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/cm^3 molecule^{-1} s^{-1}	Temp. range/K	$\Delta(E/R)$/K[a]
[a]The cited uncertainty is an expanded uncertainty corresponding approximately to a 95% confidence limit.						
O_x Reactions - based on data sheets on this website.						
$O + O_2 + M \rightarrow O_3 + M$	6.0×10^{-34} [O_2]	(k_o)	±0.05	$6.0 \times 10^{-34}(T/300)^{-2.6}$[$O_2$]	100-300	$\Delta n = \pm 0.5$
	5.6×10^{-34} [N_2]	(k_o)	±0.05	$5.6 \times 10^{-34}(T/300)^{-2.6}$[$N_2$]	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
$O(^1D) + O_3 \rightarrow O_2 + 2\ O(^3P)$	1.2×10^{-10}		±0.1			
$\rightarrow 2\ O_2(^3\Sigma_g^-)$	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}	($M = O_2$)	±0.2	$3.0 \times 10^{-18}\exp(-200/T)$	100-450	±200
	$\leq 1.4 \times 10^{-19}$	($M = N_2$)				
	5×10^{-18}	($M = H_2O$)	±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}	($M = O(^3P)$)	±0.3			
	4.6×10^{-12}	($M = H_2O$)	±0.3			
	4.1×10^{-13}	($M = CO_2$)	±0.10	4.1×10^{-13}	245-360	±200
$O_2(^1\Sigma_g^+) + O_3 \rightarrow 2O_2 + O$ $\rightarrow O_2(^1\Delta_g) + O_3$ $\rightarrow O_2(^3\Sigma_g^-) + O_3$	2.2×10^{-11}		±0.06	2.2×10^{-11}	295-360	±300
$O_2 + h\nu \rightarrow$ products	See data sheet					
$O_3 + h\nu \rightarrow$ products	See data sheet					

HO_x Reactions - based on data sheets on this website

$H + HO_2 \rightarrow H_2 + O_2$	5.6×10^{-12}		±0.5	5.6×10^{-12}	245-300	$\Delta \log k = \pm 0.5$
$\rightarrow 2\ HO$	7.2×10^{-11}		±0.1	7.2×10^{-11}	245-300	$\Delta \log k = \pm 0.1$
$\rightarrow H_2O + O$	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
$H + O_2 + M \rightarrow HO_2 + M$	$5.4 \times 10^{-32}[N_2]$	(k_o)	±0.1	$5.4 \times 10^{-32}(T/300)^{-1.8}[N_2]$	200-600	$\Delta n = \pm 0.6$
$O + HO \rightarrow O_2 + H$	3.5×10^{-11}		±0.1	$2.4 \times 10^{-11}\exp(110/T)$	150-500	±100
$O + HO_2 \rightarrow HO + O_2$	5.8×10^{-11}		±0.08	$2.7 \times 10^{-11}\exp(224/T)$	220-400	±100
$O + H_2O_2 \rightarrow HO + HO_2$	1.7×10^{-15}		±0.3	$1.4 \times 10^{-12}\exp(-2000/T)$	280-390	±1000
$O(^1D) + H_2 \rightarrow HO + H$	1.1×10^{-10}		±0.1	1.1×10^{-10}	200-350	±100
$O(^1D) + H_2O \rightarrow 2\ HO$	2.2×10^{-10}		±0.1	2.2×10^{-10}	200-350	±100
$HO + H_2 \rightarrow H_2O + H$	6.7×10^{-15}		±0.1	$7.7 \times 10^{-12}\exp(-2100/T)$	200-450	±200
$HO + HO \rightarrow H_2O + O$	1.48×10^{-12}		±0.15	$6.2 \times 10^{-14}(T/298)^{2.6}\exp(945/T)$	200-350	±250

$HO + HO + M \rightarrow H_2O_2 + M$	$6.9 \times 10^{-31}[N_2]$	(k_o)	±0.1	$6.9 \times 10^{-31}(T/300)^{-0.8}[N_2]$	200-400	$\Delta n = \pm 0.5$
	2.6×10^{-11}	(k_∞)	±0.2	2.6×10^{-11}	200-400	$\Delta \log k_\infty = \pm 0.2$
	$F_c = 0.50 \pm 0.05$		±0.05	$F_c = 0.50 \pm 0.05$	200-400	
$HO + HO_2 \rightarrow H_2O + O_2$	1.1×10^{-10}		±0.1	$4.8 \times 10^{-11}\exp(250/T)$	250-400	±200
$HO + H_2O_2 \rightarrow H_2O + HO_2$	1.7×10^{-12}		±0.1	$2.9 \times 10^{-12}\exp(-160/T)$	240-460	±100
$HO + O_3 \rightarrow HO_2 + O_2$	7.3×10^{-14}		±0.15	$1.7 \times 10^{-12}\exp(-940/T)$	220-450	±300
$HO_2 + HO_2 \rightarrow H_2O_2 + O_2$	1.6×10^{-12}		±0.15	$2.2 \times 10^{-13}\exp(600/T)$	230-420	±200
$HO_2 + HO_2 + M \rightarrow H_2O_2 + O_2 + M$	5.2×10^{-32} $[N_2]$		±0.15	1.9×10^{-33} $[N_2]$ $\exp(980/T)$	230-420	±300
	4.5×10^{-32} $[O_2]$		±0.15			
	See data sheet for effect of H_2O					
$HO_2 + O_3 \rightarrow HO + 2\ O_2$	2.0×10^{-15}		±0.2	2.03×10^{-16} $(T/300)^{4.57}$ $\exp(693/T)$	250-340	+500/-100
$H_2O + h\nu \rightarrow HO + H$	See data sheets					
$H_2O_2 + h\nu \rightarrow 2\ HO$	See data sheets					

NO_x Reactions - based on data sheets on this website

$O + NO + M \rightarrow NO_2 + M$	1.0×10^{-31} $[N_2]$	(k_o)	±0.1	$1.0 \times 10^{-31}(T/300)^{-1.6}[N_2]$	200-300	$\Delta n = \pm 0.3$
	3.0×10^{-11}	(k_∞)	±0.3	$3.0 \times 10^{-11}(T/300)^{0.3}$	200-300	$\Delta n = \pm 0.3$
	$F_c = 0.85$			$F_c = 0.85$	200-300	
$O + NO_2 \rightarrow O_2 + NO$	1.0×10^{-11}		±0.06	$5.5 \times 10^{-12}\exp(188/T)$	220-420	±80
$O + NO_2 + M \rightarrow NO_3 + M$	1.3×10^{-31} $[N_2]$	(k_o)	±0.30	$1.3 \times 10^{-31}(T/300)^{-1.5}[N_2]$	200-400	$\Delta n = \pm 1$
	2.3×10^{-11}	(k_∞)	±0.2	$2.3 \times 10^{-11}(T/300)^{0.24}$	200-400	
	$F_c = 0.6$			$F_c = 0.6$	200-400	
$O + NO_3 \rightarrow O_2 + NO_2$	1.7×10^{-11}		±0.3			

$O(^1D) + N_2 + M \rightarrow N_2O + M$	2.8×10^{-36} $[N_2]$	(k_o)	±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
$HO + NO + M \rightarrow HONO + M$	7.4×10^{-31} $[N_2]$	(k_o)	±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	$\Delta \log k_\infty = \pm 0.2$
	$F_c = 0.81$					
$HO + NO_2 + M \rightarrow HONO_2 + M$	3.3×10^{-30} $[N_2]$	(k_o)	±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
$HO_2 + NO_2 + M \rightarrow HO_2NO_2 + M$	1.8×10^{-31} $[N_2]$	(k_o)	±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	$\Delta n = \pm 1$
	$F_c = 0.6$			$F_c = 0.6$		

$HO_2NO_2 + M \rightarrow HO_2 + NO_2 + M$	1.3×10^{-20} $[N_2]$	(k_o/s^{-1})	±0.3	$4.1 \times 10^{-5}\exp(-10650/T)[N_2]$	260-300	±500
	0.25	(k_∞/s^{-1})	±0.5	$4.8 \times 10^{15}\exp(-11170/T)$	260-300	±500
	$F_c = 0.6$			$F_c = 0.6$	260-300	
$HO_2 + NO_3 \rightarrow$ products	4.0×10^{-12}		±0.2			
$NH_2 + O_2 \rightarrow$ products	$<6 \times 10^{-21}$					
$NH_2 + O_3 \rightarrow$ products	1.7×10^{-13}		±0.5	$4.9 \times 10^{-12}\exp(-1000/T)$	250-380	±500
$NH_2 + NO \rightarrow$ products	1.6×10^{-11}		±0.15	$1.6 \times 10^{-11}(T/298)^{-1.4}$	210-500	$\Delta n = \pm 0.5$
$NH_2 + NO_2 \rightarrow$ products	2.0×10^{-11}		±0.2	$2.0 \times 10^{-11}(T/298)^{-1.3}$	250-500	$\Delta n = \pm 0.7$
$2NO + O_2 \rightarrow 2\ NO_2$	2.0×10^{-38} (cm^6 $molecule^{-2}$ s^{-1})		±0.1	$3.3 \times 10^{-39}\exp(530/T)$	270-600	±400
$NO + O_3 \rightarrow NO_2 + O_2$	1.8×10^{-14}		±0.08	$1.4 \times 10^{-12}\exp(-1310/T)$	195-308	±200
$NO + NO_2 + M \rightarrow N_2O_3 + M$	3.1×10^{-34} $[N_2]$	(k_o)	±0.3	3.1×10^{-34} $(T/300)^{-7.7}$ $[N_2]$	200-300	$\Delta n = \pm 1$
	7.9×10^{-12}	(k_∞)	±0.3	7.9×10^{-12} $(T/300)^{1.4}$	200-300	$\Delta n = \pm 0.5$
	$F_c = 0.6$					
$N_2O_3 + M \rightarrow NO + NO_2 + M$	$1.6 \times 10^{-14}[N_2]$	(k_0/s^{-1})	±0.4	$1.9 \times 10^{-7}(T/300)^{-8.7}$ $\exp(-4880/T)[N_2]$	225-300	±200 $\Delta n = \pm 1$
	3.6×10^{8}	(k_∞/s^{-1})	±0.3	$4.7 \times 10^{15}(T/300)^{0.4}$ $\exp(-4880/T)$	225-300	±100 $\Delta n = \pm 1$
	$F_c = 0.6$					
$NO + NO_3 \rightarrow 2\ NO_2$	2.6×10^{-11}		±0.1	$1.8 \times 10^{-11}\exp(110/T)$	220-420	±100
$NO_2 + O_3 \rightarrow NO_3 + O_2$	3.5×10^{-17}		±0.06	$1.4 \times 10^{-13}\exp(-2470/T)$	230-360	±150
$NO_2 + NO_2 + M \rightarrow N_2O_4 + M$	$1.4 \times 10^{-33}[N_2]$	(k_0)	±0.3	$1.4 \times 10^{-33}(T/300)^{-3.8}[N_2]$	300-500	$\Delta n = \pm 1$
	1.0×10^{-12}	(k_∞)	±0.3	1.0×10^{-12}	250-300	$\Delta \log k = \pm 0.3$
	$F_c = 0.40$					

$N_2O_4 + M \rightarrow NO_2 + NO_2 + M$	$6.1 \times 10^{-15}[N_2]$	(k_0/s^{-1})	±0.3	$1.3 \times 10^{-5}(T/300)^{-3.8} \exp(-6400/T)[N_2]$	300-500	±500
	4.4×10^{6}	(k_∞/s^{-1})	±0.4	$1.15 \times 10^{16}\exp(-6460/T)$	250-300	±500
	$F_c = 0.40$					
$NO_2 + NO_3 + M \rightarrow N_2O_5 + M$	$3.6 \times 10^{-30}[N_2]$	(k_0)	±0.10	$3.6 \times 10^{-30}(T/300)^{-4.1}[N_2]$	200-300	$\Delta n = \pm 0.5$
	1.9×10^{-12}	(k_∞)	±0.2	$1.9 \times 10^{-12}(T/300)^{0.2}$	200-400	$\Delta n = \pm 0.6$
	$F_c = 0.35$			$F_c = 0.35$	200-400	
$N_2O_5 + M \rightarrow NO_2 + NO_3 + M$	$1.2 \times 10^{-19}[N_2]$	(k_0/s^{-1})	±0.2	$1.3 \times 10^{-3}(T/300)^{-3.5} \exp(-11000/T)[N_2]$	200-400	$\Delta n = \pm 0.5$
	6.9×10^{-2}	(k_∞/s^{-1})	±0.3	$9.7 \times 10^{14}(T/300)^{0.1} \exp(-11080/T)$	200-300	$\Delta n = \pm 0.2$
	$F_c = 0.35$			$F_c = 0.35$	200-300	
$N_2O_5 + H_2O \rightarrow 2\ HNO_3$	2.5×10^{-22}		±0.3 (at 290 K)			
$N_2O_5 + 2H_2O \rightarrow HNO_3 + H_2O$	1.8×10^{-39}	(cm^6 molecule^{-2} s^{-1})	±0.3 (at 290 K)			
$HONO + h\nu \rightarrow$ products	see data sheet					
$HONO_2 + h\nu \rightarrow$ products	see data sheet					
$HO_2NO_2 + h\nu \rightarrow$ products	see data sheet					
$NO_2 + h\nu \rightarrow$ products	see data sheet					
$NO_3 + h\nu \rightarrow$ products	see data sheet					
$N_2O + h\nu \rightarrow$ products	see data sheet					
$N_2O_5 + h\nu \rightarrow$ products	see data sheet					

$O + CH_3 \rightarrow$ products	1.3×10^{-10}	±0.1	1.3×10^{-10}	290-900	±100
$O(^1D) + CH_4 \rightarrow HO + CH_3$	1.05×10^{-10}		1.05×10^{-10}	200-350	
$\rightarrow CH_3O$ or $CH_2OH + H$	3.45×10^{-11}		3.45×10^{-11}	200-350	
$\rightarrow HCHO + H_2$	7.50×10^{-12}		7.50×10^{-12}	200-350	
Overall	1.50×10^{-10}	±0.10	1.50×10^{-10}	200-350	±100
$HO + CH_4 \rightarrow H_2O + CH_3$	6.4×10^{-15}	±0.08	$1.85 \times 10^{-12} \exp(-1690/T)$	200-300	±100
$HO + C_2H_2 + M \rightarrow C_2H_2OH + M$	$5.0 \times 10^{-30}[N_2]$ (k_0)	±0.1	$5 \times 10^{-30}(T/300)^{-1.5}[N_2]$	300-800	$\Delta n = \pm 1.5$
	1.0×10^{-12} (k_∞)	±0.3			
	$F_c = 0.37$				
	7.8×10^{-13} (1 bar air)	±0.15			
$HO + C_2H_4 + M \rightarrow C_2H_4OH + M$	$8.6 \times 10^{-29}[N_2]$ (k_0)	±0.3	$8.6 \times 10^{-29}(T/300)^{-3.1}[N_2]$	200-300	$\Delta n = \pm 2$
	9×10^{-12} (k_∞)	±0.3	$9 \times 10^{-12}(T/300)^{-0.85}$	100-500	$\Delta n = \pm 0.3$
	$F_c = 0.48$				
	7.9×10^{-12} (1 bar air)				
$HO + C_2H_6 \rightarrow H_2O + C_2H_5$	2.4×10^{-13}	±0.08	$6.9 \times 10^{-12}\exp(-1000/T)$	200-300	±100
$HO + C_3H_6 + M \rightarrow C_3H_6OH + M$	$8 \times 10^{-27}[N_2]$ (k_0)	±0.5	$8 \times 10^{-27}(T/300)^{-3.5}[N_2]$	200-300	$\Delta n = \pm 1$
	3.0×10^{-11} (k_∞)	±0.1	$3.0 \times 10^{-11}(T/300)^{-1.0}$	200-300	$\Delta n = \pm 1$
	$F_c = 0.5$				
	2.9×10^{-11} (1 bar air)				
$HO + C_3H_8 \rightarrow H_2O + C_3H_7$	1.10×10^{-12}	±0.08	$7.6 \times 10^{-12}\exp(-585/T)$	200-300	±100
$HO + CH_3CH_2CH_2CH_3 \rightarrow$ products	2.3×10^{-12}	±0.10	$9.1 \times 10^{-12}\exp(-405/T)$	230-300	±150
$HO + CH_2C(CH_3)CHCH_2 \rightarrow$products	1.0×10^{-10}	±0.10	$2.7 \times 10^{-11}\exp(390/T)$	240-430	±100
HO + α-pinene → products	5.3×10^{-11}	±0.15	$1.2 \times 10^{-11}\exp(440/T)$	290-430	±200
$HO + CO$ (+M) → products	$1.44 \times 10^{-13}(1 + [N_2] / 4 \times 10^{19})$ (pressure range: 0 – 1 bar)	±0.05	$1.44 \times 10^{-13}(1 + [N_2] / 4 \times 10^{19})$ (pressure range: 0 – 1 bar)	200-300	$\Delta \log k = \pm 0.1$

