Supplementary Table S1: List of reactions with rate constants and sources for the Archean photochemical code. For photolysis reactions at the bottom of the table, the "Reaction Rate Constant" refers to the reaction rate at the top of the atmosphere during a "standard" simulation for pCO_2 = 0.02, pCH_4 = 0.0035, 1 bar total pressure (a moderately hazy Case B atmosphere). Refer to Sander et al. (2006) for more information about reaction rate calculations.

Rxn. #	Reaction	Reaction Rate Constant	Reference
1.	$OCS + CH \rightarrow CO + HCS$	$1.99 \cdot 10^{-10} \times e^{-190/T}$	(Zabarnick *et al.,* 1989)
2.	$OCS + H \rightarrow CO + HS$	$9.07 \cdot 10^{-12} \times e^{-1940/T}$	(Lee *et al.,* 1977)
3.	$OCS + O \rightarrow S + CO_2$	$8.3 \cdot 10^{-11} \times e^{-5530/T}$	(Singleton and Cvetanovic 1988)
4.	$OCS + O \rightarrow SO + CO$	$2.1 \cdot 10^{-11} \times e^{-2200/T}$	(Toon *et al.,* 1987)
5.	$OCS + OH \rightarrow CO_2 + HS$	$1.1 \cdot 10^{-13} \times e^{-1200/T}$	(Atkinson *et al.,* 2004)
6.	$OCS + S \rightarrow CO + S_2$	$1.5 \cdot 10^{-10} \times e^{-1830/T}$	(Schofield 1973)
7.	$OCS + S + M \rightarrow OCS_2 + M$	$8.3 \cdot 10^{-33} \times$ den	(Basco and Pearson 1967)
8.	$OCS_2 + CO \rightarrow OCS + OCS$	$3.0 \cdot 10^{-12}$	(Zahnle *et al.,* 2006)
9.	$OCS_2 + S \rightarrow OCS + S_2$	$2.0 \cdot 10^{-11}$	(Zahnle *et al.,* 2006)
10.	$CH + CS_2 \rightarrow HCS + CS$	$3.49 \cdot 10^{-10} \times e^{-40/T}$	(Zabarnick *et al.,* 1989)
11.	$CS + HS \rightarrow CS_2 + H$	$1.5 \cdot 10^{-13} \times (1 + 0.6 \times$ den)	Assumed same as k(CO + OH)
12.	$CS + O \rightarrow CO + S$	$2.7 \cdot 10^{-10} \times e^{-760/T}$	(Atkinson *et al.,* 2004)
13.	$CS + O_2 \rightarrow CO + SO$	$5 \cdot 10^{-20}$	(Wine *et al.,* 1981)
14.	$CS + O_2 \rightarrow OCS + O$	$4 \cdot 10^{-19}$	(Wine *et al.,* 1981)
15.	$CS + O_3 \rightarrow CO + SO_2$	$3 \cdot 10^{-12}$	(Wine *et al.,* 1981)
16.	$CS + O_3 \rightarrow OCS + O_2$	$3 \cdot 10^{-12}$	(Wine *et al.,* 1981)
17.	$CS + O_3 \rightarrow SO + CO_2$	$3 \cdot 10^{-12}$	(Wine *et al.,* 1981)
18.	$CS_2 + O \rightarrow CO + S_2$	$5.81 \cdot 10^{-14}$	(Singleton and Cvetanovic 1988)
19.	$CS_2 + O \rightarrow OCS + S$	$3 \cdot 10^{-12} \times e^{-650/T}$	(Toon *et al.,* 1987)
20.	$CS_2 + O \rightarrow SO + CS$	$3.2 \cdot 10^{-11} \times e^{-650/T}$	(Toon *et al.,* 1987)

21.	$CS_2 + OH \rightarrow OCS + HS$	$2 \cdot 10^{-15}$	(Atkinson *et al.,* 2004)
22.	$CS_2 + S \rightarrow CS + S_2$	$1.9 \cdot 10^{-14} \times e^{-580/T} \times (T/300)^{3.97}$	(Woiki and Roth 1995)
23.	$CS_2 + SO \rightarrow OCS + S_2$	$2.4 \cdot 10^{-13} \times e^{-2370/T}$	Assumed same as k($SO^* + O_2$)
24.	$CS_2^* + CS_2 \rightarrow CS + CS + S_2$	$1 \cdot 10^{-12}$	Assumed same as k($CS_2^* + CS_2$)
25.	$CS_2^* + M \rightarrow CS_2 + M$	$2.5 \cdot 10^{-11}$	(Wine *et al.,* 1981)
26.	$CS_2^* + O_2 \rightarrow CS + SO_2$	$1 \cdot 10^{-12}$	(Wine *et al.,* 1981)
27.	$C + HS \rightarrow CS + H$	$4 \cdot 10^{-11}$	Assumed same as k(C + OH)
28.	$C + S_2 \rightarrow CS + S$	$3.3 \cdot 10^{-11}$	Assumed same as k($C + O_2$)
29.	$C_2 + S \rightarrow C + CS$	$5 \cdot 10^{-11}$	Assumed same as k($C_2 + O$)
30.	$C_2 + S_2 \rightarrow CS + CS$	$1.5 \cdot 10^{-11} \times e^{-550/T}$	Assumed same as k($C_2 + O_2$)
31.	$CH + S \rightarrow CS + H$	$9.5 \cdot 10^{-11}$	Assumed same as k($CH + CS_2$)
32.	$CH + S_2 \rightarrow CS + HS$	$5.9 \cdot 10^{-11}$	Assumed same as k($CH + O_2$)
33.	$CH_2^1 + S_2 \rightarrow HCS + HS$	$3 \cdot 10^{-11}$	Assumed same as k($CH_2^1 + O_2$)
34.	$CH_3 + HCS \rightarrow CH_4 + CS$	$5.0 \cdot 10^{-11}$	Assumed same as k($CH_3 + HCO$)
35.	$H + CS + M \rightarrow HCS + M$	$2.0 \cdot 10^{-33} \times e^{-850/T} \times den$	Assumed same as k(H + CO)
36.	$H + HCS \rightarrow H_2 + CS$	$1.2 \cdot 10^{-10}$	Assumed same as k(H + HCO)
37.	$HS + CO \rightarrow OCS + H$	$4.2 \cdot 10^{-14} \times e^{-7650/T}$	(Kurbanov and Mamedov 1995)
38.	$HS + HCS \rightarrow H_2S + CS$	$2.0 \cdot 10^{-11}$	Assumed same as k(HS + HCO)
39.	$OCS + CH \rightarrow CO + HCS$	$1.99 \cdot 10^{-10} \times e^{-190/T}$	(Zabarnick *et al.,* 1989)
40.	$S + CO + M \rightarrow OCS + M$	$6.5 \cdot 10^{-33} \times e^{-2180/T} \times den$	Assumed same as k(CO + O)
41.	$S + HCS \rightarrow H + CS_2$	$5.0 \cdot 10^{-11}$	Assumed same as k($O + HCO \rightarrow H + CO_2$)
42.	$S + HCS \rightarrow HS + CS$	$5.0 \cdot 10^{-11}$	Assumed same as k($O + HCO \rightarrow HS + CO$)
43.	$2CH_2^3 \rightarrow C_2H_2 + H_2$	$5.3 \cdot 10^{-11}$	(Braun *et al.,* 1970)
44.	$C + H_2 + M \rightarrow CH_2^3 + M$	$k_0 = 8.75 \cdot 10^{-31} \times e^{524/T}$ $k_\infty = 8.3 \cdot 10^{-1}$	(Zahnle 1986)
45.	$C + O_2 \rightarrow CO + O$	$3.3 \cdot 10^{-11}$	(Donovan and Husain 1970)
46.	$C + OH \rightarrow CO + H$	$4 \cdot 10^{-11}$	(Giguere and Huebner 1978)

