| Bimolecular Reactions | Bimolecular Rate Constants ($cm^3$ $molecule^{-1}$ $s^{-1}$) | Notes |
|---|---|---|
| A1. $O(^1D) + N_2 \rightarrow O + N_2$ | $1.8 \times 10^{-11}\ e^{(110/T)}$ | 2 |
| A2. $O(^1D) + O_2 \rightarrow O + O_2$ | $3.2 \times 10^{-11}\ e^{(70/T)}$ | 2 |
| A3. $O(^1D) + H_2O \rightarrow OH + OH$ | $2.2 \times 10^{-10}$ | 2 |
| A4. $O(^1D) + CH_4 \rightarrow CH_3 + OH$ (0.75), $CH_3O + H$ (0.2), $HCHO + H_2$ (0.05) | $1.5 \times 10^{-10}$ | 2 |
| A5. $O(^1D) + H_2 \rightarrow OH + H$ | $1.1 \times 10^{-10}$ | 2 |
| A6. $OH + CO \rightarrow H + CO_2$ | $1.5 \times 10^{-13} \times (1 + 0.6 \times P_{atm})$ | 2 |
| A7. $HO_2 + NO \rightarrow NO_2 + OH$ | $3.5 \times 10^{-12}\ e^{(250/T)}$ | 2 |
| A8. $O_3 + HO_2 \rightarrow OH + 2O_2$ | $1.1 \times 10^{-14}\ e^{(-500/T)}$ | 2 |
| A9. $HO_2 + HO_2 \rightarrow H_2O_2 + O_2$ | $2.3 \times 10^{-13}\ e^{(600/T)}$ | 2 |
| A10. $OH + H_2 \rightarrow H_2O + H$ | $5.5 \times 10^{-12}\ e^{(-2000/T)}$ | 2 |
| A11. $O_3 + OH \rightarrow HO_2 + O_2$ | $1.6 \times 10^{-12}\ e^{(-940/T)}$ | 2 |
| A12. $OH + HNO_3 \rightarrow H_2O + NO_3$ | $k_0 = 7.2 \times 10^{-15}\ e^{(785/T)}$ | 2 |
| | $k_2 = 4.1 \times 10^{-16}\ e^{(1440/T)}$ | |
| | $k_3 = 1.9 \times 10^{-33}\ e^{(725/T)}$ | |
| | $k = k_0 + (k_3 \times [M] / (1 + k_3 \times [M] / k_2))$ | |
| A13. $H_2O_2 + OH \rightarrow H_2O + HO_2$ | $2.9 \times 10^{-12}\ e^{(-160/T)}$ | 2 |
| A14. $OH + HO_2NO_2 \rightarrow NO_2 + HO_2 + OH$ | $1.3 \times 10^{-12}\ e^{(380/T)}$ | 2 |
| A15. $OH + HO_2 \rightarrow H_2O + O_2$ | $4.8 \times 10^{-11}\ e^{(250/T)}$ | 2 |
| A16. $OH + HONO \rightarrow H_2O + NO_2$ | $1.8 \times 10^{-11}\ e^{(390/T)}$ | 2 |
| A17. $C_2H_5 + O_2 \rightarrow C_2H_4 + HO_2$ | $2 \times 10^{-14}$ | 2,b |
| A18. $OH + CH_4 \rightarrow CH_3 + H_2O$ | $2.45 \times 10^{-12}\ e^{(-1775/T)}$ | 2 |
| A19. $O(^3P) + CH_3 \rightarrow CH_3O$ | $1.1 \times 10^{-10}$ | 2 |
| A20. $CH_3O_2 + HO_2 \rightarrow CH_3OOH + O_2$ | $3.8 \times 10^{-13}\ e^{(800/T)}$ | 2 |
| A21. $CH_3OOH + OH \rightarrow CH_3(O)O + H_2O$ | $0.7 \times 3.8 \times 10^{-12}\ e^{(200/T)}$ | 2 |
| A22. $CH_3O + O_2 \rightarrow CH_2O + HO_2$ | $3.9 \times 10^{-14}\ e^{(-900/T)}$ | 2 |
| A23. $OH + HCHO \rightarrow H_2O + HCO$ | $8.8 \times 10^{-12}\ e^{(25/T)}$ | 2 |
| A24. $HCO + O_2 \rightarrow CO + HO_2$ | $3.5 \times 10^{-12}\ e^{(140/T)}$ | 2 |
| A25. $CH_3O_2 + CH_3O_2 \rightarrow 2CH_3O + O_2$ 29% | $0.29 \times 2.5 \times 10^{-13}\ e^{(190/T)}$ | 2 |
| A26. $NO + CH_3O_2 \rightarrow NO_2 + CH_3O$ | $3 \times 10^{-12}\ e^{(280/T)}$ | 2 |
| A27. $NO + O_3 \rightarrow NO_2 + O_2$ | $2 \times 10^{-12}\ e^{(-1400/T)}$ | 2 |
| A28. $NO + NO_3 \rightarrow 2NO_2$ | $1.5 \times 10^{-11}\ e^{(170/T)}$ | 2 |
| A29. $NO_3 + HCHO \rightarrow$ Products | $5.8 \times 10^{-16}$ | 2,b |
| A30. $HO_2 + SO_2 \rightarrow$ Products | $1 \times 10^{-18}$ | 2,b |
