1.9 x 10 ⁻¹⁰	±0.3	1.9 x 10 ⁻¹⁰	180-350	Δlog k = ±0.3
O(¹ D) + CH ₃ CF ₂ Cl → O(³ P) + CH ₃ F ₂ Cl → other products	5.7 x 10 ⁻¹¹ 1.6 x 10 ⁻¹⁰				
overall	2.2 x 10 ⁻¹⁰	±0.3			
O(¹ D) + CH ₃ CFCl ₂ → O(³ P) + CH ₃ CFCl ₂ → other products	8.1 x 10 ⁻¹¹ 1.8 x 10 ⁻¹⁰				
overall	2.6 x 10 ⁻¹⁰	±0.3			
O(¹ D) + CH ₂ ClCF ₃ → O(³ P) + CH ₂ ClCF ₃ → other products	2.4 x 10 ⁻¹¹ 9.6 x 10 ⁻¹¹				
overall	1.2 x 10 ⁻¹⁰	±0.3			

$O(^1D) + CH_2ClCF_2Cl \rightarrow O(^3P) + CH_2ClCF_2Cl$						
→ other products	1.6×10^{-10}		± 0.5			
$O(^1D) + CHFCICF_3 \rightarrow O(^3P) + CHFCICF_3$	2.7×10^{-11}					
→ other products	5.9×10^{-11}					
overall	8.6×10^{-11}		± 0.3			
$O(^1D) + CHCl_2CF_3 \rightarrow O(^3P) + CHCl_2CF_3$	4.2×10^{-11}					
→ other products	1.6×10^{-10}					
overall	2.0×10^{-10}		± 0.3			
$O(^1D) + CF_2Cl_2 \rightarrow ClO + CF_2Cl$	1.2×10^{-10}					
→ $O(^3P) + CF_2Cl_2$	2.4×10^{-11}					
overall	1.4×10^{-10}		± 0.1	1.4×10^{-10}	170-350	$\Delta \log k = \pm 0.1$
$O(^1D) + CFCl_3 \rightarrow ClO + CFCl_2$	2.0×10^{-10}					
→ $O(^3P) + CFCl_3$	3.0×10^{-11}					
overall	2.3×10^{-10}		± 0.1	2.3×10^{-10}	170-350	$\Delta \log k = \pm 0.1$
$O(^1D) + CCl_4 \rightarrow ClO + CCl_3$	2.9×10^{-10}					
→ $O(^3P) + CCl_4$	4.0×10^{-11}					
overall	3.3×10^{-10}		± 0.1	3.3×10^{-10}	200-350	$\Delta \log k = \pm 0.1$
$O(^1D) + COFCl \rightarrow O(^3P) + COFCl$	1.9×10^{-10}		± 0.3			
$O(^1D) + COCl_2 \rightarrow$ products	2.2×10^{-10}		± 0.1	$2.2 \times 10^{-10} \exp(25/T)$	190-430	± 25
$Cl + H_2 \rightarrow HCl + H$	1.7×10^{-14}		± 0.1	$3.9 \times 10^{-11} \exp(-2310/T)$	200-310	± 200
$Cl + HO_2 \rightarrow HCl + O_2$	3.4×10^{-11}		± 0.2			
→ $ClO + HO$	9.3×10^{-12}		± 0.2	$6.3 \times 10^{-11} \exp(-570/T)$	230-420	± 200
Overall	4.3×10^{-11}			4.3×10^{-11}	230-420	
$Cl + H_2O_2 \rightarrow HCl + HO_2$	4.1×10^{-13}		± 0.2	$1.1 \times 10^{-11} \exp(-980/T)$	260-430	± 500
$Cl + O_2 + M \rightarrow ClOO + M$	$1.4 \times 10^{-33}[N_2]$	(k_0)	± 0.2 (200 K)	$1.4 \times 10^{-33}(T/300)^{-3.9}[N_2]$	160-300	$\Delta n = \pm 1$
	$1.6 \times 10^{-33}[O_2]$	(k_0)	± 0.2 (200 K)	$1.6 \times 10^{-33}(T/300)^{-2.9}[O_2]$	160-300	$\Delta n = \pm 1$

$\text{ClOO} + \text{M} \rightarrow \text{Cl} + \text{O}_2 + \text{M}$	$6.2 \times 10^{-13}[\text{N}_2]$	(k_0/s^{-1})	± 0.3	$2.8 \times 10^{-10} \exp(-1820/T)[\text{N}_2]$	160-300	± 200
$\text{Cl} + \text{CO} + \text{M} \rightarrow \text{ClCO} + \text{M}$	$1.3 \times 10^{-33}[\text{N}_2]$	(k_0)	± 0.3	$1.3 \times 10^{-33}(T/300)^{-3.8}[\text{N}_2]$	180-300	$\Delta n = \pm 1$
$\text{ClCO} + \text{M} \rightarrow \text{Cl} + \text{CO} + \text{M}$	$2.0 \times 10^{-14}[\text{N}_2]$	(k_0/s^{-1})	± 0.4	$4.1 \times 10^{-10} \exp(-2960/T)[\text{N}_2]$	180-300	± 200
$\text{Cl} + \text{O}_3 \rightarrow \text{ClO} + \text{O}_2$	1.2×10^{-11}		± 0.06	$2.8 \times 10^{-11} \exp(-250/T)$	180-300	$+100/-150$
$\text{Cl} + \text{HONO}_2 \rightarrow \text{HCl} + \text{NO}_3$	$< 2.0 \times 10^{-16}$					
$\text{Cl} + \text{NO}_3 \rightarrow \text{ClO} + \text{NO}_2$	2.4×10^{-11}		± 0.2	2.4×10^{-11}	200-300	± 400
$\text{Cl} + \text{OCLO} \rightarrow \text{ClO} + \text{ClO}$	5.7×10^{-11}		± 0.1	$3.2 \times 10^{-11} \exp(170/T)$	220-430	± 200
$\text{Cl} + \text{Cl}_2\text{O} \rightarrow \text{Cl}_2 + \text{ClO}$	9.6×10^{-11}		± 0.1	$6.2 \times 10^{-11} \exp(130/T)$	230-380	± 130
$\text{Cl} + \text{Cl}_2\text{O}_2 \rightarrow \text{Cl}_2 + \text{ClOO}$	1.0×10^{-10}		± 0.3	1.0×10^{-10}	230-300	± 300
$\text{Cl} + \text{ClONO}_2 \rightarrow \text{Cl}_2 + \text{NO}_3$	1.0×10^{-11}		± 0.10	$6.2 \times 10^{-12} \exp(145/T)$	190-360	± 50
$\text{Cl} + \text{HC(O)Cl} \rightarrow \text{HCl} + \text{ClCO}$	7.5×10^{-13}		± 0.1	$8.1 \times 10^{-12} \exp(-710/T)$	220-330	± 150
$\text{Cl} + \text{CH}_3\text{OCl} \rightarrow \text{Cl}_2 + \text{CH}_3\text{O}$ $\rightarrow \text{HCl} + \text{CH}_2\text{OCl}$	5.2×10^{-11} 9.15×10^{-12}		± 0.1 ± 0.1			
overall	6.1×10^{-11}		± 0.1			
$\text{Cl} + \text{CH}_3\text{F} \rightarrow \text{HCl} + \text{CH}_2\text{F}$	3.5×10^{-13}		± 0.15	$4.0 \times 10^{-12} \exp(-730/T)$	240-370	± 400
$\text{Cl} + \text{CH}_3\text{Cl} \rightarrow \text{HCl} + \text{CH}_2\text{Cl}$	4.8×10^{-13}		± 0.1	$2.3 \times 10^{-11} \exp(-1150/T)$	220-360	± 200
$\text{Cl} + \text{CH}_2\text{F}_2 \rightarrow \text{HCl} + \text{CHF}_2$	5.0×10^{-14}		± 0.5	$7.0 \times 10^{-12} \exp(-1470/T)$	280-370	± 500
$\text{Cl} + \text{CH}_2\text{FCl} \rightarrow \text{HCl} + \text{CHFCl}$	1.1×10^{-13}		± 0.3	$7.0 \times 10^{-12} \exp(-1230/T)$	270-370	± 500
$\text{Cl} + \text{CH}_2\text{Cl}_2 \rightarrow \text{HCl} + \text{CHCl}_2$	3.4×10^{-13}		± 0.1	$5.9 \times 10^{-12} \exp(-850/T)$	220-400	± 200
$\text{Cl} + \text{CHF}_2\text{Cl} \rightarrow \text{HCl} + \text{CF}_2\text{Cl}$	1.7×10^{-15}		± 0.15	$5.9 \times 10^{-12} \exp(-2430/T)$	290-430	± 400