47.	$C_2 + CH_4 \rightarrow C_2H + CH_3$	$5.05 \cdot 10^{-11} \times e^{-297/T}$	(Pitts *et al.,* 1982)
48.	$C_2 + H_2 \rightarrow C_2H + H$	$1.77 \cdot 10^{-10} \times e^{-1469/T}$	(Pitts *et al.,* 1982)
49.	$C_2 + O \rightarrow C + CO$	$5 \cdot 10^{-11}$	(Prasad and Huntress 1980)
50.	$C_2 + O_2 \rightarrow CO + CO$	$1.5 \cdot 10^{-11} \times e^{-550/T}$	(Baughcum and Oldenborg 1984)
51.	$C_2H + C_2H_2 \rightarrow HCAER + H$	$1.5 \cdot 10^{-10}$	(Stephens *et al.,* 1987)
52.	$C_2H + C_2H_6 \rightarrow C_2H_2 + C_2H_5$	$3.6 \cdot 10^{-11}$	(Lander *et al.,* 1990)
53.	$C_2H + C_3H_8 \rightarrow C_2H_2 + C_3H_7$	$1.4 \cdot 10^{-11}$	(Okabe 1983)
54.	$C_2H + CH_2CCH_2 \rightarrow HCAER2 + H$	$1.5 \cdot 10^{-10}$	(Pavlov *et al.,* 2001b)
55.	$C_2H + CH_4 \rightarrow C_2H_2 + CH_3$	$6.94 \cdot 10^{-12} \times e^{-250/T}$	(Allen *et al.,* 1992; Lander *et al.,* 1990)
56.	$C_2H + H + M \rightarrow C_2H_2 + M$	$k_0 = 2.64 \cdot 10^{-26} \times e^{-721/T} \times (T/300)^{-3.1}$ $k_\infty = 3.0 \cdot 10^{-10}$	(Tsang and Hampson 1986)
57.	$C_2H + H_2 \rightarrow C_2H_2 + H$	$5.58 \cdot 10^{-11} \times e^{-1443/T}$	(Allen *et al.,* 1992; Stephens *et al.,* 1987)
58.	$C_2H + O \rightarrow CO + CH$	$1 \cdot 10^{-10} \times e^{-250/T}$	(Zahnle 1986)
59.	$C_2H + O_2 \rightarrow CO + HCO$	$2 \cdot 10^{-11}$	(Brown and Laufer 1981)
60.	$C_2H_2 + H + M \rightarrow C_2H_3 + M$	$k_0 = 2.6 \cdot 10^{-31}$ $k_\infty = 8.3 \cdot 10^{-11} \times e^{-1374/T}$	(Romani *et al.,* 1993)
61.	$C_2H_2 + O \rightarrow CH_2{}^3 + CO$	$2.9 \cdot 10^{-11} \times e^{-1600/T}$	(Zahnle 1986)
62.	$C_2H_2 + OH + M \rightarrow C_2H_2OH + M$	$k_0 = 5.5 \cdot 10^{-30} +$ $k_\infty = 8.3 \cdot 10^{-13} \times (T/300)^{-2}$	(Sander *et al.,* 2006)
63.	$C_2H_2 + OH + M \rightarrow CH_2CO + H + M$	$k_0 = 5.8 \cdot 10^{-31} \times e^{1258/T}$ $k_\infty = 1.4 \cdot 10^{-12} \times e^{388/T}$	(Perry and Williamson 1982)
64.	$C_2H_2 + OH \rightarrow CO + CH_3$	$2. \cdot 10^{-12} \times e^{-250/T}$	(Hampson and Garvin 1977)
65.	$C_2H_2OH + H \rightarrow H_2 + CH_2CO$	$3.3 \cdot 10^{-11} \times e^{-2000/T}$	(Miller *et al.,* 1982)
66.	$C_2H_2OH + H \rightarrow H_2O + C_2H_2$	$5 \cdot 10^{-11}$	(Miller *et al.,* 1982)
67.	$C_2H_2OH + O \rightarrow OH + CH_2CO$	$3.3 \cdot 10^{-11} \times e^{-2000/T}$	(Miller *et al.,* 1982)
68.	$C_2H_2OH + OH \rightarrow H_2O + CH_2CO$	$1.7 \cdot 10^{-11} \times e^{-1000/T}$	(Miller *et al.,* 1982)
69.	$C_2H_3 + C_2H_3 \rightarrow C_2H_4 + C_2H_2$	$2.4 \cdot 10^{-11}$	(Fahr *et al.,* 1991)
70.	$C_2H_3 + C_2H_5 \rightarrow C_2H_4 + C_2H_4$	$3 \cdot 10^{-12}$	(Laufer *et al.,* 1983)

71.	$C_2H_3 + C_2H_5 + M \rightarrow CH_3 + C_3H_5 + M$	$k_0 = 1.9 \cdot 10^{-27}$ $k_\infty = 2.5 \cdot 10^{-11}$	(Romani *et al.,* 1993)
72.	$C_2H_3 + C_2H_6 \rightarrow C_2H_4 + C_2H_5$	$3. \cdot 10^{-13} \times e^{-5170/T}$	(Kasting *et al.,* 1983)
73.	$C_2H_3 + CH_3 \rightarrow C_2H_2 + CH_4$	$3.4 \cdot 10^{-11}$	(Fahr *et al.,* 1991)
74.	$C_2H_3 + CH_3 + M \rightarrow C_3H_6 + M$	$k_0 = 1.3 \cdot 10^{-22}$ $k_\infty = 1.2 \cdot 10^{-10}$	(Raymond *et al.,* 2006)
75.	$C_2H_3 + CH_4 \rightarrow C_2H_4 + CH_3$	$2.4 \cdot 10^{-24} \times e^{-2754/T} \times T^{4.02}$	(Tsang and Hampson 1986)
76.	$C_2H_3 + H \rightarrow C_2H_2 + H_2$	$3.3 \cdot 10^{-11}$	(Warnatz 1984)
77.	$C_2H_3 + H_2 \rightarrow C_2H_4 + H$	$2.6 \cdot 10^{-13} \times e^{-2646/T}$	(Allen *et al.,* 1992)
78.	$C_2H_3 + O \rightarrow CH_2CO + H$	$5.5 \cdot 10^{-11}$	(Hoyermann *et al.,* 1981)
79.	$C_2H_3 + OH \rightarrow C_2H_2 + H_2O$	$8.3 \cdot 10^{-12}$	(Benson and Haugen 1967)
80.	$C_2H_4 + H + M \rightarrow C_2H_5 + M$	$k_0 = 2.15 \cdot 10^{-29} \times e^{-349/T}$ $k_\infty = 4.95 \cdot 10^{-11} \times e^{-1051/T}$	(Lightfoot and Pilling 1987)
81.	$C_2H_4 + O \rightarrow HCO + CH_3$	$5.5 \cdot 10^{-12} \times e^{-565/T}$	(Hampson and Garvin 1977)
82.	$C_2H_4 + OH + M \rightarrow C_2H_4OH + M$	$k_0 = 1.0 \cdot 10^{-28} \times (T/300)^{4.5}$ $k_\infty = 8.8 \cdot 10^{-12} \times (T/300)^{0.85}$	(Sander *et al.,* 2006)
83.	$C_2H_4 + OH \rightarrow H_2CO + CH_3$	$2.2 \cdot 10^{-12} \times e^{385/T}$	(Hampson and Garvin 1977)
84.	$C_2H_4OH + H \rightarrow H_2 + CH_3CHO$	$3.3 \cdot 10^{-11} \times e^{-2000/T}$	(Zahnle and Kasting 1986)
85.	$C_2H_4OH + H \rightarrow H_2O + C_2H_4$	$5 \cdot 10^{-11}$	(Miller *et al.,* 1982)
86.	$C_2H_4OH + O \rightarrow OH + CH_3CHO$	$3.3 \cdot 10^{-11} \times e^{-2000/T}$	(Zahnle and Kasting 1986)
87.	$C_2H_4OH + OH \rightarrow H_2O + CH_3CHO$	$1.7 \cdot 10^{-11} \times e^{-1000/T}$	(Zahnle and Kasting 1986)
88.	$C_2H_5 + C_2H_3 \rightarrow C_2H_6 + C_2H_2$	$6 \cdot 10^{-12}$	(Laufer *et al.,* 1983)
89.	$C_2H_5 + C_2H_5 \rightarrow C_2H_6 + C_2H_4$	$2.3 \cdot 10^{-12}$	(Tsang and Hampson 1986)
90.	$C_2H_5 + CH_3 \rightarrow C_2H_4 + CH_4$	$1.88 \cdot 10^{-12} \times (T/300)^{-0.5}$	(Romani *et al.,* 1993)
91.	$C_2H_5 + CH_3 + M \rightarrow C_3H_8 + M$	$k_0 = 3.9 \cdot 10^{-10} \times (T/300)^{2.5}$ $k_\infty = 1.4 \cdot 10^{-8} \times (T/300)^{0.5}$	(Romani *et al.,* 1993)
92.	$C_2H_5 + H \rightarrow C_2H_4 + H_2$	$3 \cdot 10^{-12}$	(Tsang and Hampson 1986)
93.	$C_2H_5 + H + M \rightarrow C_2H_6 + M$	$k_0 = 5.5 \cdot 10^{-23} \times e^{-1040/T}$ $k_\infty = 1.5 \cdot 10^{-10}$	(Gladstone *et al.,* 1996)