| A31. $N_2O_5 + H_2O \rightarrow 2HNO_3$ | $2.5 \times 10^{-22}$ | 2,b |
| A32. $NO_2 + O_3 \rightarrow NO_3 + O_2$ | $1.2 \times 10^{-13}\ e^{(-2450/T)}$ | 2 |
| A33. $OH + O(^3P) \rightarrow H + O_2$ | $2.2 \times 10^{-11}\ e^{(120/T)}$ | 2 |
| A34. $O(^3P) + HO_2 \rightarrow OH + O_2$ | $3 \times 10^{-11}\ e^{(200/T)}$ | 2 |
| A35. $H_2O_2 + O(^3P) \rightarrow OH + HO_2$ | $1.4 \times 10^{-12}\ e^{(-2000/T)}$ | 2 |
| A36. $OH + OH \rightarrow H_2O + O(^3P)$ | $4.2 \times 10^{-12}\ e^{(-240/T)}$ | 2 |
| A37. $O_3$ + Alkenes $\rightarrow$ Products | $1.2 \times 10^{-14}\ e^{(-2630/T)}$ | 2,b |
| A38. $NO_3 + CO \rightarrow$ Products | $4 \times 10^{-19}$ | 2,b |
| A39. $OH + CH_3OOH \rightarrow CH_2OOH + H_2O \rightarrow CH_2O + OH + H_2O$ | $0.3 \times 3.8 \times 10^{-12}\ e^{(200/T)}$ | 2 |
| A40. $O(^3P) + HCHO \rightarrow OH + HCO$ | $3.4 \times 10^{-11}\ e^{(-1600/T)}$ | 2 |
| A41. $H_2S + NO_3 \rightarrow$ Products | $8 \times 10^{-16}$ | 7,b |
| A42. $HCHO + HO_2 \rightarrow HO_2CH_2O$ | $6.7 \times 10^{-15}\ e^{(600/T)}$ | 2 |
| A43. $H + O_3 \rightarrow OH + O_2$ | $1.4 \times 10^{-10}\ e^{(-470/T)}$ | 2 |
| A44. $HO_2 + H \rightarrow 2OH$ | $0.9 \times 8.1 \times 10^{-11}$ | 2 |
| A45. $O(^3P) + HO_2NO_2 \rightarrow$ Products | $7.8 \times 10^{-11}\ e^{(-3400/T)}$ | 2 |
| A46. $O(^1D) + O_3 \rightarrow 2O_2$ | $1.2 \times 10^{-10}$ | 2 |
| A47. $O(^1D) + O_3 \rightarrow O_2 + 2O$ | $1.2 \times 10^{-10}$ | 2 |

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| A48. $CH_3O_2 + SO_2 \rightarrow$ Products | $5 \times 10^{-17}$ | 1,b |
| A49. $NO_3 + HO_2 \rightarrow OH + NO_2 + O_2$ | $3.5 \times 10^{-12}$ | 2 |
| A50. $CH_3 + O_3 \rightarrow$ Products | $5.4 \times 10^{-12}\ e^{(-220 / T)}$ | 2 |
| A51. $H_2S + OH \rightarrow SH + H_2O$ | $6 \times 10^{-12}\ e^{(-75 / T)}$ | 7 |
| A52. $SO_2 + O_3 \rightarrow SO_3 + O_2$ | $3 \times 10^{-12}\ e^{(-7000 / T)}$ | 2,b |
| A53. $NO_3 + OH \rightarrow NO_2 + HO_2$ | $2.2 \times 10^{-11}$ | 2 |
| A54. $O_3 + O(^3P) \rightarrow 2O_2$ | $8 \times 10^{-12}\ e^{(-2060 / T)}$ | 2 |
| A55. $O_3 + HONO \rightarrow O_2 + HNO_3$ | $5 \times 10^{-19}$ | 2,b |
| A56. $CH_3O_2 + O_3 \rightarrow$ Products | $3 \times 10^{-17}$ | 2,b |
| A57. $NO_3$ + Alkenes $\rightarrow HOCH_2CH_2 + NO_2$ | $3 \times 10^{-14}$ | 1 |
| A58. $SO_2 + NO_2 \rightarrow$ Products | $2 \times 10^{-26}$ | 1,b |
| A59. $NO_3$ + Alkanes $\rightarrow C_2H_5 + HNO_3$ | $3.6 \times 10^{-17}$ | 1 |
| A60. $CH_3O_2 + CH_3O_2 \rightarrow CH_2O + CH_3OH + O_2$ | $0.71 \times 2.5 \times 10^{-13}\ e^{(190 / T)}$ | 2 |
| A61. $NO_2 + NO_3 \rightarrow NO + NO_2 + O_2$ | $4.5 \times 10^{-14}\ e^{(-1260 / T)}$ | 2 |
| A62. $C_2H_5O_2 + C_2H_5O_2 \rightarrow 2C_2H_5O + O_2$ (0.6), $CH_3CHO + C_2H_5OH + O_2$ (0.4) | $6.8 \times 10^{-14}\ e^{(-300 / T)}$ | 7 |
| A63. $SO_2 + NO_3 \rightarrow$ Products Upper limit | $7 \times 10^{-21}$ | 7 |