$HO + HCHO \rightarrow H_2O + HCO$	8.5×10^{-12}	±0.08	$5.4 \times 10^{-12}\exp(135/T)$	200-300	±100
$HO + CH_3CHO \rightarrow H_2O + CH_3CO$	1.5×10^{-11}	±0.08	$4.4 \times 10^{-12}\exp(365/T)$	200-350	±100
$HO + C_2H_5CHO \rightarrow$ products	2.0×10^{-11}	±0.10	$5.1 \times 10^{-12}\exp(405/T)$	240-380	±200
$HO + CH_3CH_2CH_2CHO \rightarrow$ products	2.4×10^{-11}	±0.10	$6.0 \times 10^{-12}\exp(410/T)$	250-430	±250
$HO + CH_2{=}C(CH_3)CHO \rightarrow$ products	2.9×10^{-11}	±0.10	$8.0 \times 10^{-12}\exp(380/T)$	230-380	±200
$HO + (CHO)_2 \rightarrow H_2O + HC(O)CO$	1.1×10^{-11}	±0.3			
$HO + HOCH_2CHO \rightarrow H_2O + HOCH_2CO$	8.8×10^{-12}	±0.10			
$\rightarrow H_2O + HOCHCHO$	2.2×10^{-12}	±0.10			
Overall	1.1×10^{-11}	±0.15			
$HO + CH_3C(O)CHO \rightarrow H_2O + CH_3C(O)CO$	1.5×10^{-11}	±0.2			
$HO + CH_3C(O)CH_3 \rightarrow H_2O + CH_2C(O)CH_3$	1.8×10^{-13}	±0.08	$\{8.8 \times 10^{-12}\exp(-1320/T) + 1.7 \times 10^{-14}\exp(423/T)\}$	195-440	$\Delta\log k = \pm 0.08$
$HO + CH_3C(O)CH_2CH_3 \rightarrow$ products	1.2×10^{-12}	±0.15	$1.3 \times 10^{-12}\exp(-25/T)$	240-300	±200
$HO + CH_2{=}CHC(O)CH_3 \rightarrow$ products	2.0×10^{-11}	±0.10	$2.6 \times 10^{-12}\exp(610/T)$	230-380	±200
HO + pinonaldehyde → products	4.2×10^{-11}	±0.25			
$HO + CH_3OH \rightarrow H_2O + CH_2OH$	7.65×10^{-13}				
$\rightarrow H_2O + CH_3O$	1.35×10^{-13}				
Overall	9.0×10^{-13}	±0.08	$2.85 \times 10^{-12}\exp(-345/T)$	210-300	±150
$HO + C_2H_5OH \rightarrow H_2O + CH_2CH_2OH$	1.6×10^{-13}	+0.10/-0.05		298	
$\rightarrow H_2O + CH_3CHOH$	2.9×10^{-12}			298	
$\rightarrow H_2O + CH_3CH_2O$	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
$HO + CH_3CH_2CH_2OH \rightarrow$ products	5.8×10^{-12}	±0.10	$4.6 \times 10^{-12}\exp(70/T)$	260-380	±100

HO + $CH_3CH(OH)CH_3$ → products	5.1 x 10^{-12}	±0.08	2.6 x 10^{-12}exp(200/*T*)	250-360	±100
HO + $CH_3CH_2CH_2CH_2OH$ → products	8.5 x 10^{-12}	±0.15	5.3 x 10^{-12}exp(140/*T*)	260-380	±200
HO + $CH_3CH(OH)CH_2CH_3$ → products	8.7 x 10^{-12}	±0.15			
HO + $(CH_3)_2C(OH)CH=CH_2$ → products	6.4 x 10^{-11}	±0.15	8.2 x 10^{-12}exp(610/*T*)	230-300	±200
HO + CH_3OCH_3 → H_2O + CH_3OCH_2	2.8 x 10^{-12}	±0.08	5.7 x 10^{-12}exp(-215/*T*)	230-300	±100
HO + [-$CH_2CHC(CH_3)CH_2O$-] → products	9.3 x 10^{-11}	±0.3			
HO + $CH_3C(O)CH_2OH$ → products	3.0 x 10^{-12}	±0.15			
HO + $(CH_3)_2C(OH)CHO$ → products	1.5 x 10^{-11}	±0.3			
HO + CH_3OOH → H_2O + CH_2OOH	1.9 x 10^{-12}			298	
→ H_2O + CH_3OO	3.6 x 10^{-12}	±0.15		298	
Overall	5.5 x 10^{-12}	±0.2	2.9 x 10^{-12}exp(190/*T*)	220-430	±150
HO + HC(O)OH → products	4.5 x 10^{-13}	±0.15	4.5 x 10^{-13}	290-450	±250
HO + $CH_3C(O)OH$ → products	7.4 x 10^{-13}	±0.15	4.2 x 10^{-14}exp(855/*T*)	220-300	±400
HO + $C_2H_5C(O)OH$ → products	1.2 x 10^{-12}	±0.2	1.2 x 10^{-12}	290-450	±300
HO + CH_3ONO_2 → products	2.3 x 10^{-14}	$^{+0.5}_{-0.2}$	4.0 x 10^{-13}exp(-845/*T*)	220-300	±400
HO + $C_2H_5ONO_2$ → products	1.8 x 10^{-13}	±0.3	6.7 x 10^{-13}exp(-395/*T*)	230-300	±400
HO + 1-$C_3H_7ONO_2$ → products	5.8 x 10^{-13} (1 bar air)	±0.3			
HO + 2-$C_3H_7ONO_2$ → products	2.9 x 10^{-13}	±0.2	6.2 x 10^{-13}exp(-230/*T*)	230-300	±300
HO + 1-$C_4H_9ONO_2$ → products	1.6 x 10^{-12}	±0.2			
HO + 2-$C_4H_9ONO_2$ → products	8.6 x 10^{-13}	±0.3			

$HO + CH_3C(O)OONO_2 \rightarrow$ products	$<3 \times 10^{-14}$				
$HO + CH_3C(O)CH_2ONO_2 \rightarrow$ products	$<1 \times 10^{-12}$				
$HO + CH_3CH_2C(O)CH_2ONO_2 \rightarrow$ products	8.2×10^{-13}	±0.3			
$HO + CH_3CH(ONO_2)C(O)CH_3 \rightarrow$ products	1.2×10^{-12}	±0.3			
$HO + CH_2{=}C(CH_3)C(O)OONO_2 \rightarrow$ products	2.9×10^{-11}	+0.2/-0.5			
$HO + HCN \rightarrow$ products	3.0×10^{-14} (1 bar)	±0.5	$1.2 \times 10^{-13}(-400/T)$ (1 bar)	290-440	±300
$HO + CH_3CN \rightarrow$ products	2.2×10^{-14} (1 bar)	±0.15	$8.1 \times 10^{-13}\exp(-1080/T)$ (1 bar)	250-390	±200
$HO_2 + CH_3O_2 \rightarrow O_2 + CH_3OOH$	4.7×10^{-12}			298	
$\rightarrow O_2 + HCHO + H_2O$	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
$HO_2 + HOCH_2O_2 \rightarrow O_2 + HOCH_2O_2H$	7.2×10^{-12}			298	
$\rightarrow O_2 + HC(O)OH + H_2O$	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
$HO_2 + C_2H_5O_2 \rightarrow O_2 + C_2H_5OOH$	7.8×10^{-12}	±0.2	$3.8 \times 10^{-13}\exp(900/T)$	200-500	±400
$HO_2 + CH_3C(O)OO \rightarrow$ products	1.4×10^{-11}	±0.3	$5.2 \times 10^{-13}\exp(980/T)$	250-400	±500
$HO_2 + HOCH_2CH_2O_2 \rightarrow$ products	1.2×10^{-11}	±0.2			
$HO_2 + CH_3OCH_2O_2 \rightarrow O_2 + CH_3OCH_2OOH$ $\rightarrow O_2 + CH_3OCHO + H_2O$	See data sheet				
$HO_2 + CH_3C(O)CH_2O_2 \rightarrow$ products	9.0×10^{-12}	±0.3			
$HO_2 + HCHO \rightarrow HOCH_2OO$	7.9×10^{-14}	±0.3	$9.7 \times 10^{-15}\exp(625/T)$	275-333	±600
$HOCH_2OO \rightarrow HO_2 + HCHO$	1.5×10^{2} (k/s^{-1})±0.3	$2.4 \times 10^{12}\exp(-7000/T)$		275-330	±2000

$NO_3 + CH_4 \rightarrow HNO_3 + CH_3$	$<1 \times 10^{-18}$				
$NO_3 + C_2H_2 \rightarrow$ products	$<1 \times 10^{-16}$				
$NO_3 + C_2H_4 \rightarrow$ products	2.1×10^{-16}	±0.2	$3.3 \times 10^{-12}\exp(-2880/T)$	270-340	±500
$NO_3 + C_2H_6 \rightarrow HNO_3 + C_2H_5$	$<1 \times 10^{-17}$				
$NO_3 + C_3H_6 \rightarrow$ products	9.5×10^{-15}	±0.2	$4.6 \times 10^{-13}\exp(-1155/T)$	290-430	±300
$NO_3 + C_3H_8 \rightarrow HNO_3 + C_3H_7$	$<7 \times 10^{-17}$				
$NO_3 + n\text{-}C_4H_{10} \rightarrow$ products	4.6×10^{-17}	±0.2	$2.8 \times 10^{-12}\exp(-3280/T)$	290-430	±400
$NO_3 + CH_2=C(CH_3)CH=CH_2 \rightarrow$ products	7.0×10^{-13}	±0.2	$3.15 \times 10^{-12}\exp(-450/T)$	250-390	±200
$NO_3 + \alpha$-pinene $\rightarrow$ products	6.2×10^{-12}	±0.1	$1.2 \times 10^{-12}\exp(490/T)$	260-390	±300
$NO_3 + HCHO \rightarrow HNO_3 + HCO$	5.6×10^{-16}	±0.3			
$NO_3 + CH_3CHO \rightarrow HNO_3 + CH_3CO$	2.7×10^{-15}	±0.2	$1.4 \times 10^{-12}\exp(-1860/T)$	260-380	±500
$NO_3 + C_2H_5CHO \rightarrow HNO_3 + C_2H_5CO$	6.5×10^{-15}	±0.2			
$NO_3 + CH_3C(O)CH_3 \rightarrow HNO_3 + CH_3C(O)CH_2$	$<3 \times 10^{-17}$				
$NO_3 + C_3H_7CHO \rightarrow HNO_3 + C_3H_7CO$	1.1×10^{-14}	±0.15	$1.70 \times 10^{-12}\exp(-1500/T)$	260-340	±500
$NO_3 + (CH_3)_2CHCHO \rightarrow$ products	1.25×10^{-14}	±0.20	$1.67 \times 10^{-12}\exp(-1460/T)$	260-420	±300
$NO_3 + CH_2=C(CH_3)CHO \rightarrow$ products	3.4×10^{-15}	±0.15			
$NO_3 + CH_2=CHC(O)CH_3 \rightarrow$ products	$< 6.0 \times 10^{-16}$				
$NO_3 +$ pinonaldehyde $\rightarrow$ products	2×10^{-14}	±0.25			
$NO_3 + [\text{-}CH_2CHC(CH_3)CH_2O\text{-}] \rightarrow$ products	1.9×10^{-11}	±0.5			

$NO_3 + CH_2{=}C(CH_3)C(O)OONO_2 \rightarrow$ products	1.6 x 10^{-16}		±0.7			
$NO_3 + CH_3OH \rightarrow$ products	1.3 x 10^{-16}		±0.5	9.4 x $10^{-13}\exp(-2650/T)$	250-370	±700
$NO_3 + C_2H_5OH \rightarrow$ products	<2 x 10^{-15}					
$NO_3 + CH_3CH(OH)CH_3 \rightarrow$ products	1.4 x 10^{-15}		±0.3			
$NO_3 + CH_3CH(OH)CH_2CH_3 \rightarrow$ products	2.1 x 10^{-15}		±0.3			
$NO_3 + (CH_3)_2C(OH)CH{=}CH_2 \rightarrow$ products	1.2 x 10^{-14}		±0.2	4.6 x $10^{-14}\exp(-400/T)$	260-400	±200
$CH_3 + O_2 + M \rightarrow CH_3O_2 + M$	1.0 x $10^{-30}[N_2]$	(k_0)	±0.2	1.0 x $10^{-30}(T/300)^{-3.3}[N_2]$	200-300	$\Delta n = \pm 1$
	1.8 x 10^{-12}	(k_∞)	±0.3	1.8 x $10^{-12}(T/300)^{1.1}$	200-300	$\Delta n = \pm 1$
	$F_c = 0.27$					
	9.5 x 10^{-13} (1 bar air)					
$CH_3 + O_3 \rightarrow$ products	2.3 x 10^{-12}		±0.3	4.7 x $10^{-12}\exp(-210/T)$	240-400	±200
$C_2H_5 + O_2 \rightarrow C_2H_4 + HO_2$	3.8 x 10^{-15}	(1 bar air)	±0.5			
	1.9 x 10^{-14}	(0.133 bar air)	±0.5			
$C_2H_5 + O_2 + M \rightarrow C_2H_5O_2 + M$	5.9 x $10^{-29}[N_2]$	(k_0)	±0.3	5.9 x $10^{-29}(T/300)^{-3.8}[N_2]$	200-300	$\Delta n = \pm 1$
	7.8 x 10^{-12}	(k_∞)	±0.2	7.8 x 10^{-12}	200-300	
				$F_c = \{0.58 \exp(-T/1250)$	200-300	
				$+ 0.42 \exp(-T/183)\}$		
	7.0 x 10^{-12} (1 bar air)					
n-$C_3H_7 + O_2 + M \rightarrow n$-$C_3H_7O_2 + M$	8 x 10^{-12}	(k_∞)	±0.2	8 x 10^{-12}	200-300	$\Delta\log k_\infty = \pm 0.2$
i-$C_3H_7 + O_2 + M \rightarrow i$-$C_3H_7O_2 + M$	1.1 x 10^{-11}	(k_∞)	±0.3	1.1 x 10^{-11}	200-300	$\Delta\log k_\infty = \pm 0.3$
1-$C_4H_9 + O_2 + M \rightarrow$ 1-$C_4H_9O_2 + M$	7.5 x 10^{-12}	(k_∞)	±0.5			
2-$C_4H_9 + O_2 + M \rightarrow$ 2-$C_4H_9O_2 + M$	1.7 x 10^{-11}	(k_∞)	±0.5			

$CH_3COCH_2 + O_2 + M \rightarrow CH_3COCH_2O_2 + M$	1.5×10^{-12}	(k_∞)	±0.5			
$HCO + O_2 \rightarrow CO + HO_2$	5.1×10^{-12}		±0.15	5.1×10^{-12}	200-300	±150
$CH_3C(O) + O_2 + M \rightarrow CH_3C(O)OO + M$	5.1×10^{-12}	(k_∞)	±0.2	5.1×10^{-12}	220-300	
$CH_2OH + O_2 \rightarrow HCHO + HO_2$	9.7×10^{-12}		±0.12			
$CH_3CHOH + O_2 \rightarrow CH_3CHO + HO_2$	1.9×10^{-11}		±0.3			
$CH_2CH_2OH + O_2 \rightarrow$ products	3.0×10^{-12}		±0.3			
$CH_3O + O_2 \rightarrow HCHO + HO_2$	1.9×10^{-15}		±0.2	$7.2 \times 10^{-14}\exp(-1080/T)$	290-610	±300
$C_2H_5O + O_2 \rightarrow CH_3CHO + HO_2$	8.1×10^{-15}		±0.2	$2.4 \times 10^{-14}\exp(-325/T)$	295-354	±300
$1\text{-}C_3H_7O + O_2 \rightarrow C_2H_5CHO + HO_2$	1.0×10^{-14}		±0.2	$2.6 \times 10^{-14}\exp(-253/T)$	220-380	±500
$2\text{-}C_3H_7O + O_2 \rightarrow CH_3COCH_3 + HO_2$	7.0×10^{-15}		±0.2	$1.9 \times 10^{-14}\exp(-300/T)$	218-364	±200
$CH_3CH_2CH_2CH_2O + O_2 \rightarrow CH_3CH_2CH_2CHO + HO_2$	1.4×10^{-14}		±0.3	$8.9 \times 10^{-14}\exp(-550/T)$	270-340	±300
$CH_3CH_2CH_2CH_2O + M \rightarrow CH_2CH_2CH_2CH_2OH + M$	2.9×10^{5}	(s^{-1}) (1 bar)	±0.2	$4.6 \times 10^{10}\exp(-3570/T)$ (1 bar)	250-350	±300
$CH_3OCH_2O + O_2 \rightarrow CH_3OCHO + HO_2$ $CH_3OCH_2O + M \rightarrow CH_3OCHO + H + M$	see data sheet					
$CH_3COCH_2O + O_2 \rightarrow CH_3COCHO + HO_2$ $CH_3COCH_2O + M \rightarrow CH_3CO + HCHO + M$	see data sheet					
$CH_3CH(O)CH_2CH_3 + O_2 \rightarrow CH_3C(O)CH_2CH_3 + HO_2$	7.6×10^{-15}		±0.3	$1.5 \times 10^{-14}\exp(-200/T)$	250-350	±300