94.	$C_2H_5 + H \rightarrow CH_3 + CH_3$	$6.00 \cdot 10^{-11}$	(Baluch, 1992)
95.	$C_2H_5 + HCO \rightarrow C_2H_6 + CO$	$1 \cdot 10^{-10}$	(Pavlov *et al.,* 2001b)
96.	$C_2H_5 + HNO \rightarrow C_2H_6 + NO$	$3 \cdot 10^{-14}$	(Pavlov *et al.,* 2001b)
97.	$C_2H_5 + O \rightarrow CH_3 + HCO + H$	$3.0 \cdot 10^{-11}$	(Tsang and Hampson 1986)
98.	$C_2H_5 + O \rightarrow CH_3CHO + H$	$1.33 \cdot 10^{-10}$	(Tsang and Hampson 1986)
99.	$C_2H_5 + O \rightarrow H_2CO + CH_3$	$2.67 \cdot 10^{-11}$	(Tsang and Hampson, 1986)
100	$C_2H_5 + O_2 + M \rightarrow CH_3 + HCO + OH + M$	$k_0 = 1.5 \cdot 10^{-28} \times (T/300)^{3.0}$ $k_\infty = 1.9 \cdot 10^{-11}$	(Sander *et al.,* 2006)
101	$C_2H_5 + OH \rightarrow CH_3CHO + H_2$	$1 \cdot 10^{-10}$	(Pavlov *et al.,* 2001b)
102	$C_2H_5 + OH \rightarrow C_2H_4 + H_2O$	$4.0 \cdot 10^{-11}$	(Pavlov *et al.,* 2001b)
103	$C_2H_6 + O \rightarrow C_2H_5 + OH$	$8.62 \cdot 10^{-12} \times e^{-2920/T} \times (T/300)^{1.5}$	(Baulch *et al.,* 1994)
104	$C_2H_6 + O^1D \rightarrow C_2H_5 + OH$	$6.29 \cdot 10^{-10}$	(Matsumi *et al.,* 1993)
105	$C_2H_6 + OH \rightarrow C_2H_5 + H_2O$	$8.7 \cdot 10^{-12} \times e^{-1070/T}$	(Sander *et al.,* 2006)
106	$C_3H_2 + H + M \rightarrow C_3H_3 + M$	$k_0 = 1.7 \cdot 10^{-26}$ $k_\infty = 1.5 \cdot 10^{-10}$	(Yung *et al.,* 1984)
107	$C_3H_3 + H + M \rightarrow CH_2CCH_2 + M$	$k_0 = 1.7 \cdot 10^{-26}$ $k_\infty = 1.5 \cdot 10^{-10}$	(Yung *et al.,* 1984)
108	$C_3H_3 + H + M \rightarrow CH_3C_2H + M$	$k_0 = 1.7 \cdot 10^{-26}$ $k_\infty = 1.5 \cdot 10^{-10}$	(Yung *et al.,* 1984)
109	$C_3H_5 + CH_3 \rightarrow CH_2CCH_2 + CH_4$	$4.5 \cdot 10^{-12}$	(Yung *et al.,* 1984)
110	$C_3H_5 + CH_3 \rightarrow CH_3C_2H + CH_4$	$4.5 \cdot 10^{-12}$	(Yung *et al.,* 1984)
111	$C_3H_5 + H + M \rightarrow C_3H_6 + M$	$k_0 = 1.0 \cdot 10^{-28}$ $k_\infty = 1.0 \cdot 10^{-11}$	(Yung *et al.,* 1984)
112	$C_3H_5 + H \rightarrow CH_2CCH_2 + H_2$	$1.5 \cdot 10^{-11}$	(Yung *et al.,* 1984)
113	$C_3H_5 + H \rightarrow CH_3C_2H + H_2$	$1.5 \cdot 10^{-11}$	(Yung *et al.,* 1984)
114	$C_3H_5 + H \rightarrow CH_4 + C_2H_2$	$1.5 \cdot 10^{-11}$	(Yung *et al.,* 1984)
115	$C_3H_6 + H + M \rightarrow C_3H_7 + M$	$k_0 = 2.15 \cdot 10^{-29} \times e^{-349/T}$ $k_\infty = 4.95 \cdot 10^{-11} \times e^{-1051/T}$	(Pavlov *et al.,* 2001b) assumed same as $k(C_2H_4 + H)$
116	$C_3H_6 + O \rightarrow CH_3 + CH_3CO$	$4.1 \cdot 10^{-12} \times e^{-38/T}$	(Hampson and Garvin 1977)