| A64. $C_2H_5O_2 + HO_2 \rightarrow C_2H_5OOH + O_2$ | $7.5 \times 10^{-13}\ e^{(700 / T)}$ | 7 |
| A65. $C_2H_5O_2 + CH_3O_2 \rightarrow C_2H_5O + CH_3O + O_2$ ($\rightarrow CH_3CHO + HCHO + 2HO_2$) | $0.53 \times 2 \times (k_{62} \times (k_{25} + k_{60}))^{0.5}$ | 2 |
| A66. OH + Alkanes $\rightarrow C_2H_5 + H_2O$ | $1.1 \times 10^{-11} e^{(-1100 / T)}$ | 1 |
| A67. $C_2H_5O_2 + NO \rightarrow NO_2 + C_2H_5O$ | $2.6 \times 10^{-12}\ e^{(365 / T)}$ | 2 |
| A68. $CH_3CHO + NO_3 \rightarrow HNO_3 + CH_3CO$ ($\rightarrow CH_3C(O)O_2$) | $1.4 \times 10^{-12}\ e^{(-1900 / T)}$ | 2 |
| A69. $CH_3CHO + O(^3P) \rightarrow OH + CH_3CO$ ($\rightarrow CH_3C(O)O_2$) | $1.8 \times 10^{-11}\ e^{(-1100 / T)}$ | 2 |
| A70. $CH_3CHO + OH \rightarrow H_2O + CH_3CO$ ($\rightarrow CH_3C(O)O_2$) | $5.6 \times 10^{-12}\ e^{(270 / T)}$ | 2 |
| A71. $O(^3P) + H_2S \rightarrow OH + SH$ | $9.2 \times 10^{-12}\ e^{(-1800 / T)}$ | 7 |
| A72. $HO_2 + H \rightarrow H_2O + O$ | $0.02 \times (8.1 \times 10^{-11})$ | 7 |
| A73. $HO_2 + H \rightarrow H_2 + O_2$ | $0.08 \times (8.1 \times 10^{-11})$ | 7 |
| A74. $O(^3P) + H_2 \rightarrow OH + H$ | $4.11 \times 10^{-18}$ | 1 |
| A75. $NO + CH_3C(O)O_2 \rightarrow NO_2 + CH_3 + CO_2$ | $5.3 \times 10^{-12}\ e^{(360 / T)}$ | 2 |
| A76. $OH + C_2H_5OOH \rightarrow C_2H_4OOH + H_2O$ | $3.64 \times 10^{-12}$ | 1 |
| A77. $OH + C_2H_5OOH \rightarrow C_2H_5O_2 + H_2O$ | $5.95 \times 10^{-12}$ | 1 |
| A78. $NO_2 + O(^3P) \rightarrow NO + O_2$ | $6.5 \times 10^{-12}\ e^{(120 / T)}$ | 2 |
| A79. $NO_3 + O(^3P) \rightarrow NO_2 + O_2$ | $1 \times 10^{-11}$ | 2 |
| A80. $HNO_3 + O(^3P) \rightarrow NO_3 + OH$ | $3 \times 10^{-17}$ | 2,b |
| A81. $C_2H_5O + O_2 \rightarrow CH_3CHO + HO_2$ | $6.3 \times 10^{-14}\ e^{(-550 / T)}$ | 2 |
| A82. $HO_2CH_2O \rightarrow HO_2 + CH_2O$ | $2.4 \times 10^{12}\ e^{(-7000 / T)}$ | 1 |
| A83. $HO_2CH_2O + HO_2 \rightarrow HCOOH + O_2 + H_2O$ | $5.6 \times 10^{-15}\ e^{(2300 / T)}$ | 1 |
| A84. $I_2 + O_3 \rightarrow IO + I + O_2$ | $3.8 \times 10^{-18}$ | 2 |
| A85. $I_2 + O_3 \rightarrow OIO + I\ O$ | $3.8 \times 10^{-18}$ | 2 |
| A86. $I + O_3 \rightarrow IO + O_2$ | $2 \times 10^{-11}\ e^{(-890 / T)}$ | 2 |
| A87. $I + HO_2 \rightarrow HI + O_2$ | $1.5 \times 10^{-11}\ e^{(-1190 / T)}$ | 2 |
| A88. $IO + NO \rightarrow I + NO_2$ | $7.3 \times 10^{-12}\ e^{(330 / T)}$ | 2 |
| A89. $IO + HO_2 \rightarrow HOI + O_2$ | $5.8 \times 10^{-11}$ | 2 |
| A90. $IO + IO \rightarrow OIO + I / I_2O_2$ | $8.6 \times 10^{-11}$ | 3 |
| A91. $IO + OIO \rightarrow I_2O_3$ | $1.5 \times 10^{-10}$ | 3 |
| A92. $OIO + OIO \rightarrow I_2O_4$ | $1 \times 10^{-10}$ | 2 |
| A93. $IONO_2 \rightarrow IO + NO_2$ | $2.07 \times 10^{15}\ e^{(-11859 / T)}$ | 2 |
| A94. $OIO + NO \rightarrow IO + NO_2$ | $6.7 \times 10^{-12}$ | 18 |
| A95. $I_2O_2 + O_3 \rightarrow I_2O_3 + O_2$ | $1 \times 10^{-12}$ | 17 |
| A96. $I_2O_2 \rightarrow OIO + I$ | $0.21\ s^{-1}$ @ 265 K | e |