$CH_3CH(O)CH_2CH_3 + M \rightarrow$ products		2.0×10^4	(s^{-1}) (1 bar)	±0.3	$7.2 \times 10^{12}\exp(-5780/T)$ (1 bar)	240-340	±500
$CH_3O + NO + M \rightarrow CH_3ONO + M$	}	$2.6 \times 10^{-29}[N_2]$	(k_0)	±0.1	$2.6 \times 10^{-29}(T/300)^{-2.8}[N_2]$	200-400	$\Delta n = \pm 0.5$
		3.3×10^{-11}	(k_∞)	±0.5	$3.3 \times 10^{-11}(T/300)^{-0.6}$	200-400	$\Delta n = \pm 0.5$
		$F_c = \exp(-T/900)$					
$CH_3O + NO \rightarrow HCHO + HNO$		see data sheet					
$C_2H_5O + NO + M \rightarrow C_2H_5ONO + M$	}	2.2×10^{-28} $[N_2]$	(k_0)	±0.3			
		4.4×10^{-11}	(k_∞)	±0.3	4.4×10^{-11}	200-400	$\Delta n = \pm 0.5$
		$F_c = 0.6$					
$C_2H_5O + NO \rightarrow CH_3CHO + HNO$		see data sheet					
n-$C_3H_7O + NO + M \rightarrow n$-$C_3H_7ONO + M$		3.8×10^{-11}	(k_∞)	±0.3			
i-$C_3H_7O + NO + M \rightarrow i$-$C_3H_7ONO + M$		3.4×10^{-11}	(k_∞)	±0.3			
$(CH_3)_3CO + NO + M \rightarrow (CH_3)_3CONO + M$		2.6×10^{-11}	(k_∞)	±0.3	$2.6 \times 10^{-11}(T/300)^{-1.4}$	200-400	$\Delta n = \pm 0.5$
2-$C_4H_9O + NO + M \rightarrow$ 2-$C_4H_9ONO + M$		2.5×10^{-11}	(k_∞)	±0.5			$\Delta n = \pm 1$
$CH_3O + NO_2 + M \rightarrow CH_3ONO_2 + M$	}	$8.1 \times 10^{-29}[N_2]$	(k_0)	±0.3	$8.1 \times 10^{-29}(T/300)^{-4.5}[N_2]$	200-400	$\Delta n = \pm 1$
		2.1×10^{-11}	(k_∞) (1 bar)	±0.3	2.1×10^{-11}	200-400	$\Delta n = \pm 0.5$
		$F_c = 0.44$					
		1.5×10^{-11} (1 bar air)					
$CH_3O + NO_2 \rightarrow HCHO + HONO$		see data sheet					
$C_2H_5O + NO_2 + M \rightarrow C_2H_5ONO_2 + M$	}	2.8×10^{-11}	(k_∞)	±0.3	2.8×10^{-11}	200-300	$\Delta n = \pm 0.5$
$C_2H_5O + NO_2 \rightarrow CH_3CHO + HONO$		see data sheet					
1-$C_3H_7O + NO_2 + M \rightarrow$ 1-$C_3H_7ONO_2 + M$		3.6×10^{-11}	(k_∞)	±0.3			
2-$C_3H_7O + NO_2 + M \rightarrow$ 2-$C_3H_7ONO_2 + M$		3.4×10^{-11}	(k_∞)	±0.2	3.4×10^{-11}	200-300	
$CH_3O_2 + NO \rightarrow CH_3O + NO_2$		7.7×10^{-12}		±0.05	$2.3 \times 10^{-12}\exp(360/T)$	200-430	±100
$C_2H_5O_2 + NO \rightarrow$ products		9.1×10^{-12}		±0.1	$2.6 \times 10^{-12}\exp(380/T)$	200-410	±50

$HOCH_2CH_2O_2 + NO \rightarrow HOCH_2CH_2O + NO_2$	9×10^{-12}		±0.5		
$n\text{-}C_3H_7O_2 + NO \rightarrow n\text{-}C_3H_7O + NO_2$	9.4×10^{-12}		±0.2	$2.9 \times 10^{-12}\exp(350/T)$	200-410	±100
$i\text{-}C_3H_7O_2 + NO \rightarrow i\text{-}C_3H_7O + NO_2$	9.0×10^{-12}		±0.1	$2.7 \times 10^{-12}\exp(360/T)$	200-410	±100
$CH_3C(O)CH_2O_2 + NO \rightarrow CH_3C(O)CH_2O + NO_2$	8.0×10^{-12}		±0.2			
$CH_3C(O)OO + NO \rightarrow CH_3C(O)O + NO_2$	2.0×10^{-11}		±0.15	$7.5 \times 10^{-12}\exp(290/T)$	200-350	±250
$C_2H_5C(O)OO + NO \rightarrow C_2H_5C(O)O + NO_2$	2.1×10^{-11}		±0.15	$6.7 \times 10^{-12}\exp(340/T)$	220-410	±200
$CH_3O_2 + NO_2 + M \rightarrow CH_3O_2NO_2 + M$	$2.5 \times 10^{-30}[N_2]$	(k_0)	±0.3	$2.5 \times 10^{-30}(T/300)^{-5.5}[N_2]$	250-350	$\Delta n = \pm 1$
	1.8×10^{-11}	(k_∞)	±0.3	1.8×10^{-11}	250-350	$\Delta n = \pm 0.5$
	$F_c = 0.36$					
	4.0×10^{-12} (1 bar air)					
$CH_3O_2NO_2 + M \rightarrow CH_3O_2 + NO_2 + M$	$6.8 \times 10^{-19}[N_2]$	(k_0/s^{-1})	±0.3	$9 \times 10^{-5}\exp(-9690/T)[N_2]$	250-300	±500
	4.5	(k_∞/s^{-1})	±0.3	$1.1 \times 10^{16}\exp(-10560/T)$	250-300	±500
	$F_c = 0.60$					
	1.8 (1 bar air)					
$C_2H_5O_2 + NO_2 + M \rightarrow C_2H_5O_2NO_2 + M$	$1.3 \times 10^{-29}[N_2]$	(k_0)	±0.3	$1.3 \times 10^{-29}(T/300)^{-6.2}[N_2]$	200-300	$\Delta n = \pm 1$
	8.8×10^{-12}	(k_∞)	±0.3	8.8×10^{-12}	200-300	
	$F_c = 0.31$					
	6.1×10^{-12} (1 bar air)					
$C_2H_5O_2NO_2 + M \rightarrow C_2H_5O_2 + NO_2 + M$	$1.4 \times 10^{-17}[N_2]$	(k_0/s^{-1})	±0.5	$4.8 \times 10^{-4}\exp(-9285/T)[N_2]$	250-300	±1000
	5.4	(k_∞/s^{-1})	±0.5	$8.8 \times 10^{15}\exp(-10440/T)$	250-300	±1000
	$F_c = 0.31$					
	4.0 (1 bar air)					
$CH_3C(O)OO + NO_2 + M \rightarrow CH_3C(O)OONO_2 + M$	$2.7 \times 10^{-28}[N_2]$	(k_0)	±0.4	$2.7 \times 10^{-28}(T/300)^{-7.1}[N_2]$	250-300	$\Delta n = \pm 2$
	1.2×10^{-11}	(k_∞)	±0.2	$1.2 \times 10^{-11}(T/300)^{-0.9}$	250-300	$\Delta n = \pm 1$
	$F_c = 0.3$					
	1.0×10^{-11} (1 bar air)					

$CH_3C(O)OONO_2 + M \rightarrow CH_3C(O)OO + NO_2 + M$	$1.1 \times 10^{-20}[N_2]$	(k_0/s^{-1})	±0.3	$4.9 \times 10^{-3}\exp(-12100/T)[N_2]$	300-330	±1000
	3.8×10^{-4}	(k_∞/s^{-1})	±0.3	$5.4 \times 10^{16}\exp(-13830/T)$	300-330	±300
	$F_c = 0.3$					
	3.3×10^{-4} (1 bar air)					
$C_2H_5C(O)OONO_2 + M \rightarrow C_2H_5C(O)OO + NO_2 + M$	$6.2 \times 10^{-20}[N_2]$	(k_0/s^{-1})	±0.5	$1.7 \times 10^{-3}\exp(-11280/T)[N_2]$	290-320	±2000
	4.0×10^{-4}	(k_∞/s^{-1})	±0.2	$8.3 \times 10^{16}\exp(-13940/T)$	290-320	±1000
	$F_c = 0.36$					
	3.6×10^{-4} (1 bar air)					
$CH_3C(O)CH_2O_2NO_2 + M \rightarrow CH_3C(O)CH_2O_2 + NO_2 + M$	$3.2\ (s^{-1})$		±0.3 (250K)	$1.4 \times 10^{16}\exp(-10730/T)$ (1 bar)	240-260	±200
$CH_2C(CH_3)C(O)OONO_2 + M \rightarrow CH_2C(CH_3)C(O)OO + NO_2$	$3.5 \times 10^{-4}\ (s^{-1})$ (1 bar)		±0.3	$1.6 \times 10^{16}\exp(-13500/T)$ (1 bar)	290-330	±1000
$CH_3O_2 + NO_3 \rightarrow CH_3O + NO_2 + O_2$	1.3×10^{-12}		±0.3			
$C_2H_5O_2 + NO_3 \rightarrow C_2H_5O + NO_2 + O_2$	2.3×10^{-12}		±0.2			
$CH_3O_2 + CH_3O_2 \rightarrow CH_3OH + HCHO + O_2$						
$\rightarrow 2\ CH_3O + O_2$	1.3×10^{-13}		±0.15	$7.4 \times 10^{-13}\exp(-520/T)$	220-330	±300
$\rightarrow CH_3OOCH_3 + O_2$						
Overall	3.5×10^{-13}		±0.12	$1.0 \times 10^{-13}\exp(365/T)$	200-400	±200
$CH_3O_2 + CH_3C(O)OO$						
$\rightarrow CH_3O + CH_3C(O)O + O_2$	9.9×10^{-12}					
$\rightarrow CH_3C(O)OH + HCHO + O_2$	1.1×10^{-12}					
Overall	1.1×10^{-11}		±0.15	$2.0 \times 10^{-12}\exp(500/T)$	200-350	±250
$CH_3O_2 + CH_3COCH_2O_2$						
$\rightarrow CH_3OH + CH_3COCHO + O_2$	1.9×10^{-12}					
$\rightarrow HCHO + CH_3COCH_2OH + O_2$	7.6×10^{-13}					
$\rightarrow CH_3O + CH_3COCH_2O + O_2$	1.1×10^{-12}					
Overall	3.8×10^{-12}		±0.3			

$HOCH_2O_2 + HOCH_2O_2$					
$\rightarrow HC(O)OH + CH_2(OH)_2 + O_2$	7.0×10^{-13}	±0.3	$5.7 \times 10^{-14} \exp(750/T)$	270-330	±750
$\rightarrow 2\ HOCH_2O + O_2$	5.5×10^{-12}	±0.3			
$C_2H_5O_2 + C_2H_5O_2 \rightarrow C_2H_5OH + CH_3CHO + O_2$	2.4×10^{-14}				
$\rightarrow 2\ C_2H_5O + O_2$	4.0×10^{-14}	±0.1			
Overall	6.4×10^{-14}	±0.12	6.4×10^{-14}	250-450	+300/-100
$C_2H_5O_2 + CH_3C(O)OO$					
$\rightarrow C_2H_5O + CH_3C(O)O + O_2$					
$\rightarrow CH_3CHO + CH_3C(O)OH + O_2$					
Overall	1.6×10^{-11}	±0.5	$4.4 \times 10^{-13} \exp(1070/T)$	220-440	±500
$CH_3OCH_2O_2 + CH_3OCH_2O_2$					
$\rightarrow CH_3OCH_2OH + CH_3OCHO + O_2$					
$\rightarrow 2\ CH_3OCH_2O + O_2$	1.4×10^{-12}				
Overall	2.1×10^{-12}	±0.3			
$CH_3C(O)OO + CH_3C(O)OO \rightarrow 2\ CH_3C(O)O + O_2$	1.6×10^{-11}	±0.1	$2.9 \times 10^{-12} \exp(500/T)$	200-370	±200
$CH_3C(O)OO + CH_3C(O)CH_2O_2$					
$\rightarrow CH_3COOH + CH_3COCHO + O_2$	2.5×10^{-12}				
$\rightarrow CH_3C(O)O + CH_3COCH_2O + O_2$	2.5×10^{-12}				
Overall	5.0×10^{-12}	±0.3			
$HOCH_2CH_2O_2 + HOCH_2CH_2O_2$					
$\rightarrow HOCH_2CH_2OH + HOCH_2CHO + O_2$	1.1×10^{-12}				
$\rightarrow 2\ HOCH_2CH_2O + O_2$	1.1×10^{-12}				
Overall	2.2×10^{-12}	±0.1	$7.8 \times 10^{-14} \exp(1000/T)$	250-450	±300
$n\text{-}C_3H_7O_2 + n\text{-}C_3H_7O_2$					
$\rightarrow n\text{-}C_3H_7OH + C_2H_5CHO + O_2$					
$\rightarrow 2\ n\text{-}C_3H_7O + O_2$					
Overall	3×10^{-13}	±0.5			

$i\text{-}C_3H_7O_2 + i\text{-}C_3H_7O_2$					
$\rightarrow i\text{-}C_3H_7OH + CH_3COCH_3 + O_2$	4.4×10^{-16}				
$\rightarrow 2\ i\text{-}C_3H_7O + O_2$	5.6×10^{-16}				
Overall	1.0×10^{-15}	±0.30	$1.6 \times 10^{-12}\exp(-2200/T)$	300-400	±300
$CH_3COCH_2O_2 + CH_3COCH_2O_2$					
$\rightarrow CH_3COCH_2OH + CH_3COCHO + O_2$	3.0×10^{-12}				
$\rightarrow 2\ CH_3COCH_2O + O_2$	5.0×10^{-12}				
Overall	8.0×10^{-12}	±0.3			
$RCHOO + O_3 \rightarrow RCHO + 2O_2$					
$RCHOO + H_2O \rightarrow$ products					
$RCHOO + CO \rightarrow$ products					
$RCHOO + HCHO \rightarrow$ products					
$RCHOO + C_2H_4 \rightarrow$ products	No recommendations (See data sheet)				
$RCHOO + NO \rightarrow RCHO + NO_2$					
$RCHOO + NO_2 \rightarrow RCHO + NO_3$					
$RCHOO + SO_2 \rightarrow$ products					
$RCHOO + HCOOH \rightarrow$ products					
O_3 + alkene $\rightarrow$ OH + products	see data sheet				
$O_3 + C_2H_2 \rightarrow$ products	1×10^{-20}	±1.0			
$O_3 + C_2H_4 \rightarrow$ products	1.6×10^{-18}	±0.10	$9.1 \times 10^{-15}\exp(-2580/T)$	180-360	±100
$O_3 + C_3H_6 \rightarrow$ products	1.0×10^{-17}	±0.10	$5.5 \times 10^{-15}\exp(-1880/T)$	230-370	±200
$O_3 + CH_2C(CH_3)CHCH_2 \rightarrow$ products	1.27×10^{-17}	±0.10	$1.03 \times 10^{-14}\exp(-1995/T)$	240-360	±200
O_3 + α-pinene $\rightarrow$products	9.0×10^{-17}	±0.20	$6.3 \times 10^{-16}\exp(-580/T)$	270-370	±300
$O_3 + CH_2{=}C(CH_3)CHO \rightarrow$ products	1.2×10^{-18}	±0.20	$1.4 \times 10^{-15}\exp(-2100/T)$	240-330	±300
$O_3 + CH_2{=}CHC(O)CH_3 \rightarrow$ products	5.2×10^{-18}	±0.20	$8.5 \times 10^{-16}\exp(-1520/T)$	240-330	±200
O_3 + pinonaldehyde $\rightarrow$ products	$<2 \times 10^{-20}$				

O_3 + [-$CH_2CHC(CH_3)CH_2O$-] → products	2.0 x 10^{-17}		±0.3			
O_3 + $CH_2{=}C(CH_3)C(O)OONO_2$ → products	8.2 x 10^{-18}		±0.3			
O_3 + $(CH_3)_2C(OH)CH{=}CH_2$ → products	1.0 x 10^{-17}		±0.2			
F + CH_4 → HF + CH_3	6.3 x 10^{-11}		±0.15	1.3 x 10^{-10}exp(-215/T)	180-410	±200
Cl + CH_4 → HCl + CH_3	1.0 x 10^{-13}		±0.06	6.6 x 10^{-12}exp(-1240/T)	200-300	±200
Cl + C_2H_2 + M → C_2H_2Cl + M	6.1 x 10^{-30}[N_2]	(k_0)	±0.3	6.1 x 10^{-30}(T/300)$^{-3}$[N_2]	200-300	Δn = ±1
	2.0 x 10^{-10}	(k_∞)	±0.3	2.0 x 10^{-10}	200-400	Δn = ±1
	F_c = 0.6					
	5.2 x 10^{-11}	(1 bar air)				
Cl + C_2H_4 + M → C_2H_4Cl + M	1.85 x 10^{-29}[air]	(k_0)	±0.5	1.85 x 10^{-29}(T/300) $^{-3.3}$[air]	250-300	Δn = ±1
	6 x 10^{-10}	(k_∞)	±0.3	6 x 10^{-10}	250-300	Δn = ±1
	F_c = 0.4					
	1.1 x 10^{-10}	(1 bar air)				
Cl + C_2H_6 → HCl + C_2H_5	5.9 x 10^{-11}		±0.06	8.3 x 10^{-11}exp(-100/T)	220-600	±100
Cl + C_3H_6 + M → C_3H_6Cl + M	4.0 x 10^{-28}[N_2]	(k_0)	±0.5			
	2.8 x 10^{-10}	(k_∞)	±0.3			
	2.3 x 10^{-10} (1 bar air)					
Cl + C_3H_8 → HCl + n-C_3H_7						
→ HCl + i-C_3H_7						
Overall	1.4 x 10^{-10}		±0.06	1.4 x 10^{-10}	200-700	±100
Cl + n-C_4H_{10} → HCl + C_4H_9	2.05 x 10^{-10}		±0.06	2.05 x 10^{-10}	290-600	±100
Cl + HCHO → HCl + HCO	7.2 x 10^{-11}		±0.06	8.1 x 10^{-11}exp(-34/T)	200-500	±100
Cl + CH_3CHO → HCl + CH_3CO	8.0 x 10^{-11}		±0.07	8.0 x 10^{-11}	210-340	±300
Cl + C_2H_5CHO → products	1.3 x 10^{-10}		±0.2			