117	$C_3H_6 + O \rightarrow CH_3 + CH_3 + CO$	$4.1 \cdot 10^{-12} e^{-38/T}$	Hampson and Garvin (1977)
118	$C_3H_6 + OH \rightarrow CH_3CHO + CH_3$	$4.1 \cdot 10^{-12} \times e^{540/T}$	(Hampson and Garvin 1977)
119	$C_3H_7 + CH_3 \rightarrow C_3H_6 + CH_4$	$2.5 \cdot 10^{-12} \times e^{-200/T}$	(Yung *et al.,* 1984)
120	$C_3H_7 + H \rightarrow CH_3 + C_2H_5$	$7.95 \cdot 10^{-11} \times e^{-127/T}$	(Pavlov *et al.,* 2001b)
121	$C_3H_7 + O \rightarrow C_2H_5CHO + H$	$1.1 \cdot 10^{-10}$	(Pavlov *et al.,* 2001b)
122	$C_3H_7 + OH \rightarrow C_2H_5CHO + H_2$	$1.1 \cdot 10^{-10}$	(Pavlov *et al.,* 2001b)
123	$C_3H_8 + O + M \rightarrow C_3H_7 + OH + M$	$k_0 = 1.6 \cdot 10^{-11} \times e^{-2900/T}$ $k_\infty = 2.2 \cdot 10^{-11} \times e^{-2200/T}$	(Hampson and Garvin 1977)
124	$C_3H_8 + O^1D \rightarrow C_3H_7 + OH$	$1.4 \cdot 10^{-10}$	(Pavlov *et al.,* 2001b)
125	$C_3H_8 + OH \rightarrow C_3H_7 + H_2O$	$1.1 \cdot 10^{-11} \times e^{-700/T}$	(DeMore *et al.,* 1992)
126	$CH + C_2H_2 + M \rightarrow C_3H_2 + H + M$	$k_0 = 2.15 \cdot 10^{-29} \times e^{-349/T}$ $k_\infty = 4.95 \cdot 10^{-11} \times e^{-1051/T}$	(Romani *et al.,* 1993)
127	$CH + C_2H_4 + M \rightarrow CH_2CCH_2 + H + M$	$k_0 = 1.75 \cdot 10^{-10} \times e^{61/T}$ $k_\infty = 5.3 \cdot 10^{-10}$	(Romani *et al.,* 1993)
128	$CH + C_2H_4 + M \rightarrow CH_3C_2H + H + M$	$k_0 = 1.75 \cdot 10^{-10} \times e^{61/T}$ $k_\infty = 5.3 \cdot 10^{-10}$	(Romani *et al.,* 1993)
129	$CH + CH_4 + M \rightarrow C_2H_4 + H + M$	$k_0 = 2.5 \cdot 10^{-11} \times e^{200/T}$ $k_\infty = 1.7 \cdot 10^{-10}$	(Romani *et al.,* 1993)
130	$CH + CO_2 \rightarrow HCO + CO$	$5.9 \cdot 10^{-12} \times e^{-350/T}$	(Berman *et al.,* 1982)
131	$CH + H \rightarrow C + H_2$	$1.4 \cdot 10^{-11}$	(Becker *et al.,* 1989)
132	$CH + H_2 \rightarrow CH_2^3 + H$	$2.38 \cdot 10^{-10} \times e^{-1760/T}$	(Zabarnick *et al.,* 1986)
133	$CH + H_2 + M \rightarrow CH_3 + M$	$k_0 = 8.75 \cdot 10^{-31} \times e^{524/T}$ $k_\infty = 8.3 \cdot 10^{-11}$	(Romani *et al.,* 1993)
134	$CH + O \rightarrow CO + H$	$9.5 \cdot 10^{-11}$	(Messing *et al.,* 1981)
135	$CH + O_2 \rightarrow CO + OH$	$5.9 \cdot 10^{-11}$	(Butler *et al.,* 1981)
136	$CH_2^1 + CH_4 \rightarrow CH_3 + CH_3$	$7.14 \cdot 10^{-12} \times e^{-5050/T}$	(Böhland *et al.,* 1985)
137	$CH_2^1 + CO_2 \rightarrow H_2CO + CO$	$1 \cdot 10^{-12}$	(Zahnle 1986)
138	$CH_2^1 + H_2 \rightarrow CH_2^3 + H_2$	$1.26 \cdot 10^{-11}$	(Romani *et al.,* 1993)
139	$CH_2^1 + H_2 \rightarrow CH_3 + H$	$5 \cdot 10^{-15}$	(Tsang and Hampson 1986)

140	$CH_2^1 + M \rightarrow CH_2^3 + M$	$8.8 \cdot 10^{-12}$	(Ashfold *et al.,* 1981)
141	$CH_2^1 + O_2 \rightarrow HCO + OH$	$3 \cdot 10^{-11}$	(Ashfold *et al.,* 1981)
142	$CH_2^3 + C_2H_2 + M \rightarrow CH_2CCH_2 + M$	$k_0 = 3.8 \cdot 10^{-25}$ $k_\infty = 3.7 \cdot 10^{-12}$	(Laufer 1981; Laufer *et al.,* 1983)
143	$CH_2^3 + C_2H_2 + M \rightarrow CH_3C_2H + M$	$k_0 = 3.8 \cdot 10^{-25}$ $k_\infty = 2.2 \cdot 10^{-12}$	(Laufer 1981; Laufer *et al.,* 1983)
144	$CH_2^3 + C_2H_3 \rightarrow CH_3 + C_2H_2$	$3 \cdot 10^{-11}$	(Tsang and Hampson 1986)
145	$CH_2^3 + C_2H_5 \rightarrow CH_3 + C_2H_4$	$3 \cdot 10^{-11}$	(Tsang and Hampson 1986)
146	$CH_2^3 + CH_3 \rightarrow C_2H_4 + H$	$7 \cdot 10^{-11}$	(Tsang and Hampson 1986)
147	$CH_2^3 + CO + M \rightarrow CH_2CO + M$	$k_0 = 1.0 \cdot 10^{-28}$ $k_\infty = 1.0 \cdot 10^{-15}$	(Yung *et al.,* 1984)
148	$CH_2^3 + CO_2 \rightarrow H_2CO + CO$	$1.0 \cdot 10^{-14}$	(Laufer 1981)
149	$CH_2^3 + H \rightarrow CH + H_2$	$4.7 \cdot 10^{-10} \times e^{-370/T}$ $k_0 = 3.1 \cdot 10^{-30} \times e^{457/T}$	(Zabarnick *et al.,* 1986)
150	$CH_2^3 + H + M \rightarrow CH_3 + M$	$k_\infty = 1.5 \cdot 10^{-10}$	(Gladstone *et al.,* 1996)
151	$CH_2^3 + O \rightarrow CH + OH$	$8 \cdot 10^{-12}$	(Huebner and Giguere 1980)
152	$CH_2^3 + O \rightarrow CO + HH$	$8.3 \cdot 10^{-11}$	(Homann and Wellmann 1983)
153	$CH_2^3 + O \rightarrow HCO + H$	$1 \cdot 10^{-11}$	(Huebner and Giguere 1980)
154	$CH_2^3 + O_2 \rightarrow HCO + OH$	$4.1 \cdot 10^{-11} \times e^{-750/T}$	(Baulch *et al.,* 1994)
155	$CH_2^3 + S_2 \rightarrow HCS + HS$	$4.1 \cdot 10^{-11} e^{-750/T}$	Assumed same as $k(CH_2^3 + O_2)$
156	$CH_2CCH_2 + H \rightarrow C_3H_5$	$k_0 = 8.9 \cdot 10^{-29} \times e^{-1225/T} \times (T/300)^{-2.0}$ $k_\infty = 1.4 \cdot 10^{-11} \times e^{-1000/T}$	(Yung *et al.,* 1984)
157	$CH_2CCH_2 + H \rightarrow CH_3 + C_2H_2$	$k_0 = 8.9 \cdot 10^{-29} \times e^{-1225/T} \times (T/300)^{-2.0}$ $k_\infty = 9.7 \cdot 10^{-13} \times e^{-1550/T}$	(Yung *et al.,* 1984)
158	$CH_2CCH_2 + H \rightarrow CH_3C_2H + H$	$1 \cdot 10^{-11} \times e^{-1000/T}$	(Yung *et al.,* 1984)
159	$CH_2CO + H \rightarrow CH_3 + CO$	$1.9 \cdot 10^{-11} \times e^{-1725/T}$	(Michael *et al.,* 1979)
160	$CH_2CO + O \rightarrow H_2CO + CO$	$3.3 \cdot 10^{-11}$	(Lee 1980; Miller *et al.,* 1982)
161	$CH_3 + C_2H_3 \rightarrow C_3H_5 + H$	$2.4 \cdot 10^{-13}$	(Romani *et al.,* 1993)
162	$CH_3 + CH_3 + M \rightarrow C_2H_6 + M$	$k_0 = 4.0 \cdot 10^{-24} \times e^{-1390/T} \times (T/300)^{-7.0}$ $k_\infty = 1.79 \cdot 10^{-10} \times e^{-329/T}$	(Wagner and Wardlaw 1988)