| A97. $I_2O_2 \rightarrow IO + IO$ | $1.3 \times 10^{-4}\ s^{-1}$ @ 265 K | e |
| A98. $I_2O_3 + O_3 \rightarrow I_2O_4 + O_2$ | $1 \times 10^{-12}$ | 17 |
| A99. $I_2O_4 + O_3 \rightarrow I_2O_5 + O_2$ | $1 \times 10^{-12}$ | 17 |

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| A100. $I_2O_4 \rightarrow 2OIO$ | $4.4 \times 10^{-4}\ s^{-1}$ @ 265 K | e |
| A101. $I_2 + OH \rightarrow HOI + I$ | $2.1 \times 10^{-10}$ | 2 |
| A102. $I_2 + NO_3 \rightarrow IO + INO_2$ | $1.5 \times 10^{-12}$ | 16 |
| A103. $I + NO_3 \rightarrow IO + NO_2$ | $4.5 \times 10^{-10}$ | 16 |
| A104. $OH + HI \rightarrow I + H_2O$ | $3 \times 10^{-11}$ | 2 |
| A105. $HOI + OH \rightarrow IO + H_2O$ | $2 \times 10^{-13}$ | 2 |
| A106. $IO + DMS \rightarrow$ Products | $1.2 \times 10^{-14}$ | 2 |
| A107. $INO_2 \rightarrow I + NO_2$ | $(2.4 / 0.005) \times 2.07 \times 10^{15} e^{(-11859 / T)}$ | 2 |
| A108. $Br + O_3 \rightarrow BrO + O_2$ | $1.7 \times 10^{-11} e^{(-800 / T)}$ | 2 |
| A109. $OH + HBr \rightarrow Br + H_2O$ | $1.1 \times 10^{-11}$ | 2 |
| A110. $Br + HO_2 \rightarrow HBr + O_2$ | $1.5 \times 10^{-11} e^{(-600 / T)}$ | 2 |
| A111. $Br + HCHO \rightarrow HBr + HCO$ | $7.7 \times 10^{-12} e^{(580 / T)}$ | 2 |
| A112. $Br + CH_3CHO \rightarrow HBr + CH_3CO$ | $1.8 \times 10^{-11} e^{(-460 / T)}$ | 2 |
| A113. $BrO + HO_2 \rightarrow HOBr + O_2$ | $3.4 \times 10^{-12} e^{(545/ T)}$ | 2 |
| A114. $BrO + NO \rightarrow Br + NO_2$ | $8.8 \times 10^{-12} e^{(260/ T)}$ | 2 |
| A115. $BrO + DMS \rightarrow Br + DMSO$ | $1.5 \times 10^{-14} e^{(850/ T)}$ | 2 |
| A116. $BrO + BrO \rightarrow 2Br + O_2$ | $2.4 \times 10^{-12} e^{(40/ T)}$ | 2 |
| A117. $BrO + BrO \rightarrow Br_2 + O_2$ | $2.8 \times 10^{-14} e^{(860/ T)}$ | 2 |
| A118. $BrNO_3 \rightarrow BrO + NO_2$ | $2.8 \times 10^{13} e^{(-12360/ T)}$ | 4 |
| A119. $BrO + IO \rightarrow Br + I + O_2$ (30%) | $1.5 \times 10^{-11} e^{(510/ T)}$ | 2 |
| A120. $BrO + IO \rightarrow Br + OIO$ (70%) | $1.5 \times 10^{-11} e^{(510/ T)}$ | 2 |
| A121. $Br_2 + OH \rightarrow HOBr + Br$ | $1.9 \times 10^{-11} e^{(240/ T)}$ | 2 |
| A122. $BrO + OH \rightarrow$ Products | $1.65 \times 10^{-11} e^{(-250/ T)}$ | 2 |
| A123. $OH + DMS (+ O_2) \rightarrow CH_3SCH_2O_2 + H_2O$ | $9.6 \times 10^{-12} e^{(-234 / T)}$ | 6 |
| A124. $OH + DMS \rightarrow DMS.OH$ | $(T e^{(-234 / T)} + 8.46 \times 10^{-10} e^{(7230 / T)} + 2.68 \times 10^{-10} e^{(7810 / T)}) / (1.04 \times 10^{11} \times T + 88.1 e^{(7460 / T)})$ | 8 |
| A125. $NO_3 + DMS (+ O_2) \rightarrow CH_3SCH_2O_2 + HNO_3$ | $1.9 \times 10^{-13} e^{(520 / T)}$ | 6 |
| A126. $CH_3S + O_3 \rightarrow CH_3SO + O_2$ | $1.98 \times 10^{-12} e^{(290 / T)}$ | 6 |
| A127. $CH_3S + NO_2 \rightarrow CH_3SO + NO$ | $2.06 \times 10^{-11} e^{(320 / T)}$ | 6 |
| A128. $CH_3SO + O_3 \rightarrow CH_3SO_2 + O_2$ | $6 \times 10^{-13}$ | 6 |