$Cl + CH_3C(O)CH_3 \rightarrow HCl + CH_3COCH_2$	2.1×10^{-12}	±0.15	$3.2 \times 10^{-11}\exp(-815/T)$	215-300	±300
$Cl + CH_3C(O)CH_2CH_3 \rightarrow$ products	3.6×10^{-11}	±0.15			
$Cl + CH_3OH \rightarrow HCl + CH_2OH$	5.5×10^{-11}	±0.07	5.5×10^{-11}	200-580	±200
$Cl + C_2H_5OH \rightarrow$ products	1.0×10^{-10}	±0.08	$8.6 \times 10^{-11}\exp(45/T)$	295-600	±100
$Cl + n\text{-}C_3H_7OH \rightarrow$ products	1.6×10^{-10}	±0.15	$2.5 \times 10^{-11}\exp(-130/T)$	270-350	±100
$Cl + i\text{-}C_3H_7OH \rightarrow$ products	8.6×10^{-11}	±0.1			
$Cl + CH_3OOH \rightarrow$ products	5.9×10^{-11}	±0.5			
$Cl + HC(O)OH \rightarrow$ products	1.9×10^{-13}	±0.15			
$Cl + CH_3C(O)OH \rightarrow$ products	2.65×10^{-14}	±0.2			
$Cl + CH_3ONO_2 \rightarrow$ products	2.4×10^{-13}	±0.15			
$Cl + C_2H_5ONO_2 \rightarrow$ products	4.7×10^{-12}	±0.2			
$Cl + n\text{-}C_3H_7ONO_2 \rightarrow$ products	2.2×10^{-11}	±0.2			
$Cl + i\text{-}C_3H_7ONO_2 \rightarrow$ products	3.8×10^{-12}	±0.3			
$Cl + 1\text{-}C_4H_9ONO_2 \rightarrow$ products	8.5×10^{-11}	±0.3			
$Cl + CH_3C(O)OONO_2 \rightarrow$ products	$<2 \times 10^{-14}$				
$Cl + CH_3CN \rightarrow$ products	1.2×10^{-14}	±0.3	$1.6 \times 10^{-11}\exp(-2140/T)$	270-350	±300
$Br + C_2H_2 + M \rightarrow$ products	2.6×10^{-14} (1 bar air)	±0.2	$6.35 \times 10^{-15}\exp(440/T)$	230-300	±200
$Br + C_2H_4 + M \rightarrow$ products	1.3×10^{-13} (1 bar air)	±0.15			
$Br + C_3H_6 \rightarrow$ products	3.6×10^{-12} (1 bar air and 296 K)	±0.2			

$Br + HCHO \rightarrow HBr + HCO$	1.1×10^{-12}	±0.15	$7.7 \times 10^{-12}\exp(-580/T)$	220-300	±200
$Br + CH_3CHO \rightarrow HBr + CH_3CO$	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

$HCHO + h\nu \rightarrow$ products

$CH_3CHO + h\nu \rightarrow$ products

$C_2H_5CHO + h\nu \rightarrow$ products

$(CHO)_2 + h\nu \rightarrow$ products

$HOCH_2CHO + h\nu \rightarrow$ products

$CH_3COCHO + h\nu \rightarrow$ products

$CH_3C(O)CH_3 + h\nu \rightarrow$ products

$CH_3C(O)C_2H_5 + h\nu \rightarrow$ products

$CH_2=C(CH_3)CHO + h\nu \rightarrow$ products

$CH_3C(O)CH=CH_2 + h\nu \rightarrow$ products

$n\text{-}C_3H_7CHO + h\nu \rightarrow$ products

$CH_3OOH + h\nu \rightarrow$ products

$HOCH_2OOH + h\nu \rightarrow$ products

$CH_3ONO_2 + h\nu \rightarrow$ products

$C_2H_5ONO_2 + h\nu \rightarrow$ products

$n\text{-}C_3H_7ONO_2 + h\nu \rightarrow$ products

$i\text{-}C_3H_7ONO_2 + h\nu \rightarrow$ products

$1\text{-}C_4H_9ONO_2 + h\nu \rightarrow$ products

2-$C_4H_9ONO_2$ + hν → products						
$CH_3O_2NO_2$ + hν → products						
$CH_3C(O)OONO_2$ + hν → products						
Pinonladehyde + hν → products						
SO_x Reactions - based on data sheets on this website						
O + CS → CO + S	2.1×10^{-11}		±0.1	$2.7 \times 10^{-10}\exp(-760/T)$	150-300	±250
O + CH_3SCH_3 → CH_3SO + CH_3	5.0×10^{-11}		±0.1	$1.3 \times 10^{-11}\exp(409/T)$	270-560	±100
O + CS_2 → products	3.7×10^{-12}		±0.2	$3.3 \times 10^{-11}\exp(-650/T)$	210-500	±100
O + CH_3SSCH_3 → CH_3SO + CH_3S	1.5×10^{-10}		±0.3	$6.5 \times 10^{-11}\exp(250/T)$	290-570	±100
O + OCS → SO + CO	1.2×10^{-14}		±0.2	$1.6 \times 10^{-11}\exp(-2150/T)$	230-500	±150
O + SO_2 + M → SO_3 + M	$1.4 \times 10^{-33}[N_2]$	(k_o)	±0.3	$4.0 \times 10^{-32}\exp(-1000/T)[N_2]$	200-400	±200
S + O_2 → SO + O	2.1×10^{-12}		±0.2	2.1×10^{-12}	250-430	±200
S + O_3 → SO + O_2	1.2×10^{-11}		±0.3			
Cl + H_2S → HCl + HS	7.4×10^{-11}		±0.1	$3.7 \times 10^{-11}\exp(208/T)$	200-430	±100
Cl + OCS → SCl + CO	$<1.0 \times 10^{-16}$					
Cl + CS_2 + O_2 → products	$\leq 4 \times 10^{-15}$	(1 bar air)				
Cl + CH_3SH → products	2.0×10^{-10}		±0.1	$1.2 \times 10^{-10}\exp(150/T)$	190-430	±100
Cl + CH_3SCH_3 → products	3.4×10^{-10}	(1 bar N_2)	±0.2			
HO + H_2S → H_2O + HS	4.7×10^{-12}		±0.08	$6.1 \times 10^{-12}\exp(-80/T)$	220-520	±80

$HO + SO_2 + M \rightarrow HOSO_2 + M$	$4.5 \times 10^{-31}[N_2]$	(k_o)	±0.3	$4.5 \times 10^{-31}(T/300)^{-3.9}[N_2]$	200-300	$\Delta n = \pm 1$
	1.3×10^{-12}	(k_∞)	±0.3	1.3×10^{-12} (T/300)$^{-0.7}$	200-300	$\Delta \log k = \pm 0.3$
	$F_c = 0.525$			$F_c = 0.525$	200-300	
$HOSO_2 + O_2 \rightarrow HO_2 + SO_3$	4.3×10^{-13}		±0.10	$1.3 \times 10^{-12}\exp(-330/T)$	290-420	±200
$HO + OCS \rightarrow$ products	2.0×10^{-15}		±0.3	$1.1 \times 10^{-13}\exp(-1200/T)$	250-500	±500
$HO + CS_2 + M \rightarrow HOCS_2 + M$	$1 \times 10^{-30}[N_2]$	(k_o)	±0.5	$1 \times 10^{-30}[N_2]$	250-320	$\Delta \log k = \pm 0.5$
	2.5×10^{-11}	(k_∞)	±0.5	2.5×10^{-11}	250-300	$\Delta \log k = \pm 0.5$
	$F_c = 0.44$					
$HOCS_2 + M \rightarrow HO + CS_2 + M$	$4.8 \times 10^{-14}[N_2]$	(k_o/s^{-1})	±0.5	$1.6 \times 10^{-6}\exp(-5160/T)[N_2]$	250-300	±500
	4.8×10^{5}	(k_∞/s^{-1})	±0.5	$1.6 \times 10^{13}\exp(-5160/T)$	250-300	±500
	$F_c = 0.8$					
$HOCS_2 + O_2 \rightarrow$ products	2.8×10^{-14}		±0.15	2.8×10^{-14}	240-350	$\Delta \log k = \pm 0.15$
$HO + CH_3SH \rightarrow$ products	3.3×10^{-11}		±0.10	$9.9 \times 10^{-12}\exp(356/T)$	240-430	±100
$HO + CH_3SCH_3 \rightarrow H_2O + CH_2SCH_3$	4.8×10^{-12}		±0.10	$1.13 \times 10^{-11}\exp(-253/T)$	240-400	±150
$\rightarrow CH_3S(OH)CH_3$	1.5×10^{-12}	(1 bar air)	±0.30	$1.0 \times 10^{-39}[O_2]\exp(5820/T)$ / $\{1 + 5.0 \times 10^{-30}[O_2]\exp(6280/T)\}$	240-360	±150
$HO + CH_3SSCH_3 \rightarrow$ products	2.3×10^{-10}		±0.10	$7.0 \times 10^{-11}\exp(350/T)$	250-370	±200
$HO_2 + H_2S \rightarrow$ products	$<3 \times 10^{-15}$					
$HO_2 + SO_2 \rightarrow$ products	$<1 \times 10^{-18}$					
$HO_2 + CH_3SH \rightarrow$ products	$<4 \times 10^{-15}$					
$HO_2 + CH_3SCH_3 \rightarrow$ products	$<5 \times 10^{-15}$					
$NO_3 + H_2S \rightarrow$ products	$<1 \times 10^{-15}$					
$NO_3 + CS_2 \rightarrow$ products	$< 4 \times 10^{-16}$					

$NO_3 + OCS \rightarrow$ products	$<1 \times 10^{-16}$					
$NO_3 + SO_2 \rightarrow$ products	$<1 \times 10^{-19}$					
$NO_3 + CH_3SH \rightarrow$ products	9.2×10^{-13}		±0.15	9.2×10^{-13}	250-370	±400
$NO_3 + CH_3SCH_3 \rightarrow CH_3SCH_2 + HNO_3$	1.1×10^{-12}		±0.15	$1.9 \times 10^{-13}\exp(520/T)$	250-380	±200
$NO_3 + CH_3SSCH_3 \rightarrow$ products	7×10^{-13}		±0.3	7×10^{-13}	300-380	±500
$HS + O_2 \rightarrow$ products	$<4 \times 10^{-19}$					
$HS + O_3 \rightarrow HSO + O_2$	3.7×10^{-12}		±0.2	$9.5 \times 10^{-12}\exp(-280/T)$	290-440	±250
$HS + NO + M \rightarrow HSNO + M$	$2.4 \times 10^{-31}[N_2]$	(k_o)	±0.3	$2.4 \times 10^{-31}(T/300)^{-2.5}[N_2]$	250-300	$\Delta n = \pm 1$
	2.7×10^{-11}	(k_∞)	±0.5	2.7×10^{-11}	250-300	$\Delta \log k = \pm 0.5$
	$F_c = 0.6$					
$HS + NO_2 \rightarrow HSO + NO$	6.7×10^{-11}		±0.3	$2.9 \times 10^{-11}\exp(240/T)$	220-420	±100
$HSO + O_2 \rightarrow$ products	$\leq 2.0 \times 10^{-17}$					
$HSO + O_3 \rightarrow$ products	1.1×10^{-13}		±0.2			
$HSO + NO \rightarrow$ products	$<1.0 \times 10^{-15}$					
$HSO + NO_2 \rightarrow$ products	9.6×10^{-12}		±0.3			
$HSO_2 + O_2 \rightarrow$ products	3.0×10^{-13}		±0.8			
$SO + O_2 \rightarrow SO_2 + O$	7.6×10^{-17}		±0.15	$1.6 \times 10^{-13}\exp(-2280/T)$	230-420	±500
$SO + O_3 \rightarrow SO_2 + O_2$	8.9×10^{-14}		±0.1	$4.5 \times 10^{-12}\exp(-1170/T)$	230-420	±150
$SO + NO_2 \rightarrow SO_2 + NO$	1.4×10^{-11}		±0.1	1.4×10^{-11}	210-360	±100
$SO_3 (+ H_2O) \rightarrow H_2SO_4$	5.7×10^4 s^{-1} (at 50% relative humidity)					

$SO_3 + NH_3 \rightarrow$ products	2.0 x 10^{-11} (1 atm)		±0.2			
$CS + O_2 \rightarrow$ products	2.9 x 10^{-19}		±0.6			
$CS + O_3 \rightarrow OCS + O_2$	3.0 x 10^{-16}		±0.5			
$CS + NO_2 \rightarrow OCS + NO$	7.6 x 10^{-17}		±0.5			
$CH_2SH + O_2 \rightarrow$ products	6.6 x 10^{-12}		±0.3			
$CH_2SH + O_3 \rightarrow$ products	3.5 x 10^{-11}		±0.3			
$CH_2SH + NO \rightarrow$ products	1.5 x 10^{-11}		±0.3			
$CH_2SH + NO_2 \rightarrow$ products	4.4 x 10^{-11}		±0.5			
$CH_3S + O_2 + M \rightarrow CH_3SOO + M$	see data sheet.					
$CH_3SOO + M \rightarrow CH_3S + O_2 + M$	see data sheet					
$CH_3S + O_3 \rightarrow$ products	4.9 x 10^{-12}		±0.2	1.15 x $10^{-12}\exp(432/T)$	259-381	±100
$CH_3S + NO + M \rightarrow CH_3SNO + M$	3.3 x $10^{-29}[N_2]$	(k_o)	±0.3	3.3 x $10^{-29}(T/300)^{-4}[N_2]$	290-450	$\Delta n = \pm 2$
	4 x 10^{-11}	(k_∞)	±0.5	4 x 10^{-11}	290-450	$\Delta \log k = \pm 0.5$
	$F_c = 0.54$					
$CH_3S + NO_2 \rightarrow CH_3SO + NO$	6.0 x 10^{-11}		±0.15	3.0 x $10^{-11}\exp(210/T)$	240-350	±200
$CH_3SO + O_3 \rightarrow$ products	6.0 x 10^{-13}		±0.3			
$CH_3SO + NO_2 \rightarrow$ products	1.2 x 10^{-11}		±0.2			
$CH_3SOO + O_3 \rightarrow$ products	<8 x 10^{-13}	(227 K)				
$CH_3SOO + NO \rightarrow$ products				1.1 x 10^{-11}	227-256	$\Delta \log k = \pm 0.3$
$CH_3SOO + NO_2 \rightarrow$ products				2.2 x 10^{-11}	227-246	$\Delta \log k = \pm 0.3$

$CH_3SO_2 + NO_2 \rightarrow$ products	$\leq 1 \times 10^{-15}$					
$CH_3SCH_2 + O_2 \rightarrow CH_3SCH_2O_2$	5.7×10^{-12}	(1 bar)	±0.4			
$CH_3SCH_2O_2 + NO \rightarrow CH_3SCH_2O + NO_2$	1.2×10^{-11}		±0.2	$4.9 \times 10^{-12} \exp(260/T)$	260-400	±300
$CH_3SCH_2O_2 + NO_2 + M \rightarrow CH_3SCH_2O_2NO_2 + M$	9×10^{-12}	(1 bar)	±0.5			
$CH_3SCH_2O_2 + CH_3SCH_2O_2 \rightarrow 2CH_3SCH_2O + O_2$	1.0×10^{-11}		±0.3			
$CH_3SS + O_3 \rightarrow$ products	4.6×10^{-13}		±0.3			
$CH_3SS + NO_2 \rightarrow$ products	1.8×10^{-11}		±0.3			
$CH_3SSO + NO_2 \rightarrow$ products	4.5×10^{-12}		±0.3			
$O_3 + CH_3SCH_3 \rightarrow$ products	$<1 \times 10^{-18}$					
$ClO + CH_3SCH_3 \rightarrow$ products	5.3×10^{-15}		±0.5	$1.7 \times 10^{-15} \exp(340/T)$	250-340	±400
$BrO + CH_3SCH_3 \rightarrow$ products	4.3×10^{-13}		±0.3	$1.5 \times 10^{-14} \exp(1000/T)$	270-340	±500
$IO + CH_3SCH_3 \rightarrow$ 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