163	$CH_3 + CO + M \rightarrow CH_3CO + M$	$1.4 \cdot 10^{-32} \times e^{-3000/T} \times den$ $k_0 = 1.0 \cdot 10^{-28} \times (T/298)^{-1.80}$	(Watkins and Word 1974)
164	$CH_3 + H + M \rightarrow CH_4 + M$	$k_\infty = 2.0 \cdot 10^{-10} \times (T/298)^{-0.40}$	(Baulch *et al.,* 1994; Tsang and Hampson 1986)
165	$CH_3 + H_2CO \rightarrow CH_4 + HCO$	$1.60 \cdot 10^{-16} \times e^{899/T} \times (T/298)^{6.10}$	(Baulch *et al.,* 1994)
166	$CH_3 + HCO \rightarrow CH_4 + CO$	$5.0 \cdot 10^{-11}$	(Tsang and Hampson 1986)
167	$CH_3 + HNO \rightarrow CH_4 + NO$	$3.3 \cdot 10^{-12} \times e^{-1000/T}$	(Choi and Lin 2005)
168	$CH_3 + O \rightarrow H_2CO + H$	$1.1 \cdot 10^{-10}$	(Sander *et al.,* 2006)
169	$CH_3 + O_2 \rightarrow H_2CO + OH$	$k_0 = 4.5 \cdot 10^{-31} \times (T/300)^{-3.0}$ $k_\infty = 1.8 \cdot 10^{-12} \times (T/300)^{-1.7}$	(Sander *et al.,* 2006)
170	$CH_3 + O_3 \rightarrow H_2CO + HO_2$	$5.4 \cdot 10^{-12} \times e^{-220/T}$	(Sander *et al.,* 2006)
171	$CH_3 + O_3 \rightarrow CH_3O + O_2$	$5.4 \cdot 10^{-12}\ e^{-220/T}$	(Sander *et al.,* 2006)
172	$CH_2^3 + CH_2^3 \rightarrow CH_3 + C_2H_2$	$3 \cdot 10^{-11}$	Tsang and Hampson (1986)
173	$CH_3 + OH \rightarrow CH_3O + H$	$9.3 \cdot 10^{-11} \times e^{-1606/T} \times (T/298)$	(Jasper *et al.,* 2007)
174	$CH_3 + OH \rightarrow CO + H_2 + H_2$	$6.7 \cdot 10^{-12}$	
175	$CH_3C_2H + H + M \rightarrow C_3H_5 + M$	$k_0 = 8.88 \cdot 10^{-29} \times e^{-1225/T} \times (T/300)^{-2}$ $k_\infty = 9.7 \cdot 10^{-12} \times e^{-1550/T}$	(Yung *et al.,* 1984)
176	$CH_3C_2H + H \rightarrow CH_3 + C_2H_2$	$k_0 = 8.88 \cdot 10^{-29} \times e^{-1225/T} \times (T/300)^{-2}$ $k_\infty = 9.7 \cdot 10^{-12} \times e^{-1550/T}$	(Whytock *et al.,* 1976)
177	$CH_3CHO + CH_3 \rightarrow CH_3CO + CH_4$	$2.8 \cdot 10^{-11} \times e^{-1540/T}$	(Zahnle 1986)
178	$CH_3CHO + H \rightarrow CH_3CO + H_2$	$2.8 \cdot 10^{-11} \times e^{-1540/T}$	(Zahnle 1986)
179	$CH_3CHO + O \rightarrow CH_3CO + OH$	$5.8 \cdot 10^{-13}$	(Washida 1981)
180	$CH_3CHO + OH \rightarrow CH_3CO + H_2O$	$1.6 \cdot 10^{-11}$	(Niki *et al.,* 1978)
181	$CH_3CO + CH_3 \rightarrow C_2H_6 + CO$	$5.4 \cdot 10^{-11}$	(Adachi *et al.,* 1981)
182	$CH_3CO + CH_3 \rightarrow CH_4 + CH_2CO$	$8.6 \cdot 10^{-11}$	(Adachi *et al.,* 1981)
183	$CH_3CO + H \rightarrow CH_4 + CO$	$1 \cdot 10^{-10}$	(Zahnle 1986)
184	$CH_3CO + O \rightarrow H_2CO + HCO$	$5 \cdot 10^{-11}$	(Zahnle 1986)
185	$CH_3O + CO \rightarrow CH_3 + CO_2$	$2.6 \cdot 10^{-11} \times e^{-5940/T}$	(Wen *et al.,* 1989)
186	$CH_3O_2 + H \rightarrow CH_4 + O_2$	$1.4 \cdot 10^{-11}$	(Tsang and Hampson 1986)

187	$CH_3O_2 + H \rightarrow H_2O + H_2CO$	$1 \cdot 10^{-11}$	(Zahnle *et al.,* 2006)
188	$CH_3O + NO \rightarrow HNO + H_2CO$	$2.3 \cdot 10^{-12} \times (300/T)^{0.7}$	IUPAC datasheet
189	$NO_2 + CH_3O \rightarrow H_2CO + HNO_2$	$9.6 \cdot 10^{-12}\ e^{-1150/T}$	IUPAC datasheet
190	$CH_3O_2 + O \rightarrow H_2CO + HO_2$	$1 \cdot 10^{-11}$	(Vaghjiani and Ravishankara 1990)
191	$CH_3O_2 + NO \rightarrow CH_3O + NO_2$	$2.8 \cdot 10^{-12}\ e^{-300/T}$	(Sander *et al.,* 2006)
192	$CH_4 + HS \rightarrow CH_3 + H_2S$	$2.99 \cdot 10^{-31}$	(Kerr and Trotman-Dickenson 1957)
193	$CH_4 + O \rightarrow CH_3 + OH$	$8.75 \cdot 10^{-12} \times e^{-4330/T} \times (T/298)^{1.5}$	(Tsang and Hampson 1986)
194	$CH_4 + O^1D \rightarrow CH_3 + OH$	$1.125 \cdot 10^{-10}$	(Sander *et al.,* 2006)
195	$CH_4 + O^1D \rightarrow H_2CO + H_2$	$7.5 \cdot 10^{-12}$	(Sander *et al.,* 2006)
196	$CH_4 + O^1D \rightarrow CH_3O + H$	$3.0 \cdot 10^{-11}$	(Sander *et al.,* 2006)
197	$CH_4 + OH \rightarrow CH_3 + H_2O$	$2.45 \cdot 10^{-12} \times e^{-1775/T}$	(Sander *et al.,* 2006)
198	$CO + O + M \rightarrow CO_2 + M$	$2.2 \cdot 10^{-33} \times e^{-1780/T} \times den$	(Tsang and Hampson 1986)
199	$CO + OH \rightarrow CO_2 + H$	$1.5 \cdot 10^{-13} \times (1 + 0.6 \times den)$	(Sander *et al.,* 2006)
200	$CO + O^1D \rightarrow CO + O$	$7.0 \cdot 10^{-11}$	(Sander *et al.,* 2006)
201	$H + CO + M \rightarrow HCO + M$	$1.4 \cdot 10^{-34} \times e^{-100/T} \times den$	(Baulch *et al.,* 1994)
202	$H + H + M \rightarrow H_2 + M$	$8.85 \cdot 10^{-33} \times (T/298)^{-0.6} \times den$	(Baulch *et al.,* 1994)
203	$H + HCO \rightarrow H_2 + CO$	$1.8 \cdot 10^{-10}$	(Baulch *et al.,* 1992)
204	$H + HNO \rightarrow H_2 + NO$	$3.01 \cdot 10^{-11} \times e^{500/T}$	(Tsang and Herron 1991)
205	$H + HO_2 \rightarrow H_2 + O_2$	$7.2 \cdot 10^{-12}$	(Sander *et al.,* 2006)
206	$H + HO_2 \rightarrow H_2O + O$	$1.60 \cdot 10^{-12}$	(Sander *et al.,* 2006)
207	$H + HO_2 \rightarrow OH + OH$	$7.12 \cdot 10^{-11}$	(Sander *et al.,* 2006)
208	$H + NO + M \rightarrow HNO + M$	$2.1 \cdot 10^{-32} \times (T/298)^{1.00} \times den$	(Hampson and Garvin 1977)
209	$H + O_2 + M \rightarrow HO_2 + M$	$5.7 \cdot 10^{-32} \times 7.5 \cdot 10^{-11} \times (T/298)^{1.6}$	(Sander *et al.,* 2006)
210	$H + O_3 \rightarrow OH + O_2$	$1.4 \cdot 10^{-10} \times e^{-470/T}$	(Sander *et al.,* 2006)
211	$H + OH + M \rightarrow H_2O + M$	$6.8 \cdot 10^{-31} \times (T/300)^{-2} \times den$	(McEwan and Phillips 1975)
212	$H + SO + M \rightarrow HSO + M$	$k_0 = 5.7 \cdot 10^{-32} \times (T/298)^{1.6}$ $k_\infty = 7.5 \cdot 10^{-11}$	(Kasting 1990)