$\text{Cl} + \text{CHFCl}_2 \rightarrow \text{HCl} + \text{CFCl}_2$	2.0×10^{-14}	± 0.2	$5.5 \times 10^{-12} \exp(-1675/T)$	290-430	± 400
$\text{Cl} + \text{CHCl}_3 \rightarrow \text{HCl} + \text{CCl}_3$	1.1×10^{-13}	± 0.2	$2.4 \times 10^{-12} \exp(-920/T)$	220-500	± 400
$\text{Cl} + \text{CH}_3\text{CH}_2\text{F} \rightarrow \text{HCl} + \text{CH}_3\text{CHF}$	6.5×10^{-12}	± 0.3	$1.0 \times 10^{-11} \exp(-130/T)$	280-370	± 500
$\rightarrow \text{HCl} + \text{CH}_2\text{CH}_2\text{F}$	7.4×10^{-13}	± 0.3	$8.3 \times 10^{-12} \exp(-720/T)$	280-370	± 500
$\text{Cl} + \text{CH}_3\text{CHF}_2 \rightarrow \text{HCl} + \text{CH}_3\text{CF}_2$	2.5×10^{-13}	± 0.15	$6.3 \times 10^{-12} \exp(-965/T)$	280-360	± 500
$\rightarrow \text{HCl} + \text{CH}_2\text{CHF}_2$	2.3×10^{-15}	± 0.5	$7.0 \times 10^{-12} \exp(-2400/T)$	280-360	± 500
$\text{Cl} + \text{CH}_2\text{FCH}_2\text{F} \rightarrow \text{HCl} + \text{CH}_2\text{FCHF}$	7.0×10^{-13}	± 0.2	$2.5 \times 10^{-11} \exp(-1065/T)$	280-360	± 400
$\text{Cl} + \text{CH}_3\text{CF}_3 \rightarrow \text{HCl} + \text{CH}_2\text{CF}_3$	2.6×10^{-17}	± 0.5	$6.9 \times 10^{-12} \exp(-3720/T)$	280-370	± 500
$\text{Cl} + \text{CH}_2\text{FCHF}_2 \rightarrow \text{HCl} + \text{CH}_2\text{FCF}_2$	2.5×10^{-14}	± 0.5	$3.3 \times 10^{-12} \exp(-1450/T)$	280-370	± 500
$\rightarrow \text{HCl} + \text{CHFCHF}_2$	2.5×10^{-14}	± 0.5	$4.6 \times 10^{-12} \exp(-1560/T)$	280-370	± 500
$\text{Cl} + \text{CH}_3\text{CF}_2\text{Cl} \rightarrow \text{HCl} + \text{CH}_2\text{CF}_2\text{Cl}$	4.1×10^{-16}	± 0.15	$1.4 \times 10^{-12} \exp(-2420/T)$	296-440	± 500
$\text{Cl} + \text{CH}_3\text{CFCl}_2 \rightarrow \text{HCl} + \text{CH}_2\text{CFCl}_2$	2.1×10^{-15}	± 0.1	$1.7 \times 10^{-12} \exp(-2000/T)$	298-376	± 300
$\text{Cl} + \text{CH}_3\text{CCl}_3 \rightarrow \text{HCl} + \text{CH}_2\text{CCl}_3$	7×10^{-15}	± 0.2	$2.8 \times 10^{-12} \exp(-1790/T)$	298-418	± 400
$\text{Cl} + \text{CH}_2\text{FCF}_3 \rightarrow \text{HCl} + \text{CHFCF}_3$	1.5×10^{-15}	± 0.1	$3.4 \times 10^{-12} \exp(-2300/T)$	290-340	± 500
$\text{Cl} + \text{CHF}_2\text{CHF}_2 \rightarrow \text{HCl} + \text{CF}_2\text{CHF}_2$	2.2×10^{-15}	± 0.2	$7.9 \times 10^{-12} \exp(-2440/T)$	280-360	± 500
$\text{Cl} + \text{CHF}_2\text{CF}_3 \rightarrow \text{HCl} + \text{CF}_2\text{CF}_3$	2.5×10^{-16}	± 0.2			
$\text{Cl} + \text{CHFCICF}_3 \rightarrow \text{HCl} + \text{CFCICF}_3$	2.7×10^{-15}	± 0.1	$1.1 \times 10^{-12} \exp(-1800/T)$	270-380	± 500
$\text{Cl} + \text{CHCl}_2\text{CF}_3 \rightarrow \text{HCl} + \text{CCl}_2\text{CF}_3$	1.2×10^{-14}	± 0.1	$4.4 \times 10^{-12} \exp(-1740/T)$	270-380	± 500
$\text{Cl} + \text{OCS} \rightarrow \text{SCI} + \text{CO}$	$< 1.0 \times 10^{-16}$				
$\text{Cl} + \text{CS}_2 + \text{O}_2 \rightarrow \text{products}$	$\leq 4 \times 10^{-15}$	(1 bar air)			