$OCS + h\nu \rightarrow$ products	See data sheet
$CS_2 + h\nu \rightarrow$ products	See data sheet
$CH_3SSCH_3 + h\nu \rightarrow$ products	See data sheet
$CH_3SNO + h\nu \rightarrow$ products	See data sheet

FO_x Reactions - based on data sheets on this website

$O + FO \rightarrow O_2 + F$	2.7×10^{-11}	±0.3
$O + FO_2 \rightarrow O_2 + FO$	5×10^{-11}	±0.7
$O(^1D) + HF \rightarrow HO + F$	1.5×10^{-11}	±0.1
$\rightarrow O(^3P) + HF$	3.6×10^{-11}	±0.1
overall	5.1×10^{-11}	±0.2
$O(^1D) + COF_2 \rightarrow O(^3P) + COF_2$	5.2×10^{-11}	
$\rightarrow$ other products	2.2×10^{-11}	
overall	7.4×10^{-11}	±0.3
$O(^1D) + CH_3F \rightarrow O(^3P) + CH_3F$	2.7×10^{-11}	
$\rightarrow$ other products	1.2×10^{-10}	
overall	1.5×10^{-10}	±0.15
$O(^1D) + CH_2F_2 \rightarrow O(^3P) + CH_2F_2$	3.6×10^{-11}	
$\rightarrow$ other products	1.5×10^{-11}	
overall	5.1×10^{-11}	±0.3
$O(^1D) + CHF_3 \rightarrow O(^3P) + CHF_3$	8.2×10^{-12}	
$\rightarrow$ other products	9.1×10^{-13}	
overall	9.1×10^{-12}	±0.15
$O(^1D) + CH_3CH_2F \rightarrow O(^3P) + CH_3CH_2F$	4.7×10^{-11}	
$\rightarrow$ other products	2.1×10^{-10}	
overall	2.6×10^{-10}	±0.3
$O(^1D) + CH_3CHF_2 \rightarrow O(^3P) + CH_3CHF_2$	1.1×10^{-10}	
$\rightarrow$ other products	9.2×10^{-11}	
overall	2.0×10^{-10}	±0.3
$O(^1D) + CH_3CF_3 \rightarrow O(^3P) + CH_3CF_3$		
$\rightarrow$ other products	5.8×10^{-11}	±0.5

$O(^1D) + CH_2FCF_3 \rightarrow O(^3P) + CH_2FCF_3$	4.6×10^{-11}					
$\rightarrow$ 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}					
$\rightarrow$ 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
$F + O_2 + M \rightarrow FO_2 + M$	5.8×10^{-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	$\Delta \log k_\infty = \pm 0.3$
	$F_c \approx 0.5$			$F_c \approx 0.5$		
$FO_2 + M \rightarrow F + O_2 + M$	1.5×10^{-17} [N_2]	(k_0/s^{-1})	±0.3	8.4×10^{-9} $(T/300)^{-1.25}$ $\exp(-5990/T)$[N_2]	310-420	±500 $\Delta n = \pm 0.5$
	3.1×10^{5}	(k_∞/s^{-1})	±0.3	1.7×10^{14} $(T/300)^{0.45}$ $\exp(-5990/T)$	310-420	±500 $\Delta n = \pm 0.5$
	$F_c \approx 0.5$			$F_c \approx 0.5$		
$F + O_3 \rightarrow FO + O_2$	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
$HO + CF_4 \rightarrow HOF + CF_3$	$<2 \times 10^{-18}$					
$HO + CH_3CH_2F \rightarrow$ products	2.1×10^{-13}		±0.2	$2.7 \times 10^{-12}\exp(-765/T)$	210-300	±300
$HO + CH_3CHF_2 \rightarrow$ products	3.6×10^{-14}		$^{+0.10}_{-0.20}$	$1.25 \times 10^{-12}\exp(-1070/T)$	210-300	$^{+200}_{-400}$

$HO + CH_3CF_3 \rightarrow H_2O + CH_2CF_3$	1.2×10^{-15}	±0.15	$9.2 \times 10^{-13}\exp(-1970/T)$	220-300	±300
$HO + CH_2FCH_2F \rightarrow H_2O + CH_2FCHF$	1.0×10^{-13}	±0.3	$1.5 \times 10^{-12}\exp(-800/T)$	210-300	±200
$HO + CH_2FCHF_2 \rightarrow$ products	1.5×10^{-14}	±0.2	$3.3 \times 10^{-12}\exp(-1610/T)$	270-330	±300
$HO + CH_2FCF_3 \rightarrow H_2O + CHFCF_3$	4.6×10^{-15}	±0.2	$4.9 \times 10^{-13}\exp(-1395/T)$	220-300	±300
$HO + CHF_2CHF_2 \rightarrow H_2O + CF_2CHF_2$	6.1×10^{-15}	±0.2	$1.4 \times 10^{-12}\exp(-1620/T)$	290-360	±300
$HO + CHF_2CF_3 \rightarrow H_2O + CF_2CF_3$	1.9×10^{-15}	±0.2	$4.4 \times 10^{-13}\exp(-1630/T)$	220-300	±300
$HO + CHF_2CF_2CH_2F \rightarrow$ products	7.7×10^{-15}	±0.3	$2.2 \times 10^{-12}\exp(-1685/T)$	285-365	±300
$HO + CF_3CF_2CH_2F \rightarrow H_2O + CF_3CF_2CHF$	6.5×10^{-15}	±0.3	$2.6 \times 10^{-13}\exp(-1100/T)$	250-320	±400
$HO + CF_3CHFCHF_2 \rightarrow$ products	5.0×10^{-15}	±0.3	$1.4 \times 10^{-12}\exp(-1680/T)$	290-380	±300
$HO + CF_3CH_2CF_3 \rightarrow H_2O + CF_3CHCF_3$	3.3×10^{-16}	±0.3	$1.3 \times 10^{-12}\exp(-2465/T)$	270-340	±400
$HO + CF_3CHFCF_3 \rightarrow H_2O + CF_3CFCF_3$	1.9×10^{-15}	±0.2	$2.9 \times 10^{-13}\exp(-1500/T)$	270-380	±300
$HO + CHF_2OCHF_2 \rightarrow H_2O + CHF_2OCF_2$	2.2×10^{-15}	±0.1	$1.9 \times 10^{-12}\exp(-2020/T)$	273-460	±300
$HO + HCOF \rightarrow H_2O + FCO$	$<1 \times 10^{-14}$				
$HO + CHF_2CHO \rightarrow$ products	1.6×10^{-12}	±0.2			
$HO + CF_3CHO \rightarrow H_2O + CF_3CO$	5.7×10^{-13}	±0.2			
$HO + CF_3COOH \rightarrow$ products	1.3×10^{-13}	±0.1	1.3×10^{-13}	280-350	$\Delta\log k = \pm 0.1$
$HO_2 + CH_2FO_2 \rightarrow O_2 + CH_2FO_2H$ $\rightarrow O_2 + HCOF + H_2O$	See data sheet				

$HO_2 + CF_3O_2 \rightarrow CF_3O_2H + O_2$ $\rightarrow C(O)F_2 + HOF + O_2$	See data sheet					
$HO_2 + CF_3CHFO_2 \rightarrow$ products	4.3×10^{-12}		±0.2	$2.0 \times 10^{-13}\exp(910/T)$	210-365	±300
$HO_2 + CF_3CF_2O_2 \rightarrow$ products	1.2×10^{-12}		±0.5			
$FO + O_3 \rightarrow$ products	$<1 \times 10^{-14}$					
$FO + NO \rightarrow F + NO_2$	2.2×10^{-11}		±0.15	$8.2 \times 10^{-12}\exp(300/T)$	290-850	±200
$FO + FO \rightarrow$ products	1.0×10^{-11}		±0.2	1.0×10^{-11}	290-440	±250
$FO_2 + O_3 \rightarrow$ products	$<4 \times 10^{-16}$					
$FO_2 + NO \rightarrow FNO + O_2$	7.5×10^{-13}		±0.3	$7.5 \times 10^{-12}\exp(-690/T)$	190-300	±400
$FO_2 + NO_2 \rightarrow$ products	4.0×10^{-14}		±0.3	$3.8 \times 10^{-11}\exp(-2040/T)$	260-320	±500
$FO_2 + CO \rightarrow$ products	$<6 \times 10^{-16}$					
$FO_2 + CH_4 \rightarrow$ products	$<4.1 \times 10^{-15}$					
$CF_3 + O_2 + M \rightarrow CF_3O_2 + M$	$2.2 \times 10^{-29}[N_2]$	(k_o)	±0.1	$2.2 \times 10^{-29}(T/300)^{-4.7}[N_2]$	230-380	$\Delta n = \pm 1.5$
	4.0×10^{-12}	(k_∞)	±0.3	4.0×10^{-12}	200-300	$\Delta n = \pm 1.5$
	$F_c = 0.39$					
$CF_3O + O_2 \rightarrow COF_2 + FO_2$	$<1 \times 10^{-18}$			$<1 \times 10^{-10}\exp(-5600/T)$	250-370	
$CF_3O + O_3 \rightarrow CF_3O_2 + O_2$	1.8×10^{-14}		±1	$2 \times 10^{-12}\exp(-1400/T)$	250-370	±600
$CF_3O + H_2O \rightarrow CF_3OH + HO$	$<2 \times 10^{-17}$			$<3 \times 10^{-12}\exp(-3600/T)$	250-380	
$CF_3O + NO \rightarrow COF_2 + FNO$	5.4×10^{-11}		±0.1	$3.7 \times 10^{-11}\exp(110/T)$	230-390	±100
$CF_3O + CH_4 \rightarrow CF_3OH + CH_3$	2.2×10^{-14}		±0.1	$2.6 \times 10^{-12}\exp(-1420/T)$	230-380	±200

$CF_3O + C_2H_6 \rightarrow CF_3OH + C_2H_5$	1.3×10^{-12}	±0.1	$4.9 \times 10^{-12}\exp(-400/T)$	230-360	±200
$CH_2FO + O_2 \rightarrow HCOF + HO_2$					
$CH_2FO + M \rightarrow HCOF + H + M$					
$CH_3CF_2O + O_2 \rightarrow$ products					
$CH_3CF_2O + M \rightarrow CH_3 + COF_2 + M$					
$CH_2FCHFO + O_2 \rightarrow CH_2FCOF + HO_2$					
$CH_2FCHFO + M \rightarrow CH_2F + HCOF + M$					
$CF_3CHFO + O_2 \rightarrow CF_3COF + HO_2$					
$CF_3CHFO + M \rightarrow CF_3 + HCOF + M$					
$CF_3CF_2O + O_2 \rightarrow$ products					
$CF_3CF_2O + M \rightarrow CF_3 + COF_2 + M$					
$CH_2FO_2 + NO \rightarrow CH_2FO + NO_2$	1.3×10^{-11}	±0.3			
$CHF_2O_2 + NO \rightarrow CHF_2O + NO_2$	1.3×10^{-11}	±0.3			
$CF_3O_2 + O_3 \rightarrow CF_3O + 2O_2$	$<3 \times 10^{-15}$				
$CF_3O_2 + NO \rightarrow CF_3O + NO_2$	1.6×10^{-11}	±0.15	$1.6 \times 10^{-11}(T/298)^{-1.2}$	230-430	$\Delta\log k = \pm 0.15$
$CH_2FCHFO_2 + NO \rightarrow CH_2FCHFO + NO_2$	$>9 \times 10^{-12}$				
$CHF_2CF_2O_2 + NO \rightarrow CHF_2CF_2O + NO_2$	$>1 \times 10^{-11}$				
$CF_3CHFO_2 + NO \rightarrow CF_3CHFO + NO_2$	1.3×10^{-11}	±0.3			
$CF_3CF_2O_2 + NO \rightarrow CF_3CF_2O + NO_2$	$>1 \times 10^{-11}$				

$CF_3O_2 + NO_2 + M \rightarrow CF_3O_2NO_2 + M$	$5.6 \times 10^{-29}[N_2]$	(k_o)	±0.2	$5.6 \times 10^{-29} (T/298)^{-9}[N_2]$	260-300	$\Delta n = \pm 3$
	7.7×10^{-12}	(k_∞)	±0.2	$7.7 \times 10^{-12}(T/298)^{-0.67}$	260-300	$\Delta n = \pm 0.5$
	$F_c = 0.31$			$F_c = 0.31$	260-300	
$CF_3O_2NO_2 + M \rightarrow CF_3O_2 + NO_2 + M$	$4.5 \times 10^{-19}[N_2]$	(k_o/s^{-1})	±0.3	$2.5 \times 10^{-5}\exp(-9430/T)[N_2]$	260-300	±250
	6.0×10^{-2}	(k_∞/s^{-1})	±0.3	$1.5 \times 10^{16}\exp(-11940/T)$	260-300	±250
	$F_c = 0.31$			$F_c = 0.31$	260-300	
$CH_2FO_2 + CH_2FO_2 \rightarrow$ products	2.6×10^{-12}		±0.3	$2.5 \times 10^{-13}\exp(700/T)$	220-380	±300
$CHF_2O_2 + CHF_2O_2 \rightarrow$ products	$(2.5\text{-}5) \times 10^{-12}$					
$CF_3O_2 + CF_3O_2 \rightarrow 2\ CF_3O + O_2$	1.5×10^{-12}		±0.3			
$CF_3O_2 + CF_3CHFO_2 \rightarrow$ products	8×10^{-12}		±0.5			
$CHF_2CF_2O_2 + CHF_2CF_2O_2 \rightarrow$ products	no recommendation					
$CF_3CHFO_2 + CF_3CHFO_2 \rightarrow$ products	4.7×10^{-12}		±0.3	$6.2 \times 10^{-13}\exp(605/T)$	210-375	±200
$CF_3CF_2O_2 + CF_3CF_2O_2 \rightarrow 2\ CF_3CF_2O + O_2$	no recommendation					

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

$HCOF + h\nu \rightarrow$ products

$COF_2 + h\nu \rightarrow$ products

$CF_3CHO + h\nu \rightarrow$ products

$CF_3COF + h\nu \rightarrow$ products

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

$O + HOCl \rightarrow HO + ClO$	1.7×10^{-13}		±0.5	1.7×10^{-13}	210-300	±300
$O + ClO \rightarrow Cl + O_2$	3.7×10^{-11}		±0.06	$2.5 \times 10^{-11} \exp(110/T)$	220-390	±50
$O + OClO \rightarrow O_2 + ClO$	1.0×10^{-13}		±0.3	$2.4 \times 10^{-12} \exp(-960/T)$	240-400	±300
$O + OClO + M \rightarrow ClO_3 + M$	$1.8 \times 10^{-31}[N_2]$	(k_o)	±0.3	$1.8 \times 10^{-31}(T/298)^{-1}[N_2]$	240-320	$\Delta n = \pm 0.5$
	2.8×10^{-11}	(k_∞)	±0.3	2.8×10^{-11}	240-320	$\Delta n = \pm 1$
	$F_c = 0.5$					
$O + Cl_2O \rightarrow ClO + ClO$	4.5×10^{-12}		±0.15	$2.7 \times 10^{-11} \exp(-530/T)$	230-380	±200
$O + ClONO_2 \rightarrow$ products	2.2×10^{-13}		±0.08	$4.5 \times 10^{-12} \exp(-900/T)$	200-330	±150
$O(^1D) + CHF_2Cl \rightarrow O(^3P) + CHF_2Cl$	2.8×10^{-11}					
$\rightarrow ClO + CHF_2$	5.5×10^{-11}					
$\rightarrow$ other products	1.7×10^{-11}					
overall	1.0×10^{-10}		±0.1	1.0×10^{-10}	170-350	$\Delta \log k = \pm 0.1$
$O(^1D) + CHFCl_2 \rightarrow ClO + CHFCl_2$	1.4×10^{-10}					
$\rightarrow$ other products	5.0×10^{-11}					
overall	1.9×10^{-10}		±0.3	1.9×10^{-10}	180-350	$\Delta \log k = \pm 0.3$
$O(^1D) + CH_3CF_2Cl \rightarrow O(^3P) + CH_3F_2Cl$	5.7×10^{-11}					
$\rightarrow$ other products	1.6×10^{-10}					
overall	2.2×10^{-10}		±0.3			
$O(^1D) + CH_3CFCl_2 \rightarrow O(^3P) + CH_3CFCl_2$	8.1×10^{-11}					
$\rightarrow$ other products	1.8×10^{-10}					
overall	2.6×10^{-10}		±0.3			
$O(^1D) + CH_2ClCF_3 \rightarrow O(^3P) + CH_2ClCF_3$	2.4×10^{-11}					
$\rightarrow$ other products	9.6×10^{-11}					
overall	1.2×10^{-10}		±0.3			

$O(^1D) + CH_2ClCF_2Cl \rightarrow O(^3P) + CH_2ClCF_2Cl$						
$\rightarrow$ other products	1.6×10^{-10}		±0.5			
$O(^1D) + CHFClCF_3 \rightarrow O(^3P) + CHFClCF_3$	2.7×10^{-11}					
$\rightarrow$ 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}					
$\rightarrow$ 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}					
$\rightarrow O(^3P) + CF_2Cl_2$	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}					
$\rightarrow O(^3P) + CFCl_3$	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}					
$\rightarrow O(^3P) + CCl_4$	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			
$\rightarrow ClO + HO$	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_o)	±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_o)	±0.2 (200 K)	$1.6 \times 10^{-33}(T/300)^{-2.9}[O_2]$	160-300	$\Delta n = \pm 1$