| A129. $CH_3SO + NO_2 \rightarrow CH_3SO_2 + NO$ | $1.2 \times 10^{-11}$ | 1 |
| A130. $CH_3SO_2 + M \rightarrow CH_3 + SO_2 + M$ | $5 \times 10^{13} e^{(-(17.2 \times 41840000 + R T) / (R T))}$ | 6 |
| A131. $CH_3SO_2 + O_3 \rightarrow CH_3SO_3 + O_2$ | $3 \times 10^{-13}$ | 6 |
| A132. $CH_3SO_2 + NO_2 \rightarrow CH_3SO_3 + NO$ | $4 \times 10^{-12}$ | 6 |
| A133. $CH_3SO_3 + M \rightarrow CH_3 + SO_3 + M$ | $5 \times 10^{13} e^{(-(22 \times 41840000 + R T) / (R T))}$ | 6 |
| A134. $CH_3SO_3 + CH_2O \rightarrow CH_3SO_3H + CHO$ | $1.6 \times 10^{-15}$ | 6 |
| A135. $CH_3SO_3 + HO_2 \rightarrow CH_3SO_3H + O_2$ | $5 \times 10^{-11}$ | 6 |
| A136. $CH_3S(O)_xOO + NO \rightarrow CH_3S(O)_xO + NO_2$ | $2.4 \times 10^{-11}$ | 6 |
| A137. $CH_3S(O)_x + O_2 \rightarrow CH_3S(O)_xOO$ | $1.7 \times 10^{-16} e^{(1510 / T)}$ | 6 |
| A138. $CH_3S(O)_xOO \rightarrow CH_3S(O)_x + O_2$ | $1.8 \times 10^{11} e^{(-3950 / T)}$ | 6 |
| A139. $CH_3S(O_2)OO + NO_2 \rightarrow CH_3S(O_2)OONO_2$ | $4.7 \times 10^{-12}$ | 6 |
| A140. $CH_3S(O_2)OONO_2 \rightarrow CH_3S(O_2)OO + NO_2$ | $1.9 \times 10^{16} e^{(-13543 / T)}$ | 6 |
| A141. $CH_3S(O_2)OONO_2 \rightarrow CH_3SO_3H$ (MSA) | $5 \times 10^{-5}$ | 6 |
| A142. $CH_3SO_3 + NO_2 \rightarrow CH_3SO_3NO_2$ | $4.7 \times 10^{-12}$ | 6 |
| A143. $CH_3SO_3NO_2 \rightarrow CH_3SO_3 + NO_2$ | $1.9 \times 10^{16} e^{(-13543 / T)}$ | 6 |
| A144. $CH_3SO_3NO_2 \rightarrow CH_3SO_3H$ (MSA) | $5 \times 10^{-5}$ | 6 |
| A145. $OH + DMSO \rightarrow DMSO_2 + HO_2$ | $5.8 \times 10^{-11}$ | 6 |
| A146. $OH + DMSO_2 \rightarrow CH_3SO_2CH_2O_2$ | $1 \times 10^{-12}$ | 6 |
| A147. $CH_3SO_2CH_2O_2 + NO \rightarrow CH_3SO_2 + HCHO + NO_2$ | $4.1 \times 10^{-12} e^{(180 / T)}$ | 6 |
| A148. $CH_3SO_2CH_2O_2 + HO_2 \rightarrow CH_3SO_2CH_2OOH$ | $1.5 \times 10^{-13} e^{(1250 / T)}$ | 6 |
| A149. $CH_3SO_2CH_2O_2 + CH_3O_2 \rightarrow CH_3SO_2 + HCHO + CH_3O$ | $3 \times 10^{-13}$ | 6 |
| A150. $OH + CH_3SO_2CH_2OOH \rightarrow CH_3SO_2CH_2O_2$ | $1.5 \times 10^{-11}$ | 6 |

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| A151. $CH_3SCH_2O_2 + NO_3 \rightarrow CH_3S + NO_2 + O_2 + HCHO$ | $2 \times 10^{-12}$ | 6 |
| A152. $CH_3SCH_2O_2 + HO_2 \rightarrow CH_3SCH_2OOH$ | $1.5 \times 10^{-13}\ e^{(1250 / T)}$ | 6 |
| A153. $CH_3SCH_2O_2 + CH_3O_2 \rightarrow CH_3S + CH_3O + HCHO$ | $3.0 \times 10^{-13}$ | 6 |
| A154. $DMDS + OH \rightarrow CH_3SOH + CH_3S$ | $6 \times 10^{-11}\ e^{(400 / T)}$ | 6 |
| A155. $DMDS + NO_3 \rightarrow CH_3SO + CH_3S + NO_2$ | $1.3 \times 10^{-12}\ e^{(-270 / T)}$ | 6 |
| A156. $CH_3SOH + OH \rightarrow CH_3SO + H_2O$ | $1.1 \times 10^{-10}$ | 6 |
| A157. $CH_3SOH + NO_3 \rightarrow CH_3SO + HNO_3$ | $3.4 \times 10^{-12}$ | 6 |
| A158. $SH + O_3 \rightarrow SO_2 + OH$ | $9 \times 10^{-12}\ e^{(-280 / T)}$ | 6 |
| A159. $CH_3S + CH_3S \rightarrow DMDS$ | $4.15 \times 10^{-11}$ | 6 |