213	$H_2 + O \rightarrow OH + H$	$1.34 \cdot 10^{-15} \times e^{-1460/T} \times (T/298)^{6.52}$	(Robie *et al.,* 1990)
214	$H_2 + O^1D \rightarrow OH + H$	$1.1 \cdot 10^{-10}$	(Sander *et al.,* 2006)
215	$H_2 + OH \rightarrow H_2O + H$	$5.5 \cdot 10^{-12} \times e^{-2000/T}$	(Sander *et al.,* 2006)
216	$H_2CO + H \rightarrow H_2 + HCO$	$2.14^{-12} \times e^{-1090/T} \times (T/298)^{1.62}$	(Baulch *et al.,* 1994)
217	$H_2CO + O \rightarrow HCO + OH$	$3.4 \cdot 10^{-11} \times e^{-1600/T}$	(Sander *et al.,* 2006)
218	$H_2CO + OH \rightarrow H_2O + HCO$	$5.5 \cdot 10^{-12} \times e^{125/T}$	(Sander *et al.,* 2006)
219	$H_2O + O^1D \rightarrow OH + OH$	$2.2 \cdot 10^{-10}$	(Sander *et al.,* 2006)
220	$H_2O_2 + O \rightarrow OH + HO_2$	$1.4 \cdot 10^{-12} \times e^{-2000/T}$	(Sander *et al.,* 2006)
221	$H_2O_2 + OH \rightarrow HO_2 + H_2O$	$2.9 \cdot 10^{-12} \times e^{-160/T}$	(Sander *et al.,* 2006)
222	$H_2S + H \rightarrow H_2 + HS$	$3.66 \cdot 10^{-12} \times e^{-455/T} \times (T/298)^{1.94}$	(Peng *et al.,* 1999)
223	$H_2S + O \rightarrow OH + HS$	$9.2 \cdot 10^{-12} \times e^{-1800/T}$	(Sander *et al.,* 2006)
224	$H_2S + OH \rightarrow H_2O + HS$	$6.0 \cdot 10^{-12} \times e^{-70/T}$	(Sander *et al.,* 2006)
225	$HCO + H_2CO \rightarrow CH_3O + CO$	$3.8 \cdot 10^{-17}$	(Wen *et al.,* 1989)
226	$HCO + HCO \rightarrow H_2CO + CO$	$4.5 \cdot 10^{-11}$	(Tsang and Hampson 1986)
227	$HCO + NO \rightarrow HNO + CO$	$1.3 \cdot 10^{-11}$	(Tsang and Hampson 1986)
228	$HCO + O_2 \rightarrow HO_2 + CO$	$5.2 \cdot 10^{-12}$	(Sander *et al.,* 2006)
229	$HNO_2 + OH \rightarrow H_2O + NO_2$	$1.8 \cdot 10^{-11} \times e^{-390/T}$	(Sander *et al.,* 2006)
230	$HNO_3 + OH \rightarrow H_2O + NO_2 + O$	$7.2 \cdot 10^{-15} \times e^{-785/T} + (1.9 \cdot 10^{-33} \times e^{725/T} \times \text{den})/(1 + 4.6 \cdot 10^{-16} \times e^{-715/T} \times \text{den})$	(Sander *et al.,* 2006)
231	$HO_2 + HO_2 \rightarrow H_2O_2 + O_2$	$k_0 = 2.3 \cdot 10^{-13} \times e^{590/T}$ $k_\infty = 1.7 \cdot 10^{-33} \times e^{1000/T}$	(Sander *et al.,* 2006)
232	$HO_2 + O \rightarrow OH + O_2$	$3.0 \cdot 10^{-11} \times e^{200/T}$	(Sander *et al.,* 2006)
233	$HO_2 + O_3 \rightarrow OH + O_2 + O_2$	$1.0 \cdot 10^{-14} \times e^{-490/T}$	(Sander *et al.,* 2006)
234	$HO_2 + NO_2 \rightarrow HNO_2 + O_2$	$5.0 \cdot 10^{-16}$	(Sander *et al.,* 2006)
235	$HS + H \rightarrow H_2 + S$	$2.0 \cdot 10^{-11}$	(Schofield 1973)
236	$HS + HCO \rightarrow H_2S + CO$	$2.0 \cdot 10^{-11}$	(Kasting 1990)
237	$HS + HO_2 \rightarrow H_2S + O_2$	$1.0 \cdot 10^{-11}$	(Stachnik and Molina 1987)

238	$HS + HS \rightarrow H_2S + S$	2.0^{-11}	(Schofield 1973)
239	$HS + NO_2 \rightarrow HSO + NO$	$2.9 \cdot 10^{-11} \times e^{240/T}$	(Sander *et al.,* 2006)
240	$HS + O \rightarrow H + SO$	$7.0 \cdot 10^{-11}$	(Sander *et al.,* 2006)
241	$HS + O_3 \rightarrow HSO + O_2$	$9.0 \cdot 10^{-12} \times e^{-280/T}$	(Sander *et al.,* 2006)
242	$HS + S \rightarrow H + S_2$	$1.0 \cdot 10^{-11}$	(Kasting 1990)
243	$HSO + H \rightarrow H_2 + SO$	$1.0 \cdot 10^{-11}$	(Kasting 1990)
244	$HSO + H \rightarrow HS + OH$	$2.0 \cdot 10^{-11}$	(Kasting 1990)
245	$HSO + HS \rightarrow H_2S + SO$	$3.0 \cdot 10^{-12}$	(Kasting 1990)
246	$HSO + O \rightarrow OH + SO$	$3.0 \cdot 10^{-11}$	(Kasting 1990)
247	$HSO + OH \rightarrow H_2O + SO$	$3.0 \cdot 10^{-11}$	(Kasting 1990)
248	$HSO + S \rightarrow HS + SO$	$1.0 \cdot 10^{-11}$	(Kasting 1990)
249	$HSO_3 + O_2 \rightarrow HO_2 + SO_3$	$1.3 \cdot 10^{-12} \times e^{-330/T}$	(Sander *et al.,* 2006)
250	$N + NO \rightarrow N_2 + O$	$2.1 \cdot 10^{-11} \times e^{-100/T}$	(Sander *et al.,* 2006)
251	$N + O_2 \rightarrow NO + O$	$1.5 \cdot 10^{-12} \times e^{-3600/T}$	(Sander *et al.,* 2006)
252	$N + OH \rightarrow NO + H$	$3.8 \cdot 10^{-11} \times e^{85/T}$	(Atkinson *et al.,* 1989)
253	$N + HO_2 \rightarrow NO + OH$	$2.2 \cdot 10^{-11}$	(Brune et al. 1983)
254	$NO + HO_2 \rightarrow NO_2 + OH$	$3.5 \cdot 10^{-12} \times e^{250/T}$	(Sander *et al.,* 2006)
255	$NO + O + M \rightarrow NO_2 + M$	$9 \cdot 10^{-31} 3. \cdot 10^{-11} \times (T/298)^{1.5}$	(Sander *et al.,* 2006)
256	$NO + O_3 \rightarrow NO_2 + O_2$	$2.0 \cdot 10^{-12} \times e^{-1500/T}$	(Sander *et al.,* 2006)
257	$NO + OH + M \rightarrow HNO_2 + M$	$k_0 = 7 \cdot 10^{-31} \times (T/298)^{2.6}$ $k_\infty = 3.6 \cdot 10^{-11} \times (T/298)^{0.1}$	(Sander *et al.,* 2006)
258	$NO_2 + H \rightarrow NO + OH$	$4. \cdot 10^{-10} \times e^{-340/T}$	(Sander *et al.,* 2006)
259	$NO_2 + O \rightarrow NO + O_2$	$5.6 \cdot 10^{-12} \times e^{180/T}$	(Sander *et al.,* 2006)
260	$NO_2 + OH + M \rightarrow HNO_3 + M$	$k_0 = 2.0 \cdot 10^{-30} \times (T/298)^{3.0}$ $k_\infty = 2.5 \cdot 10^{-11}$	(Sander *et al.,* 2006)
261	$O + HCO \rightarrow H + CO_2$	$5.0 \cdot 10^{-11}$	(Tsang and Hampson 1986)
262	$O + HCO \rightarrow OH + CO$	$1.0 \cdot 10^{-10}$	(Hampson and Garvin 1977)