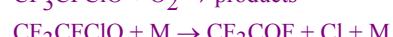
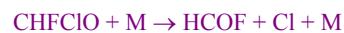
$\text{HO} + \text{Cl}_2 \rightarrow \text{HOCl} + \text{Cl}$	6.5×10^{-14}	± 0.08	$3.6 \times 10^{-12} \exp(-1200/T)$	230-360	± 300
$\text{HO} + \text{HCl} \rightarrow \text{H}_2\text{O} + \text{Cl}$	8.0×10^{-13}	± 0.06	$1.8 \times 10^{-12} \exp(-240/T)$	200-300	± 100
$\text{HO} + \text{HOCl} \rightarrow \text{ClO} + \text{H}_2\text{O}$	5.0×10^{-13}	± 0.5			
$\text{HO} + \text{ClO} \rightarrow \text{products}$	2.0×10^{-11}	± 0.15	$7.3 \times 10^{-12} \exp(300/T)$	200-380	± 100
$\text{HO} + \text{OCIO} \rightarrow \text{products}$	6.6×10^{-12}	± 0.3	$4.5 \times 10^{-13} \exp(800/T)$	290-480	± 200
$\text{HO} + \text{ClNO}_2 \rightarrow \text{HOCl} + \text{NO}_2$	3.6×10^{-14}	± 0.3	$2.4 \times 10^{-12} \exp(-1250/T)$	260-350	± 300
$\text{HO} + \text{ClONO}_2 \rightarrow \text{products}$	4.0×10^{-13}	± 0.2	$1.2 \times 10^{-12} \exp(-330/T)$	240-390	± 200
$\text{HO} + \text{CH}_3\text{Cl} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{Cl}$	3.6×10^{-14}	± 0.10	$2.1 \times 10^{-12} \exp(-1210/T)$	220-300	± 200
$\text{HO} + \text{CH}_2\text{FCl} \rightarrow \text{H}_2\text{O} + \text{CHFCl}$	3.9×10^{-14}	± 0.10	$1.6 \times 10^{-12} \exp(-1105/T)$	240-300	± 200
$\text{HO} + \text{CH}_2\text{Cl}_2 \rightarrow \text{H}_2\text{O} + \text{CHCl}_2$	1.0×10^{-13}	± 0.10	$1.8 \times 10^{-12} \exp(-860/T)$	210-400	± 150
$\text{HO} + \text{CHF}_2\text{Cl} \rightarrow \text{H}_2\text{O} + \text{CF}_2\text{Cl}$	4.7×10^{-15}	± 0.08	$7.9 \times 10^{-13} \exp(-1530/T)$	240-300	± 150
$\text{HO} + \text{CHFCl}_2 \rightarrow \text{H}_2\text{O} + \text{CFCl}_2$	2.9×10^{-14}	± 0.10	$1.04 \times 10^{-12} \exp(-1065/T)$	240-300	± 200
$\text{HO} + \text{CHCl}_3 \rightarrow \text{H}_2\text{O} + \text{CCl}_3$	1.05×10^{-13}	± 0.10	$1.8 \times 10^{-12} \exp(-850/T)$	240-300	± 300
$\text{HO} + \text{CF}_2\text{Cl}_2 \rightarrow \text{HOCl} + \text{CF}_2\text{Cl}$	$< 7 \times 10^{-18}$		$< 1 \times 10^{-12} \exp(-3540/T)$	250-480	
$\text{HO} + \text{CFCl}_3 \rightarrow \text{HOCl} + \text{CFCl}_2$	$< 5 \times 10^{-18}$		$< 1 \times 10^{-12} \exp(-3650/T)$	250-480	
$\text{HO} + \text{CCl}_4 \rightarrow \text{HOCl} + \text{CCl}_3$	$< 5 \times 10^{-16}$		$< 1 \times 10^{-12} \exp(-2260/T)$	250-300	
$\text{HO} + \text{C}_2\text{HCl}_3 \rightarrow \text{products}$	2.0×10^{-12}	± 0.10	$3.0 \times 10^{-13} \exp(565/T)$	230-300	± 200
$\text{HO} + \text{C}_2\text{Cl}_4 \rightarrow \text{products}$	1.6×10^{-13}	± 0.10	$3.5 \times 10^{-12} \exp(-920/T)$	290-420	± 300
$\text{HO} + \text{CH}_3\text{CF}_2\text{Cl} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{CF}_2\text{Cl}$	3.0×10^{-15}	± 0.10	$8.5 \times 10^{-13} \exp(-1685/T)$	220-300	± 200

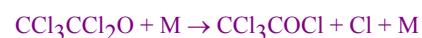
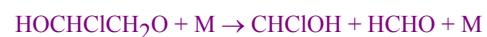
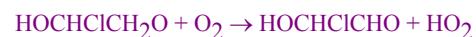
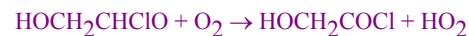
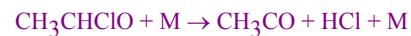
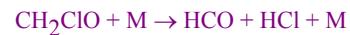
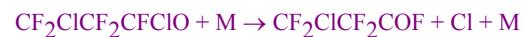
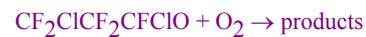
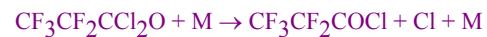
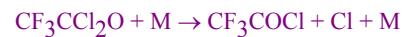
$\text{HO} + \text{CH}_3\text{CFCl}_2 \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{CFCl}_2$	5.8×10^{-15}	± 0.10	$8.1 \times 10^{-13} \exp(-1470/T)$	220-300	± 200
$\text{HO} + \text{CH}_3\text{CCl}_3 \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{CCl}_3$	9.5×10^{-15}	± 0.10	$1.2 \times 10^{-12} \exp(-1440/T)$	240-300	± 200
$\text{HO} + \text{CH}_2\text{ClCF}_3 \rightarrow \text{H}_2\text{O} + \text{CHClCF}_3$	1.4×10^{-14}	± 0.15	$5.6 \times 10^{-13} \exp(-1100/T)$	260-380	± 200
$\text{HO} + \text{CH}_2\text{ClCF}_2\text{Cl} \rightarrow \text{H}_2\text{O} + \text{CHClCF}_2\text{Cl}$	1.7×10^{-14}	± 0.15	$3.5 \times 10^{-12} \exp(-1585/T)$	250-350	± 300
$\text{HO} + \text{CHFClCF}_3 \rightarrow \text{H}_2\text{O} + \text{CFClCF}_3$	8.7×10^{-15}	± 0.20	$3.5 \times 10^{-13} \exp(-1100/T)$	210-300	± 300
$\text{HO} + \text{CHCl}_2\text{CF}_3 \rightarrow \text{H}_2\text{O} + \text{CCl}_2\text{CF}_3$	3.6×10^{-14}	± 0.10	$6.6 \times 10^{-13} \exp(-870/T)$	210-300	± 200
$\text{HO} + \text{CHFClCF}_2\text{Cl} \rightarrow \text{H}_2\text{O} + \text{CFClCF}_2\text{Cl}$	1.2×10^{-14}	± 0.3	$8.4 \times 10^{-13} \exp(-1255/T)$	298-460	± 400
$\text{HO} + \text{CHCl}_2\text{CF}_2\text{Cl} \rightarrow \text{H}_2\text{O} + \text{CCl}_2\text{CF}_2\text{Cl}$	5.1×10^{-14}	± 0.2	$8.1 \times 10^{-13} \exp(-825/T)$	270-340	± 200
$\text{HO} + \text{CHFClCFCl}_2 \rightarrow \text{H}_2\text{O} + \text{CFClCFCl}_2$	1.6×10^{-14}	± 0.3	$5.8 \times 10^{-13} \exp(-1065/T)$	270-340	± 400
$\text{HO} + \text{CHCl}_2\text{CF}_2\text{CF}_3 \rightarrow$ $\text{H}_2\text{O} + \text{CCl}_2\text{CF}_2\text{CF}_3$	2.5×10^{-14}	± 0.15	$1.1 \times 10^{-12} \exp(-1130/T)$	270-400	± 300
$\text{HO} + \text{CHFClCF}_2\text{CF}_2\text{Cl} \rightarrow$ $\text{H}_2\text{O} + \text{CFClCF}_2\text{CF}_2\text{Cl}$	8.9×10^{-15}	± 0.10	$5.5 \times 10^{-13} \exp(-1230/T)$	290-400	± 300
$\text{HO} + \text{CH}_3\text{CF}_2\text{CFCl}_2 \rightarrow$ $\text{H}_2\text{O} + \text{CH}_2\text{CF}_2\text{CFCl}_2$	2.4×10^{-15}	± 0.3	$7.0 \times 10^{-13} \exp(-1690/T)$	290-370	± 300
$\text{HO} + \text{HC(O)Cl} \rightarrow \text{H}_2\text{O} + \text{ClCO}$	$< 5 \times 10^{-13}$				
$\text{HO} + \text{CH}_3\text{OCl} \rightarrow \text{products}$	7.2×10^{-13}	± 0.3	$2.4 \times 10^{-12} \exp(-360/T)$	250-350	± 300
$\text{HO} + \text{COCl}_2 \rightarrow \text{products}$	$< 5 \times 10^{-15}$				
$\text{HO} + \text{CH}_2\text{ClCHO} \rightarrow \text{products}$	3.1×10^{-12}	± 0.15			
$\text{HO} + \text{CHFClCHO} \rightarrow \text{products}$	2.1×10^{-12}	± 0.15			