$ClOO + M \rightarrow Cl + O_2 + M$	$6.2 \times 10^{-13}[N_2]$	(k_0/s^{-1})	±0.3	$2.8 \times 10^{-10}\exp(-1820/T)[N_2]$	160-300	±200
$Cl + CO + M \rightarrow ClCO + M$	$1.3 \times 10^{-33}[N_2]$	(k_0)	±0.3	$1.3 \times 10^{-33}(T/300)^{-3.8}[N_2]$	180-300	$\Delta n = \pm 1$
$ClCO + M \rightarrow Cl + CO + M$	$2.0 \times 10^{-14}[N_2]$	(k_0/s^{-1})	±0.4	$4.1 \times 10^{-10}\exp(-2960/T)[N_2]$	180-300	±200
$Cl + O_3 \rightarrow ClO + O_2$	1.2×10^{-11}		±0.06	$2.8 \times 10^{-11}\exp(-250/T)$	180-300	+100/-150
$Cl + HONO_2 \rightarrow HCl + NO_3$	$<2.0 \times 10^{-16}$					
$Cl + NO_3 \rightarrow ClO + NO_2$	2.4×10^{-11}		±0.2	2.4×10^{-11}	200-300	±400
$Cl + OClO \rightarrow ClO + ClO$	5.7×10^{-11}		±0.1	$3.2 \times 10^{-11}\exp(170/T)$	220-430	±200
$Cl + Cl_2O \rightarrow Cl_2 + ClO$	9.6×10^{-11}		±0.1	$6.2 \times 10^{-11}\exp(130/T)$	230-380	±130
$Cl + Cl_2O_2 \rightarrow Cl_2 + ClOO$	1.0×10^{-10}		±0.3	1.0×10^{-10}	230-300	±300
$Cl + ClONO_2 \rightarrow Cl_2 + NO_3$	1.0×10^{-11}		±0.10	$6.2 \times 10^{-12}\exp(145/T)$	190-360	±50
$Cl + HC(O)Cl \rightarrow HCl + ClCO$	7.5×10^{-13}		±0.1	$8.1 \times 10^{-12}\exp(-710/T)$	220-330	±150
$Cl + CH_3OCl \rightarrow Cl_2 + CH_3O$	5.2×10^{-11}		±0.1			
$\rightarrow HCl + CH_2OCl$	9.15×10^{-12}		±0.1			
overall	6.1×10^{-11}		±0.1			
$Cl + CH_3F \rightarrow HCl + CH_2F$	3.5×10^{-13}		±0.15	$4.0 \times 10^{-12}\exp(-730/T)$	240-370	±400
$Cl + CH_3Cl \rightarrow HCl + CH_2Cl$	4.8×10^{-13}		±0.1	$2.3 \times 10^{-11}\exp(-1150/T)$	220-360	±200
$Cl + CH_2F_2 \rightarrow HCl + CHF_2$	5.0×10^{-14}		±0.5	$7.0 \times 10^{-12}\exp(-1470/T)$	280-370	±500
$Cl + CH_2FCl \rightarrow HCl + CHFCl$	1.1×10^{-13}		±0.3	$7.0 \times 10^{-12}\exp(-1230/T)$	270-370	±500
$Cl + CH_2Cl_2 \rightarrow HCl + CHCl_2$	3.4×10^{-13}		±0.1	$5.9 \times 10^{-12}\exp(-850/T)$	220-400	±200
$Cl + CHF_2Cl \rightarrow HCl + CF_2Cl$	1.7×10^{-15}		±0.15	$5.9 \times 10^{-12}\exp(-2430/T)$	290-430	±400

$Cl + CHFCl_2 \rightarrow HCl + CFCl_2$	2.0×10^{-14}		±0.2	$5.5 \times 10^{-12}\exp(-1675/T)$	290-430	±400
$Cl + CHCl_3 \rightarrow HCl + CCl_3$	1.1×10^{-13}		±0.2	$2.4 \times 10^{-12}\exp(-920/T)$	220-500	±400
$Cl + CH_3CH_2F \rightarrow HCl + CH_3CHF$	6.5×10^{-12}		±0.3	$1.0 \times 10^{-11}\exp(-130/T)$	280-370	±500
$\rightarrow HCl + CH_2CH_2F$	7.4×10^{-13}		±0.3	$8.3 \times 10^{-12}\exp(-720/T)$	280-370	±500
$Cl + CH_3CHF_2 \rightarrow HCl + CH_3CF_2$	2.5×10^{-13}		±0.15	$6.3 \times 10^{-12}\exp(-965/T)$	280-360	±500
$\rightarrow HCl + CH_2CHF_2$	2.3×10^{-15}		±0.5	$7.0 \times 10^{-12}\exp(-2400/T)$	280-360	±500
$Cl + CH_2FCH_2F \rightarrow HCl + CH_2FCHF$	7.0×10^{-13}		±0.2	$2.5 \times 10^{-11}\exp(-1065/T)$	280-360	±400
$Cl + CH_3CF_3 \rightarrow HCl + CH_2CF_3$	2.6×10^{-17}		±0.5	$6.9 \times 10^{-12}\exp(-3720/T)$	280-370	±500
$Cl + CH_2FCHF_2 \rightarrow HCl + CH_2FCF_2$	2.5×10^{-14}		±0.5	$3.3 \times 10^{-12}\exp(-1450/T)$	280-370	±500
$\rightarrow HCl + CHFCHF_2$	2.5×10^{-14}		±0.5	$4.6 \times 10^{-12}\exp(-1560/T)$	280-370	±500
$Cl + CH_3CF_2Cl \rightarrow HCl + CH_2CF_2Cl$	4.1×10^{-16}		±0.15	$1.4 \times 10^{-12}\exp(-2420/T)$	296-440	±500
$Cl + CH_3CFCl_2 \rightarrow HCl + CH_2CFCl_2$	2.1×10^{-15}		±0.1	$1.7 \times 10^{-12}\exp(-2000/T)$	298-376	±300
$Cl + CH_3CCl_3 \rightarrow HCl + CH_2CCl_3$	7×10^{-15}		±0.2	$2.8 \times 10^{-12}\exp(-1790/T)$	298-418	±400
$Cl + CH_2FCF_3 \rightarrow HCl + CHFCF_3$	1.5×10^{-15}		±0.1	$3.4 \times 10^{-12}\exp(-2300/T)$	290-340	±500
$Cl + CHF_2CHF_2 \rightarrow HCl + CF_2CHF_2$	2.2×10^{-15}		±0.2	$7.9 \times 10^{-12}\exp(-2440/T)$	280-360	±500
$Cl + CHF_2CF_3 \rightarrow HCl + CF_2CF_3$	2.5×10^{-16}		±0.2			
$Cl + CHFClCF_3 \rightarrow HCl + CFClCF_3$	2.7×10^{-15}		±0.1	$1.1 \times 10^{-12}\exp(-1800/T)$	270-380	±500
$Cl + CHCl_2CF_3 \rightarrow HCl + CCl_2CF_3$	1.2×10^{-14}		±0.1	$4.4 \times 10^{-12}\exp(-1740/T)$	270-380	±500
$Cl + OCS \rightarrow SCl + CO$	$<1.0 \times 10^{-16}$					
$Cl + CS_2 + O_2 \rightarrow$ products	$\leq 4 \times 10^{-15}$	(1 bar air)				

$HO + Cl_2 \rightarrow HOCl + Cl$	6.5×10^{-14}	±0.08	$3.6 \times 10^{-12}\exp(-1200/T)$	230-360	±300
$HO + HCl \rightarrow H_2O + Cl$	8.0×10^{-13}	±0.06	$1.8 \times 10^{-12}\exp(-240/T)$	200-300	±100
$HO + HOCl \rightarrow ClO + H_2O$	5.0×10^{-13}	±0.5			
$HO + ClO \rightarrow$ products	2.0×10^{-11}	±0.15	$7.3 \times 10^{-12}\exp(300/T)$	200-380	±100
$HO + OClO \rightarrow$ products	6.6×10^{-12}	±0.3	$4.5 \times 10^{-13}\exp(800/T)$	290-480	±200
$HO + ClNO_2 \rightarrow HOCl + NO_2$	3.6×10^{-14}	±0.3	$2.4 \times 10^{-12}\exp(-1250/T)$	260-350	±300
$HO + ClONO_2 \rightarrow$ products	4.0×10^{-13}	±0.2	$1.2 \times 10^{-12}\exp(-330/T)$	240-390	±200
$HO + CH_3Cl \rightarrow H_2O + CH_2Cl$	3.6×10^{-14}	±0.10	$2.1 \times 10^{-12}\exp(-1210/T)$	220-300	±200
$HO + CH_2FCl \rightarrow H_2O + CHFCl$	3.9×10^{-14}	±0.10	$1.6 \times 10^{-12}\exp(-1105/T)$	240-300	±200
$HO + CH_2Cl_2 \rightarrow H_2O + CHCl_2$	1.0×10^{-13}	±0.10	$1.8 \times 10^{-12}\exp(-860/T)$	210-400	±150
$HO + CHF_2Cl \rightarrow H_2O + CF_2Cl$	4.7×10^{-15}	±0.08	$7.9 \times 10^{-13}\exp(-1530/T)$	240-300	±150
$HO + CHFCl_2 \rightarrow H_2O + CFCl_2$	2.9×10^{-14}	±0.10	$1.04 \times 10^{-12}\exp(-1065/T)$	240-300	±200
$HO + CHCl_3 \rightarrow H_2O + CCl_3$	1.05×10^{-13}	±0.10	$1.8 \times 10^{-12}\exp(-850/T)$	240-300	±300
$HO + CF_2Cl_2 \rightarrow HOCl + CF_2Cl$	$<7 \times 10^{-18}$		$<1 \times 10^{-12}\exp(-3540/T)$	250-480	
$HO + CFCl_3 \rightarrow HOCl + CFCl_2$	$<5 \times 10^{-18}$		$<1 \times 10^{-12}\exp(-3650/T)$	250-480	
$HO + CCl_4 \rightarrow HOCl + CCl_3$	$<5 \times 10^{-16}$		$<1 \times 10^{-12}\exp(-2260/T)$	250-300	
$HO + C_2HCl_3 \rightarrow$ products	2.0×10^{-12}	±0.10	$3.0 \times 10^{-13}\exp(565/T)$	230-300	±200
$HO + C_2Cl_4 \rightarrow$ products	1.6×10^{-13}	±0.10	$3.5 \times 10^{-12}\exp(-920/T)$	290-420	±300
$HO + CH_3CF_2Cl \rightarrow H_2O + CH_2CF_2Cl$	3.0×10^{-15}	±0.10	$8.5 \times 10^{-13}\exp(-1685/T)$	220-300	±200

$HO + CH_3CFCl_2 \rightarrow H_2O + CH_2CFCl_2$	5.8×10^{-15}	±0.10	$8.1 \times 10^{-13}\exp(-1470/T)$	220-300	±200
$HO + CH_3CCl_3 \rightarrow H_2O + CH_2CCl_3$	9.5×10^{-15}	±0.10	$1.2 \times 10^{-12}\exp(-1440/T)$	240-300	±200
$HO + CH_2ClCF_3 \rightarrow H_2O + CHClCF_3$	1.4×10^{-14}	±0.15	$5.6 \times 10^{-13}\exp(-1100/T)$	260-380	±200
$HO + CH_2ClCF_2Cl \rightarrow H_2O + CHClCF_2Cl$	1.7×10^{-14}	±0.15	$3.5 \times 10^{-12}\exp(-1585/T)$	250-350	±300
$HO + CHFClCF_3 \rightarrow H_2O + CFClCF_3$	8.7×10^{-15}	±0.20	$3.5 \times 10^{-13}\exp(-1100/T)$	210-300	±300
$HO + CHCl_2CF_3 \rightarrow H_2O + CCl_2CF_3$	3.6×10^{-14}	±0.10	$6.6 \times 10^{-13}\exp(-870/T)$	210-300	±200
$HO + CHFClCF_2Cl \rightarrow H_2O + CFClCF_2Cl$	1.2×10^{-14}	±0.3	$8.4 \times 10^{-13}\exp(-1255/T)$	298-460	±400
$HO + CHCl_2CF_2Cl \rightarrow H_2O + CCl_2CF_2Cl$	5.1×10^{-14}	±0.2	$8.1 \times 10^{-13}\exp(-825/T)$	270-340	±200
$HO + CHFClCFCl_2 \rightarrow H_2O + CFClCFCl_2$	1.6×10^{-14}	±0.3	$5.8 \times 10^{-13}\exp(-1065/T)$	270-340	±400
$HO + CHCl_2CF_2CF_3 \rightarrow H_2O + CCl_2CF_2CF_3$	2.5×10^{-14}	±0.15	$1.1 \times 10^{-12}\exp(-1130/T)$	270-400	±300
$HO + CHFClCF_2CF_2Cl \rightarrow H_2O + CFClCF_2CF_2Cl$	8.9×10^{-15}	±0.10	$5.5 \times 10^{-13}\exp(-1230/T)$	290-400	±300
$HO + CH_3CF_2CFCl_2 \rightarrow H_2O + CH_2CF_2CFCl_2$	2.4×10^{-15}	±0.3	$7.0 \times 10^{-13}\exp(-1690/T)$	290-370	±300
$HO + HC(O)Cl \rightarrow H_2O + ClCO$	$<5 \times 10^{-13}$				
$HO + CH_3OCl \rightarrow$ products	7.2×10^{-13}	±0.3	$2.4 \times 10^{-12}\exp(-360/T)$	250-350	±300
$HO + COCl_2 \rightarrow$ products	$<5 \times 10^{-15}$				
$HO + CH_2ClCHO \rightarrow$ products	3.1×10^{-12}	±0.15			
$HO + CHFClCHO \rightarrow$ products	2.1×10^{-12}	±0.15			

$HO + CHCl_2CHO \rightarrow products$	2.4×10^{-12}	±0.15			
$HO + CF_2ClCHO \rightarrow H_2O + CF_2ClCO$	8.2×10^{-13}	±0.25			
$HO + CFCl_2CHO \rightarrow H_2O + CFCl_2CO$	1.2×10^{-12}	±0.15			
$HO + CCl_3CHO \rightarrow H_2O + CCl_3CO$	8.0×10^{-13}	±0.15	$1.8 \times 10^{-12}\exp(-240/T)$	230-420	±200
$HO + CH_3COCl \rightarrow H_2O + CH_2COCl$	6.8×10^{-14}	±0.3			
$HO + CHF_2OCHClCF_3 \rightarrow products$	1.5×10^{-14}	±0.10	$1.1 \times 10^{-12}\exp(-1280/T)$	250-430	±250
$HO + CHF_2OCF_2CHFCl \rightarrow products$	1.2×10^{-14}	±0.10	$7.5 \times 10^{-13}\exp(-1230/T)$	250-430	±150
$HO_2 + CF_3CCl_2O_2 \rightarrow O_2 + CF_3CCl_2O_2H$	1.9×10^{-12}	±0.3			
$HO_2 + CH_2ClO_2 \rightarrow products$	5.0×10^{-12}	±0.3	$3.2 \times 10^{-13}\exp(820/T)$	250-600	±300
$HO_2 + CHCl_2O_2 \rightarrow products$	5.9×10^{-12}	±0.3	$5.6 \times 10^{-13}\exp(700/T)$	280-440	±300
$HO_2 + CF_2ClO_2 \rightarrow products$	3.4×10^{-12}	±0.5			
$HO_2 + CCl_3O_2 \rightarrow products$	5.1×10^{-12}	±0.3	$4.7 \times 10^{-13}\exp(710/T)$	280-440	±300
$HO_2 + CFCl_2CH_2O_2 \rightarrow products$	9.2×10^{-12}	±0.5			
$HO_2 + CF_2ClCH_2O_2 \rightarrow products$	6.8×10^{-12}	±0.5			
$NO_3 + HCl \rightarrow HNO_3 + Cl$	$<5 \times 10^{-17}$				
$NO_3 + C_2HCl_3 \rightarrow products$	3.5×10^{-16}	±0.2	$3.2 \times 10^{-13}\exp(-2030/T)$	270-370	±500
$NO_3 + C_2Cl_4 \rightarrow products$	$<1 \times 10^{-16}$				
$ClO + HO_2 \rightarrow products$	6.9×10^{-12}	±0.20	$2.2 \times 10^{-12}\exp(340/T)$	230-300	±350
$ClO + O_3 \rightarrow ClOO + O_2$	$<1.5 \times 10^{-17}$				