263	$O + HNO \rightarrow OH + NO$	$3.8 \cdot 10^{-11}$	(Tsang and Hampson 1986)
264	$O + O + M \rightarrow O_2 + M$	$9.46 \cdot 10^{-34} \times e^{480/T} \times den$	(Campbell and Gray 1973)
265	$O + O_2 + M \rightarrow O_3 + M$	$6 \cdot 10^{-34} \times 3 \cdot 10^{-11} \times (T/298)^{2.40}$	(Sander *et al.,* 2006)
266	$O + O_3 \rightarrow O_2 + O_2$	$8.0 \cdot 10^{-12} \times e^{-2060/T}$	(Sander *et al.,* 2006)
267	$O^1D + M \rightarrow O + M$	$1.8 \cdot 10^{-11} \times e^{110/T}$	(Sander *et al.,* 2006)
268	$O^1D + O_2 \rightarrow O + O_2$	$3.2 \cdot 10^{-11} \times e^{70/T}$	(Sander *et al.,* 2006)
269	$OH + HCO \rightarrow H_2O + CO$	$1.0 \cdot 10^{-10}$	(Baulch *et al.,* 1992)
270	$OH + HNO \rightarrow H_2O + NO$	$5 \cdot 10^{-11}$	(Sun *et al.,* 2001)
271	$OH + HO_2 \rightarrow H_2O + O_2$	$4.8 \cdot 10^{-11} \times e^{250/T}$	(Sander *et al.,* 2006)
272	$OH + O \rightarrow H + O_2$	$2.2 \cdot 10^{-11} \times e^{120/T}$	(Sander *et al.,* 2006)
273	$OH + O_3 \rightarrow HO_2 + O_2$	$1.6 \cdot 10^{-12} \times e^{-940/T}$	(Sander *et al.,* 2006)
274	$OH + OH \rightarrow H_2O + O$	$4.2 \cdot 10^{-12} \times e^{-240/T}$	(Sander *et al.,* 2006)
275	$OH + OH \rightarrow H_2O_2$	$6.9 \cdot 10^{-31} \times 2.6 \cdot 10^{-11} \times (T/298)^{1.00}$	(Sander *et al.,* 2006)
276	$S + HCO \rightarrow HS + CO$	$1.0 \cdot 10^{-11}$	(Kasting 1990)
277	$S + HO_2 \rightarrow HS + O_2$	$5.0 \cdot 10^{-12}$	(Kasting 1990)
278	$S + HO_2 \rightarrow SO + OH$	$5.0 \cdot 10^{-12}$	(Kasting 1990)
279	$S + O_2 \rightarrow SO + O$	$2.3 \cdot 10^{-12}$	(Sander *et al.,* 2006)
280	$S + O_3 \rightarrow SO + O_2$	$1.2 \cdot 10^{-11}$	(Sander *et al.,* 2006)
281	$S + OH \rightarrow SO + H$	$6.6 \cdot 10^{-11}$	(Sander *et al.,* 2006)
282	$S + S + M \rightarrow S_2 + M$	$1.98 \cdot 10^{-33} \times e^{-206/T} \times den$	(Du *et al.,* 2008)
283	$S + S_2 + M \rightarrow S_3 + M$	$2.8 \cdot 10^{-32} \times den$	(Kasting 1990)
284	$S + S_3 + M \rightarrow S_4 + M$	$2.8 \cdot 10^{-31} \times den$	(Kasting 1990) (Hills *et al.,* 1987)
285	$S_2 + O \rightarrow S + SO$	$1.1 \cdot 10^{-11}$	
286	$S_2 + S_2 + M \rightarrow S_4 + M$	$2.8 \cdot 10^{-31} \times den$	(Baulch *et al.,* 1976)
287	$S_4 + S_4 + M \rightarrow S_8AER + M$	$2.8 \cdot 10^{-31} \times den$	(Kasting 1990)
288	$SO + HCO \rightarrow HSO + CO$	$5.6 \cdot 10^{-12} \times (T/298)^{-0.4}$	(Kasting 1990)

289	$SO + NO_2 \rightarrow SO_2 + NO$	$1.4 \cdot 10^{-11}$	(Sander *et al.,* 2006)
290	$SO + O + M \rightarrow SO_2 + M$	$5.1 \cdot 10^{-31} \times den$	(Sander *et al.,* 2006)
291	$SO + O_2 \rightarrow O + SO_2$	$2.6 \cdot 10^{-13} \times e^{-2400/T}$	(Sander *et al.,* 2006)
292	$SO + O_3 \rightarrow SO_2 + O_2$	$4.5 \cdot 10^{-12} \times e^{-1170/T}$	(Atkinson *et al.,* 2004)
293	$SO + OH \rightarrow SO_2 + H$	$8.6 \cdot 10^{-11}$	(Sander *et al.,* 2006)
294	$SO + SO \rightarrow SO_2 + S$	$3.5 \cdot 10^{-15}$	(Martinez and Herron 1983)
295	$SO_2 + HO_2 \rightarrow SO_3 + OH$	$8.63 \cdot 10^{-16}$	(Lloyd 1974)
296	$SO_2 + O + M \rightarrow SO_3 + M$	$k_0 = 1.3 \cdot 10^{-33} \times (T/298)^{-3.6}$ $k_\infty = 1.5 \cdot 10^{-11}$	(Sander *et al.,* 2006)
297	$SO_2 + OH + M \rightarrow HSO_3 + M$	$k_0 = 3 \cdot 10^{-31} \times (T/298)^{3.3}$ $k_\infty = 1.5 \cdot 10^{-12}$	(Sander *et al.,* 2006)
298	$SO_2^1 + O_2 \rightarrow SO_3 + O$	$1.0 \cdot 10^{-16}$	(Turco *et al.,* 1982)
299	$SO_2^1 + SO_2 \rightarrow SO_3 + SO$	$4.0 \cdot 10^{-12}$	(Turco *et al.,* 1982)
300	$SO_2^3 + SO_2 \rightarrow SO_3 + SO$	$7.0 \cdot 10^{-14}$	(Turco *et al.,* 1982)
301	$SO_3 + H_2O \rightarrow H_2SO_4$	$1.2 \cdot 10^{-15}$	(Sander *et al.,* 2006)
302	$SO_3 + SO \rightarrow SO_2 + SO_2$	$2.0 \cdot 10^{-15}$	(Chung *et al.,* 1975)
303	$SO_2^1 + h\nu \rightarrow SO_2 + h\nu$	$0.0 \cdot 10^{0}$	(Turco *et al.,* 1982)
304	$SO_2^1 + h\nu \rightarrow SO_2^3 + h\nu$	$0.0 \cdot 10^{0}$	(Turco *et al.,* 1982)
305	$SO_2^3 + h\nu \rightarrow SO_2 + h\nu$	$0.0 \cdot 10^{0}$	(Turco *et al.,* 1982)
306	$O_2 + h\nu \rightarrow O + O^1D$	$2.38 \cdot 10^{-06}$	
307	$O_2 + h\nu \rightarrow O + O$	$4.77 \cdot 10^{-08}$	
308	$H_2O + h\nu \rightarrow H + OH$	$8.25 \cdot 10^{-06}$	
309	$O_3 + h\nu \rightarrow O_2 + O^1D$	$2.47 \cdot 10^{-03}$	
310	$O_3 + h\nu \rightarrow O_2 + O$	$7.37 \cdot 10^{-04}$	
311	$H_2O_2 + h\nu \rightarrow OH + OH$	$3.65 \cdot 10^{-05}$	
312	$CO_2 + h\nu \rightarrow CO + O$	$1.00 \cdot 10^{-09}$	
313	$H_2CO + h\nu \rightarrow H_2 + CO$	$2.51 \cdot 10^{-05}$	