$\text{HO} + \text{CHCl}_2\text{CHO} \rightarrow \text{products}$	2.4×10^{-12}	± 0.15				
$\text{HO} + \text{CF}_2\text{ClCHO} \rightarrow \text{H}_2\text{O} + \text{CF}_2\text{ClCO}$	8.2×10^{-13}	± 0.25				
$\text{HO} + \text{CFCl}_2\text{CHO} \rightarrow \text{H}_2\text{O} + \text{CFCl}_2\text{CO}$	1.2×10^{-12}	± 0.15				
$\text{HO} + \text{CCl}_3\text{CHO} \rightarrow \text{H}_2\text{O} + \text{CCl}_3\text{CO}$	8.0×10^{-13}	± 0.15	$1.8 \times 10^{-12}\exp(-240/T)$	230-420	± 200	
$\text{HO} + \text{CH}_3\text{COCl} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{COCl}$	6.8×10^{-14}	± 0.3				
$\text{HO} + \text{CHF}_2\text{OCHClCF}_3 \rightarrow \text{products}$	1.5×10^{-14}	± 0.10	$1.1 \times 10^{-12}\exp(-1280/T)$	250-430	± 250	
$\text{HO} + \text{CHF}_2\text{OCF}_2\text{CHFCI} \rightarrow \text{products}$	1.2×10^{-14}	± 0.10	$7.5 \times 10^{-13}\exp(-1230/T)$	250-430	± 150	
$\text{HO}_2 + \text{CF}_3\text{CCl}_2\text{O}_2 \rightarrow \text{O}_2 + \text{CF}_3\text{CCl}_2\text{O}_2\text{H}$	1.9×10^{-12}	± 0.3				
$\text{HO}_2 + \text{CH}_2\text{ClO}_2 \rightarrow \text{products}$	5.0×10^{-12}	± 0.3	$3.2 \times 10^{-13}\exp(820/T)$	250-600	± 300	
$\text{HO}_2 + \text{CHCl}_2\text{O}_2 \rightarrow \text{products}$	5.9×10^{-12}	± 0.3	$5.6 \times 10^{-13}\exp(700/T)$	280-440	± 300	
$\text{HO}_2 + \text{CF}_2\text{ClO}_2 \rightarrow \text{products}$	3.4×10^{-12}	± 0.5				
$\text{HO}_2 + \text{CCl}_3\text{O}_2 \rightarrow \text{products}$	5.1×10^{-12}	± 0.3	$4.7 \times 10^{-13}\exp(710/T)$	280-440	± 300	
$\text{HO}_2 + \text{CFCl}_2\text{CH}_2\text{O}_2 \rightarrow \text{products}$	9.2×10^{-12}	± 0.5				
$\text{HO}_2 + \text{CF}_2\text{ClCH}_2\text{O}_2 \rightarrow \text{products}$	6.8×10^{-12}	± 0.5				
$\text{NO}_3 + \text{HCl} \rightarrow \text{HNO}_3 + \text{Cl}$	$<5 \times 10^{-17}$					
$\text{NO}_3 + \text{C}_2\text{HCl}_3 \rightarrow \text{products}$	3.5×10^{-16}	± 0.2	$3.2 \times 10^{-13}\exp(-2030/T)$	270-370	± 500	
$\text{NO}_3 + \text{C}_2\text{Cl}_4 \rightarrow \text{products}$	$<1 \times 10^{-16}$					
$\text{ClO} + \text{HO}_2 \rightarrow \text{products}$	6.9×10^{-12}	± 0.20	$2.2 \times 10^{-12}\exp(340/T)$	230-300	± 350	
$\text{ClO} + \text{O}_3 \rightarrow \text{ClOO} + \text{O}_2$	$<1.5 \times 10^{-17}$					

$\rightarrow \text{OCIO} + \text{O}_2$	$<1 \times 10^{-18}$					
$\text{ClO} + \text{NO} \rightarrow \text{Cl} + \text{NO}_2$	1.7×10^{-11}		± 0.1	$6.2 \times 10^{-12} \exp(295/T)$	200-420	± 100
$\text{ClO} + \text{NO}_2 + \text{M} \rightarrow \text{ClONO}_2 + \text{M}$	$1.6 \times 10^{-31} [\text{N}_2]$ 7.0×10^{-11} $F_c = 0.4$	(k_0) (k_∞)	± 0.1 ± 0.3	$1.6 \times 10^{-31} (T/300)^{-3.4} [\text{N}_2]$ 7.0×10^{-11}	250-350 250-350 250-350	$\Delta n = \pm 1$ $\Delta \log k = \pm 0.3$
$\text{ClO} + \text{NO}_3 \rightarrow \text{products}$	4.6×10^{-13}		± 0.2	4.6×10^{-13}	210-360	± 400
$\text{ClO} + \text{ClO} \rightarrow \text{Cl}_2 + \text{O}_2$ $\rightarrow \text{Cl} + \text{ClOO}$ $\rightarrow \text{Cl} + \text{OCIO}$	4.8×10^{-15} 8.0×10^{-15} 3.5×10^{-15}		± 0.2 ± 0.2 ± 0.2	$1.0 \times 10^{-12} \exp(-1590/T)$ $3.0 \times 10^{-11} \exp(-2450/T)$ $3.5 \times 10^{-13} \exp(-1370/T)$	260-390 260-390 260-390	± 300 ± 500 ± 300
$\text{ClO} + \text{ClO} + \text{M} \rightarrow \text{Cl}_2\text{O}_2 + \text{M}$	$2.0 \times 10^{-32} [\text{N}_2]$ 1.0×10^{-11} $F_c = 0.45$	(k_0) (k_∞)	± 0.1 ± 0.3	$2.0 \times 10^{-32} (T/300)^{-4} [\text{N}_2]$ 1.0×10^{-11} $F_c = 0.45$	190-300 190-300 190-300	$\Delta n = \pm 1.5$ $\Delta \log k = \pm 0.3$
$\text{Cl}_2\text{O}_2 + \text{M} \rightarrow \text{ClO} + \text{ClO} + \text{M}$	$2.3 \times 10^{-18} [\text{N}_2]$ 1.1×10^3 $F_c = 0.45$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.3 ± 0.3	$3.7 \times 10^{-7} \exp(-7690/T) [\text{N}_2]$ $1.8 \times 10^{14} \exp(-7690/T)$ $F_c = 0.45$	260-310 260-310 260-310	± 900 ± 500
$\text{ClO} + \text{OCIO} + \text{M} \rightarrow \text{Cl}_2\text{O}_3 + \text{M}$	$6.2 \times 10^{-32} [\text{N}_2]$ 2.4×10^{-11} $F_c = 0.6$	(k_0) (k_∞)	± 0.3 ± 0.3	$6.2 \times 10^{-32} (T/300)^{-4.7} [\text{N}_2]$ 2.4×10^{-11} $F_c = 0.6$	200-300 200-300 200-300	$\Delta n = \pm 1$ $\Delta \log k_\infty = \pm 0.3$
$\text{Cl}_2\text{O}_3 + \text{M} \rightarrow \text{ClO} + \text{OCIO} + \text{M}$	$4.5 \times 10^{-25} [\text{N}_2]$ $1.6 \times 10^5 [\text{N}_2]$ $F_c = 0.6$	(k_0) (k_∞)	± 0.5 (240 K) ± 0.5 (240 K)	$1.6 \times 10^{-19} \exp(-3810/T) [\text{N}_2]$ $2.5 \times 10^{12} \exp(-4940/T) [\text{N}_2]$ $F_c = 0.6$	200-300 200-300	± 500 ± 500
$\text{ClO} + \text{CH}_3\text{O}_2 \rightarrow \text{products}$	2.2×10^{-12}		± 0.15	$2.4 \times 10^{-12} \exp(-20/T)$	220-360	± 200
$\text{OCIO} + \text{O}_3 \rightarrow \text{ClO}_3 + \text{O}_2$	3.0×10^{-19}		± 0.4	$2.1 \times 10^{-12} \exp(-4700/T)$	260-300	± 1000
$\text{OCIO} + \text{NO} \rightarrow \text{NO}_2 + \text{ClO}$ $\text{OCIO} + \text{NO}_3 + \text{M} \rightarrow \text{products}$	3.6×10^{-13} see data sheet		± 0.15	$1.1 \times 10^{-13} \exp(350/T)$	220-370	± 200