| A160. $HSO_3 + O_2 \rightarrow SO_3 + HO_2$ | $1 \times 10^{-11}$ | 6 |
| A161. $SO_3 + H_2O \rightarrow H_2SO_4$ | $1.2 \times 10^{-15}$ | 6 |
| A162. $NO_3 + CH_3O_2 \rightarrow NO_2 + CH_3O + O_2$ | $1 \times 10^{-12}$ | 9 |
| A163. $CH_3C(O)O_2 + CH_3C(O)O_2 \rightarrow 2CH_3CO_2 + O_2 \rightarrow 2CH_3O_2 + 2CO_2$ | $2.9 \times 10^{-12}\ e^{(500/T)}$ | 9 |
| A164. $CH_3C(O)O_2 + CH_3O_2 \rightarrow\rightarrow CH_3O_2 + HCHO + HO_2$ | $\beta = 4.4 \times 10^{5}\ e^{(-3910 / T)}$<br>$5.1 \times 10^{-12}\ e^{(272 / T)} \times \beta$ | 9 |
| Recombination Reactions and their Reverse Reactions (where calculated from the Equilibrium Constant) | $n = \{1 + (Log_{10}(k_0 \times [M] / k_\infty))^2\}^{-1}$<br>$k = ((k_0 \times [M] / (1 + k_0[M] / k_\infty)) \times F_c^{\,n})$<br>$F_c$ = 0.6 unless otherwise noted | |
| B1. $O(^1D) + N_2 (+M) \rightarrow N_2O (+M)$ | $[M] \times 3.5 \times 10^{-37} \times (T / 300)^{-0.6}$ | 2 |
| B2. $HO_2 + HO_2 (+M) \rightarrow H_2O_2 (+M)$ | $[M] \times 1.7 \times 10^{-33}\ e^{(1000 / T)}$ | 2 |
| B3. $H + O_2 (+ M) \rightarrow HO_2 (+ M)$ | $k_0 = 5.7 \times 10^{-32} \times (T / 300)^{-1.6}$<br>$k_\infty = 7.5 \times 10^{-11}$ | 2 |
| B4. $O2 + O(^3P) \rightarrow O_3$ | $[M] \times 6 \times 10^{-34} \times (T / 300)^{-2.3}$ | 2 |
| B5. $NO_2 + OH \rightarrow HNO_3$ | $k_0 = 2.5 \times 10^{-30} \times (T / 300)^{-4.4}$<br>$k_\infty = 1.6 \times 10^{-11} \times (T / 300)^{-1.7}$ | 2 |
| B6. $NO + OH (+ M) \rightarrow HONO (+ M)$ | $k_0 = 7 \times 10^{-31} \times (T / 300)^{-2.6}$<br>$k_\infty = 1.5 \times 10^{-11} \times (T / 300)^{-0.5}$ | 2 |
| B7. $HO_2 + NO_2 (+ M) \rightarrow HO_2NO_2 (+ M)$ | $k_0 = 1.8 \times 10^{-31} \times (T / 300)^{-3.2}$<br>$k_\infty = 4.7 \times 10^{-12} \times (T / 300)^{-1.4}$ | 2 |
| B8. $HO_2NO_2 \rightarrow HO_2 + NO_2$ | $k_R = k_F / k_{EQ}$<br>$k_R = k_F / (2.1 \times 10^{-27}\ e^{(10900 / T)})$ | 2 |
| B9. $O_2 + CH_3 (+ M) \rightarrow CH_3O_2 (+ M)$ | $k_0 = 4.5 \times 10^{-31} \times (T / 300)^{-3}$<br>$k_\infty = 1.8 \times 10^{-12} \times (T / 300)^{-1.7}$ | 2 |
| B10. $NO_2 + NO_3 (+ M) \rightarrow N_2O_5 (+ M)$ | $k_0 = 2.2 \times 10^{-30} \times (T / 300)^{-3.9}$<br>$k_\infty = 1.5 \times 10^{-12} \times (T / 300)^{-0.7}$ | 2 |
| B11. $N_2O_5 (+ N_2) \rightarrow NO_2 + NO_3 (+ N_2)$ | $k_R = k_F / k_{EQ}$<br>$k_R = k_F / (2.7 \times 10^{-27}\ e^{(11000 / T)})$ | 2 |
| B12. $OH + OH (+ M) \rightarrow H_2O_2 (+ M)$ | $k_0 = 6.2 \times 10^{-31} \times (T / 300)^{-1}$<br>$k_\infty = 2.6 \times 10^{-11}$ | 2 |
| B13. $NO + O(^3P) (+ M) \rightarrow NO_2 (+ M)$ | $k_0 = 9 \times 10^{-32} \times (T / 300)^{-1.5}$<br>$k_\infty = 3 \times 10^{-11}$ | 2 |
| B14. $NO_2 + O(^3P) (+ M) \rightarrow NO_3 (+ M)$ | $k_0 = 9 \times 10^{-32} \times (T / 300)^{-2}$<br>$k_\infty = 2.2 \times 10^{-11}$ | 2 |
| B15. $SO_2 + OH (+ M) \rightarrow HOSO_2 (+ M)$ | $k_0 = 3 \times 10^{-31} \times (T / 300)^{-3.3}$<br>$k_\infty = 1.5 \times 10^{-12}$ | 2 |