314	$H_2CO + h\nu \rightarrow HCO + H$	$2.86 \cdot 10^{-05}$
315	$CO_2 + h\nu \rightarrow CO + O^1D$	$2.90 \cdot 10^{-07}$
316	$HO_2 + h\nu \rightarrow OH + O$	$2.17 \cdot 10^{-04}$
317	$CH_4 + h\nu \rightarrow CH_2^1 + H_2$	$2.08 \cdot 10^{-06}$
318	$C_2H_6 + h\nu \rightarrow CH_4 + CH_2^1$	$1.34 \cdot 10^{-06}$
319	$HNO_2 + h\nu \rightarrow NO + OH$	$1.58 \cdot 10^{-09}$
320	$HNO_3 + h\nu \rightarrow NO_2 + OH$	$7.40 \cdot 10^{-05}$
321	$HNO + h\nu \rightarrow NO + N$	$7.0 \cdot 10^{-04}$
322	$HCO + h\nu \rightarrow H + CO$	$1.0 \cdot 10^{-02}$
323	$NO + h\nu \rightarrow N + O$	$1.92 \cdot 10^{-06}$
324	$NO_2 + h\nu \rightarrow NO + O$	$3.23 \cdot 10^{-03}$
325	$CH_3 + h\nu \rightarrow CH_2^1 + H$	$1.64 \cdot 10^{-01}$
326	$SO + h\nu \rightarrow S + O$	$1.65 \cdot 10^{-04}$
327	$SO_2 + h\nu \rightarrow SO + O$	$7.27 \cdot 10^{-05}$
328	$H_2S + h\nu \rightarrow HS + H$	$1.02 \cdot 10^{-04}$
329	$SO_2 + h\nu \rightarrow SO_2^1$	$7.14 \cdot 10^{-04}$
330	$SO_2 + h\nu \rightarrow SO_2^3$	$4.94 \cdot 10^{-07}$
331	$S_2 + h\nu \rightarrow S + S$	$4.56 \cdot 10^{-04}$
332	$SO_3 + h\nu \rightarrow SO_2 + O$	$1.57 \cdot 10^{-05}$
333	$SO_2^1 + h\nu \rightarrow SO_2^3 + h\nu$	$0.00 \cdot 10^{0}$
334	$SO_2^1 + h\nu \rightarrow SO_2 + h\nu$	$0.00 \cdot 10^{0}$
335	$SO_2^3 + h\nu \rightarrow SO_2 + h\nu$	$0.00 \cdot 10^{0}$
336	$HSO + h\nu \rightarrow HS + O$	$2.17 \cdot 10^{-04}$
337	$S_4 + h\nu \rightarrow S_2 + S_2$	$4.56 \cdot 10^{-04}$
338	$S_3 + h\nu \rightarrow S_2 + S$	$4.45 \cdot 10^{-04}$
339	$C_2H_2 + h\nu \rightarrow C_2H + H$	$1.02 \cdot 10^{-06}$
340	$C_2H_2 + h\nu \rightarrow C_2 + H_2$	$4.65 \cdot 10^{-07}$

341	$C_2H_4 + h\nu \rightarrow C_2H_2 + H_2$	$1.60 \cdot 10^{-05}$
342	$C_3H_8 + h\nu \rightarrow C_3H_6 + H_2$	$0.00 \cdot 10^{-00}$
343	$C_3H_8 + h\nu \rightarrow C_2H_6 + CH_2^1$	$1.43 \cdot 10^{-06}$
344	$C_3H_8 + h\nu \rightarrow C_2H_4 + CH_4$	$6.98 \cdot 10^{-06}$
345	$C_3H_8 + h\nu \rightarrow C_2H_5 + CH_3$	$3.69 \cdot 10^{-06}$
346	$C_2H_6 + h\nu \rightarrow C_2H_2 + H_2 + H_2$	$1.46 \cdot 10^{-06}$
347	$C_2H_6 + h\nu \rightarrow C_2H_4 + H + H$	$1.67 \cdot 10^{-06}$
348	$C_2H_6 + h\nu \rightarrow C_2H_4 + H_2$	$9.15 \cdot 10^{-07}$
349	$C_2H_6 + h\nu \rightarrow CH_3 + CH_3$	$4.31 \cdot 10^{-07}$
350	$C_2H_4 + h\nu \rightarrow C_2H_2 + H + H$	$1.67 \cdot 10^{-05}$
351	$C_3H_6 + h\nu \rightarrow C_2H_2 + CH_3 + H$	$1.07 \cdot 10^{-05}$
352	$CH_4 + h\nu \rightarrow CH_2^3 + H + H$	$3.94 \cdot 10^{-06}$
353	$CH_4 + h\nu \rightarrow CH_3 + H$	$1.93 \cdot 10^{-06}$
354	$CH + h\nu \rightarrow C + H$	$3.27 \cdot 10^{-05}$
355	$CH_2CO + h\nu \rightarrow CH_2^3 + CO$	$1.53 \cdot 10^{-04}$
356	$CH_3CHO + h\nu \rightarrow CH_3 + HCO$	$3.25 \cdot 10^{-05}$
357	$CH_3CHO + h\nu \rightarrow CH_4 + CO$	$3.25 \cdot 10^{-05}$
358	$C_2H_5CHO + h\nu \rightarrow C_2H_5 + HCO$	$7.77 \cdot 10^{-05}$
359	$C_3H_3 + h\nu \rightarrow C_3H_2 + H$	$7.16 \cdot 10^{-04}$
360	$CH_3C_2H + h\nu \rightarrow C_3H_3 + H$	$1.75 \cdot 10^{-05}$
361	$CH_3C_2H + h\nu \rightarrow C_3H_2 + H_2$	$6.57 \cdot 10^{-06}$
362	$CH_3C_2H + h\nu \rightarrow CH_3 + C_2H$	$8.75 \cdot 10^{-07}$
363	$CH_2CCH_2 + h\nu \rightarrow C_3H_3 + H$	$1.91 \cdot 10^{-11}$
364	$CH_2CCH_2 + h\nu \rightarrow C_3H_2 + H_2$	$7.16 \cdot 10^{-12}$
365	$CH_2CCH_2 + h\nu \rightarrow C_2H_2 + CH_2^3$	$2.87 \cdot 10^{-12}$
366	$C_3H_6 + h\nu \rightarrow CH_2CCH_2 + H_2$	$1.80 \cdot 10^{-05}$
367	$C_3H_6 + h\nu \rightarrow C_2H_4 + CH_2^3$	$6.30 \cdot 10^{-07}$

368	$C_3H_6 + h\nu \rightarrow C_2H + CH_4 + H$	$1.58 \cdot 10^{-06}$
369	$OCS + h\nu \rightarrow CO + S$	$8.71 \cdot 10^{-06}$
370	$CS_2 + h\nu \rightarrow CS + S$	$9.33 \cdot 10^{-04}$
371	$CS_2 + h\nu \rightarrow CS_2^*$	$9.71 \cdot 10^{-05}$