$\text{Cl}_2\text{O}_2 + \text{O}_3 \rightarrow \text{ClO} + \text{ClOO} + \text{O}_2$	$<1 \times 10^{-19}$	(200 K)				
$\text{CF}_2\text{Cl} + \text{O}_2 + \text{M} \rightarrow \text{CF}_2\text{ClOO} + \text{M}$	$1.4 \times 10^{-29}[\text{N}_2]$ 7×10^{-12} $F_c = 0.4$	(k_0) (k_∞)	± 0.5 ± 0.5	$1.4 \times 10^{-29}(T/300)^{-5}[\text{N}_2]$ $7 \times 10^{-12}(T/298)^{-0.6}$	200-300 200-300	$\Delta n = \pm 3$ $\Delta \log k = \pm 0.5$
$\text{CFCl}_2 + \text{O}_2 + \text{M} \rightarrow \text{CFCl}_2\text{O}_2 + \text{M}$	$6 \times 10^{-30}[\text{N}_2]$ 9×10^{-12} $F_c = 0.4$	(k_0) (k_∞)	± 0.3 ± 0.3	$6 \times 10^{-30}(T/298)^{-6}[\text{N}_2]$ 9×10^{-12}	230-380 230-300	$\Delta n = \pm 3$ $\Delta n = \pm 1$
$\text{CCl}_3 + \text{O}_2 + \text{M} \rightarrow \text{CCl}_3\text{O}_2 + \text{M}$	$1.1 \times 10^{-30}[\text{N}_2]$ 5.2×10^{-12} $F_c = 0.35$	(k_0) (k_∞)	± 0.2 ± 0.3	$1.1 \times 10^{-30}(T/300)^{-6.2}[\text{N}_2]$ $5.2 \times 10^{-12}(T/300)^{-1.4}$	230-350 260-350	$\Delta n = \pm 1$ $\Delta n = \pm 1.5$

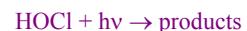
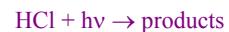


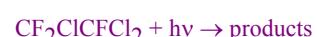
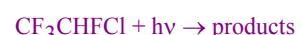
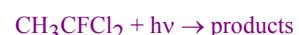
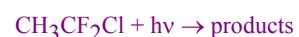
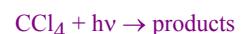
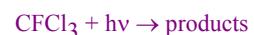
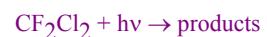
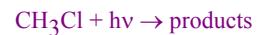
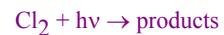
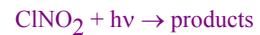
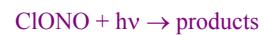
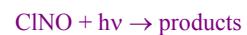
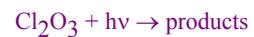
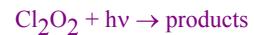
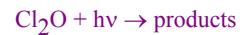


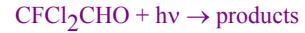
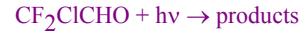
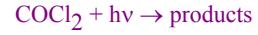
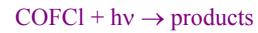
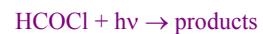
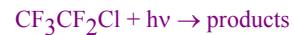
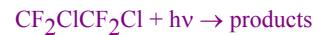
$\text{CH}_2\text{ClO}_2 + \text{NO} \rightarrow \text{CH}_2\text{ClO} + \text{NO}_2$	1.9×10^{-11}	± 0.3				
$\text{CF}_2\text{ClO}_2 + \text{NO} \rightarrow \text{CF}_2\text{ClO} + \text{NO}_2$	1.5×10^{-11}	± 0.2	$1.5 \times 10^{-11}(T/298)^{-1.5}$	230-430	$\Delta \log k = \pm 0.2$	
$\text{CFCl}_2\text{O}_2 + \text{NO} \rightarrow \text{CFCl}_2\text{O} + \text{NO}_2$	1.5×10^{-11}	± 0.2	$1.5 \times 10^{-11}(T/298)^{-1.3}$	230-430	$\Delta \log k = \pm 0.2$	
$\text{CCl}_3\text{O}_2 + \text{NO} \rightarrow \text{CCl}_3\text{O} + \text{NO}_2$	1.8×10^{-11}	± 0.2	$1.8 \times 10^{-11}(T/298)^{-1.0}$	230-430	$\Delta \log k = \pm 0.2$	
$\text{CF}_2\text{ClCH}_2\text{O}_2 + \text{NO} \rightarrow \text{CF}_2\text{ClCH}_2\text{O} + \text{NO}_2$	1.2×10^{-11}	± 0.3				
$\text{CFCl}_2\text{CH}_2\text{O}_2 + \text{NO} \rightarrow \text{CFCl}_2\text{CH}_2\text{O} + \text{NO}_2$	1.3×10^{-11}	± 0.3				
$\text{CF}_3\text{CCl}_2\text{O}_2 + \text{NO} \rightarrow \text{CF}_3\text{CCl}_2\text{O} + \text{NO}_2$	1.8×10^{-11}	± 0.3				
$\text{CF}_2\text{ClO}_2 + \text{NO}_2 + \text{M} \rightarrow \text{CF}_2\text{ClO}_2\text{NO}_2 + \text{M}$	$5.0 \times 10^{-29}[\text{N}_2]$ 6.3×10^{-12} $F_c = 0.30$	(k_0) (k_∞)	± 0.3	$5.0 \times 10^{-29}(T/298)^{-6.2}[\text{N}_2]$ $6.3 \times 10^{-12}(T/298)^{-0.7}$ $F_c = 0.30$	250-320	$\Delta n = \pm 2$ $\Delta n = \pm 0.5$
$\text{CF}_2\text{ClO}_2\text{NO}_2 + \text{M} \rightarrow \text{CF}_2\text{ClO}_2 + \text{NO}_2 + \text{M}$	$9.0 \times 10^{-19}[\text{N}_2]$ 5.4×10^{-2} $F_c = 0.30$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.3	$1.8 \times 10^{-3}\exp(-10500/T)[\text{N}_2]$ $1.6 \times 10^{16}\exp(-11990/T)$ $F_c = 0.30$	270-290	± 200 ± 200
$\text{CFCl}_2\text{O}_2 + \text{NO}_2 + \text{M} \rightarrow \text{CFCl}_2\text{O}_2\text{NO}_2 + \text{M}$	$5.5 \times 10^{-29}[\text{N}_2]$ 8.3×10^{-12} $F_c = 0.42$	(k_0) (k_∞)	± 0.3	$5.5 \times 10^{-29}(T/298)^{-5.5}[\text{N}_2]$ $8.3 \times 10^{-12}(T/298)^{-0.66}$ $F_c = 0.42$	230-380	$\Delta n = \pm 2$ $\Delta n = \pm 0.5$
$\text{CFCl}_2\text{O}_2\text{NO}_2 + \text{M} \rightarrow \text{CFCl}_2\text{O}_2 + \text{NO}_2 + \text{M}$	$1.5 \times 10^{-18}[\text{N}_2]$ 9.6×10^{-2} $F_c = 0.28$	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.3	$1.0 \times 10^{-2}\exp(-10860/T)[\text{N}_2]$ $6.6 \times 10^{16}\exp(-12240/T)$ $F_c = 0.28$	260-300	± 200 ± 500
$\text{CCl}_3\text{O}_2 + \text{NO}_2 + \text{M} \rightarrow \text{CCl}_3\text{O}_2\text{NO}_2 + \text{M}$	$9.2 \times 10^{-29}[\text{N}_2]$ 1.5×10^{-12} $F_c = 0.32$	(k_0) (k_∞)	± 0.3	$9.2 \times 10^{-29}(T/298)^{-6.0}[\text{N}_2]$ $1.5 \times 10^{-12}(T/298)^{-0.7}$ $F_c = 0.32$	230-380	$\Delta n = \pm 2$ $\Delta n = \pm 0.5$
$\text{CCl}_3\text{O}_2\text{NO}_2 + \text{M} \rightarrow \text{CCl}_3\text{O}_2 + \text{NO}_2 + \text{M}$	$5.2 \times 10^{-18}[\text{N}_2]$ 0.29	(k_0/s^{-1}) (k_∞/s^{-1})	± 0.3	$4.3 \times 10^{-3}\exp(-10235/T)[\text{N}_2]$ $4.8 \times 10^{16}\exp(-11820/T)$	260-300	± 500 ± 500