| B16. $CH_3C(O)O_2 + NO_2 (+ M) \rightarrow PAN (+ M)$ | $k_0 = 9.7 \times 10^{-29} \times (T / 300)^{-5.6}$<br>$k_\infty = 9.3 \times 10^{-12} \times (T / 300)^{-1.5}$ | 2 |
| B17. $PAN (+ M) \rightarrow CH_3C(O)O_2 + NO_2 (+ M)$ | $k_R = k_F / k_{EQ}$<br>$k_R = k_F / (9 \times 10^{-29}\ e^{(14000 / T)})$ | 2 |
| B18. $OH + Alkenes (+ M) \rightarrow HOCH_2CH_2 (+ M)$ | $k_0 = 1.5 \times 10^{-28} \times (T / 300)^{-0.8}$<br>$k_\infty = 8.8 \times 10^{-12}$ | 2, 1 |
| B19. $C_2H_5 + O_2 (+ M) \rightarrow C_2H_5O_2 (+ M)$ | $k_0 = 1.5 \times 10^{-28} \times (T / 300)^{-3.8}$<br>$k_\infty = 8 \times 10^{-12}$ | 2 |

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|---|---|---|
| B20. $NO_2 + CH_3O_2 (+ M) \rightarrow CH_3O_2NO_2 (+ M)$ | $k_0 = 1.5 \times 10^{-30} \times (T / 300)^{-4}$ | 2 |
| | $k_\infty = 6.5 \times 10^{-12} \times (T / 300)^{-2}$ | |
| B21. $CH_3O_2NO_2 \rightarrow CH_3O_2 + NO_2$ | $k_R = k_F / k_{EQ}$ | 2 |
| | $k_R = k_F / (1.3 \times 10^{-28} e^{(11200 / T)})$ | |
| B22. $I + NO_2 (+ M) \rightarrow INO_2 (+ M)$ | $k_0 = 3 \times 10^{-31} \times (T / 300)^{-1}$ | 2 |
| | $k_\infty = 6.6 \times 10^{-11}$ | |
| | $F_c = e^{(-T / 650)} + e^{(-2600 / T)}$ | |
| B23. $IO + NO_2 (+ M) \rightarrow IONO_2 (+ M)$ | $k_0 = 7.7 \times 10^{-31} \times (T / 300)^{-5}$ | 2 |
| | $k_\infty = 1.6 \times 10^{-11}$ | |
| | $F_c = 0.4$ | |
| B24. $BrO + NO_2 (+ M) \rightarrow BrONO_2 (+ M)$ | $k_0 = 4.7 \times 10^{-31} \times (T / 300)^{-3.1}$ | 2 |
| | $k_\infty = 1.8 \times 10^{-11}$ | |
| | $F_c = 0.4$ | |
| B25. $Br + NO_2 (+ M) \rightarrow BrNO_2 (+ M)$ | $k_0 = 4.2 \times 10^{-31} \times (T / 300)^{-2.4}$ | 2 |
| | $k_\infty = 2.7 \times 10^{-11} \times (T / 300)^{-0}$ | |
| | $F_c = 0.55$ | |
| Loss to aerosol | | |
| C1. IO accommodation $= \gamma_I / 4 \times \sqrt{(8 R T / 0.142 \pi)}$ | $\gamma_I$ varied, base value 0.02 | d |
| C2. OIO accommodation $= \gamma_{OIO} / 4 \times \sqrt{(8 R T / 0.159 \pi)}$ | $\gamma_{OIO} = 1$ | d |
| C3. HI accommodation $= \gamma_I / 4 \times \sqrt{(8 R T / 0.128 \pi)}$ | $\gamma_I$ varied, base value 0.02 | 5 |
| C4. HOI accommodation $= \gamma_I / 4 \times \sqrt{(8 R T / 0.144 \pi)}$ | $\gamma_I$ varied, base value 0.02 | 5 |
| C5. $INO_2$ accommodation $= \gamma_I / 4 \times \sqrt{(8 R T / 0.173 \pi)}$ | $\gamma_I$ varied, base value 0.02 | d |
| C6. $IONO_2$ accommodation $= \gamma_I / 4 \times \sqrt{(8 R T / 0.189 \pi)}$ | $\gamma_I$ varied, base value 0.02 | 5 |
| C7. $I_2O_5$ accommodation $= \gamma_I / 4 \times \sqrt{(8 R T / 0.336 \pi)}$ | $\gamma_I$ varied, base value 0.02 | d |
| C8. HOBr accommodation $= \gamma_{Br} / 4 \times \sqrt{(8 R T / 0.098\pi)}$ | $\gamma_{Br}$ varied, base value 0.02 | d |
| C9. HBr accommodation $= \gamma_{Br} / 4 \times \sqrt{(8 R T / 0.082\pi)}$ | $\gamma_{Br}$ varied, base value 0.02 | d |