$\rightarrow OClO + O_2$	$<1 \times 10^{-18}$					
$ClO + NO \rightarrow Cl + NO_2$	1.7×10^{-11}		±0.1	$6.2 \times 10^{-12}\exp(295/T)$	200-420	±100
$ClO + NO_2 + M \rightarrow ClONO_2 + M$	$1.6 \times 10^{-31}[N_2]$	(k_o)	±0.1	$1.6 \times 10^{-31}(T/300)^{-3.4}[N_2]$	250-350	$\Delta n = \pm 1$
	7.0×10^{-11}	(k_∞)	±0.3	7.0×10^{-11}	250-350	$\Delta \log k = \pm 0.3$
	$F_c = 0.4$				250-350	
$ClO + NO_3 \rightarrow$ products	4.6×10^{-13}		±0.2	4.6×10^{-13}	210-360	±400
$ClO + ClO \rightarrow Cl_2 + O_2$	4.8×10^{-15}		±0.2	$1.0 \times 10^{-12}\exp(-1590/T)$	260-390	±300
$\rightarrow Cl + ClOO$	8.0×10^{-15}		±0.2	$3.0 \times 10^{-11}\exp(-2450/T)$	260-390	±500
$\rightarrow Cl + OClO$	3.5×10^{-15}		±0.2	$3.5 \times 10^{-13}\exp(-1370/T)$	260-390	±300
$ClO + ClO + M \rightarrow Cl_2O_2 + M$	$2.0 \times 10^{-32}[N_2]$	(k_o)	±0.1	$2.0 \times 10^{-32}(T/300)^{-4}[N_2]$	190-300	$\Delta n = \pm 1.5$
	1.0×10^{-11}	(k_∞)	±0.3	1.0×10^{-11}	190-300	$\Delta \log k = \pm 0.3$
	$F_c = 0.45$			$F_c = 0.45$	190-300	
$Cl_2O_2 + M \rightarrow ClO + ClO + M$	$2.3 \times 10^{-18}[N_2]$	(k_o/s^{-1})	±0.3	$3.7 \times 10^{-7}\exp(-7690/T)[N_2]$	260-310	±900
	1.1×10^{3}	(k_∞/s^{-1})	±0.3	$1.8 \times 10^{14}\exp(-7690/T)$	260-310	±500
	$F_c = 0.45$			$F_c = 0.45$	260-310	
$ClO + OClO + M \rightarrow Cl_2O_3 + M$	$6.2 \times 10^{-32}[N_2]$	(k_o)	±0.3	$6.2 \times 10^{-32}(T/300)^{-4.7}[N_2]$	200-300	$\Delta n = \pm 1$
	2.4×10^{-11}	(k_∞)	±0.3	2.4×10^{-11}	200-300	$\Delta \log k_\infty = \pm 0.3$
	$F_c = 0.6$			$F_c = 0.6$	200-300	
$Cl_2O_3 + M \rightarrow ClO + OClO + M$	$4.5 \times 10^{-25}[N_2]$	(k_o)	±0.5 (240 K)	$1.6 \times 10^{-19}\exp(-3810/T)[N2]$	200-300	±500
	$1.6 \times 10^{5}[N_2]$	(k_∞)	±0.5 (240 K)	$2.5 \times 10^{12}\exp(-4940/T)[N2]$	200-300	±500
	$F_c = 0.6$			$F_c = 0.6$		
$ClO + CH_3O_2 \rightarrow$ products	2.2×10^{-12}		±0.15	$2.4 \times 10^{-12}\exp(-20/T)$	220-360	±200
$OClO + O_3 \rightarrow ClO_3 + O_2$	3.0×10^{-19}		±0.4	$2.1 \times 10^{-12}\exp(-4700/T)$	260-300	±1000
$OClO + NO \rightarrow NO_2 + ClO$	3.6×10^{-13}		±0.15	$1.1 \times 10^{-13}\exp(350/T)$	220-370	±200
$OClO + NO_3 + M \rightarrow$ products	see data sheet					

$Cl_2O_2 + O_3 \rightarrow ClO + ClOO + O_2$	$<1 \times 10^{-19}$	(200 K)				
$CF_2Cl + O_2 + M \rightarrow CF_2ClO_2 + M$	$1.4 \times 10^{-29}[N_2]$	(k_o)	±0.5	$1.4 \times 10^{-29}(T/300)^{-5}[N_2]$	200-300	$\Delta n = \pm 3$
	7×10^{-12}	(k_∞)	±0.5	$7 \times 10^{-12}(T/298)^{-0.6}$	200-300	$\Delta \log k = \pm 0.5$
	$F_c = 0.4$					
$CFCl_2 + O_2 + M \rightarrow CFCl_2O_2 + M$	$6 \times 10^{-30}[N_2]$	(k_o)	±0.3	$6 \times 10^{-30}(T/298)^{-6}[N_2]$	230-380	$\Delta n = \pm 3$
	9×10^{-12}	(k_∞)	±0.3	9×10^{-12}	230-300	$\Delta n = \pm 1$
	$F_c = 0.4$					
$CCl_3 + O_2 + M \rightarrow CCl_3O_2 + M$	$1.1 \times 10^{-30}[N_2]$	(k_o)	±0.2	$1.1 \times 10^{-30}(T/300)^{-6.2}[N_2]$	230-350	$\Delta n = \pm 1$
	5.2×10^{-12}	(k_∞)	±0.3	$5.2 \times 10^{-12}(T/300)^{-1.4}$	260-350	$\Delta n = \pm 1.5$
	$F_c = 0.35$					

$CHFClO + O_2 \rightarrow COFCl + HO_2$

$CHFClO + M \rightarrow HCOF + Cl + M$

$CF_2ClO + O_2 \rightarrow$ products

$CF_2ClO + M \rightarrow COF_2 + Cl + M$

$CFCl_2O + O_2 \rightarrow$ products

$CFCl_2O + M \rightarrow COFCl + Cl + M$

$CCl_3O + M \rightarrow COCl_2 + Cl + M$

$CF_2ClCH_2O + O_2 \rightarrow CF_2ClCHO + HO_2$

$CF_2ClCH_2O + M \rightarrow CF_2Cl + HCHO + M$

$CFCl_2CH_2O + O_2 \rightarrow CFCl_2CHO + HO_2$

$CFCl_2CH_2O + M \rightarrow CFCl_2 + HCHO + M$

$CF_3CFClO + O_2 \rightarrow$ products

$CF_3CFClO + M \rightarrow CF_3COF + Cl + M$

$CF_3CCl_2O + O_2 \rightarrow$ products

$CF_3CCl_2O + M \rightarrow CF_3COCl + Cl + M$

$CF_3CF_2CCl_2O + O_2 \rightarrow$ products

$CF_3CF_2CCl_2O + M \rightarrow CF_3CF_2COCl + Cl + M$

$CF_2ClCF_2CFClO + O_2 \rightarrow$ products

$CF_2ClCF_2CFClO + M \rightarrow CF_2ClCF_2COF + Cl + M$

$CH_2ClO + O_2 \rightarrow HCOCl + HO_2$

$CH_2ClO + M \rightarrow HCO + HCl + M$

$CH_3CHClO + O_2 \rightarrow CH_3COCl + HO_2$

$CH_3CHClO + M \rightarrow CH_3CO + HCl + M$

$HOCH_2CHClO + O_2 \rightarrow HOCH_2COCl + HO_2$

$HOCH_2CHClO + M \rightarrow CH_2OH + HCOCl + M$

$HOCHClCH_2O + O_2 \rightarrow HOCHClCHO + HO_2$

$HOCHClCH_2O + M \rightarrow CHClOH + HCHO + M$

$CH_3CCl_2O + O_2 \rightarrow$ products

$CH_3CCl_2O + M \rightarrow CH_3COCl + Cl + M$

$CCl_3CH_2O + O_2 \rightarrow CCl_3CHO + HO_2$

$CCl_3CH_2O + M \rightarrow CCl_3 + HCHO + M$

$CCl_3CCl_2O + O_2 \rightarrow$ products

$CCl_3CCl_2O + M \rightarrow CCl_3COCl + Cl + M$

$CH_2ClO_2 + NO \rightarrow CH_2ClO + NO_2$	1.9×10^{-11}		±0.3			
$CF_2ClO_2 + NO \rightarrow CF_2ClO + NO_2$	1.5×10^{-11}		±0.2	$1.5 \times 10^{-11}(T/298)^{-1.5}$	230-430	$\Delta \log k = \pm 0.2$
$CFCl_2O_2 + NO \rightarrow CFCl_2O + NO_2$	1.5×10^{-11}		±0.2	$1.5 \times 10^{-11}(T/298)^{-1.3}$	230-430	$\Delta \log k = \pm 0.2$
$CCl_3O_2 + NO \rightarrow CCl_3O + NO_2$	1.8×10^{-11}		±0.2	$1.8 \times 10^{-11}(T/298)^{-1.0}$	230-430	$\Delta \log k = \pm 0.2$
$CF_2ClCH_2O_2 + NO \rightarrow CF_2ClCH_2O + NO_2$	1.2×10^{-11}		±0.3			
$CFCl_2CH_2O_2 + NO \rightarrow CFCl_2CH_2O + NO_2$	1.3×10^{-11}		±0.3			
$CF_3CCl_2O_2 + NO \rightarrow CF_3CCl_2O + NO_2$	1.8×10^{-11}		±0.3			
$CF_2ClO_2 + NO_2 + M \rightarrow CF_2ClO_2NO_2 + M$	$5.0 \times 10^{-29}[N_2]$	(k_o)	±0.3	$5.0 \times 10^{-29}(T/298)^{-6.2}[N_2]$	250-320	$\Delta n = \pm 2$
	6.3×10^{-12}	(k_∞)	±0.3	$6.3 \times 10^{-12}(T/298)^{-0.7}$	250-320	$\Delta n = \pm 0.5$
	$F_c = 0.30$			$F_c = 0.30$	250-320	
$CF_2ClO_2NO_2 + M \rightarrow CF_2ClO_2 + NO_2 + M$	$9.0 \times 10^{-19}[N_2]$	(k_o/s^{-1})	±0.3	$1.8 \times 10^{-3}\exp(-10500/T)[N_2]$	270-290	±200
	5.4×10^{-2}	(k_∞/s^{-1})	±0.3	$1.6 \times 10^{16}\exp(-11990/T)$	270-290	±200
	$F_c = 0.30$			$F_c = 0.30$	270-290	
$CFCl_2O_2 + NO_2 + M \rightarrow CFCl_2O_2NO_2 + M$	$5.5 \times 10^{-29}[N_2]$	(k_o)	±0.3	$5.5 \times 10^{-29}(T/298)^{-5.5}[N_2]$	230-380	$\Delta n = \pm 2$
	8.3×10^{-12}	(k_∞)	±0.2	$8.3 \times 10^{-12}(T/298)^{-0.66}$	230-380	$\Delta n = \pm 0.5$
	$F_c = 0.42$			$F_c = 0.42$	230-380	
$CFCl_2O_2NO_2 + M \rightarrow CFCl_2O_2 + NO_2 + M$	$1.5 \times 10^{-18}[N_2]$	(k_o/s^{-1})	±0.3	$1.0 \times 10^{-2}\exp(-10860/T)[N_2]$	260-300	±200
	9.6×10^{-2}	(k_∞/s^{-1})	±0.3	$6.6 \times 10^{16}\exp(-12240/T)$	260-300	±500
	$F_c = 0.28$			$F_c = 0.28$	260-300	
$CCl_3O_2 + NO_2 + M \rightarrow CCl_3O_2NO_2 + M$	$9.2 \times 10^{-29}[N_2]$	(k_o)	±0.3	$9.2 \times 10^{-29}\ (T/298)^{-6.0}[N_2]$	230-380	$\Delta n = \pm 2$
	1.5×10^{-12}	(k_∞)	±0.3	$1.5 \times 10^{-12}(T/298)^{-0.7}$	230-380	$\Delta n = \pm 0.5$
	$F_c = 0.32$			$F_c = 0.32$	230-380	
$CCl_3O_2NO_2 + M \rightarrow CCl_3O_2 + NO_2 + M$	$5.2 \times 10^{-18}[N_2]$	(k_o/s^{-1})	±0.3	$4.3 \times 10^{-3}\exp(-10235/T)[N_2]$	260-300	±500
	0.29	(k_∞/s^{-1})	±0.3	$4.8 \times 10^{16}\exp(-11820/T)$	260-300	±500

	$F_c = 0.32$		$F_c = 0.32$	260-300	
$CH_3O_2 + CH_2ClO_2 \rightarrow$ products	2.5×10^{-12}	±0.3			
$CH_3O_2 + CCl_3O_2 \rightarrow$ products	6.6×10^{-12}	±0.3			
$C_2H_5O_2 + CF_3CCl_2O_2$					
$\rightarrow CH_3CHO + CF_3CCl_2OH + O_2$	3.6×10^{-12}	±0.3			
$\rightarrow C_2H_5O + CF_3CCl_2O + O_2$	9.0×10^{-13}	±0.5			
$CF_2ClCH_2O_2 + CF_2ClCH_2O_2 \rightarrow$ products	2.8×10^{-12}	±0.4			
$CFCl_2CH_2O_2 + CFCl_2CH_2O_2 \rightarrow$ products	2.9×10^{-12}	±0.4			
$CF_3CCl_2O_2 + CF_3CCl_2O_2 \rightarrow 2CF_3CCl_2O + O_2$	3.5×10^{-12}	±0.3			
$CH_2ClO_2 + CH_2ClO_2 \rightarrow 2\ CH_2ClO + O_2$	3.5×10^{-12}	±0.2	$1.9 \times 10^{-13}\exp(870/T)$	250-600	±200
$CHCl_2O_2 + CHCl_2O_2 \rightarrow$ products	see data sheet				
$CCl_3O_2 + CCl_3O_2 \rightarrow 2CCl_3O + O_2$	4.0×10^{-12}	±0.3	$3.3 \times 10^{-13}\exp(740/T)$	270-460	±300
$CH_3CHClO_2 + CH_3CHClO_2$					
$\rightarrow CH_3CHClOH + CH_3COCl + O_2$					
$\rightarrow 2\ CH_3CHClO + O_2$	5×10^{-12}	±0.3			
$CH_2ClCH_2O_2 + CH_2ClCH_2O_2 \rightarrow$ products	3.3×10^{-12}	±0.3	$4.2 \times 10^{-14}\exp(1300/T)$	220-380	±500
$O_3 + C_2HCl_3 \rightarrow$ products	$<5 \times 10^{-20}$				
$O_3 + C_2Cl_4 \rightarrow$ products	$<10^{-21}$				

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

$HCl + h\nu \rightarrow$ products

$HOCl + h\nu \rightarrow$ products

$OClO + h\nu \rightarrow$ products

$Cl_2O + h\nu \rightarrow$ products

$Cl_2O_2 + h\nu \rightarrow$ products

$Cl_2O_3 + h\nu \rightarrow$ products

$ClNO + h\nu \rightarrow$ products

$ClONO + h\nu \rightarrow$ products

$ClNO_2 + h\nu \rightarrow$ products

$ClONO_2 + h\nu \rightarrow$ products

$Cl_2 + h\nu \rightarrow$ products

$CH_3Cl + h\nu \rightarrow$ products

$CH_3OCl + h\nu \rightarrow$ products

$CHF_2Cl + h\nu \rightarrow$ products

$CF_2Cl_2 + h\nu \rightarrow$ products

$CFCl_3 + h\nu \rightarrow$ products

$CCl_4 + h\nu \rightarrow$ products

$CH_3CF_2Cl + h\nu \rightarrow$ products

$CH_3CFCl_2 + h\nu \rightarrow$ products

$CH_3CCl_3 + h\nu \rightarrow$ products

$CF_3CHFCl + h\nu \rightarrow$ products

$CF_3CHCl_2 + h\nu \rightarrow$ products

$CF_2ClCFCl_2 + h\nu \rightarrow$ products

$CF_2ClCF_2Cl + h\nu \rightarrow$ products

$CF_3CF_2Cl + h\nu \rightarrow$ products

$CF_3CF_2CHCl_2 + h\nu \rightarrow$ products

$CF_2ClCF_2CHFCl + h\nu \rightarrow$ products

$HCOCl + h\nu \rightarrow$ products

$COFCl + h\nu \rightarrow$ products

$COCl_2 + h\nu \rightarrow$ products

$CF_2ClCHO + h\nu \rightarrow$ products

$CFCl_2CHO + h\nu \rightarrow$ products

$CCl_3CHO + h\nu \rightarrow$ products

$CF_3COCl + h\nu \rightarrow$ products

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

$O + HOBr \rightarrow HO + BrO$	2.8×10^{-11}		±0.2	$1.2 \times 10^{-10}\exp(-430/T)$	230-430	±300
$O + BrO \rightarrow O_2 + Br$	4.1×10^{-11}		±0.2	$1.9 \times 10^{-11}\exp(230/T)$	230-330	±150
$Br + HO_2 \rightarrow HBr + O_2$	1.7×10^{-12}		±0.2	$7.7 \times 10^{-12}\exp(-450/T)$	230-390	±200
$Br + H_2O_2 \rightarrow HBr + HO_2$ $\rightarrow HOBr + HO$						
Overall	$<5 \times 10^{-16}$					
$Br + O_3 \rightarrow BrO + O_2$	1.2×10^{-12}		±0.08	$1.7 \times 10^{-11}\exp(-800/T)$	190-430	±200
$Br + NO_2 + M \rightarrow BrNO_2 + M$	4.2×10^{-31} [N_2]	(k_o)	±0.3	$4.2 \times 10^{-31}(T/300)^{-2.4}$[$N_2$]	250-350	$\Delta n = \pm 1$
	2.7×10^{-11}	(k_∞)	±0.4	2.7×10^{-11}	250-350	$\Delta \log k = \pm 0.4$
	$F_c = 0.55$					