	$F_c = 0.32$		$F_c = 0.32$	260-300	
$\text{CH}_3\text{O}_2 + \text{CH}_2\text{ClO}_2 \rightarrow \text{products}$	2.5×10^{-12}	± 0.3			
$\text{CH}_3\text{O}_2 + \text{CCl}_3\text{O}_2 \rightarrow \text{products}$	6.6×10^{-12}	± 0.3			
$\text{C}_2\text{H}_5\text{O}_2 + \text{CF}_3\text{CCl}_2\text{O}_2$					
$\rightarrow \text{CH}_3\text{CHO} + \text{CF}_3\text{CCl}_2\text{OH} + \text{O}_2$	3.6×10^{-12}	± 0.3			
$\rightarrow \text{C}_2\text{H}_5\text{O} + \text{CF}_3\text{CCl}_2\text{O} + \text{O}_2$	9.0×10^{-13}	± 0.5			
$\text{CF}_2\text{ClCH}_2\text{O}_2 + \text{CF}_2\text{ClCH}_2\text{O}_2 \rightarrow \text{products}$	2.8×10^{-12}	± 0.4			
$\text{CFCl}_2\text{CH}_2\text{O}_2 + \text{CFCl}_2\text{CH}_2\text{O}_2 \rightarrow \text{products}$	2.9×10^{-12}	± 0.4			
$\text{CF}_3\text{CCl}_2\text{O}_2 + \text{CF}_3\text{CCl}_2\text{O}_2 \rightarrow 2\text{CF}_3\text{CCl}_2\text{O} + \text{O}_2$	3.5×10^{-12}	± 0.3			
$\text{CH}_2\text{ClO}_2 + \text{CH}_2\text{ClO}_2 \rightarrow 2\text{CH}_2\text{ClO} + \text{O}_2$	3.5×10^{-12}	± 0.2	$1.9 \times 10^{-13} \exp(870/T)$	250-600	± 200
$\text{CHCl}_2\text{O}_2 + \text{CHCl}_2\text{O}_2 \rightarrow \text{products}$		see data sheet			
$\text{CCl}_3\text{O}_2 + \text{CCl}_3\text{O}_2 \rightarrow 2\text{CCl}_3\text{O} + \text{O}_2$	4.0×10^{-12}	± 0.3	$3.3 \times 10^{-13} \exp(740/T)$	270-460	± 300
$\text{CH}_3\text{CHClO}_2 + \text{CH}_3\text{CHClO}_2$					
$\rightarrow \text{CH}_3\text{CHClOH} + \text{CH}_3\text{COCl} + \text{O}_2$					
$\rightarrow 2\text{CH}_3\text{CHClO} + \text{O}_2$	5×10^{-12}	± 0.3			
$\text{CH}_2\text{ClCH}_2\text{O}_2 + \text{CH}_2\text{ClCH}_2\text{O}_2 \rightarrow \text{products}$	3.3×10^{-12}	± 0.3	$4.2 \times 10^{-14} \exp(1300/T)$	220-380	± 500
$\text{O}_3 + \text{C}_2\text{HCl}_3 \rightarrow \text{products}$	$< 5 \times 10^{-20}$				
$\text{O}_3 + \text{C}_2\text{Cl}_4 \rightarrow \text{products}$	$< 10^{-21}$				

Data for the following Photochemical Reactions is based on data sheets on this website.







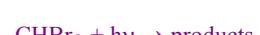
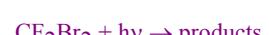
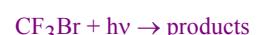
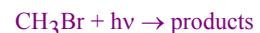
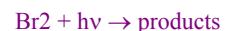
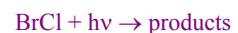
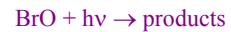
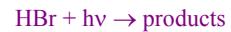
BrO_x Reactions - based on data in J. Phys. Chem. Ref. Data 26, 521, 1997, and updated (*) in J. Phys. Chem. Ref. Data, 29, 167, 2000

O + HOBr → HO + BrO	2.8 × 10 ⁻¹¹	±0.2	1.2 × 10 ⁻¹⁰ exp(-430/T)	230-430	±300
O + BrO → O ₂ + Br	4.1 × 10 ⁻¹¹	±0.2	1.9 × 10 ⁻¹¹ exp(230/T)	230-330	±150
Br + HO ₂ → HBr + O ₂	1.7 × 10 ⁻¹²	±0.2	7.7 × 10 ⁻¹² exp(-450/T)	230-390	±200
Br + H ₂ O ₂ → HBr + HO ₂ → HOBr + HO					
Overall	<5 × 10 ⁻¹⁶				
Br + O ₃ → BrO + O ₂	1.2 × 10 ⁻¹²	±0.08	1.7 × 10 ⁻¹¹ exp(-800/T)	190-430	±200
Br + NO ₂ + M → BrNO ₂ + M	4.2 × 10 ⁻³¹ [N ₂] (k ₀) 2.7 × 10 ⁻¹¹ (k _∞) F _C = 0.55	±0.3 ±0.4	4.2 × 10 ⁻³¹ (T/300) ^{-2.4} [N ₂] 2.7 × 10 ⁻¹¹	250-350 250-350	Δn = ±1 Δlog k = ±0.4