| C10. $BrNO_3$ accommodation $= \gamma_{Br} / 4 \times \sqrt{(8 R T / 0.142\pi)}$ | $\gamma_{Br}$ varied, base value 0.02 | 15 |
| C11. $N_2O_5$ accommodation $= \gamma_{N2O5} / 4 \times \sqrt{(8 R T / 0.108 \pi)}$ | $\gamma_{N2O5} = 0.03$ | 15 |
| C12. $NO_3$ accommodation $= \gamma_{NO3} / 4 \times \sqrt{(8 R T / 0.062 \pi)}$ | $\gamma_{NO3} = 0.003$ | 15 |
| C13. OH accommodation $= \gamma_{OH} / 4 \times \sqrt{(8 R T / 0.017 \pi)}$ | $\gamma_{OH} = 0.000012 e^{(1750 / T)}$ | 15 |
| C14. $HO_2$ accommodation $= \gamma_{HO2} / 4 \times \sqrt{(8 R T / 0.033 \pi)}$ | $\gamma_{HO2} = 0.000000014 e^{(3780 / T)}$ | 15 |
| C15. $CH_3O_2$ accommodation $= \gamma_{CH3O2} / 4 \times \sqrt{(8 R T / 0.047 \pi)}$ | $\gamma_{CH3O2} = 0.004$ | 15 |
| C16. $HNO_3$ accommodation $= \gamma_{HNO3} / 4 \times \sqrt{(8 R T / 0.063 \pi)}$ | $\gamma_{HNO3} = 0.014$ | 11 |
| C17. $H_2SO_4$ accommodation $= \gamma_{H2SO4} / 4 \times \sqrt{(8 R T / 0.098 \pi)}$ | $\gamma_{H2SO4} = 0.4$ | 11 |
| Photolysis Rates of Gas phase species | | |
| J1. $O_3 + h\nu \rightarrow O_2 + O(^1D)$ | Photolysis rates calculated online from absorption cross-sections and quantum yields reported in the relevant reference and actinic flux calculated as detailed in the text, with a 2-stream radiative transfer code. | 1,2,c |
| J2. $H_2O_2 + h\nu \rightarrow 2OH$ | | 1,2,c |
| J3. $HNO_3 + h\nu \rightarrow OH + NO_2$ | | 1,2,c |
| J4. $HO_2NO_2 + h\nu \rightarrow OH + NO_3$ | | 1,2,c |
| J5. $HONO + h\nu \rightarrow OH + NO$ | | 1,2,c |
| J6. $CH_3OOH + h\nu \rightarrow CH_3O + OH$ | | 1,2,c |
| J7. $CH_2O + h\nu \rightarrow HCO + H$ | | 1,2,c |
| J8. $CH_2O + h\nu \rightarrow CO + H_2$ | | 1,2,c |
| J9. $NO_2 + h\nu \rightarrow NO + O$ | | 1,2,c |
| J10. $NO_3 + h\nu \rightarrow NO_2 + O$ | | 1,2,c |
| J11. $N_2O_5 + h\nu \rightarrow NO_2 + NO_3$ | | 1,2,c |

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|---|---|---|
| J12. | $C_2H_5O_2H + h\nu \rightarrow OH + C_2H_5O$ | 1,2,c |
| J13. | $CH_3CHO + h\nu \rightarrow CH_3 + HCO$ | 1,2,c |
| J15. | PAN ($CH3C(O)O_2NO_2$) $+ h\nu \rightarrow CH_3C(O)O_2 + NO_2$ | 1,2,c |
| J16. | $NO_3 + h\nu \rightarrow NO + O_2$ | 1,2,c |
| J17. | $CH_3I + h\nu \rightarrow CH_3 + I$ | 1,2,c |
| J18. | $CH_2I_2 + h\nu \rightarrow CH_2I + I \rightarrow CH_2 + 2I$ | 1,2,c |
| J19. | $CH_2IBr + h\nu \rightarrow CH_2Br + I$ | 1,2,c |
| J20. | $I_2 + h\nu \rightarrow 2I$ | 1,2,c |
| J21. | $INO_2 + h\nu \rightarrow I + NO_2$ / $IO + NO$ | 1,2,c |
| J22. | $IO + h\nu \rightarrow I + O$ | 1,2,c |
| J23. | $OIO + h\nu \rightarrow I + O_2$ | 1,2,c |
| J24. | $IONO_2 + h\nu \rightarrow I + NO_3$ | 1,2,c |
| J25. | $BrO + h\nu \rightarrow Br + O$ | 1,2,c |

( [a] Used in sensitivity trials only, [b] set as upper limit, [c] absorption cross-sections taken from *Atkinson et al.*, 2000, d assumed, [e]calculated using RRKM theory)

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