$Br + OClO \rightarrow BrO + ClO$	3.5×10^{-13}	±0.3	$2.7 \times 10^{-11}\exp(-1300/T)$	260-430	±300
$Br + Cl_2O \rightarrow BrCl + ClO$	4.3×10^{-12}	±0.1	$2.1 \times 10^{-11}\exp(-470/T)$	220-410	±200
$Br + Cl_2O_2 \rightarrow BrCl + ClOO$	3.0×10^{-12}	±0.3			
$HO + HBr \rightarrow H_2O + Br$	1.1×10^{-11}	±0.10	$5.5 \times 10^{-12}\exp(205/T)$	180-360	±250
$HO + Br_2 \rightarrow HOBr + Br$	4.5×10^{-11}	±0.10	$2.0 \times 10^{-11}\exp(240/T)$	230-360	±150
$HO + BrO \rightarrow$ products	4.1×10^{-11}	±0.3	$1.8 \times 10^{-11}\exp(250/T)$	230-350	±300
$HO + CH_3Br \rightarrow H_2O + CH_2Br$	2.9×10^{-14}	±0.08	$1.7 \times 10^{-12}\exp(-1215/T)$	240-300	±150
$HO + CH_2Br_2 \rightarrow H_2O + CHBr_2$	1.1×10^{-13}	±0.15	$1.5 \times 10^{-12}\exp(-775/T)$	240-300	±200
$HO + CHF_2Br \rightarrow H_2O + CF_2Br$	1.0×10^{-14}	±0.10	$7.9 \times 10^{-13}\exp(-1300/T)$	230-360	±150
$HO + CF_3Br \rightarrow$ products	$< 6 \times 10^{-18}$		$<1 \times 10^{-12}\exp(-3600/T)$	250-460	
$HO + CF_2ClBr \rightarrow$ products	$< 1 \times 10^{-17}$		$<1 \times 10^{-12}\exp(-3450/T)$	250-380	
$HO + CF_2Br_2 \rightarrow$ products	$< 5 \times 10^{-16}$		$<1 \times 10^{-12}\exp(-2200/T)$	250-460	
$HO + CF_3CH_2Br \rightarrow H_2O + CF_3CHBr$	1.6×10^{-14}	±0.20	$1.4 \times 10^{-12}\exp(-1340/T)$	280-460	±300
$HO + CF_3CHFBr \rightarrow H_2O + CF_3CFBr$	1.7×10^{-14}	±0.20	$8.1 \times 10^{-13}\exp(-1155/T)$	279-460	±300
$HO + CF_3CHClBr \rightarrow H_2O + CF_3CClBr$	4.6×10^{-14}	±0.20	$1.2 \times 10^{-12}\exp(-970/T)$	290-460	±300
$HO + CF_2BrCF_2Br \rightarrow$ products	$< 6 \times 10^{-18}$		$<1 \times 10^{-12}\exp(-3600/T)$	250-460	
$Br + NO_3 \rightarrow BrO + NO_2$	1.6×10^{-11}	±0.3			
$BrO + NO_3 \rightarrow BrOO + NO_2$	1.0×10^{-12}	±0.5			
$NO_3 + HBr \rightarrow HNO_3 + Br$	$< 1 \times 10^{-16}$				

$BrO + HO_2 \rightarrow HOBr + O_2$						
$\rightarrow HBr + O_3$						
Overall	2.4×10^{-11}		±0.3	$4.5 \times 10^{-12}\exp(500/T)$	210-360	±200
$BrO + O_3 \rightarrow Br + 2O_2$	$< 2 \times 10^{-17}$					
$BrO + NO \rightarrow Br + NO_2$	2.1×10^{-11}		±0.1	$8.7 \times 10^{-12}\exp(260/T)$	220-430	±100
$BrO + NO_2 + M \rightarrow BrONO_2 + M$	4.7×10^{-31} [N_2]	(k_o)	±0.1	$4.7 \times 10^{-31}(T/300)^{-3.1}$[$N_2$]	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	
$BrO + ClO \rightarrow Br + OClO$	6.8×10^{-12}		±0.1	$1.6 \times 10^{-12}\exp(430/T)$	220-400	±200
$\rightarrow Br + ClOO$	6.1×10^{-12}		±0.1	$2.9 \times 10^{-12}\exp(220/T)$	220-400	±200
$\rightarrow BrCl + O_2$	1.0×10^{-12}		±0.1	$5.8 \times 10^{-13}\exp(170/T)$	220-400	±200
$\rightarrow Cl + OBrO$						
$BrO + ClO + M \rightarrow BrOOCl + M$	see data sheet					
$BrO + BrO \rightarrow 2Br + O_2$	2.7×10^{-12}		±0.1	2.7×10^{-12}	250-390	±200
$\rightarrow Br_2 + O_2$	4.8×10^{-13}		±0.1	$2.9 \times 10^{-14}\exp(840/T)$	250-390	±200
$\rightarrow Br_2 + OBrO$						
$BrO + BrO + M \rightarrow Br_2O_2 + M$	see data sheet					
Overall	3.2×10^{-12}			$1.6 \times 10^{-12}\exp(210/T)$	200-390	
$CH_2BrO_2 + HO_2 \rightarrow$ products	6.7×10^{-12}		±0.5			
$CH_2BrO_2 + NO \rightarrow CH_2BrO + NO_2$	1.1×10^{-11}		±0.3			
$CH_2BrO_2 + CH_2BrO_2 \rightarrow$ products	see data sheet					
$BrCH_2CH_2O_2 + BrCH_2CH_2O_2$						
$\rightarrow BrCH_2CH_2OH + BrCH_2CHO + O_2$						
$\rightarrow 2\ BrCH_2CH_2O + O_2$	2.3×10^{-12}		±0.1			
Overall	4.0×10^{-12}		±0.2	$6.0 \times 10^{-14}\exp(1250/T)$	270-380	±500
$BrO + CH_3O_2 \rightarrow$ products	5.7×10^{-12}		±0.3			

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

$HBr + h\nu \rightarrow$ products

$HOBr + h\nu \rightarrow$ products

$BrO + h\nu \rightarrow$ products

$OBrO + h\nu \rightarrow$ products

$BrONO_2 + h\nu \rightarrow$ products

$BrCl + h\nu \rightarrow$ products

$Br2 + h\nu \rightarrow$ products

$CH_3Br + h\nu \rightarrow$ products

$CF_3Br + h\nu \rightarrow$ products

$CF_2ClBr + h\nu \rightarrow$ products

$CF_2Br_2 + h\nu \rightarrow$ products

$CHBr_3 + h\nu \rightarrow$ products

$CF_2BrCF_2Br + h\nu \rightarrow$ products

$CH_2Br_2 + h\nu \rightarrow$ products

IO_x Reactions - based on data sheets on this website

$O + I_2 \rightarrow IO + I$	1.25×10^{-10}	±0.1			
$O + IO \rightarrow O_2 + I$	1.4×10^{-10}	±0.2			
$I + HO_2 \rightarrow HI + O_2$	3.8×10^{-13}	±0.3	$1.5 \times 10^{-11}\exp(-1090/T)$	280-360	±500
$I + O_3 \rightarrow IO + O_2$	1.3×10^{-12}	±0.05	$2.1 \times 10^{-11}\exp(-830/T)$	230-370	±150

$I + NO + M \rightarrow INO + M$	1.8×10^{-32} [N_2] 1.7×10^{-11} $F_c = 0.6$	(k_o) (k_∞)	±0.1 ±0.5	$1.8 \times 10^{-32}(T/300)^{-1.0}$[$N_2$] 1.7×10^{-11} $F_c = 0.6$	290-450 300-400	$\Delta n = \pm 0.5$ $\Delta \log k = \pm 0.5$
$I + NO_2 + M \rightarrow INO_2 + M$	3.0×10^{-31} [N_2] 6.6×10^{-11} $F_c = 0.63$	(k_o) (k_∞)	±0.2 ±0.3	$3.0 \times 10^{-31}(T/300)^{-1}$[$N_2$] 6.6×10^{-11} $F_c = 0.63$	290-450 290-450	$\Delta n = \pm 1$ $\Delta \log k = \pm 0.3$
$I + NO_3 \rightarrow IO + NO_2$	No recommendation					
$I_2 + NO_3 \rightarrow I + IONO_2$	No recommendation					
$HO + HI \rightarrow H_2O + I$	7.0×10^{-11}		±0.3	$1.6 \times 10^{-11}\exp(440/T)$	240-360	±400
$HO + I_2 \rightarrow HOI + I$	2.1×10^{-10}		±0.15	2.1×10^{-10}	240-350	±300
$HO + CH_3I \rightarrow H_2O + CH_2I$	1.0×10^{-13}		±0.2	$4.3 \times 10^{-12}\exp(-1120/T)$	270-430	±500
$HO + CF_3I \rightarrow$ products	2.6×10^{-14}		±0.2	$2.1 \times 10^{-11}\exp(-2000/T)$	270-370	±500
$NO_3 + HI \rightarrow HNO_3 + I$	No recommendation					
$IO + HO_2 \rightarrow HOI + O_2$	8.4×10^{-11}		±0.2	$1.4 \times 10^{-11}\exp(540/T)$	270-380	±300
$IO + O_3 \rightarrow I + 2O_2$ $\rightarrow OIO + O_2$	$<1.0 \times 10^{-15}$ $<2.0 \times 10^{-16}$					
$IO + ClO \rightarrow$ products	1.2×10^{-11}		±0.1	$4.7 \times 10^{-12}\exp(280/T)$	200-370	±100
$IO + BrO \rightarrow$ products	8.5×10^{-11}		±0.1	$1.5 \times 10^{-11}\exp(510/T)$	200-390	±350
$IO + IO \rightarrow$ products	9.9×10^{-11}		±0.1	$5.4 \times 10^{-11}\exp(180/T)$	250-320	±200
$IO + NO \rightarrow I + NO_2$	1.95×10^{-11}		±0.15	$7.15 \times 10^{-12}\exp(300/T)$	240-370	±100

$IO + NO_2 + M \rightarrow IONO_2 + M$	$7.7 \times 10^{-31}[N_2]$ 1.6×10^{-11} $F_c = 0.4$	(k_o) (k_∞)	±0.3 ±0.3	$7.7 \times 10^{-31}(T/300)^{-5}[N_2]$ 1.6×10^{-11}	250-360 250-360	$\Delta n = \pm 2$ $\Delta \log k = \pm 0.3$
$IONO_2 + M \rightarrow IO + NO_2 + M$	2.9×10^{-3} (s^{-1}) (1 bar air)		±1.0 at 300K	$1.1 \times 10^{15}\exp(-12060/T)$	240-305	±500
$INO + INO \rightarrow I_2 + 2\ NO$	1.3×10^{-14}		±0.4	$8.4 \times 10^{-11}\exp(-2620/T)$	300-450	±600
$INO_2 + INO_2 \rightarrow I_2 + 2\ NO_2$	1.7×10^{-15}		±0.7	$4.7 \times 10^{-13}\exp(-1670/T)$	270-350	±1000
$OIO + NO \rightarrow$ products						
$CH_2IO_2 + CH_2IO_2$ $\rightarrow CH_2IOH + HCOI + O_2$ $\rightarrow 2\ CH_2IO + O_2$	No recommendation					

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

$HI + h\nu \rightarrow$ products

$HOI + h\nu \rightarrow$ products

$IO + h\nu \rightarrow$ products

$OIO + h\nu \rightarrow$ products

$ICl + h\nu \rightarrow$ products

$IBr + h\nu \rightarrow$ products

$I_2 + h\nu \rightarrow$ products

$CH_3I + h\nu \rightarrow$ products

$CF_3I + h\nu \rightarrow$ products

$CH_2ClI + h\nu \rightarrow$ products

$CH_2BrI + h\nu \rightarrow$ products

$CH_2I_2 + h\nu \rightarrow$ products

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

Uptake Kinetics with Chemical Reaction

$N_2O_5 + H_2O \rightarrow 2\ HNO_3$
(including uptake studies)

$N_2O_5 + HCl \rightarrow ClNO_2 + HNO_3$

$N_2O_5 + HBr \rightarrow BrNO_2 + HNO_3$

$N_2O_5 + NaCl \rightarrow ClNO_2 + NaNO_3$

$HNO_3 + NaCl \rightarrow HCl + NaNO_3$

HNO_3 + amorphous → carbon products

$HONO + HCl \rightarrow NOCl + H_2O$

$HONO + HBr \rightarrow NOBr + H_2O$

$ClONO_2 + H_2O \rightarrow HOCl + HNO_3$
(including uptake studies)

$ClONO_2 + HCl \rightarrow Cl_2 + HNO_3$

$ClONO_2 + HBr \rightarrow BrCl + HNO_3$

$ClONO_2 + HF \rightarrow$ products

$ClONO_2 + NaCl \rightarrow Cl_2 + NaNO_3$

$ClNO_2 + H_2O \rightarrow$ products (HNO_3 + HCl)

$ClNO_2 + X^-$ (various ions) → products

$ClNO + H_2O \rightarrow HONO + HCl$

$HOCl + HCl \rightarrow Cl_2 + H_2O$

HOCl + XBr (X=H, Na) → BrCl + (H_2O, NaOH)

$BrO + BrO \rightarrow Br_2 + O_2$

$BrONO_2 + H_2O \rightarrow HOBr + HNO_3$

$BrONO_2 + HCl \rightarrow BrCl + HNO_3$

$BrNO_2 + X^- \rightarrow$ products

$HOBr + HBr \rightarrow Br_2 + H_2O$

$HOBr + HCl \rightarrow BrCl + H_2O$

$HOBr + NaCl \rightarrow BrCl + NaOH$

$HOBr + MBr$ (M = Na, K) $\rightarrow Br_2 + MOH$

$BrO + HSO_3^-/SO_3^{2-} \rightarrow HOBr/BrO^- + SO_3^{2-}$

HOI + substrate (KBr, NaCl, ice, H_2SO_4/ice, NaOH) $\rightarrow$ products

interhalogens + hydrohalic acids/alkali halides $\rightarrow$ products

$Cl_2 + 2MBr$ (M = Na, K) $\rightarrow Br_2 + 2MCl$

O_3 + Substrate (C_{am}) $\rightarrow$ products
(O_2, CO, CO_2, {C_{am}°O})

O_3 + various substrates $\rightarrow$ products

$SO_2 + H_2O/H_2O_2$/carbon

$SO_3 + H_2O \rightarrow$ products

$CCl_3COCl + H_2O \rightarrow CCl_3COOH + HCl$

$CF_3COF + H_2O \rightarrow CF_3COOH + HF$

$CF_3COCl + H_2O \rightarrow CF_3COOH + HCl$

$NO_3 + NaCl \rightarrow Cl + NaNO_3$

$NO_3 + MBr$ (M = Na, K) $\rightarrow Br + MNO_3$

NO_3 + H_2O, H_2O/H_2SO_4, X^- → products

NO_2/N_2O_4 + Substrate (amorphous Carbon, NaCl) → products

HO_2NO_2 + HCl → products

Uptake Kinetics without Chemical Reaction

HO_2 + Substrate (SiO_2, water aerosol)

HO + Substrate (water, SiO2, H2SO4)

H_2O + Substrate (water ice, NAT, NaCl)

HCl + Substrate (water ice, NAT, H_2SO_4-H_2O, NaCl)

HOCl + Substrate (water ice)

HBr + Substrate (water ice, NAT)

HOBr + Substrate (Pyrex, water ice, H_2SO_4-H_2O)

HI + Substrate

HNO_3 + Substrate (water ice, water droplets, H_2SO_4-H_2O, salt surfaces)

HONO + Substrate (water droplets and liquid jet)

HO_2NO_2 + Substrate

NO + Substrate (water ice, 70% H_2SO_4-H_2O-ice)

NO_2 + Substrate (water ice and droplets, 70% H_2SO_4-H_2O-ice)

$CH_3CO(O)_2NO_2$ (PAN) + Substrate (water jet)

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, H_2SO_4-H_2O, NAT, Pyrex)

Cl + Substrate (SiO_2, H_2SO_4-H_2O, Teflon)

H_2O_2 + Substrate (water droplets)

CH_3COCH_3 + Substrate (water droplets)

H_2CO + Substrate (water droplets, H_2SO_4-H_2O solution)

CH_3CHO + Substrate (water droplets)

CHOCHO + Substrate (water droplets)

$CHBr_3$ + Substrate (water ice, H_2SO_4)

CH_3OH + Substrate (water droplets)

C_2H_5OH + Substrate (water droplets)

1-C_3H_7OH + Substrate (water droplets)

2-C_3H_7OH + Substrate (water droplets)

$CH_3C(CH_3)(OH)CH_3$ + Substrate (water droplets)

$ClCH_2CH_2OH$ + Substrate (water droplets)

$BrCH_2CH_2OH$ + Substrate (water droplets)

ICH_2CH_2OH + Substrate (water droplets)

$HOCH_2CH_2OH$ + Substrate (water droplets)

$HCOOH$ + Substrate (water droplets)

CH_3COOH + Substrate (water droplets)

CCl_3COOH + Substrate (water droplets)

CCl_2HCOOH + Substrate (water droplets)

$CClH_2COOH$ + Substrate (water droplets)

$CF_2ClCOOH$ + Substrate (water droplets)

CF_3COOH + Substrate (water droplets)

CH_3OOH + Substrate (water droplets)

H_2SO_4 + Substrate (water droplets and jet)