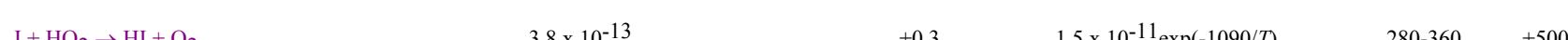
$\text{Br} + \text{OCIO} \rightarrow \text{BrO} + \text{ClO}$	3.5×10^{-13}	± 0.3	$2.7 \times 10^{-11} \exp(-1300/T)$	260-430	± 300
$\text{Br} + \text{Cl}_2\text{O} \rightarrow \text{BrCl} + \text{ClO}$	4.3×10^{-12}	± 0.1	$2.1 \times 10^{-11} \exp(-470/T)$	220-410	± 200
$\text{Br} + \text{Cl}_2\text{O}_2 \rightarrow \text{BrCl} + \text{ClOO}$	3.0×10^{-12}	± 0.3			
$\text{HO} + \text{HBr} \rightarrow \text{H}_2\text{O} + \text{Br}$	1.1×10^{-11}	± 0.10	$5.5 \times 10^{-12} \exp(205/T)$	180-360	± 250
$\text{HO} + \text{Br}_2 \rightarrow \text{HOBr} + \text{Br}$	4.5×10^{-11}	± 0.10	$2.0 \times 10^{-11} \exp(240/T)$	230-360	± 150
$\text{HO} + \text{BrO} \rightarrow \text{products}$	4.1×10^{-11}	± 0.3	$1.8 \times 10^{-11} \exp(250/T)$	230-350	± 300
$\text{HO} + \text{CH}_3\text{Br} \rightarrow \text{H}_2\text{O} + \text{CH}_2\text{Br}$	2.9×10^{-14}	± 0.08	$1.7 \times 10^{-12} \exp(-1215/T)$	240-300	± 150
$\text{HO} + \text{CH}_2\text{Br}_2 \rightarrow \text{H}_2\text{O} + \text{CHBr}_2$	1.1×10^{-13}	± 0.15	$1.5 \times 10^{-12} \exp(-775/T)$	240-300	± 200
$\text{HO} + \text{CHF}_2\text{Br} \rightarrow \text{H}_2\text{O} + \text{CF}_2\text{Br}$	1.0×10^{-14}	± 0.10	$7.9 \times 10^{-13} \exp(-1300/T)$	230-360	± 150
$\text{HO} + \text{CF}_3\text{Br} \rightarrow \text{products}$	$< 6 \times 10^{-18}$		$< 1 \times 10^{-12} \exp(-3600/T)$	250-460	
$\text{HO} + \text{CF}_2\text{ClBr} \rightarrow \text{products}$	$< 1 \times 10^{-17}$		$< 1 \times 10^{-12} \exp(-3450/T)$	250-380	
$\text{HO} + \text{CF}_2\text{Br}_2 \rightarrow \text{products}$	$< 5 \times 10^{-16}$		$< 1 \times 10^{-12} \exp(-2200/T)$	250-460	
$\text{HO} + \text{CF}_3\text{CH}_2\text{Br} \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CHBr}$	1.6×10^{-14}	± 0.20	$1.4 \times 10^{-12} \exp(-1340/T)$	280-460	± 300
$\text{HO} + \text{CF}_3\text{CHFBr} \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CFBr}$	1.7×10^{-14}	± 0.20	$8.1 \times 10^{-13} \exp(-1155/T)$	279-460	± 300
$\text{HO} + \text{CF}_3\text{CHClBr} \rightarrow \text{H}_2\text{O} + \text{CF}_3\text{CClBr}$	4.6×10^{-14}	± 0.20	$1.2 \times 10^{-12} \exp(-970/T)$	290-460	± 300
$\text{HO} + \text{CF}_2\text{BrCF}_2\text{Br} \rightarrow \text{products}$	$< 6 \times 10^{-18}$		$< 1 \times 10^{-12} \exp(-3600/T)$	250-460	
$\text{Br} + \text{NO}_3 \rightarrow \text{BrO} + \text{NO}_2$	1.6×10^{-11}	± 0.3			
$\text{BrO} + \text{NO}_3 \rightarrow \text{BrOO} + \text{NO}_2$	1.0×10^{-12}	± 0.5			
$\text{NO}_3 + \text{HBr} \rightarrow \text{HNO}_3 + \text{Br}$	$< 1 \times 10^{-16}$				

$\text{BrO} + \text{HO}_2 \rightarrow \text{HOBr} + \text{O}_2$						
$\rightarrow \text{HBr} + \text{O}_3$						
Overall	2.4×10^{-11}	± 0.3	$4.5 \times 10^{-12} \exp(500/T)$	210-360	± 200	
$\text{BrO} + \text{O}_3 \rightarrow \text{Br} + 2\text{O}_2$	$< 2 \times 10^{-17}$					
$\text{BrO} + \text{NO} \rightarrow \text{Br} + \text{NO}_2$	2.1×10^{-11}	± 0.1	$8.7 \times 10^{-12} \exp(260/T)$	220-430	± 100	
$\text{BrO} + \text{NO}_2 + \text{M} \rightarrow \text{BrONO}_2 + \text{M}$	$4.7 \times 10^{-31} [\text{N}_2]$	(k_0)	± 0.1	$4.7 \times 10^{-31} (T/300)^{-3.1} [\text{N}_2]$	240-350	$\Delta n = \pm 1$
	1.8×10^{-11}	(k_∞)	± 0.1	1.8×10^{-11}	240-350	$\Delta n = \pm 1$
	$F_c = 0.40$			$F_c = 0.40$	240-350	
$\text{BrO} + \text{ClO} \rightarrow \text{Br} + \text{OCLO}$	6.8×10^{-12}	± 0.1	$1.6 \times 10^{-12} \exp(430/T)$	220-400	± 200	
$\rightarrow \text{Br} + \text{ClOO}$	6.1×10^{-12}	± 0.1	$2.9 \times 10^{-12} \exp(220/T)$	220-400	± 200	
$\rightarrow \text{BrCl} + \text{O}_2$	1.0×10^{-12}	± 0.1	$5.8 \times 10^{-13} \exp(170/T)$	220-400	± 200	
$\rightarrow \text{Cl} + \text{OBrO}$						
$\text{BrO} + \text{ClO} + \text{M} \rightarrow \text{BrOOCl} + \text{M}$	see data sheet					
$\text{BrO} + \text{BrO} \rightarrow 2\text{Br} + \text{O}_2$	2.7×10^{-12}	± 0.1	2.7×10^{-12}	250-390	± 200	
$\rightarrow \text{Br}_2 + \text{O}_2$	4.8×10^{-13}	± 0.1	$2.9 \times 10^{-14} \exp(840/T)$	250-390	± 200	
$\rightarrow \text{Br}_2 + \text{OBrO}$						
$\text{BrO} + \text{BrO} + \text{M} \rightarrow \text{Br}_2\text{O}_2 + \text{M}$	see data sheet					
Overall	3.2×10^{-12}		$1.6 \times 10^{-12} \exp(210/T)$	200-390		
$\text{CH}_2\text{BrO}_2 + \text{HO}_2 \rightarrow \text{products}$	6.7×10^{-12}	± 0.5				
$\text{CH}_2\text{BrO}_2 + \text{NO} \rightarrow \text{CH}_2\text{BrO} + \text{NO}_2$	1.1×10^{-11}	± 0.3				
$\text{CH}_2\text{BrO}_2 + \text{CH}_2\text{BrO}_2 \rightarrow \text{products}$	see data sheet					
$\text{BrCH}_2\text{CH}_2\text{O}_2 + \text{BrCH}_2\text{CH}_2\text{O}_2$						
$\rightarrow \text{BrCH}_2\text{CH}_2\text{OH} + \text{BrCH}_2\text{CHO} + \text{O}_2$						
$\rightarrow 2 \text{BrCH}_2\text{CH}_2\text{O} + \text{O}_2$	2.3×10^{-12}	± 0.1				
Overall	4.0×10^{-12}	± 0.2	$6.0 \times 10^{-14} \exp(1250/T)$	270-380	± 500	
$\text{BrO} + \text{CH}_3\text{O}_2 \rightarrow \text{products}$	5.7×10^{-12}	± 0.3				

Data for the following Photochemical Reactions is based on data sheets on this website.



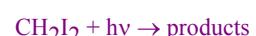
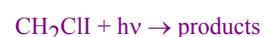
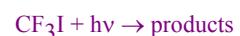
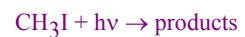
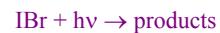
IO_x Reactions - based on data sheets on this website



$I + NO + M \rightarrow INO + M$	1.8 x 10 ⁻³² [N ₂] (k ₀) 1.7 x 10 ⁻¹¹ (k _∞) <i>F_c</i> = 0.6	±0.1 ±0.5	1.8 x 10 ⁻³² (T/300) ^{-1.0} [N ₂] 1.7 x 10 ⁻¹¹ <i>F_c</i> = 0.6	290-450 300-400	Δ <i>n</i> = ±0.5 Δlog <i>k</i> = ±0.5
$I + NO_2 + M \rightarrow INO_2 + M$	3.0 x 10 ⁻³¹ [N ₂] (k ₀) 6.6 x 10 ⁻¹¹ (k _∞) <i>F_c</i> = 0.63	±0.2 ±0.3	3.0 x 10 ⁻³¹ (T/300) ⁻¹ [N ₂] 6.6 x 10 ⁻¹¹ <i>F_c</i> = 0.63	290-450 290-450	Δ <i>n</i> = ±1 Δlog <i>k</i> = ±0.3
$I + NO_3 \rightarrow IO + NO_2$	No recommendation				
$I_2 + NO_3 \rightarrow I + IONO_2$	No recommendation				
$HO + HI \rightarrow H_2O + I$	7.0 x 10 ⁻¹¹	±0.3	1.6 x 10 ⁻¹¹ exp(440/T)	240-360	±400
$HO + I_2 \rightarrow HOI + I$	2.1x 10 ⁻¹⁰	±0.15	2.1x 10 ⁻¹⁰	240-350	±300
$HO + CH_3I \rightarrow H_2O + CH_2I$	1.0 x 10 ⁻¹³	±0.2	4.3 x 10 ⁻¹² exp(-1120/T)	270-430	±500
$HO + CF_3I \rightarrow$ products	2.6 x 10 ⁻¹⁴	±0.2	2.1 x 10 ⁻¹¹ exp(-2000/T)	270-370	±500
$NO_3 + HI \rightarrow HNO_3 + I$	No recommendation				
$IO + HO_2 \rightarrow HOI + O_2$	8.4 x 10 ⁻¹¹	±0.2	1.4 x 10 ⁻¹¹ exp(540/T)	270-380	±300
$IO + O_3 \rightarrow I + 2O_2$ → OIO + O ₂	<1.0 x 10 ⁻¹⁵ <2.0 x 10 ⁻¹⁶				
$IO + ClO \rightarrow$ products	1.2 x 10 ⁻¹¹	±0.1	4.7 x 10 ⁻¹² exp(280/T)	200-370	±100
$IO + BrO \rightarrow$ products	8.5 x 10 ⁻¹¹	±0.1	1.5 x 10 ⁻¹¹ exp(510/T)	200-390	±350
$IO + IO \rightarrow$ products	9.9 x 10 ⁻¹¹	±0.1	5.4 x 10 ⁻¹¹ exp(180/T)	250-320	±200
$IO + NO \rightarrow I + NO_2$	1.95x 10 ⁻¹¹	±0.15	7.15 x 10 ⁻¹² exp(300/T)	240-370	±100

$\text{IO} + \text{NO}_2 + \text{M} \rightarrow \text{IONO}_2 + \text{M}$	$7.7 \times 10^{-31} [\text{N}_2]$ 1.6×10^{-11} $F_c = 0.4$	(k_0) (k_∞)	± 0.3 ± 0.3	$7.7 \times 10^{-31} (T/300)^{-5} [\text{N}_2]$ 1.6×10^{-11}	250-360 250-360	$\Delta n = \pm 2$ $\Delta \log k = \pm 0.3$
$\text{IONO}_2 + \text{M} \rightarrow \text{IO} + \text{NO}_2 + \text{M}$	2.9×10^{-3} (s ⁻¹) (1 bar air)		± 1.0 at 300K	$1.1 \times 10^{15} \exp(-12060/T)$	240-305	± 500
$\text{INO} + \text{INO} \rightarrow \text{I}_2 + 2 \text{NO}$	1.3×10^{-14}		± 0.4	$8.4 \times 10^{-11} \exp(-2620/T)$	300-450	± 600
$\text{INO}_2 + \text{INO}_2 \rightarrow \text{I}_2 + 2 \text{NO}_2$	1.7×10^{-15}		± 0.7	$4.7 \times 10^{-13} \exp(-1670/T)$	270-350	± 1000
OIO + NO → products						
$\text{CH}_2\text{IO}_2 + \text{CH}_2\text{IO}_2$ → $\text{CH}_2\text{IOH} + \text{HCOI} + \text{O}_2$ → $2 \text{CH}_2\text{IO} + \text{O}_2$		No recommendation				

Data for the following Photochemical Reactions is based on data sheets on this website.

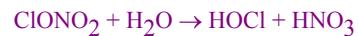
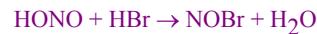
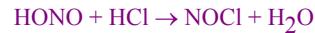
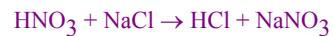
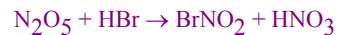


Data for the following heterogeneous processes is based on data sheets on this website

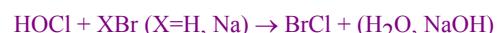
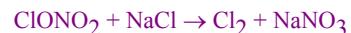
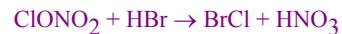
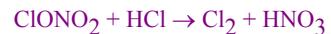
Uptake Kinetics with Chemical Reaction

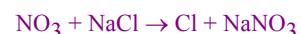
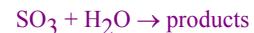
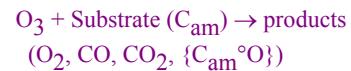
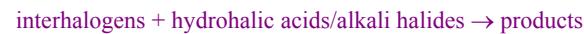
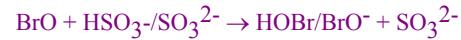
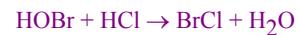
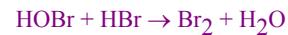
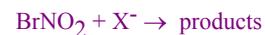
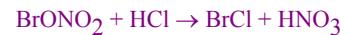
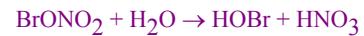


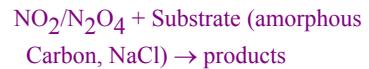
(including uptake studies)



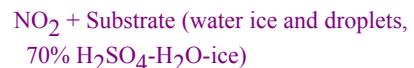
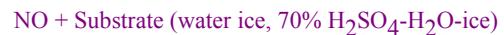
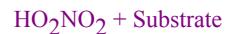
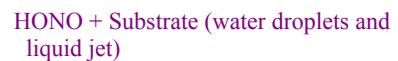
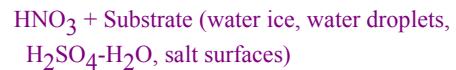
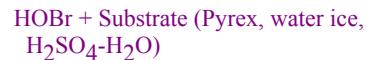
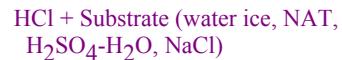
(including uptake studies)







Uptake Kinetics without Chemical Reaction



NH_3 + Substrate (liquid water jet,
water droplets)

O_3 + Substrate (water ice, liquid,
NAT, Pyrex)

Cl_2 + Substrate (water ice)

ClO + Substrate (water ice, $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$,
NAT, Pyrex)

Cl + Substrate (SiO_2 , $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$, Teflon)

H_2O_2 + Substrate (water droplets)

CH_3COCH_3 + Substrate (water droplets)

H_2CO + Substrate (water droplets,
 $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$ solution)

CH_3CHO + Substrate (water droplets)

CHOCHO + Substrate (water droplets)

CHBr_3 + Substrate (water ice, H_2SO_4)

CH_3OH + Substrate (water droplets)

$\text{C}_2\text{H}_5\text{OH}$ + Substrate (water droplets)

$1\text{-C}_3\text{H}_7\text{OH}$ + Substrate (water droplets)

$2\text{-C}_3\text{H}_7\text{OH}$ + Substrate (water droplets)

$\text{CH}_3\text{C}(\text{CH}_3)(\text{OH})\text{CH}_3$ + Substrate (water droplets)

$\text{ClCH}_2\text{CH}_2\text{OH}$ + Substrate (water droplets)

$\text{BrCH}_2\text{CH}_2\text{OH}$ + Substrate (water droplets)

$\text{I}\text{CH}_2\text{CH}_2\text{OH}$ + Substrate (water droplets)

$\text{HOCH}_2\text{CH}_2\text{OH}$ + Substrate (water droplets)

HCOOH + Substrate (water droplets)

CH₃COOH + Substrate (water droplets)

CCl₃COOH + Substrate (water droplets)

CCl₂HCOOH + Substrate (water droplets)

CClH₂COOH + Substrate (water droplets)

CF₂ClCOOH + Substrate (water droplets)

CF₃COOH + Substrate (water droplets)

CH₃OOH + Substrate (water droplets)

H₂SO₄ + Substrate (water droplets and jet)